



MediTouch Ambulatory EHR, version 5.0

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For public release:

NextGen Healthcare attests that the usability standard/process and usability report submitted for the certification of MediTouch Ambulatory EHR, version 5.0 is accurate and complete per the requirements of the ONC criterion 170.315(g)(3).

DocuSigned by:

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MediTouch used the following usability design industry standard in developing and designing their health IT module, MediTouch Ambulatory EHR, version 5.0: ISO 9241-210:2010 (Previously: ISO 13407:1999)

<https://www.iso.org/standard/52075.html>

The software was developed by a non-industry standard prior to the Meaningful Use Stage 1 initiative. We have medical professionals on staff that play a role in the software development and review process that have input into the creation of the software that impacts the measures for which the UCD process is mandated. In addition, we worked with our provider community to refine the software based on user suggestions. In general, we develop around the principles based on ISO 9241-210:2010.

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A handwritten signature in black ink that reads "Robert Murry".

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EHR Usability Test Report of MediTouch 5.0

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

Date of Usability Test: July 17 – September 6 , 2017

Date of Report: September 30, 2017

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Table of Contents

EHR Usability Test Report of MediTouch 5.0	3
Executive Summary	5
Summary of Performance.....	6
Staff Tasks (Registered Nurses, Licensed Practical Nurses, Medical Assistants)	6
Provider Tasks (Physicians and Nurse Practitioners).....	8
Introduction	10
Method	11
Study Design	13
Tasks	14
Procedures	18
Test Location	19
Test Environment	19
Test Form and Tools	19
Participant Instructions	20
Usability Metrics	20
Data Scoring	21
Results	22
Data Analysis and Reporting.....	22
Staff Tasks (Registered Nurses, Licensed Practical Nurses, Medical Assistants)	23
Provider Tasks (Physicians and Nurse Practitioners).....	24
Discussion of Findings	27
Overall Findings	27
Detailed Findings	28
170.315 (a)(1) CPOE: Medications and 170.315 (b)(3) Electronic Prescribing	28
170.315 (a)(2) CPOE: Laboratory	30
170.315 (a)(3) CPOE: Diagnostic Imaging	31
170.315 (a)(4): Drug-Drug, Drug-Allergy Interaction Checks and	32
170.315 (a)(9): Clinical Decision Support.....	32
170.315 (a)(5): Demographics	33
170.315 (a)(6): Problem List	34
170.315 (a)(7) Medication List and 170.315 (a)(9) Clinical Decision Support.....	35
170.315 (a)(8): Medication Allergy List.....	36
170.315 (a)(14) Implantable Device List	37
170.315 (b)(2) Clinical Information Reconciliation and Incorporation	38
EFFECTIVENESS	39
EFFICIENCY.....	39
SATISFACTION.....	40
Major Findings	41
Appendices	44
Appendix 1: Recruiting Screener and Initial Correspondence	44
Appendix 2: Participant Demographics	47
Appendix 3: Usability Test Agreement	47
Appendix 4: Moderator’s Guide & Tasks	50
Appendix 5: Error Analysis.....	55
Appendix 6: System Usability Scale Questionnaire	57
Summary of Performance <i>with Confidence Intervals for Completion Rates</i>	58

Executive Summary

A usability test of MediTouch was conducted between July 17 - September 6, 2017 by NextGen Healthcare UX Researcher Jennifer Olivier. Note-takers included NextGen Healthcare UX Researchers Matthew Miller, Marlana Anderson and Heidi Hang. 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. During the usability test, a total of 23 active clinicians matching the target demographic criteria served as participants and used MediTouch in simulated, but representative tasks.

This study collected performance data on 13 scenarios typically conducted in an EHR:

- Enter and update demographics
- Reconcile medications and allergies
- Add and update the medication list
- Add and update allergies
- Identify drug-drug interactions
- Review for Clinical Decision Support (CDS)
- Add and update the problem list
- Order and update labs
- Order and update a medication
- Send a medication via eRx
- Submit an eRx refill request
- Order and update a diagnostic test
- Add an implantable device and review device information

Prior to each test, participants were asked to review and sign an informed consent/agreement form (included in Appendix 3). During the 60-minute one-on-one remote usability test, each participant was greeted virtually by the moderator and instructed about the expectations of the session and that they could withdraw at any time. Participants had prior experience with the EHR. The moderator introduced the test, and instructed participants to complete a series of tasks (given one at a time) using the EHR. During the test, the administrator timed the test and, along with the data logger(s)/note taker(s) recorded user performance data on paper and electronically. The moderator did not give the participant assistance on how to complete each task. Participant screens and audio were recorded for subsequent analysis.

The following types of data were collected for each participant:

- Number of tasks successfully completed and completed within the allotted time
- 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 tasks, participants were asked to complete a post-test questionnaire and were compensated with \$100 or \$200 (staff and providers, respectively) for their time. 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 EHR. Following is a summary of the performance and rating data collected on the EHR.

Summary of Performance

Staff Tasks (Registered Nurses, Licensed Practical Nurses, Medical Assistants)

Task	N #	Task Success Mean (SD)	Path Deviation (Observed /optimal)	Task Time Mean (SD)	Task Time Deviations (Observed/ Optimal)	Errors Mean (SD)	Task Ratings 5=easy Mean (SD)
DEMOGRAPHICS							
1a. Enter sexual orientation	11	100% (0)	1.16 13.88/12 Clicks	110.75 Seconds (25.26)	1.42 110/78 Seconds	0% (0)	4.26
1b. Enter gender identity	11	91% (0.95)				9% (0.95)	
1c. Verify preferred language	11	100% (0)				0% (0)	
1d. Enter email address	11	100% (0)				0% (0)	

1e. Enter cell phone number	11	91% (0.95)				9% (0.95)	
CLINICAL RECONCILIATION AND ALLERGY LIST							
2. Add an allergy for reconciliation	11	82% (1.28)	1.88 3.75/2 Clicks	24.63 Seconds (9.29)	1.12 24/22 Seconds	18% (1.28)	4.82
3. Add an allergy	11	100% (0)	1.87 5.60/3 Clicks	30.10 Seconds (11.17)	1.00 30/30 Seconds	0% (0)	4.45
4. Add a symptom to an allergy	11	100% (0)	1.05 5.27/5 Clicks	23.45 Seconds (7.41)	0.65 23/36 Seconds	0% (0)	4.91
CLINICAL RECONCILIATION AND MEDICATION LIST							
5a. Add a medication for reconciliation	11	27% (1.48)	1.75 10.50/6 Clicks	85.00 Seconds (36.77)	1.15 85/74 Seconds	73% (1.48)	2.82
5b. Dismiss a medication for reconciliation	11	27% (1.48)	1.75 10.50/6 Clicks	85.00 Seconds (36.77)	1.15 85/74 Seconds	73% (1.48)	2.82
6. Discontinue a medication	11	82% (1.28)	4.29 4.29/1 Clicks	19.14 Seconds (6.23)	1.28 19/15 Seconds	18% (1.28)	4.36
7a. Add a medication	11	100% (0)	1.30 7.82/6 Clicks	56.00 Seconds (31.35)	0.77 56/73 Seconds	0% (0)	4.27
8. Update a medication SIG	11	91% (0.95)	1.02 6.11/6 Clicks	26.33 Seconds (11.20)	0.77 26/34 Seconds	19% (.95)	4.36
9. Find patient information about a medication	11	73% (1.48)	3.60 7.20/2 Clicks	30.40 Seconds (4.98)	1.52 30/20 Seconds	27% (1.48)	3.27
CLINICAL DECISION SUPPORT							
7b. Check for interactions to a medication	11	100% (0)	1.30 7.82/6 Clicks	56.00 Seconds (31.35)	0.77 56/73 Seconds	0% (0)	4.27
DEMOGRAPHICS FOR NEW PATIENT							
10a. Enter last name	11	100% (0)	1.16 22.00/19 Clicks	147.22 Seconds (22.17)	1.35 147/109 Seconds	0% (0)	4.64
10b. Enter first name	11	100% (0)				0% (0)	
10c. Enter date of birth	11	100% (0)				0% (0)	
10d. Enter birth sex	11	100% (0)				0% (0)	
10e. Enter races (select two)	11	100% (0)				0% (0)	

10f. Enter ethnicity	11	91% (0.95)				9% (0.95)	
10g. Enter home phone	11	100% (0)				0% (0)	

Table 1

Provider Tasks (Physicians and Nurse Practitioners)

Task	N #	Task Success Mean (SD)	Path Deviation (Observed /optimal)	Task Time Mean (SD)	Task Time Deviations (Observed/ Optimal)	Errors Mean (SD)	Task Ratings 5=easy Mean (SD)
PROBLEM LIST							
1. Review active problems	12	100% (0)	1.71 3.42/2 Clicks	22.25 Seconds (0.72)	0.72 22/31 Seconds	0% (0)	4.58
2. Search for and add a problem to the Problem List	12	92% (0.96)	1.38 8.27/6 Clicks	50.82 Seconds (0.69)	0.69 50/74 Seconds	8% (0.96)	4.17
3. Update clinical status of a problem	12	100% (0)	1.44 1.44/1 Clicks	10.11 Seconds (0.81)	0.81 16/12.5 Seconds	0% (0)	4.83
LAB ORDERS							
4. Place an in-office lab order	12	83% (1.29)	1.20 12.00/10 Clicks	74.38 Seconds (1.03)	1.03 101/72 Seconds	17% (1.29)	2.58
5. Place an out-of-office lab order	12	58% (1.71)	1.53 12.25/8 Clicks	59.00 Seconds (1.02)	1.02 127/58 Seconds	42% (1.71)	2.33
6. Change a lab order status	11	82% (1.28)	1.93 9.67/5 Clicks	38.67 Seconds (0.72)	0.72 43/54 Seconds	18% (1.28)	3.91
MEDICATION E-PRESCRIBING							
7a. Search for a medication	12	100% (0)	0.79 11.83/15 Clicks	56.42 Seconds (18.24)	0.91 56/62 Seconds	0% (0)	4.42
7b. Select a dosage	12	100% (0.00)				0% (0.00)	
7c. Update the sig	12	100% (0)				0% (0)	
7d. Select quantity	12	100% (0.00)				0% (0.00)	
7e. Select refill amount	12	100% (0.00)				0% (0.00)	
8. Modify the dosage	12	100% (0)	1.61 6.45/4	20.92 Seconds	1.00 21/21	0% (0)	4.67

			Clicks	(9.80)	Seconds		
9. Send the medication via eRx	11	100% (0)	1.70 5.09/3 Clicks	29.55 Seconds (10.60)	0.66 30/45 Seconds	0% (0)	4.82
10. Find patient information about the medication	12	83% (1.29)	2.40 4.80/2 Clicks	33.90 Seconds (13.84)	0.97 34/35 Seconds	17% (1.29)	4.33
11. Approve an Rx refill request	12	100% (0)	3.29 6.58/2 Clicks	60.18 Seconds (28.22)	1.09 60/55 Seconds	0% (0)	4.08
12. Cancel an Rx transmission	10	90% (0.95)	1.53 9.17/6 Clicks	63.67 Seconds (19.66)	1.04 64/61 Seconds	10% (0.95)	3.40
DIAGNOSTIC IMAGING							
13. Select and order a diagnostic test	12	92% (0.96)	2.46 22.10/9 Clicks	113.60 Seconds (1.16)	1.16 113/98 Seconds	8% (0.96)	3.50
14. Modify the diagnostic order	12	92% (0.96)	1.47 16.18/11 Clicks	70.55 Seconds (1.05)	1.05 71/67 Seconds	8% (0.96)	4.17
DRUG-DRUG INTERACTION CHECK							
15. Cancel a medication due to a drug-drug interaction	12	100% (0)	2.44 14.67/6 Clicks	67.75 Seconds (1.00)	1.00 68/68 Seconds	0% (0)	4.42
IMPLANTABLE DEVICE							
16. Add an implantable device	12	100% (0)	1.69 6.75/4 Clicks	56.92 Seconds (1.00)	1.00 57/57 Seconds	0% (0)	4.00
17. Review device identifier and manufacturer	12	100% (0)	1.58 3.17/2 Clicks	16.00 Seconds (070)	0.70 16/23 Seconds	0% (0)	4.50

Table 2

System Usability Scores

The System Usability Scale scored the overall perceived ease of use and satisfaction with the system based on performance with these tasks. The results are as follows:

- Staff tasks: 84
- Provider tasks: 81.4

Broadly interpreted, scores under 60 represent systems with poor usability; scores over 80 are considered above average.

