



Nexus EHR 7.0 Usability Test Report

Nexus Clinical LLC



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1 EXECUTIVE SUMMARY

Usability tests of Nexus EHR V7.0 were conducted between 12/16/2017 - 01/15/2018 and 03/12/2018 – 03/27/2018 by Nexus Clinical Support team. The purpose of this test was to validate usability of Nexus EHR. For this usability tests 10 healthcare professionals matching target demographic criteria were selected as participants and were asked to perform tasks in a test environment of Nexus EHR V7.0.

The study collected performance data of 12 measures:

- 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) Medical 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 tests were conducted with each participant in a 45 min one-on-one session with moderator. Participants have prior experience with Nexus EHR.

Following type of data was collected with each participant –

- Successful completion of task
- Time to complete task
- Number of errors
- Path deviations
- Participant's satisfaction rating of the system to perform the task
- Participants Suggestions (if any)



Following the conclusion of testing participants were asked post-test questionnaire and compensated with \$0 for their time.

2 INTRODUCTION

The EHR Under Test (EHRUT) tested for this study was Nexus EHR V7.0. Nexus EHR is designed for multi-specialty healthcare providers in ambulatory or urgent care setup.

Purpose of this testing was to test and validate usability of current user interface and provide evidence of usability in EHRUT.

3 METHOD

3.1 PARTICIPANTS

A total of 10 participants were tested on Nexus EHR. Participants were not compensated for their time. Participants were given opportunity to have same orientation and level of training as actual users would have received.

For recruitment purpose end-user characteristics were identified and translated into a recruitment screener used to solicit potential participants. Example screener is provided in Appendix 1.

Recruited participants had mix of backgrounds and demographic characteristics conforming to recruitment screener. Following is the table of participants by characteristics including demographics, professional, computer and product experience.

ID	Gender	Age (Yrs)	Education	Occupation/Role	Computer Exp (mth)	Professional Exp (mth)	Product Exp (mth)	Use Assistive Tech
1	F	20-29	Some College, No degree	Admin Staff	144	120	48	N
2	F	30-39	Master's Degree	Admin Staff	240	120	36	N
3	F	30-39	Bachelor's Degree	Admin Staff	240	96	48	N
4	F	20-29	Bachelor's	MA	180	48	36	N



			Degree					
5	M	50-59	MD	MD	300	420	36	N
6	F	50-59	Some College, No degree	LPN	360	336	36	N
7	M	40-49	MD	MD	300	84	6	N
8	F	30-39	Master's Degree	Admin Staff	300	120	18	N
9	F	30-39	Some College, No degree	Admin Staff	300	144	36	N
10	F	20-29	Some College, No degree	MA	180	96	36	N

The participants were scheduled for an online test using RingCentral meeting. The participants were debriefed by moderator at start of session.

3.2 STUDY DESIGN

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

During the usability test, participants interacted with EHR. Each participant used the same system 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 within the allotted time without assistance
- Time to complete the tasks
- Number and types of errors
- Path deviations



- Participant's verbalizations (comments, if any)
- Participant's satisfaction ratings of the system

3.3 TASKS

A number of tasks were constructed that would be realistic and representative of the kinds of activities a user might do with this EHR. The parameters for selection of tasks are frequency of use, criticality of function and possibility of errors. The tasks were prioritized according to risk associated with user errors.

List of tasks that users were asked to perform including the subtasks and their risk rating is given below.

Task ID	Task Description	Risk Associated
a.1-1	Computerized provider order entry – Order Medications a. Order Medication via CPOE	Medium/High
a.1-2	Computerized provider order entry – Change Medications a. Change Medication b. View changed medication	Medium/High
a.2-1	Computerized provider order entry – Order Lab a. Order Lab via CPOE	Low/Medium
a.2-2	Computerized provider order entry – Change Lab Order a. Change Lab order b. View changed lab order	Low/Medium
a.3-1	Computerized provider order entry – Order Diagnostic Imaging a. Place Diagnostic Imaging order via CPOE	Low/Medium
a.3-2	Computerized provider order entry – Change Diagnostic Imaging Order a. Change Imaging Order b. View changed imaging order	Low/Medium
a.4-1	Drug-drug, drug-allergy interaction checks a. Order Medication	High