Introduction

This study represents usability testing performed on the MediTouch product designed to provide healthcare professionals with a computerized method of recording and tracking patient healthcare records. MediTouch (i.e., “the system”) supports a variety of healthcare professional roles (e.g., Nurses, Medical Assistants, Physicians, etc.) across a variety of healthcare practices (e.g., Family Practice, Pediatrics, Internal Medicine, etc.).

The purpose of this study was to test and validate the usability of the user interface and provide evidence of user centered design methodologies to support certification according to criteria outlined in Safety Enhanced Design §170.315(g)(3), specifically:

- § 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 interaction checks
- § 170.315 (a)(5) Demographics
- § 170.315 (a)(6) Problem list
- § 170.315 (a)(7) Medication list
- § 170.315 (a)(8) Medication allergy list
- § 170.315 (a)(9) Clinical decision support
- § 170.315 (a)(14) Implantable device list
- § 170.315 (b)(2) Clinical information reconciliation and incorporation
- § 170.315 (b)(3) Electronic prescribing

The usability testing attempted to represent realistic exercises and conditions. Also, to provide evidence of usability in the EHR, measures of effectiveness, efficiency and user satisfaction, such as task completion rate, time on task, path deviation rate, errors, post-task rating scores, and SUS score were captured during the usability testing.

Method

Participants

A total of 23 participants were tested on the EHR. Twelve participants in the test were Providers (doctors and nurse practitioners) and eleven participants were Staff (registered nurses, licensed practical nurses, and medical assistants). Participants were recruited by the UX research team through a NextGen Healthcare Voice of the Client Survey distributed to a sampling of all MediTouch customers and were compensated \$100 (staff) or \$200 (providers) for their time. In addition, participants had no direct connection to the development of, or organization producing, the EHR. Participants were not from NextGen Healthcare/QSI. Participants did not need any orientation or training as they all were experienced MediTouch users.

For test purposes, end-user characteristics were identified and translated into a recruitment screener used to solicit potential participants (see Appendix 1).

Recruited 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.

Participant Demographics

N	Part ID	Gender	Age Range	Education	Occupation /Role	Professional Experience in Current Role	Computer Experience	Product Experience	Assistive Technology Needs
1	ID 01	Female	30-39	MA Certificate	Medical Assistant	Not reported	Not reported	Not reported	None
2	ID 02	Female	20-29	MA Certificate	Medical Assistant	Not reported	Not reported	Not reported	None
3	ID 03	Female	40-49	Associates Degree	Licensed Practice Nurse	15 years	24 years	2 years	None
4	ID 04	Female	30-39	MA Certificate	Medical Assistant	10 years	16 years	3 years	None
5	ID 05	Female	40-49	LPN Certificate	Licensed Practice Nurse	19 years	28 years	8 years	None
6	ID 06	Female	30-39	Associates Degree	Licensed Practice Nurse	9 years	9 years	8 months	None
7	ID 07	Female	50-59	Doctorate MD	Physician	24 years	30 years	2 years	None
8	ID 08	Female	40-49	Doctorate MD	Physician	12 years	27 years	14 months	None
9	ID 09	Female	40-49	Doctorate MD	Physician	21 years	25 years	4 years	None
10	ID 10	Male	40-49	Doctorate MD	Physician	5 years	25 years	10 months	None
11	ID 11	Female	20-29	MA Certificate	Medical Assistant	4 years	10 years	10 months	None
12	ID 12	Female	40-49	Doctorate MD	Physician	12 years	34 years	9 months	None
13	ID 13	Female	40-49	Associates Degree	Registered Nurse	24 years	10 years	3.5 years	None
14	ID 14	Female	40-49	Masters Degree	Nurse Practitioner	2 years	35 years	2.5 years	None
15	ID 15	Female	30-39	MA Certificate	Medical Assistant	10 years	15 years	5 years	None
16	ID 16	Male	60-69	Doctorate MD	Physician	25+ years	40 years	4 years	None
17	ID 17	Female	50-59	Masters Degree	Nurse Practitioner	2.5 years	25 years	2 years	
18	ID 18	Male	50-59	Doctorate MD	Physician	30 years	27 years	2.5 years	None
19	ID 19	Male	40-49	Doctorate MD	Physician	14 years	14 years	2 years	None
20	ID 20	Female	40-49	Doctorate MD	Physician	14 years	25 years	1.5 years	None

21	ID 21	Female	40-49	Doctorate MD	Physician	10 years	20+ years	3 years	None
22	ID 22	Female	20-29	MA Certificate	Medical Assistant	6 years	7 years	2 years	None
23	ID 23	Female	30-39	High School Diploma	Medical Assistant	1.5 years	16 years	2 years	None

Table 3

23 participants matching the demographics in the section on Participants participated in the usability test. Participants were scheduled for 60-minute sessions. A spreadsheet was used to keep track of the participant schedule.

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 the EHR in a remote, development environment, and 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 and 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 series of tasks were constructed that would be realistic and representative of the kinds of activities a user might do with this EHR, including:

Staff Tasks (Registered Nurses, Licensed Practical Nurses, Medical Assistants)

Task	Goal	Safety Enhanced Design Criteria	Task Criticality / Patient Safety Risk
DEMOGRAPHICS FOR EXISTING PATIENT			
1a. Enter sexual orientation	Enter a sexual orientation for an existing patient	§ 170.315 (a)(5) Demographics	Medium / Low
1b. Enter gender identity	Enter a gender identity for existing patient	§ 170.315 (a)(5) Demographics	Medium / Low
1c. Verify preferred language	Verify a preferred language for an existing patient	§ 170.315 (a)(5) Demographics	Medium / Low
1d. Enter email address	Enter an email address for an existing patient	§ 170.315 (a)(5) Demographics	Medium / Low
1e. Enter cell phone number	Enter a cell phone number for an existing patient.	§ 170.315 (a)(5) Demographics	Medium / Low
CLINICAL RECONCILIATION AND ALLERGY LIST			
2. Add an allergy for reconciliation	Reconcile an allergy that needs to be added to the chart.	§ 170.315 (b)(2) Clinical information reconciliation and incorporation	High / High
3. Add an allergy	Add an allergy to the allergy list.	§ 170.315 (a)(8) Medication Allergy List	High / Medium
4. Add a symptom to an allergy	Add a symptom to an existing allergy.	§ 170.315 (a)(8) Medication Allergy List	High / Medium
CLINICAL RECONCILIATION AND MEDICATION LIST			
5a. Add a medication for reconciliation	Reconcile a medication that needs to be added to the chart Commit the reconciliation changes that will be saved to the chart.	§ 170.315 (b)(2) Clinical information reconciliation and incorporation	High / High
5b. Dismiss a medication for reconciliation	Discontinue a medication that the patient is no longer taking. Commit the reconciliation changes that will be saved to the chart.	§ 170.315 (b)(2) Clinical information reconciliation and incorporation	High / High
6. Discontinue a medication	Discontinue a medication that the patient is no longer taking.	§ 170.315 (a)(7) Medication list	High / High

7a. Add a medication	Find a medication in the search feature. Save the medication selected to the list of medications.	§ 170.315 (a)(7) Medication list	High / High
8. Update a medication SIG	Update the dosage for a medication.	§ 170.315 (a)(7) Medication list	High / High
9. Provide patient information about a medication	Find relevant information to provide to the patient.	§ 170.315 (a)(7) Medication list § 170.315 (a)(9) Clinical decision support	Medium/Low
DRUG-DRUG INTERACTION CHECK / CLINICAL DECISION SUPPORT			
7b. Check for interactions to a medication	Review a medication to see if it has interactions with any current medications.	§ 170.315 (a)(4) Drug-drug, drug-allergy interaction checks § 170.315 (a)(9) Clinical decision support	High / High
DEMOGRAPHICS FOR NEW PATIENT			
10a. Enter first name	Enter a last name for a new patient	§ 170.315 (a)(5) Demographics	Medium / Low
10b. Enter last name	Enter a first name for a new patient	§ 170.315 (a)(5) Demographics	Medium / Low
10c. Enter date of birth	Enter a DOB for a new patient	§ 170.315 (a)(5) Demographics	Medium / Low
10d. Enter birth sex	Enter a birth sex for a new patient	§ 170.315 (a)(5) Demographics	Medium / Low
10e. Enter races (Select two)	Enter a race for a new patient	§ 170.315 (a)(5) Demographics	Medium / Low
10f. Enter ethnicity	Enter an ethnicity for a new patient	§ 170.315 (a)(5) Demographics	Medium / Low
10g. Enter home phone	Enter a phone number for a new patient	§ 170.315 (a)(5) Demographics	Medium / Low

Table 4

Provider Tasks (Physicians and Nurse Practitioners)

Task	Goal	Safety Enhanced Design Criteria	Task Criticality / Patient Safety Risk
PROBLEM LIST			
1. Review active problems	Review the active problems in the problem list.	§ 170.315 (a)(6) Problem list	High / High
2a. Search for a problem	Search and select a problem to be added to the problem list.	§ 170.315 (a)(6) Problem list	High / High

2b. Add to the problem list	Add the problem to the problem list.	§ 170.315 (a)(6) Problem list	High / High
3. Update clinical status of a problem	Update the status of a problem.	§ 170.315 (a)(6) Problem list	Medium / Medium
LAB ORDER			
4. Place an in-office lab order	Search and select a lab test to be ordered.	§ 170.315 (a)(2) Computerized provider order entry – laboratory	High / High
5. Place an out-of-office lab order	Search and select a lab test to be ordered.	§ 170.315 (a)(2) Computerized provider order entry – laboratory	High / High
6. Change a lab order urgency status	Change the urgency level of the lab order.	§ 170.315 (a)(2) Computerized provider order entry – laboratory	High / High
MEDICATION E-PRESCRIBING			
7a. Search for a medication	Search and select a medication to be ordered.	§ 170.315 (a)(1) Computerized provider order entry – medications § 170.315 (b)(3) Electronic prescribing	High / High
7b. Select a dosage	Select a dosage for the medication.	§ 170.315 (a)(1) Computerized provider order entry – medications § 170.315 (b)(3) Electronic prescribing	High / High
7c. Update the sig	Update the sig information to be customized in a different way.	§ 170.315 (a)(1) Computerized provider order entry – medications § 170.315 (b)(3) Electronic prescribing	High / High
7d. Select quantity	Enter the quantity information for the medication.	§ 170.315 (a)(1) Computerized provider order entry – medications § 170.315 (b)(3) Electronic prescribing	High / High
7e. Select refill	Enter a refill number for the medication order.	§ 170.315 (a)(1) Computerized provider order entry – medications § 170.315 (b)(3) Electronic prescribing	High / High
8. Modify the dosage	Update the dosage for the medication.	§ 170.315 (a)(1) Computerized provider order entry – medications § 170.315 (b)(3) Electronic prescribing	High / High
9. Send the medication via eRx	Send the medication to the pharmacy via eRx.	§ 170.315 (a)(1) Computerized provider order entry – medications § 170.315 (b)(3) Electronic prescribing	High / High

10. Find patient information about the medication	Find relevant information to provide to the patient.	§ 170.315 (a)(1) Computerized provider order entry – medications § 170.315 (a)(7) Medication list § 170.315 (a)(9) Clinical decision support	Medium/Low
11. Approve an Rx refill request	Approve an incoming eRx refill request.	§ 170.315 (a)(1) Computerized provider order entry – medications § 170.315 (b)(3) Electronic prescribing	Medium / Medium
12. Cancel an Rx transmission	Cancel an outgoing eRx transmission.	§ 170.315 (a)(1) Computerized provider order entry – medications § 170.315 (b)(3) Electronic prescribing	High / High
DIAGNOSTIC IMAGING			
13a. Select a diagnostic test	Search for and find a diagnostic test to be ordered.	§ 170.315 (a)(3) Computerized provider order entry – diagnostic imaging	High / High
13b. Place a diagnostic test order	Place the order for the diagnostic test selected.	§ 170.315 (a)(3) Computerized provider order entry – diagnostic imaging	High / High
14. Modify the diagnostic order	Update the diagnostic order to change the test type.	§ 170.315 (a)(3) Computerized provider order entry – diagnostic imaging	High / High
DRUG-DRUG INTERACTION CHECK / CLINICAL DECISION SUPPORT			
15. Cancel a medication due to a drug-drug interaction	When a drug-drug alert appears while selecting a medication, cancel the order to protect the patient's safety.	§ 170.315 (a)(4) Drug-drug, drug-allergy interaction checks § 170.315 (a)(9) Clinical decision support	High / High
IMPLANTABLE DEVICE			
16a. Search and select an implantable device	Search and find an implantable device to be added.	§ 170.315 (a)(14) Implantable device list	High / High
16b. Save the implantable device	Commit the implantable device information to the chart.	§ 170.315 (a)(14) Implantable device list	High / High
17a. Review device identifier	Review the device identifier information for the implantable device	§ 170.315 (a)(14) Implantable device list	High / Medium
17b. Review manufacturer	Review the manufacturer information for the implantable device.	§ 170.315 (a)(14) Implantable device list	High / Medium

Table 5

Tasks were selected based on their frequency of use, criticality of function, and alignment to SED Criteria.