	b. View drug-drug and drug-allergy interaction alerts for a patient	
a.4-2	Drug-drug, drug-allergy interaction - Adjust severity level a. Adjust severity level of interaction from eRx settings	High
a.5-1	Demographics – Add Patient Demographics Information a. Create New Patient and record demographics information (date of birth, birth sex, language, race, ethnicity, sexual orientation, gender identity)	Low/Medium
a.5-2	Demographics – Add Patient Demographics Information a. Change demographics information (date of birth, birth sex, language, race, ethnicity, sexual orientation, gender identity) b. View changed demographics information	Low/Medium
a.6-1	Problem list – View/Add Patient Problem a. View Active Problem List b. Add Problem for patient	High
a.6-2	Problem list – Change Problem a. Change Patient Problem	High
a.6-3	Problem List – View Problem History List a. View Problem History List of patient	Low
a.7-1	Medication list – View and Add Medication a. View medication list for a patient b. Add Medication	High
a.7-2	Medication list – Change/Discontinue Medication a. Change/Discontinue Medication	Medium/High
a.8-1	Medication allergy list – View/Add Allergy a. View allergy list for a patient	Medium/High



	b. Add medication allergy	
a.8-2	Medication allergy list – Change Allergy/View History a. Change medication allergy b. View allergy history list	Medium/High
a.9-1	Clinical Decision Support – View alerts a. View alerts triggered due to patient conditions and view bibliographic citation of the resources on which alert is configured i. Demographics information ii. Medication iii. Problems iv. Lab Order v. Medication and Age	Low/Medium
a.9-2	Clinical decision support – View Vitals alert a. Add vitals to patient and view CDS alert related to vitals b. View bibliographic citation, funding source and release date of CDS alert	Low/Medium
a.9-3	Clinical Decision Support – View medical knowledge base using Infobutton standard a. View intervention/resources based on patient age and gender b. View intervention/resources based on patient problem c. View intervention/resources based on patient medication i. View bibliographic citation for the resource	Low/Medium
a.14-1	Implantable device list – View/Add Implantable Device	High



	<ul style="list-style-type: none"> a. Add implantable device to patient record b. View device description, identifiers and attributes from device details 	
a.14-2	Implantable device list – Deactivate Device <ul style="list-style-type: none"> a. Access device list and deactivate device 	Medium/High
b.2-1	Clinical information reconciliation and incorporation - Import and Reconcile <ul style="list-style-type: none"> a. Import C-CDA file b. Reconcile Medications from C-CDA file with current medication c. Reconcile Allergies from C-CDA file with current Allergies d. Reconcile Problems from C-CDA file with current Problems 	High
b.2-2	Clinical information reconciliation and incorporation – Generate C-CDA <ul style="list-style-type: none"> a. Generate C-CDA file for Patient with all current and historical/reconciled data. 	Low
b.3-1	Electronic prescribing – Transmit Prescription <ul style="list-style-type: none"> a. Prescribe medication for a patient and transmit it electronically to pharmacy 	High
b.3-2	Electronic prescribing – Change Prescription <ul style="list-style-type: none"> a. View and respond to change medication request from pharmacy b. View fill status of medication 	Medium
b.3-3	Electronic prescribing – Request History <ul style="list-style-type: none"> a. Request medication history of a patient for last 12 months 	Low/Medium
b.3-4	Electronic prescribing – Cancel Prescription	Medium



	a. Cancel medication transmitted electronically to pharmacy	
b.3-5	Electronic Prescribing – Renew Prescription a. Accept renewal request for a medication received from pharmacy	Medium

3.4 PROCEDURE

All test sessions were held using RingCentral Meeting environment that allows screen sharing, audio conferencing and ability to take control of another person's computer. Participants operated from their own office location using their own computer. Participants were given instruction on how to interact with task instructions and inform the moderator when they are done with the task. Moderator started counting time after task instruction was given and counted time till participant informed the task was done. After each task was completed moderator obtained post-task rating data. Following completion of all tasks, participants were asked to complete SUS survey. At conclusion of session participants were thanked for their time and feedback.

3.5 TEST LOCATION

Test sessions were held remotely via RingCentral Meeting. Test administrator/moderator and participant logged into session from their own locations. The participant shared his/her screen to be able to monitor the activities during tasks. The tested product was made available on a testing URL.

3.6 TEST ENVIRONMENT

The participants typically participated from clinic or healthcare office. The testing was conducted remotely via RingCentral Meeting.

Moderator used Dell laptop with Intel core i5 processor and the participants used their own computer.

The application was setup of a staging URL which can be publicly accessed.

3.7 TEST FORMS AND TOOLS

During usability tests, various documents and instruments were used, including:

- RingCentral meeting (virtual meeting)
- Recruitment Screener
- Moderator Guide
- System Usability Survey



3.8 PARTICIPANT INSTRUCTIONS

The administrator informed following instructions aloud to each participant:

Thank you for participating in this study. Your input is very valuable to us. Our session today will last about 45-60 minutes. You will be using the Nexus EHR 7.0.