Procedures

Upon completion of a Usability Test Agreement and Form W9 (see Appendix 3) for legal consent and accounting purposes, participants were scheduled to participate during a convenient time of their choosing.

All test sessions were administered by a NextGen UX Researcher with 6 years of experience administering usability tests. Remote testing was held in a WebEx meeting environment that allows screen-sharing, audio-conferencing and the ability to take mouse control of another's persons computer.

At the beginning of each session, the UX Researcher provided an introduction to the usability session.

Participants were instructed to:

- Complete the tasks without thinking aloud
- Complete the tasks without assistance except to clarify task details.
- Re-read the task text as necessary after the moderator read each task

Participants were then given instructions on how to interact with the virtual task instructions, to click the "Start" button when they were prepared to begin a task, and to click the "Done" button whenever they felt they had finished the task. "Start" and "Done" buttons were incorporated into an Axure HTML prototype. Task time began once the user clicked the start button. The task time stopped once the participant clicked the done button. All test sessions were recorded and analyzed using WebEx meeting application. While participants completed the tasks, an observer/note taker monitored task times, obtained post-task rating data, and took notes on participant comments. When possible, additional observers/note takers served as the data logger and took notes on task success, path deviations, number and type of errors, and comments. Following completion of all tasks, participants were asked to complete a SUS survey and were debriefed about the study. In addition, participants were able to ask questions about the EHR tested and could also describe any aspects of the EHR product they currently use. At the conclusion of the session, participants were thanked for their time and feedback and were instructed that they would receive a check by email.

Test Location

Test sessions were held remotely via WebEx. The test administrator, 0-10 observers, and participant logged into the session from their various locations. The testing product was located on a remote desktop server that was accessed via VMware Horizon Client Desktop application. All observers and data loggers worked from separate locations where they could see the participant's screen, and listen to the audio of the session.

Test Environment

The EHR would typically be used in a healthcare office or facility. In this instance, the testing was conducted remotely via WebEx. For testing, the moderator used a Retina, 13-inch 2015 MacbookPro, on a 2.9 GHz Intel Core i5 processor. The participants used their own computer, keyboard and mouse when interacting with the EHR.

The application was set up by the NextGen Research team according to the documentation describing the system set-up and preparation. The application itself was running on Windows 2008 using a test environment on a wireless connection. Technically, the system performance (i.e., response time) was somewhat slower than what actual users would experience in a field, web-based implementation.

Test Form and Tools

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

Document / Instrument	Details
Recruiting Screener	Maritz-CX Survey
Informed Consent/Usability Agreement	DocuSign
Moderator's Guide	Microsoft Word
Post-test Questionnaire	Axure HTML prototype
Task List	Axure HTML prototype
Virtual Meeting	WebEx

Remote Connection to EHR Application

VMware Horizon Client 5.4.1

Table 6

Examples of the above-mentioned documents can be found in Appendices 1-4.

The participant's interaction with the EHR was captured and recorded digitally with the WebEx screen capture software running on the test machine. Screen capture recorded user activities, and verbal comments were recorded with a microphone.

Participant Instructions

The moderator shared the following instructions with each participant:

INTRODUCTION

Thank you for taking the time out of your busy schedule to participate in this study. Your input is very valuable. Our total session today will last about 60 minutes.

During this time, I will ask you to complete some tasks using the system. You should do them on your own, following the instructions closely. On completion of each task, you will be given a short survey of how easy or difficult the task was for you.

Please note that we are not testing you, we are testing the system, and so, if you have difficulty, there may be something in the system that we need to improve. I will be here in case you are stuck, but I won't be able to instruct you or provide specific steps on how to use the application.

You may have some general concerns regarding the application that is not specific to the task at hand, and that's fine. We would ask that you hold off on those comments until ALL the tasks are completed. Because we are using a remote environment and Webex, you may experience some delays. Please try to not let that influence your ratings or experience. Also, some of the data may not make clinical sense because it is placeholder data. Try not to let this distract you as well.

We realize you are helping us, and should you feel it necessary, you can withdraw or take a break at any time during the testing, for any reason.

(See the full Moderator's Guide in Appendix 4)

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 MediTouch by measuring participant success rates and errors
2. Efficiency of MediTouch by measuring the average task time and path deviations
3. Satisfaction with MediTouch by measuring ease of use ratings

Data Scoring

The following table (Table 7) details how tasks were scored, errors evaluated, and the time data analyzed.

Measures	Rationale and Scoring
<p>Effectiveness</p> <p>Task Success</p>	<p>A task was counted as a “Success” if the participant could 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. Optimal task performance time, as benchmarked by expert performance under realistic conditions, is recorded when constructing tasks.</p>
<p>Effectiveness</p> <p>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 a “Failure.”</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.¹¹ 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>Efficiency</p> <p>Task Deviation</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. It is strongly recommended that task deviations be reported. Optimal paths (i.e., procedural steps) should be recorded when constructing tasks.</p>
<p>Efficiency</p> <p>Task Time</p>	<p>Each task was timed from when the participant clicked "Start" until the participant clicked "Done." If he or she failed to click "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>Satisfaction</p> <p>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 (SUS). 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 MediTouch overall, the testing team administered the System Usability Scale (SUS) post-test questionnaire. See full System Usability Score questionnaire in Appendix 5.13</p>

Table 7. Details of how observed data were scored.

Results

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 MediTouch are detailed below. The results should be seen

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

Staff Tasks (Registered Nurses, Licensed Practical Nurses, Medical Assistants)

Task	N #	Task Success Mean (SD)	Path Deviation (Observed /optimal)	Task Time Mean (SD)	Task Time Deviations (Observed/ Optimal)	Errors Mean (SD)	Task Ratings 5=easy Mean (SD)
DEMOGRAPHICS							
1a. Enter sexual orientation	11	100% (0)	1.16 13.88/12 Clicks	110.75 Seconds (25.26)	1.42 110/78 Seconds	0% (0)	4.26
1b. Enter gender identity	11	91% (0.95)				9% (0.95)	
1c. Verify preferred language	11	100% (0)				0% (0)	
1d. Enter email address	11	100% (0)				0% (0)	
1e. Enter cell phone number	11	91% (0.95)				9% (0.95)	
CLINICAL RECONCILIATION AND ALLERGY LIST							
2. Add an allergy for reconciliation	11	82% (1.28)	1.88 3.75/2 Clicks	24.63 Seconds (9.29)	1.12 24/22 Seconds	18% (1.28)	4.82
3. Add an allergy	11	100% (0)	1.87 5.60/3 Clicks	30.10 Seconds (11.17)	1.00 30/30 Seconds	0% (0)	4.45
4. Add a symptom to an allergy	11	100% (0)	1.05 5.27/5 Clicks	23.45 Seconds (7.41)	0.65 23/36 Seconds	0% (0)	4.91
CLINICAL RECONCILIATION AND MEDICATION LIST							
5a. Add a medication for reconciliation	11	27% (1.48)	1.75 10.50/6 Clicks	85.00 Seconds (36.77)	1.15 85/74 Seconds	73% (1.48)	2.82
5b. Dismiss a medication for reconciliation	11	27% (1.48)	1.75 10.50/6 Clicks	85.00 Seconds (36.77)	1.15 85/74 Seconds	73% (1.48)	2.82
6. Discontinue a medication	11	82% (1.28)	4.29 4.29/1 Clicks	19.14 Seconds (6.23)	1.28 19/15 Seconds	18% (1.28)	4.36
7a. Add a medication	11	100% (0)	1.30 7.82/6	56.00 Seconds	0.77 56/73	0% (0)	4.27

			Clicks	(31.35)	Seconds		
8. Update a medication SIG	11	91% (0.95)	1.02 6.11/6 Clicks	26.33 Seconds (11.20)	0.77 26/34 Seconds	19% (.95)	4.36
9. Find patient information about a medication	11	73% (1.48)	3.60 7.20/2 Clicks	30.40 Seconds (4.98)	1.52 30/20 Seconds	27% (1.48)	3.27
CLINICAL DECISION SUPPORT / DRUG-DRUG INTERACTIONS							
7b. Check for interactions to a medication	11	100% (0)	1.30 7.82/6 Clicks	56.00 Seconds (31.35)	0.77 56/73 Seconds	0% (0)	4.27
DEMOGRAPHICS FOR NEW PATIENT							
10a. Enter last name	11	100% (0)	1.16 22.00/19 Clicks	147.22 Seconds (22.17)	1.35 147/109 Seconds	0% (0)	4.64
10b. Enter first name	11	100% (0)				0% (0)	
10c. Enter date of birth	11	100% (0)				0% (0)	
10d. Enter birth sex	11	100% (0)				0% (0)	
10e. Enter races (select two)	11	100% (0)				0% (0)	
10f. Enter ethnicity	11	91% (0.95)				9% (0.95)	
10g. Enter home phone	11	100% (0)				0% (0)	

Provider Tasks (Physicians and Nurse Practitioners)

Task	N #	Task Success Mean (SD)	Path Deviation (Observed /optimal)	Task Time Mean (SD)	Task Time Deviations (Observed/ Optimal)	Errors Mean (SD)	Task Ratings 5=easy Mean (SD)
PROBLEM LIST							
1. Review active problems	12	100% (0)	1.71 3.42/2 Clicks	22.25 Seconds (10.74)	0.72 22/31 Seconds	0% (0)	4.58
2. Search for and add a problem to the Problem List	12	92% (0.96)	1.38 8.27/6 Clicks	50.82 Seconds (20.54)	0.69 50/74 Seconds	8% (0.96)	4.17

3. Update clinical status of a problem	12	100% (0)	1.44 1.44/1 Clicks	10.11 Seconds (4.31)	0.81 10/12.5 Seconds	0% (0)	4.83
LAB ORDERS							
4. Place an in-office lab order	12	83% (1.29)	1.20 12.00/10 Clicks	74.38 Seconds (29.33)	1.03 74/72 Seconds	17% (1.29)	2.58
5. Place an out-of-office lab order	12	58% (1.71)	1.53 12.25/8 Clicks	59.00 Seconds (12.51)	1.02 59/58 Seconds	42% (1.71)	2.33
6. Change a lab order status	11	82% (1.28)	1.93 9.67/5 Clicks	38.67 Seconds (22.69)	0.72 39/54 Seconds	18% (1.28)	3.91
MEDICATION E-PRESCRIBING							
7a. Search for a medication	12	100% (0)	0.79 11.83/15 Clicks	56.42 Seconds (18.24)	0.91 56/62 Seconds	0% (0)	4.42
7b. Select a dosage	12	100% (0.00)				0% (0.00)	
7c. Update the sig	12	100% (0)				0% (0)	
7d. Select quantity	12	100% (0.00)				0% (0.00)	
7e. Select refill amount	12	100% (0.00)				0% (0.00)	
8. Modify the dosage	12	100% (0)	1.61 6.45/4 Clicks	20.92 Seconds (9.80)	1.00 21/21 Seconds	0% (0)	4.67
9. Send the medication via eRx	11	100% (0)	1.70 5.09/3 Clicks	29.55 Seconds (10.60)	0.66 30/45 Seconds	0% (0)	4.82
10. Find patient information about the medication	12	83% (1.29)	2.40 4.80/2 Clicks	33.90 Seconds (13.84)	0.97 34/35 Seconds	17% (1.29)	4.33
11. Approve an Rx refill request	12	100% (0)	3.29 6.58/2 Clicks	60.18 Seconds (28.22)	1.09 60/55 Seconds	0% (0)	4.08
12. Cancel an Rx transmission	10	90% (0.95)	1.53 9.17/6 Clicks	63.67 Seconds (19.66)	1.04 64/61 Seconds	10% (0.95)	3.40
DIAGNOSTIC IMAGING							
13. Select and order a diagnostic test	12	92% (0.96)	2.46 22.10/9 Clicks	113.60 Seconds (20.89)	1.16 113/98 Seconds	8% (0.96)	3.50
14. Modify the diagnostic order	12	92% (0.96)	1.47 16.18/11 Clicks	70.55 Seconds (22.67)	1.05 71/67 Seconds	8% (0.96)	4.17
DRUG-DRUG INTERACTION CHECK							

15. Cancel a medication due to a drug-drug interaction	12	100% (0)	2.44 14.67/6 Clicks	67.75 Seconds (23.31)	1.00 68/68 Seconds	0% (0)	4.42
IMPLANTABLE DEVICE							
16. Add an implantable device	12	100% (0)	1.69 6.75/4 Clicks	56.92 Seconds (17.08)	1.00 57/57 Seconds	0% (0)	4.00
17. Review device identifier and manufacturer	12	100% (0)	1.58 3.17/2 Clicks	16.00 Seconds (8.84)	0.70 16/23 Seconds	0% (0)	4.50

Discussion of Findings

Overall Findings

Many tasks experienced high completion rates (90% or higher). The higher scoring tasks include those associated with demographics, problem list, medication and allergy lists, diagnostic imaging labs, e-prescribing, and the implantable device list. It was observed that users were at ease completing these familiar tasks. In the second category of completion rates, those tasks scoring moderately well (75-89%), included the following areas: demographics for existing patient, allergy reconciliation and in-office lab orders. The lowest task completion rates (Below 75%) were logged for the following areas: medication reconciliation (27%), out of office lab orders (58%), and finding patient information for a new medication (73%). Detailed information about each area can be found below.

For most tasks, the click count rates were relatively low, less than 2 times the clicks when compared to the optimal click path. The deviations were somewhat higher when comparing observed to optimal clicks. Those tasks with a deviation between .75 and 1.25 include these areas: demographics, adding an allergy symptom and the medication list. The tasks with a deviation between 1.26 and 1.75 are within these areas: medication reconciliation, drug-drug interactions, problem list, lab orders, updating a dosage, cancelling an Rx transmission, and implantable devices. There were several tasks that had considerable click path deviations (over 1.76), specifically for clinical reconciliation, finding patient information for a medication, diagnostic orders, Rx refill requests and cancelling a medication. Those tasks averaged over 2-3 times the number clicks when compared to the optimal path. Overall, when click counts were higher than expected it was due to participants verifying their actions or adding ancillary steps to the task (ie. adding a problem before creating an order, which is not necessarily required to complete the task accurately).

Time on task deviation rates were low across all tasks. The highest deviation rates were for finding patient information about a medication and completing demographic information tasks but these task

deviations fell within the moderate range of 1.26-1.75. The rest of the tasks scored low on task time deviation and less than 2 times the optimal.

The error rate was low overall, ranging from 0-20% for all tasks, with three exceptions: finding patient information for a new medication (27%), placing an out of office lab order (42%), and medication reconciliation (73%).

The task rating scores were moderately high with 18/26 tasks averaging over 4 points on the 1-5 Likert scale. Those that scored below 4 points include the following: medication reconciliation (2.8), finding patient information for a new medication (3.2), placing lab orders (2.2 and 2.3), updating a lab order (3.91), cancelling an Rx transmission (3.4), and ordering diagnostic tests (3.5).

SUS Scores

Finally, the overall System Usability Scale (SUS) scores are as follows:

- Staff tasks: 84
- Provider tasks: 81.4

Broadly interpreted, scores under 60 represent systems with poor usability; scores over 80 are considered excellent.

Detailed Findings

170.315 (a)(1) CPOE: Medications and 170.315 (b)(3) Electronic Prescribing

CPOE MEDICATIONS AND E-PRESCRIBING							
Task	N #	Task Success Mean (SD)	Path Deviation (Observed /optimal)	Task Time Mean (SD)	Task Time Deviations (Observed/ Optimal)	Errors Mean (SD)	Task Ratings 5=easy Mean (SD)
Providers: 7a. Search for a medication	12	100% (0)	0.79 11.83/15 Clicks	56.42 Seconds (18.24)	0.91 56/62 Seconds	0% (0)	4.42

Providers: 7b. Select a dosage	12	100% (0.00)				0% (0.00)	
Providers: 7c. Update the sig	12	100% (0)				0% (0)	
Providers: 7d. Select quantity	12	100% (0.00)				0% (0.00)	
Providers: 7e. Select refill amount	12	100% (0.00)				0% (0.00)	
Providers: 8. Modify the dosage	12	100% (0)	1.61 6.45/4 Clicks	20.92 Seconds (9.80)	1.00 21/21 Seconds	0% (0)	4.67
Providers: 9. Send the medication via eRx	11	100% (0)	1.70 5.09/3 Clicks	29.55 Seconds (10.60)	0.66 30/45 Seconds	0% (0)	4.82
Providers: 10. Find patient information about the medication	12	83% (1.29)	2.40 4.80/2 Clicks	33.90 Seconds (13.84)	0.97 34/35 Seconds	17% (1.29)	4.33
Providers: 11. Approve an Rx refill request	12	100% (0)	3.29 6.58/2 Clicks	60.18 Seconds (28.22)	1.09 60/55 Seconds	0% (0)	4.08
Providers: 12. Cancel an Rx transmission	10	90% (0.95)	1.53 9.17/6 Clicks	63.67 Seconds (19.66)	1.04 64/61 Seconds	10% (0.95)	3.40

The task completion rates for all the medication and e-prescribing tasks were very high, with almost all tasks receiving a 100%, except for finding patient information about a medication (83%) and cancelling an Rx transmission (90%). The click path deviation rate was moderate except for finding patient information and approving an Rx refill request. The time on task deviation rates were near optimal and the task rating range was high with all over 4 points with the exception of cancelling an Rx transmission, which was a brand-new task for all end users.

Participants stated that finding patient information about a medication is something that they do rarely, yet when prompted to find the information, they did so quite easily, given the multiple path possibilities.

Participant mental models led them to varied paths (PDR, Monograph, Leaflet and the Question mark icon) and no clear preference emerged.

Cancelling an Rx transmission was new but when asked where they would find where to complete this task, it was clearly in their mental models to return to the Medication List. Once there, however, it was

less clear how to complete the task. Finding history and knowing how to use the date ranges proved to be somewhat problematic initially. Participants states an appreciation for the capability to do this type of task within their practice, stating that is something they need to do on occasion and handle with a telephone call.

Participants easily completed the approval for an Rx refill, however, many users stated that this task can be difficult in their own practice because making an exact match to a participant name can be problematic. If they do not remember exactly how to spell a name or if a name includes a hyphen or other character, it becomes difficult to find the patient in the approval list.

170.315 (a)(2) CPOE: Laboratory

LAB ORDERS							
Task	N #	Task Success Mean (SD)	Path Deviation (Observed /optimal)	Task Time Mean (SD)	Task Time Deviations (Observed/ Optimal)	Errors Mean (SD)	Task Ratings 5=easy Mean (SD)
Providers: 4. Place an in-office lab order	12	83% (1.29)	1.20 12.00/10 Clicks	74.38 Seconds (29.33)	1.03 74/72 Seconds	17% (1.29)	2.58
Providers: 5. Place an out-of-office lab order	12	58% (1.71)	1.53 12.25/8 Clicks	59.00 Seconds (12.51)	1.02 59/58 Seconds	42% (1.71)	2.33
Providers: 6. Change a lab order status	11	82% (1.28)	1.93 9.67/5 Clicks	38.67 Seconds (22.69)	0.72 39/54 Seconds	18% (1.28)	3.91

The task completion rates for lab orders were fair, with a range of 58% to 83%. The click deviation rate was high, while the deviation rates for time on task were just shy of optimal. The task ratings were low for placing both in- and out-of-office orders (2.5, 2.3), while changing a lab order status was higher at 3.9.

The click deviation was high for these tasks because providers elected to add a diagnosis or problem to the order, which was not necessary for success with the task. This did provide insight into their everyday use of orders.

Ratings were low and providers seemed to provide ratings based on these tasks as well as previous experience with orders, despite being asked to focus only on the tasks within this study.

Providers stated that they do not always remember where certain types of labs live within the SOAP list. They are unsure whether to click on *New Office Test*, *New Radiology*, *New Consult* or *New Office Test*. Some providers have abandoned creating orders altogether and have their staff do this task.

Three primary usability issues were noted. First, if the user has not used the “Select” button at the top of the screen to indicate “Office” or “Paper”, it is not possible to submit the order. While this requirement is fine, the dialogue box that appears does not provide information that indicates how to fix the problem.

Users do not know how to proceed unless they happen to remember about the “Select” button. Users should be taken to the problem area and the button should be highlighted in some way.

Second, the “Select” button should be labeled to the left of the button and on the button as other buttons within the system. All buttons require a user to ‘select’ it so that word does not indicate the function of that particular button. The words ‘Lab Type’ or ‘Lab Location’ could appear next to the button and the button itself could default to whichever makes sense for the practice, either ‘In-office’ or ‘Out-of-office.’

Finally, if a provider edits an order, (changes the status from Routine to STAT) there is no confirmation of the change. The end user must click back into the order itself to check to see if the change has been saved.

170.315 (a)(3) CPOE: Diagnostic Imaging

DIAGNOSTIC IMAGING							
Task	N #	Task Success Mean (SD)	Path Deviation (Observed /optimal)	Task Time Mean (SD)	Task Time Deviations (Observed/ Optimal)	Errors Mean (SD)	Task Ratings 5=easy Mean (SD)
Providers: 13. Select and order a diagnostic test	12	92% (0.96)	2.46 22.10/9 Clicks	113.60 Seconds (20.89)	1.16 114/98 Seconds	8% (0.96)	3.50
Providers: 14. Modify the diagnostic order	12	92% (0.96)	1.47 16.18/11 Clicks	70.55 Seconds (22.67)	1.05 71/67 Seconds	8% (0.96)	4.17

Ordering Diagnostic tasks scored well for task completion rate, with both tasks at 92%. While the click deviation rate was higher, the deviation for time on task was close to optimal. The task ratings were 3.5 and 4.1.

Providers performed better with radiology lab tasks because they were after the other lab order tasks and because the “Select” button is not required for an imaging order to be completed (unlike the Lab Orders). Ordering a diagnostic imaging test follows a seemingly linear progression from the top of the screen to the bottom of the screen with straightforward lists and prompts.

170.315 (a)(4): Drug-Drug, Drug-Allergy Interaction Checks and 170.315 (a)(9): Clinical Decision Support

CLINICAL DECISION SUPPORT/DRUG-DRUG INTERACTIONS							
Task	N #	Task Success Mean (SD)	Path Deviation (Observed /optimal)	Task Time Mean (SD)	Task Time Deviations (Observed/ Optimal)	Errors Mean (SD)	Task Ratings 5=easy Mean (SD)
Staff: 7b. Check for interactions to a medication	11	100% (0)	1.30 7.82/6 Clicks	56.00 Seconds (31.35)	0.77 56/73 Seconds	0% (0)	4.27
Providers: 15. Cancel a medication due to a drug-drug interaction	12	100% (0)	2.44 14.67/6 Clicks	67.75 Seconds (23.31)	1.00 68/68 Seconds	0% (0)	4.42

The CDS tasks, checking for medication interactions, scored well for both sets of end users, staff and providers. The staff tasks included adding a medication that *would not* cause an interaction alert, and the provider tasks included adding a medication that *would* cause an interaction alert. Providers then had to demonstrate how to “Acknowledge” the interaction and cancel adding that medication. All end users understood that no alert meant no interaction, due to previous familiarity with the product. No usability issues were noted.

170.315 (a)(5): Demographics

Task	N #	Task Success Mean (SD)	Path Deviation (Observed /optimal)	Task Time Mean (SD)	Task Time Deviations (Observed/ Optimal)	Errors Mean (SD)	Task Ratings 5=easy Mean (SD)
DEMOGRAPHICS FOR EXISTING PATIENT							
Staff: 1a. Enter sexual orientation	11	100% (0)	1.16 13.88/12 Clicks	110.75 Seconds (25.26)	1.42 110/78 Seconds	0% (0)	4.26
1b. Enter gender identity	11	91% (0.95)				9% (0.95)	
1c. Verify preferred language	11	100% (0)				0% (0)	
1d. Enter email address	11	100% (0)				0% (0)	
1e. Enter cell phone number	11	91% (0.95)				9% (0.95)	
DEMOGRAPHICS FOR NEW PATIENT							
Staff: 10a. Enter last name	11	100% (0)	1.16 22.00/19 Clicks	147.22 Seconds (22.17)	1.35 147/109 Seconds	0% (0)	4.64
10b. Enter first name	11	100% (0)				0% (0)	
10c. Enter date of birth	11	100% (0)				0% (0)	
10d. Enter birth sex	11	100% (0)				0% (0)	
10e. Enter races (select two)	11	100% (0)				0% (0)	
10f. Enter ethnicity	11	91% (0.95)				9% (0.95)	
10g. Enter home phone	11	100% (0)				0% (0)	

The tasks related to demographics scored well in terms of task completion rate, with all sub-tasks at 100% except three. The three participants who did not achieve a passing score did so because they 1) updated the incorrect cell (home phone instead of cell phone), 2) did not select a gender identity, and 3) selected the incorrect ethnicity.

Click path deviation was minimal and the time on task deviations were moderate. Task ratings were high at 4.2 and 4.6.

The only usability issue noted was that there is no indication that a race can be typed to circumvent needing to scroll through the entire list to find a particular race. All participants scrolled and none tried to type. The recommendation is to include a common convention to indicate that typing is possible, such as a blank field with a cursor.

170.315 (a)(6): Problem List

PROBLEM LIST							
Task	N #	Task Success Mean (SD)	Path Deviation (Observed /optimal)	Task Time Mean (SD)	Task Time Deviations (Observed/ Optimal)	Errors Mean (SD)	Task Ratings 5=easy Mean (SD)
Providers: 1. Review active problems	12	100% (0)	1.71 3.42/2 Clicks	22.25 Seconds (10.74)	0.72 22/31 Seconds	0% (0)	4.58
Providers: 2. Search for and add a problem to the Problem List	12	92% (0.96)	1.38 8.27/6 Clicks	50.82 Seconds (20.54)	0.69 51/74 Seconds	8% (0.96)	4.17
Providers: 3. Update clinical status of a problem	12	100% (0)	1.44 1.44/1 Clicks	10.11 Seconds (4.31)	0.81 10/12.5 Seconds	0% (0)	4.83

Task completion rates for problem list tasks performed well, with a range of 92% to 100%. The click path deviations were just shy of optimal and the time on task deviation was better than optimal. All the problem tasks scored over 4 points on the Likert scale with a range of 4.1 - 4.8.

In terms of usability, Providers stated that they do not use, nor bill with, SNOMED codes and are unsure why they are in the application. They stated that the SNOMED codes become a nuisance and add time to working within the Problem List. Also, if a user types a new problem in the search field then clicks from ICD9 to ICD10, the search field erases the typed problem. The user must re-type the problem before continuing their search through the new list. The user's typed problem should persist.

170.315 (a)(7) Medication List and 170.315 (a)(9) Clinical Decision Support

MEDICATION LIST							
Task	N #	Task Success Mean (SD)	Path Deviation (Observed /optimal)	Task Time Mean (SD)	Task Time Deviations (Observed/Optimal)	Errors Mean (SD)	Task Ratings 5=easy Mean (SD)
6. Discontinue a medication	11	82% (1.28)	4.29 4.29/1 Clicks	19.14 Seconds (6.23)	1.28 19/15 Seconds	18% (1.28)	4.36
7a. Add a medication	11	100% (0)	1.30 7.82/6 Clicks	56.00 Seconds (31.35)	0.77 56/73 Seconds	0% (0)	4.27
8. Update a medication SIG	11	91% (0.95)	1.02 6.11/6 Clicks	26.33 Seconds (11.20)	0.77 26/34 Seconds	19% (.95)	4.36
9. Find patient information about a medication	11	73% (1.48)	3.60 7.20/2 Clicks	30.40 Seconds (4.98)	1.52 30/20 Seconds	27% (1.48)	3.27

Medication List tasks performed very well in terms of completion rates, with the exception of a bit lower rate for finding patient information about a medication. The deviation rate for click count was high for discontinuing a medication and finding information yet low for adding a medication and updating a SIG. The deviation rate for time on task was close to optimal for all tasks. The task ratings were all above 4 except for finding information.

Finding patient information about a medication for a patient proved more difficult because participants stated they do not do this task regularly. Once shown how to find this information, staff were appreciative and a couple stated they will now use the feature more often.

Another issue participants encountered was selecting a prescriber before adding a new medication. For participants in a one- or two- physician practice, they are usually not required to do this and were unsure how to proceed when it was necessary to complete the task in this testing environment. The add new medication button stays grayed out, therefore providing no indication of what should be done to activate it (Note that this is a different convention than within Labs, for which a dialogue box appears if a user has not selected either Office or Paper at the top of the page). A universal 'required fields' convention would improve usability.

170.315 (a)(8): Medication Allergy List

ALLERGY LIST							
Task	N #	Task Success Mean (SD)	Path Deviation (Observed /optimal)	Task Time Mean (SD)	Task Time Deviations (Observed/Optimal)	Errors Mean (SD)	Task Ratings 5=easy Mean (SD)
Staff: 3. Add an allergy	11	100% (0)	1.87 5.60/3 Clicks	30.10 Seconds (11.17)	1.00 30/30 Seconds	0% (0)	4.45
Staff: 4. Add a symptom to an allergy	11	100% (0)	1.05 5.27/5 Clicks	23.45 Seconds (7.41)	0.65 23/36 Seconds	0% (0)	4.91

Allergy List tasks performed very well in terms of completion rates, with 100% for adding an allergy, and 100% for adding a symptom to an allergy. The deviation rate for click count was high for adding an allergy however a lower for adding a reaction to an allergy. The deviation rate for time on task was low for both tasks. The task ratings were 4.45 for adding an allergy, and 4.91 for adding a reaction.

Participants demonstrated ease and familiarity with the screen and stated that it was easy to add the allergy and the symptom. One participant automatically saved the new allergy as a “Favorite” and stated an appreciation for the ease and efficiency of the “Favorite” feature.

One usability issue was noted: When a symptom is typed in, rather than selected from the existing list, that symptom does not appear on the overall allergy list, in-line with the allergy. The only way to see the typed-in symptom is to click into the actual allergy. At a glance, this symptom can't be identified thereby requiring more clicks from the user to see complete information.

170.315 (a)(14) Implantable Device List

IMPLANTABLE DEVICES							
Task	N #	Task Success Mean (SD)	Path Deviation (Observed /optimal)	Task Time Mean (SD)	Task Time Deviations (Observed/ Optimal)	Errors Mean (SD)	Task Ratings 5=easy Mean (SD)
Providers: 16. Add an implantable device	12	100% (0)	1.69 6.75/4 Clicks	56.92 Seconds (17.08)	1.00 57/57 Seconds	0% (0)	4.00
Providers: 17. Review device identifier and manufacturer	12	100% (0)	1.58 3.17/2 Clicks	16.00 Seconds (8.84)	0.70 16/23 Seconds	0% (0)	4.50

The implantable device tasks scored well on all measures, with 100% completion rates, a click path deviation that was close to optimal, and an optimal time on task deviation. The task ratings were 4.0 and 4.5.

Since this was a new screen for all provider participants, the moderator first asked where the participants' mental models would lead them to find implantable devices. Most participants stated they would find them on the Problem List. However, upon seeing them in Surgical History, most felt the placement 'made sense'. They would like to be able to see evidence of an implantable device on the Problem List, too, though, so they do not have to remember to check Surgical History. Once the participants knew where to find implantable devices, they easily added the device and found the device information. It should be noted that the Search feature functions differently than other Search features within the product, in that the user must click Search to yield a return list. Other searches immediately create a return list upon a few letters being typed.

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

CLINICAL RECONCILIATION							
Task	N #	Task Success Mean (SD)	Path Deviation (Observed /optimal)	Task Time Mean (SD)	Task Time Deviations (Observed/ Optimal)	Errors Mean (SD)	Task Ratings 5=easy Mean (SD)
Staff: 2. Add an allergy for reconciliation	11	82% (1.28)	1.88 3.75/2 Clicks	24.63 Seconds (9.29)	1.12 24/22 Seconds	18% (1.28)	4.82
Staff: 5. Add and Dismiss a medication for reconciliation	11	27% (1.48)	1.75 10.50/6 Clicks	85.00 Seconds (36.77)	1.15 85/74 Seconds	73% (1.48)	2.82

Clinical reconciliation tasks proved to be the most challenging for staff participants. The task included reconciling allergies and medications. Participants were asked to add an allergy, then add a medication and dismiss another medication. The task completion rate for adding *and* dismissing a medication for reconciliation was very low at 27%. The click deviation and time deviation were not as significant. The overall task-rating was low at 2.82.

Participants found the area to reconcile both allergies and medications easily, as the tabs appear red, indicating an action is necessary. Adding an allergy for reconciliation had the highest rate of success because there was a single item to work with; just one allergy needed to be imported to the chart. When participants navigated to the medication tab, there were two medications to interact with: one needed to be imported and one needed to be dismissed.

Most participants were ultimately able to determine how to add the one medication, but they were unclear about how to dismiss the other. Participants were unsure about which information to attend to, which areas to click and whether they completed the task accurately. In some cases, participants did not realize that they had not completed the task accurately, indicating a potential patient risk.

It should be noted that this electronic process of reconciliation is not the usual process/usual use case for small, one provider practices. Rather, clinicians are most used to dealing with physical records that are faxed or brought in by the patient and new information is manually entered at the primary care site.

EFFECTIVENESS

MediTouch scored well on many measures of effectiveness. The task completion rates performed moderately well, with 24/27 tasks averaging 82% or higher. Task failures were infrequent, and when occurred, they were due to usability issues that can be addressed by design changes.

The tasks with completion rates over 90% include tasks associated with demographics, problem list, medication and allergy lists, diagnostic imaging labs, e-prescribing, and the implantable device list. It was observed that users were at ease completing these familiar tasks. In the second category of completion rates, those tasks scoring moderately well (75-89%), included the following areas: demographics for existing patient, allergy reconciliation and in-office lab orders. The lowest task completion rates (Below 75%) were logged for the following areas: medication reconciliation (27%), out of office lab orders (58%), and finding patient information for a new medication (73%).

The error rate was low for most tasks, ranging from 0.00 to 0.19 for most tasks. The few tasks with higher error rates scored at 0.27, 0.42 and 0.73 included the areas of finding patient medication information, lab orders, and reconciliation of medications, respectively.

EFFICIENCY

MediTouch scored variably on a task basis on measures of efficiency.

For most tasks, the click count rates were relatively low, less than 2 times the clicks when compared to the optimal click path. The deviations were somewhat higher when comparing observed to optimal clicks. Those tasks with a deviation between .75 and 1.25 include these areas: demographics, adding an allergy symptom and the medication list. The tasks with a deviation between 1.26 and 1.75 are within these areas: medication reconciliation, drug-drug interactions, problem list, lab orders, updating a dosage,

cancelling an RX transmission, and implantable devices. There were several tasks that had considerable click path deviations (over 1.76), specifically for clinical reconciliation, finding patient information for a medication, diagnostic orders, RX refill requests and cancelling a medication. Those tasks averaged over 2-3 times the number clicks when compared to the optimal path. Overall, when click counts were higher than expected it was due to participants verifying their actions or adding ancillary steps to the task (ie. adding a problem before creating an order, which is not necessarily required to complete the task accurately). It was also noted in some instances that extra clicks involved scrolling up and down the screen while looking for action buttons (specifically during reconciliation and ordering lab tasks).

Time on task varied based on task complexity, from 16 seconds to update a problem status on the problem list (which requires 1 click for success) to 147 seconds for entering demographic information (which requires entry in many fields). When comparing observed time on task to optimal time on task, the deviation rates were low across all tasks. The highest deviation rates were for finding patient information about a medication and completing demographic information tasks but these task deviations fell within the moderate range of 1.26-1.75. The rest of the tasks scored low on task time deviation and less than 2 times the optimal. In the cases where there was a higher deviation, there were a few noted explanations: First, users were somewhat slowed due to the remote connection that created some lag time. Second, some of the tasks were brand new to the end user; once the task was completed, however, participants stated that the next time they tried the task it would be easier and faster. Finally, many users would take time after completing the task to review the input carefully before clicking the “done” button.

SATISFACTION

MediTouch scored well on measures of satisfaction. Overall post-task rating scales scored over 4 points (on a scale of 1 to 5, 5 being “very easy”) for 21/27 tasks.

The overall System Usability Score (SUS) was 84 for staff tasks and 81.4 for provider tasks; both scores are considered “excellent” and “above average”.

Major Findings

- § 170.315 (a)(1) Computerized provider order entry – medications
 - Working with medications is user-friendly. Participants appreciate and use the Sig History feature.
- § 170.315 (a)(2) Computerized provider order entry – laboratory
 - Providers stated an annoyance with ordering labs, and in some cases, have abandoned doing this task in favor of having staff members do it for them.
 - Ordering labs involves requires users to remember where to go to order particular types of labs (there are 4 possible choices to click before getting to a list of possible labs) and once they get to the correct screen there are many steps to navigate. In addition, the “Select” button creates a problem because it is not labeled and if not selected, the dialogue box does not provide helpful information.
- § 170.315 (a)(3) Computerized provider order entry – diagnostic imaging
 - Diagnostic imaging orders are easier than other lab orders because the Select button does not appear on the screen (eliminating that potential error) and because the necessary steps are linear, from the top of the screen to the bottom of the screen. The categories and pick lists are easy to use.
- § 170.315 (a)(4) Drug-drug, drug-allergy interaction checks
 - This is a familiar task and users are familiar with the ‘no news is good news’ model that when no alert appears, there is no interaction
 - If an interaction is present, the alert is immediate and easy to see and the options for proceeding are clear
 - The number of buttons for proceeding past an alert could be reduced to one and the button could function as others where multiple clicks yields different actions.
- § 170.315 (a)(5) Demographics
 - Entering new and editing existing demographic information is easy to do and participants stated that having everything on one page made it easy

- Selecting more than one race is cumbersome because it is not apparent that typing is an option and users believe they must scroll through the entire list
- § 170.315 (a)(6) Problem list
 - Providers stated annoyance with SNOMED codes as the default, as they are not used for orders or for billing
- § 170.315 (a)(7) Medication list
 - The only issue participants encountered was selecting a prescriber before adding a new medication. For participants in a one- or two- physician practice, they are usually not required to do this and were unsure how to proceed when it was necessary to complete the task in this testing environment. The add new medication button stays grayed out, therefore providing no indication of what should be done to activate it (Note that this is a different convention than within Labs, for which a dialogue box appears if a user has not selected either Office or Paper at the top of the page). A universal 'required fields' convention would improve usability.
- § 170.315 (a)(8) Medication allergy list
 - Adding and modifying allergies (adding symptoms and onset dates) is easy with the search and list features.
 - Participants expressed appreciation for the *Save as Favorite* feature
 - Typed-in symptoms do not appear on the Allergy list, however, and could create patient health risks.
- § 170.315 (a)(9) Clinical decision support
 - Finding patient information for a medication is only done rarely, or clinicians use other means to search for the information (Google). Once encouraged to find the information however, users readily chose one of the multiple options available.
- § 170.315 (a)(14) Implantable device list
 - Provider mental models indicated they expected to be able to add an implantable device on the Problem List, although they stated that Surgical History made sense, too. They

stated that having the information in the Problem List would be helpful because they may not go to Surgical History as often as the Problem List.

- Adding the device and finding the device identifier and manufacturer was easy for all providers, however, many of their first instincts to find that information was to click on the device name rather than the Action button.
- There are potentially many returns if looking for a particular device. Users will need to be careful when selecting the exact device to add to the Surgical History.
- § 170.315 (b)(2) Clinical information reconciliation and incorporation
 - Participants did not have trouble when reconciling just one allergy or medication. The confusion surfaced when more than one medication appeared and two different actions (import and dismiss) were required. Participants thought they had completed both correctly but in fact had not, potentially increasing patient risk. Redesign the screen so that the possible actions to take are directly aligned to or in close proximity to the medication or allergy.
 - Also, when prompted to select a provider, all users scrolled up expecting the button to be at the top of the screen when the button was below where they were working.
- § 170.315 (b)(3) Electronic prescribing
 - Users knew cancelling an Rx transmission would occur on the Medication List but they were unsure where to go from there and did not know how to use the date range. Once in the cancel area, however, they knew how to select and cancel the medication using the *Action* button.
 - Approving a Rx Refill Request was easy within the testing environment but users expressed difficulty in their own practices because it requires an exact name match, which can become burdensome with hyphens and involved spellings.
 - Sending prescriptions to pharmacies can be problematic, as stated by participants, because the search function uses the zip code as the primary means to search. If the practice only has cross streets or an address, they must remove the zip code.

Appendices

Appendix 1: Recruiting Screener and Initial Correspondence

Hello,

We are recruiting individuals to participate in a usability study for NextGen. We would like to ask you a few questions to see if you qualify and if you would like to participate. This should only take a few minutes of your time. This is strictly for research purposes. If you are interested in the study, you will receive a (\$100/200) for participating in a 60-minute remote study.

If you are interested in participating in this study, and to see if you would qualify, please complete the questions below.

Question	Response
First name:	
Last name:	
Address (Street, City and State):	
Home phone:	
Work phone:	
Cell phone:	
Age:	
Gender:	<input type="radio"/> Female <input type="radio"/> Male <input type="radio"/> Other
Email address:	
When was the last time you participated in a focus group or usability test?	<input type="radio"/> Under 3 months ago <input type="radio"/> More than 3 months ago <input type="radio"/> Never
Do you, or does anyone in your home, work in marketing research, usability research, web design?	<input type="radio"/> Yes <input type="radio"/> No
Do you, or does anyone in your home, have a commercial or research interest in an electronic health record software or consulting company?	<input type="radio"/> Yes <input type="radio"/> No
Which of the following best describes your race or ethnic group?	<input type="checkbox"/> Caucasian <input type="checkbox"/> Asian <input type="checkbox"/> Black/African-American <input type="checkbox"/> Latino or Hispanic <input type="checkbox"/> Native American <input type="checkbox"/> Other
Do you require any assistive technologies to use a	<input type="radio"/> Yes

computer?	<input type="radio"/> No
Which of the following describes your highest level of education?	<input type="radio"/> High school graduate/GED <input type="radio"/> Some college <input type="radio"/> College graduate <input type="radio"/> Master's degree <input type="radio"/> Doctoral degree <input type="radio"/> Other
What is your practice/organization's specialty?	
What is your current position?	<input type="radio"/> Physician <input type="radio"/> Resident <input type="radio"/> RN <input type="radio"/> Medical Assistant <input type="radio"/> Physician Assistant <input type="radio"/> Nurse Practitioner <input type="radio"/> Other
How long have you held this position? (years)	
Describe your work location (or affiliation) and environment?	<input type="radio"/> Private Practice <input type="radio"/> Health System <input type="radio"/> Government Clinic <input type="radio"/> Other
Besides reading email, what professional activities do you do on the computer?	<input type="checkbox"/> Access EHR, research <input type="checkbox"/> Reading news <input type="checkbox"/> Shopping/banking <input type="checkbox"/> Digital pictures <input type="checkbox"/> Programming/word processing <input type="checkbox"/> No computer use at all
How many hours per week do you spend on the computer?	<input type="radio"/> 0-10 <input type="radio"/> 11-25 <input type="radio"/> 26+ hours
What computer platform do you use most frequently?	<input type="radio"/> Mac <input type="radio"/> PC
What internet browsers do you typically use?	<input type="checkbox"/> Firefox <input type="checkbox"/> Internet Explorer <input type="checkbox"/> Chrome <input type="checkbox"/> AOL
In the last month, how often have you used an electronic health record?	<input type="radio"/> Nearly every day <input type="radio"/> 3-5 days per week <input type="radio"/> 1-3 days per week
How many years have you used computers in general? (years)	
How many years have you used an electronic health record?	<input type="radio"/> 0-2 years <input type="radio"/> 2-4 years <input type="radio"/> 4-6 years <input type="radio"/> 6+ years
How many years have you used NextGen EHR? (years)	
How many EHRs do you use or are you familiar with?	<input type="checkbox"/> NextGen <input type="checkbox"/> eClinicalWorks

	<input type="checkbox"/> AllScripts <input type="checkbox"/> Epic <input type="checkbox"/> Practice Fusion
How does your work environment handle patient records?	<input type="radio"/> Entirely on paper <input type="radio"/> Some paper some electronic <input type="radio"/> All electronic
Which of the following tasks do you typically perform on a regular basis?	<input type="checkbox"/> Demographics <input type="checkbox"/> Allergy List <input type="checkbox"/> Medication List <input type="checkbox"/> Clinical Reconciliation <input type="checkbox"/> Clinical Decision Support <input type="checkbox"/> CDS configuration <input type="checkbox"/> Lab orders <input type="checkbox"/> Radiology orders <input type="checkbox"/> Medication e- Prescribing <input type="checkbox"/> Implantable Device List

Thank you very much for answering our questions. We look forward to hearing your feedback!

Initial Correspondence

Thank you for your willingness to participate in our **(MediTouch)** usability research.

Here are a few details about our upcoming study.

When: The week of _____, 2017

Time commitment: 60-minute research session

Compensation: (\$100/\$200)

Where/How: Remotely, using WebEx

Equipment: Laptop/desktop computer and phone (or computer with audio capabilities)

Other Expectations:

- Install WebEx if you do not already have it
- Submit Form W-9 – to be sent upon your willingness to participate
- Sign the Usability Test Agreement – to be sent via Docu-sign upon your willingness to participate

Please reply with your first and second choices for days and times to participate. By doing so, you are also agreeing to sign the Usability Test Agreement at a future date. You may review the attached Agreement before replying.

If you do not wish to receive payment, or your practice prohibits you from doing so, **but you would like to participate without payment**, please reply to this email with your preferred days/times of participation. You will still be required to sign the Usability Test Agreement.

Appendix 2: Participant Demographics

Following is a high-level overview of the participants in this study.

Gender	
Men	4
Women	19
Total Participants	23

Occupation/Role	
Medical Assistant	7
Licensed Practical Nurse	3
Registered Nurse	1
Nurse Practitioner	2
Physician	10

Years of Experience		
Using Computers	0-9 years	2 participants
	10-19 years	8 participants
	20-29 years	9 participants
	30-39 years	3 participants
	40 years	1 participant
Using MediTouch	0-2 years	6 participants
	2-4 years	13 participants
	4-6 years	3 participants
	6+ years	1 participants
In current Role	0-4 years	5 participants
	5-9 years	3 participants
	10-14 years	8 participants
	15-19 years	2 participants
	20+ years	5 participants

Appendix 3: Usability Test Agreement

Each participant was required to sign the Usability Test Agreement via Docu-sign and submit a W-9, per advice from the NextGen legal department. The following Agreement was co-drafted by legal and research staff and approved by legal staff.

Usability Test Agreement

This USABILITY AGREEMENT ("this Agreement") dated as of _____ 2017, is entered into by and between **NextGen Healthcare**. ("Company"), a California, with principal offices at 18111 Von Karman Avenue, Suite 800, Irvine, CA 92612, and _____ ("Customer") with principal offices at _____.

Company and Customer, intending to be legally bound, hereby agree as follows:

Section 1 GENERAL

Company offers Customer the opportunity to participate in a usability test of prior, current and/or new, unreleased versions of applications within the portfolio of NextGen Healthcare's Products and Services, including but, not limited to, NextGen®, Mirth®, QSI®, Entrada® and MediTouch® offerings. (collectively "Application") Testing may consist of onsite

interviews, completion of surveys, and/or remote sessions [e.g. Customer will be provided, via a link to a remote session (e.g. WebEx link), with access to the Application to work with a Company usability designer who will guide Customer through various scenarios, while being recorded) so that Company may analyze Customer's reaction to the application. (collectively "Usability Test")

**Section 2
RESPONSIBILITIES OF VENDOR**

Company shall:

- 2.1 At a scheduled time, furnish Customer with a WebEx link to access the Application for trial use and testing in connection with the Usability Test.
- 2.2 Assist in the connection to the Application by Customer's site in connection with the Usability Test.
- 2.3 Promptly investigate and attempt to resolve, through reasonable commercial efforts, any problem or error reports concerning the Application.

**Section 3
RESPONSIBILITIES OF CUSTOMER**

Customer shall:

- 3.1 Provide a system capable of connecting to the Application via a WebEx link.
- 3.2 Provide troubleshooting, debugging, and maintenance feedback during the Usability Test according to Company's request and detailed instructions.
- 3.3 Provide to Company such further documentation and assistance as may reasonably be required by Company to perform the Usability Test.

**Section 4
OPERATING PROCEDURES; RESERVATIONS**

- 4.1 Company will provide assistance to Customer for access to the Application for purposes of the Usability Test. However, Customer shall be responsible for the management, internal control, and implementation of the Usability Test, including acquiring adequate computer hardware, insuring proper machine configuration, internet access and program installation, and assigning suitable personnel to the Usability Test
- 4.2 Company is under no obligation to make any changes or modifications to the Application suggested by Customer. Company reserves the right, with or without prior notice, to discontinue work on the Application or to revise the Application so it provides different Applications, Applications in different combinations, and/or different environment configurations.

**Section 5
RENUMERATION**

- 5.1 Company shall reimburse Customer for the time it spends in their performance of the Usability Test at a rate mutually agreed to by the parties, which will be (\$100 or \$200/hour).
- 5.2 Upon completion of the Usability Test, Company will remit payment to Customer within 45 days from Company's receipt of the timesheet.

**Section 6
LIMITATIONS ON WARRANTY AND LIABILITY**

- 6.1 THE APPLICATIONS PROVIDED IN THIS USABILITY TEST ARE NOT A FULLY TESTED PRODUCT OFFERING, AND HAS NOT BEEN COMPLETED ACCORDING TO VENDOR'S NORMAL DEVELOPMENT PROCEDURES. CUSTOMER'S USE OF THE APPLICATION IS AT CUSTOMER'S SOLE RISK; THE APPLICATION AND ASSOCIATED DOCUMENTATION MAY CONTAIN DEFECTS, FAIL TO COMPLY WITH APPLICABLE SPECIFICATIONS, ANY MAY PRODUCE UNINTENDED OR ERRONEOUS RESULTS WHEN OPERATED IN COMBINATION WITH OTHER VENDOR PRODUCTS. CUSTOMER ACCESS TO THE APPLICATION IS PROVIDED "AS IS", WITHOUT ANY WARRANTY WHATSOEVER
- 6.2 IN NO EVENT WILL VENDOR BE LIABLE FOR DAMAGES OF ANY KIND (DIRECT, INDIRECT, INCIDENTAL OR CONSEQUENTIAL) RESULTING FROM RUNNING THE USABILITY TEST, EVEN IF IT HAS BEEN ADVISED OF THE POSSIBILITY OF SUCH DAMAGE.

**Section 7
OWNERSHIP AND CONFIDENTIALITY**

- 7.1 Company shall have sole and exclusive ownership of all right, title, and interest in and to the Application(s) and any additions or modifications thereto arising during the Usability Test or as a result of any other collaboration between Company and Customer (including their respective personnel), all media and

documentation relating to such additions or modifications, and all intellectual property rights associated therewith (including, without limitation, rights to copyrights, trade secrets, or know-how). Upon Company's request, Customer agrees to execute such further instruments and take such further action as Company may reasonably request to effect ownership of any such modifications.

- 7.2 Customer agrees to maintain in confidence the Application(s) and all media and documentation that relate to the design, development, operation, testing or use of the Application or any additions or modifications thereto. Customer agrees to use the same security measures as it uses to protect its own confidential technical information, provided that such measures shall be at least commercially reasonable for such purpose. Customer further agrees not to disclose such information to anyone other than those of its employees, and such contractors as Company may approve, under nondisclosure obligations who have a need to know such information in connection with the Usability Test. Upon completion of the Usability Test, unless Customer and Company enter into a further signed, written license agreement for the extended use of the Application, Company can de-activate the log on and password provided to Customer and Customer agrees to return all media and documentation containing such information, and Customer further agrees to certify its compliance with such obligation if requested by Company. The foregoing confidentiality obligations shall not apply to any information generally available to the public, independently developed or obtained without reliance on Company's information, or approved for release by Company without restriction.
- 7.3 Company shall have and may cumulatively exercise all rights as it might have at law or in equity for the protection of Software and Documentation, including an injunction enjoining the breach or threatened breach of this Section.
- 7.4 Customer grants permission for Company to record Customer's use of the Application during the remote session and use such recording (including any audio and/or written or oral dialogue associated therewith, and the information arising therefrom for Company's internal analysis of the Application.

Section 8 TERMINATION

- 8.1 Either party may terminate the Usability Test and this Agreement at any time, and for any reason, during the testing.
- 8.2 Upon expiration or termination of the Usability Test for any reason, provided that Customer has not entered into a License Agreement with Company on mutually agreeable terms for the ongoing use of the Application, Company may immediately de-activate Customer's log-on and password to the Application and Customer shall immediately return all copies of the Application, the Application Users Guide and System Documentation, and any media and documentation that relate to the design, development, operation, testing or use of the Application or any additions or modifications thereto, if any such material was provided to Customer. Customer agrees to certify its compliance with the foregoing promptly upon Company's request.

Section 9
MISCELLANEOUS

- 9.1 Company may refer to Customer by name in advertising and promotional materials in connection with Customer's participation in the Usability Test.
- 9.2 The provisions of Sections 4 and 5 shall survive termination of this Agreement.
- 9.3 This Agreement shall be governed by and construed in accordance with the laws of the State of California, County of Orange, without regard for principles of choice of law.
- 9.4 This Agreement constitutes the complete and exclusive statement of the agreement of the parties with respect to the subject matter hereof, and supersedes all prior oral and written proposals, representations, or other communication related to the subject matter hereof. The Application and the actions and commitments of Company with respect thereto shall not be construed as being directly or indirectly covered by or subject to any other agreement between Customer and Company.

IN WITNESS WHEREOF, the undersigned parties have caused, under seal, their authorized representatives to execute and deliver this Agreement as effective the date and year first above written.

ACCEPTED BY:

Customer:

Name:
Title:
Date:

Appendix 4: Moderator's Guide & Tasks

Administrator:
Data Logger:
Date:
Time:
Participant ID:
Location:

Prior to testing:

- Confirm schedule with participants
- Ensure remote environment is working properly
- Ensure equipment is working properly

Pre-test checklist:

- Start remote desktop and access the MediTouch testing links
- Login with the appropriate provider or staff login, open relevant screens
- Make sure placeholder data is correct
- Open Axure HTML prototype (task instructions)

September 2017

- Start Webex meeting.
- Welcome participant when he/she arrives
- Make sure participant has submitted User Testing Agreement
- Record the WebEx meeting

Method:

- Remote with WebEx

Equipment:

1. A MacbookPro laptop with webcam and microphone
2. Use Microsoft Remote Desktop to access the development server
3. Axure prototype for the task list
4. Dummy patient accounts for each specialty

User assessment schedule:

Notes on logistics: Individual Sessions last 60 minutes per session, and all sessions are recorded.

Research goals:

The primary goal is to have the user go through each task for each criteria listed for SED certification, and gather feedback on the following:

- Ease and effectiveness of use
 - Path Deviations
 - Task Time
 - Task Ratings
 - Error Score
- Task success rate
- Satisfaction scores
- Verbal feedback on general usability

INTRODUCTION

Thank you for taking the time out of your busy schedule to participate in this study. Your input is very valuable. Our total session today will last about 60 minutes.

During this time, I will ask you to complete some tasks using the system. You should do them on your own, following the instructions closely. On completion of each task, you will be given a short survey of how easy or difficult the task was for you.

Please note that we are not testing you, we are testing the system, and so, if you have difficulty, there may be something in the system that we need to improve. I will be here in case you are stuck, but I won't be able to instruct you or provide specific steps on how to use the application.

You may have some general concerns regarding the application that is not specific to the task at hand, and that's fine. We would ask that you hold off on those comments until ALL the tasks are completed. Because we are using a remote environment and Webex, you may experience some delays. Please try to not let that influence your ratings or experience. Also, some of the data may not make clinical sense because it is placeholder data. Try not to let this distract you as well.

We realize you are helping us, and should you feel it necessary, you can withdraw or take a break at any time during the testing, for any reason.

Before passing the control over to you, I want to explain how the task instructions works.

When you're ready, please click on the 'Start' button. When you're done with the task, please click on the 'Done' button to continue to the next task.

I will read the instruction for you first, and then you can feel free to re-read the scenario out loud or quietly in your head. When you are ready, click 'start'.

I'm going to pass control over to you. You will see an alert window that asks for you to take remote control. Click on the "Take Control" button.

Staff (RN, LPN, MA) Tasks

Scenario:

Monica Latte is a female who is an existing patient at Gumdrop Medical Center in Aurora, Colorado. She has been with the clinic for over a year. However, last Saturday she went to an Urgent Care due to a sore throat and high fever that lasted more than three days.

At the Urgent Care, they also observed high BP and recommend a follow up visit at her PCP for HTN screening.

Demographics Update

Task 1. Some of Monica's demographic information has changed. Please update the following:

- Gender identity: Identifies as female
- Sexual orientation: Straight or heterosexual
- Preferred language: English (participants verify this as already included)
- Email: monica.latte@gmail.com
- Cell phone: 313-243-2384

Clinical Reconciliation and Allergy List

Task 2. Because Monica has visited another clinic, you need to incorporate the new information Reconcile the allergies:

- Import codeine.

Task 3. You need to add to the allergy list.

- Add soy

Task 4. You need to update an allergy.

- Update Codeine to include nausea as a reaction. Use today's date as the onset date.

Clinical Reconciliation and Medication List

Task 5. Now you are ready to reconcile the medications.

- Dismiss Zithromax.
- Import Atenolol 50mg.

Task 6. You need to update Monica's medication list.

- Change the status of Xanax to Discontinued.

Task 7. You need to add to Monica's medication list.

- Add Lisinopril 10mg tablet.
- Determine if any drug-drug interactions appear.

Task 8. Update the Lisinopril SIG to 1 tablet by mouth daily.

Task 9. Monica is asking questions about her new medication, Lisinopril.

- Find information that you can share with her.

Add Demographics

Task 9. You need to register a new patient. Add Ayasha Morrison and include the following demographic information:

- First name: Ayasha
- Last name: Morrison
- DOB: 03/15/2000
- Birth sex: female
- Race: American Indian and Chippewa
- Ethnicity: Not Hispanic or Latino
- Phone: (123) 456-7890

Provider (Physician, Nurse Practitioner) Tasks

Scenario:

Monica Latte is a female who is an existing patient at Gumdrop Medical Center in Aurora, Colorado. She has been with the clinic for over a year. However, last Saturday she went to an Urgent Care due to a sore throat and high fever that lasted more than 3 days.

At the Urgent Care, they also observed high BP and recommend a follow up visit at her PCP for HTN screening.

Problem List

Task 1. What are Monica's current active problems?

Task 2. Add Essential Hypertension to the Problem List.

Task 3. Update Type II Diabetes to reflect the following:

- Type: Chronic
- Status: Active

Labs

Task 4: Review the Health Maintenance Alerts. You notice that Monica is due for a Hemoglobin A1C.

- Order an office test: Routine Hemoglobin A1C

Task 5. You would also like to order a routine lab for Monica's diabetes. This will have to be done out of office.

- Order a Glucose Tolerance Test (GTT) for her diabetes type 2.

Task 6. You want to make sure the Hemoglobin A1C order is completed quickly.

- Change the Hemoglobin A1C Test order urgency to “STAT”

Medications/Electronic Prescribing

Task 7. Monica’s glucose level is still high. You need to add Glyburide.

- Add 2.5mg Glyburide
- Sig: 1 tablet by oral route 2 times every day with food
- Quantity: 30
- Refills: 1

Task 8. You decide to change the Glyburide Sig.

- Change to 2 tablets, 2 times daily; quantity 30 and refills 1.

Task 9. Send the Glyburide prescription to “CA Pharmacy 10.6 MU”.

Task 10. Monica is asking questions about Glyburide.

- Find information about the medication that you can share with her.

Task 11. In Pharmacy Alerts, you notice an Rx Refill Request for Zestril.

- Review and Approve the Refill Request for Zestril.

Task 12. You would like to cancel Acetaminophen. You want to cancel the transmission of the prescription to the pharmacy.

- Cancel Acetaminophen. The Rx History Start Date is 7/7/2017.

Scenario:

A new patient, Lisa O'Brien is your next patient of the day. She is a walk-in. She has come into the clinic for frequent urination, as well as coughing and labored breathing. You have already ordered a urine culture.

Radiology

Task 13. You need to order a diagnostic imaging test for Lisa's coughing and difficulty breathing.

- Order an in-office Abdominal and Pelvic CT with contrast.

Task 14. You decide to change the order.

- Change the order to 71550 – MRI Chest without dye.

Drug-Drug Alert

Task 15. You would like to order a medication for Lisa.

- Order Bactrim 400-80 mg tablet.
- Determine if any drug-drug interactions appear.
- If there are interaction, you decide not to prescribe Bactrim.

Implantable Device List

Task 16. Lisa has an implantable device that is not listed in her chart.

- Add Viva Quad XT CRT-D US DF4.

Task 17. You need to access information about the implantable device:

- Find the Device Identifier and the Company Name.

Appendix 5: Error Analysis

Scenario	Error Analysis (indicate presence of potential safety issues)
Clinical Reconciliation	<p><i>Potential patient safety issues noted below</i></p> <ul style="list-style-type: none"> • Participants were successful with just one item on an allergy or medication list to reconcile. However, when more than one item needs reconciling, and when each item requires a different action, participants were unable to reconcile both, confused by the amount of information on the screen as well as the many potential actions to take. Allergies and medications may not be accurately reconciled which would lead to an inaccurate medication list.
Clinical Decision Support	<p><i>No patient safety issues observed</i></p> <ul style="list-style-type: none"> • Both staff and providers showed some difficulty finding patient information for a new medication, due to this being a rarely performed task. Having access to this information in-line with the specific medication is helpful. Participants demonstrated a variety of instincts about where to find this information (first clicks occurred on all possibilities: PDR, Leaflet, Monograph, and the? icon.). • While identifying drug-drug alerts is a common task and participants were familiar with the fact that no alert means no interaction, there is no messaging that indicates there is no interaction to assure the clinician the new medication is safe to prescribe.
Allergy List	<p><i>Potential patient safety issues noted below</i></p> <ul style="list-style-type: none"> • Staff participants noted that when an allergy symptom is typed in, rather than selected from the pick list, that typed in symptom does not appear on the full Allergy List. Clinicians must click into the drug to identify all symptoms. An at-a-glance look at the initial overall allergy list does not provide complete information about allergies.
Medication List	<p><i>Potential patient safety issues noted</i></p> <ul style="list-style-type: none"> • The only issue participants encountered was selecting a prescriber before adding a new medication. For participants in a one or two physician practice, they are usually not required to do this and were unsure how to proceed when it was necessary to complete the task in this testing environment. There is no

	<p>system indication of how to proceed and should be changed to improve usability.</p> <ul style="list-style-type: none"> • One participant did mention that “Additional Sigs”, that are added and not part of the pick list, do not appear correctly after the transmission to the pharmacy and often confuse pharmacies.
Demographics	<i>No patient safety issues observed</i>
Problem List	<p><i>No patient safety issues observed</i></p> <ul style="list-style-type: none"> • Providers stated that the default to SNOMED codes is a nuisance, is annoying and makes the Problem List more tedious and cumbersome to use.
Medication e-Prescribing	<p><i>Potential patient safety issues noted</i></p> <ul style="list-style-type: none"> • Participants stated that matching patient names when responding to a Rx refill request is burdensome, as the match must be exact (hyphens, spaces...) and if the exact match can't be found they are forced to exit this task, return to the chart to find DOB and the exact way the name is in the system before returning to the Refill Request.
Labs	<p><i>No patient safety issues observed</i></p> <ul style="list-style-type: none"> • Participants did not know or remember that they needed to choose either Paper or Office before proceeding with the lab order. While this impedes success with the task, it does not create a patient safety issue.
Radiology	<i>No patient safety issues observed</i>
Implantable Device List	<p><i>Potential patient safety issues noted</i></p> <ul style="list-style-type: none"> • There are potentially many returns if looking for a particular device. Users will need to be careful when selecting the exact device to add to the Surgical History. • Providers expected implantable devices to live within the Problem List, stating that they may not remember to go to Surgical History for every encounter. The Problem List provides an at-a-glance look at the whole patient and providers stated they would also want to see implanted devices here.

Appendix 6: System Usability Scale Questionnaire

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

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Summary of Performance *with Confidence Intervals for Completion Rates*

Staff Tasks (Registered Nurses, Licensed Practical Nurses, Medical Assistants)

Task	N #	Task Success Mean (SD)	Task Success	Confidence Interval We can be 95% confident the completion rate is between... ...for the population, at large.	Task Ratings 5=easy Mean (SD)
1a. Enter sexual orientation	11	100% (0)	11 out of 11	70 and 100%	4.26
1b. Enter gender identity	11	91% (0.95)	10 out of 11	60 and 100%	
1c. Verify preferred language	11	100% (0)	11 out of 11	70 and 100%	
1d. Enter email address	11	100% (0)	11 out of 11	70 and 100%	
1e. Enter cell phone number	11	91% (0.95)	10 out of 11	60 and 100%	
2. Add an allergy for reconciliation	11	82% (1.28)	9 out of 11	51 and 96%	4.82
3. Add an allergy	11	100% (0)	11 out of 11	70 and 100%	4.45
4. Add a symptom to an allergy	11	100% (0)	11 out of 11	70 and 100%	4.91
5a. Add a medication for reconciliation	11	73% (1.48)	8 out of 11	42 and 90%	2.82
5b. Dismiss a medication for reconciliation	11	27% (1.48)	3 out of 11	9.2 and 57.1%	2.82
If 8 out of 11 users encounter a particular problem, you can be 95% confident between 42.9% and 90.8% of all users will encounter the problem					
6. Discontinue a medication	11	82% (1.28)	9 out of 11	51 and 96%	4.36
7a. Add a medication	11	100% (0)	11 out of 11	70 and 100%	4.27

8. Update a medication SIG	11	91% (0.95)	10 out of 11	60 and 100%	4.36
9. Find patient information about a medication	11	73% (1.48)	8 out of 11	42 and 90%	3.27
7b. Check for interactions to a medication	11	100% (0)	11 out of 11	70 and 100%	4.27
10a. Enter last name	11	100% (0)	11 out of 11	70 and 100%	4.64
10b. Enter first name	11	100% (0)	11 out of 11	70 and 100%	
10c. Enter date of birth	11	100% (0)	11 out of 11	70 and 100%	
10d. Enter birth sex	11	100% (0)	11 out of 11	70 and 100%	
10e. Enter races (select two)	11	100% (0)	11 out of 11	70 and 100%	
10f. Enter ethnicity	11	91% (0.95)	10 out of 11	60 and 100%	
10g. Enter home phone	11	100% (0)	11 out of 11	70 and 100%	

Table 1

Provider Tasks (Physicians and Nurse Practitioners)

Task	N #	Task Success Mean (SD)	Task Success	Confidence Interval We can be 95% confident the completion rate is between... ...for the population at large.	Task Ratings 5=easy Mean (SD)
1. Review active problems	12	100% (0)	12 out of 12	71 and 100%	4.58
2. Search for and add a problem to the Problem List	12	92% (0.96)	11 out of 12	62.5 and 100%	4.17
3. Update clinical status of a problem	12	100% (0)	12 out of 12	71 and 100%	4.83
4. Place an in-office lab order	12	83% (1.29)	10 out of 12	54 and 96.5%	2.58

5. Place an out-of-office lab order	12	58% (1.71)	7 out of 12	31.9 and 80.7%	2.33
If 5 out of 12 users encounter a particular problem, you can be 95% confident between 19% and 68% of all users will encounter the problem					
6. Change a lab order status	11	82% (1.28)	9 out of 11	51 and 96%	3.91
7a. Search for a medication	12	100% (0)	12 out of 12	71 and 100%	4.42
7b. Select a dosage	12	100% (0.00)	12 out of 12	71 and 100%	
7c. Update the sig	12	100% (0)	12 out of 12	71 and 100%	
7d. Select quantity	12	100% (0.00)	12 out of 12	71 and 100%	
7e. Select refill amount	12	100% (0.00)	12 out of 12	71 and 100%	
8. Modify the dosage	12	100% (0)	12 out of 12	71 and 100%	4.67
9. Send the medication via eRx	11	100% (0)	11 out of 11	70 and 100%	4.82
10. Find patient information about the medication	12	83% (1.29)	10 out of 12	54 and 96.5%	4.33
11. Approve an Rx refill request	12	100% (0)	12 out of 12	71 and 100%	4.08
12. Cancel an Rx transmission	10	90% (0.95)	9 out of 10	57 and 100%	3.40
13. Select and order a diagnostic test	12	92% (0.96)	11 out of 12	62.5 and 100%	3.50
14. Modify the diagnostic order	12	92% (0.96)	11 out of 12	62.5 and 100%	4.17
15. Cancel a medication due to a drug-drug interaction	12	100% (0)	12 out of 12	71 and 100%	4.42
16. Add an implantable device	12	100% (0)	12 out of 12	71 and 100%	4.00
17. Review device identifier and manufacturer	12	100% (0)	12 out of 12	71 and 100%	4.50

Table 2