During this time, I will ask you to complete a few tasks using the system. You should complete these tasks on your own, and do them normally as if you are working with the system on a regular day at the practice. On completion of each task, you will be given a short survey of how easy or difficult the task was for you, and whether you have any feedback.

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. We are interested in how easy, or how difficult, this system is to use.

Don't hesitate to be honest with your opinions. 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.

3.9 USABILITY METRICS

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

The goals of the test were to assess:

1. Effectiveness of Nexus EHR 7.0 by measuring participant success rates and errors
2. Efficiency of Nexus EHR 7.0 by measuring the average task time and path deviations
3. Satisfaction with Nexus EHR 7.0 by measuring ease of use ratings

3.10 DATA SCORING

Effectiveness: Task Success	A task is counted as success if participant was able to achieve correct outcome without assistance within the time allotted per task basis
Efficiency: Path Deviation	Participant's path deviation is counted if the path to completion required more steps than optimal path due to following incorrect link, use of



	incorrect action and steps to correct incorrect actions. Path deviations were recorded and compared with optimal path.
Efficiency: Task Time	Each scenario was timed from when the administrator said 'Begin' until the participant said 'Done' for the task. Only the times for scenarios where all subtasks were included in the average task time analysis.
Satisfaction: Task Rating	After each task the participant was asked to rate the individual task. Rating 1 indicated that participant found task to be extremely difficult while rating 5 indicated the task was extremely easy.

4 RESULTS

4.1 DATA ANALYSIS AND REPORTING

Results of usability test were calculated according to usability metrics section above. Test results provided an analysis of the use, tested performance and error rates in order to identify risk prone errors – with a potential likelihood of occurrence and adverse consequences

Task Name	Task Success		Path Deviation		Task Time			Errors		Rating	
	Mean %	SD	Observed	Optimal	Mean	SD	Optimal	Mean %	SD	Mean	SD
a.1-1 Computerized provider order entry – Order Medications	100	0	0.7	0	33.3	12.8	25	0	0	4.9	0.3
a.1-2 Computerized provider order entry – Change Medications	100	0	0.1	0	36.6	6.87	30	0	0	4.9	0.3



a.2-1 Computerized provider order entry – Order Lab	100	0	0.4	0	36.1	21.63	25	0	0	4.4	0.8
a.2-2 Computerized provider order entry – Change Lab Order	100	0	0.3	0	39.9	13.57	30	0	0	4.5	0.67
a.3-1 Computerized provider order entry – Order Diagnostic Imaging	100	0	0.3	0	31.5	13.76	20	0	0	4.4	0.8
a.3-2 Computerized provider order entry – Change Diagnostic Imaging Order	100	0	0.2	0	34.7	10.88	30	0	0	4.4	0.8
a.4-1 Drug- Drug, Drug- Allergy Interaction	100	0	0	0	28.8	7.64	20	0	0	4.7	0.46
a.4-2 Drug- Drug, Drug- Allergy Interaction – Change Severity Level	100	0	0	0	21.2	3.57	15	0	0	4.9	0.3
a.5-1 Demographics – Add Patient demographic information	100	0	0	0	87.0	29.32	60	0	0	4.7	0.46



a.5-2 Demographics – Change demographic information	100	0	0	0	88.8	19.03	70	0	0	4.8	0.4
a.6-1 Problem list – View/Add Patient Problem	100	0	0.3	0	13.3	7.39	10	0	0	5	0
a.6-2 Problem List – Change Problem	100	0	0	0	16.5	3.26	15	0	0	5	0
a.6-3 Problem List – View Problem History List	100	0	0.1	0	20.1	3.81	15	0	0	4.9	0.3
a.7-1 Medication List – View/Add Medication	100	0	0	0	33.7	4.31	25	0	0	5	0
a.7-2 Medication List – Change/Discon tinue Medication	100	0	0	0	22.9	3.18	15	0	0	4.9	0.3
a.8-1 Medical Allergy List – View/Add Medication Allergy	100	0	0	0	19.6	7.02	15	0	0	4.6	0.66
a.8-2 Medical Allergy List – Change Medication Allergy	100	0	0	0	27.5	7.5	20	0	0	4.4	0.66



a.9-1 CDS – View Alerts	100	0	0	0	45	11.49	30	0	0	4.6	0.49
a.9-2 CDS - View Vitals Alert	100	0	0.1	0	37.9	15.83	25	0	0	5	0
a.9-3 CDS – View Knowledgebase	100	0	0	0	86.4	11.94	70	0	0	4.2	0.6
a.14-1 Implantable Device List – View/Add Device	90	0.3	0.8	0	27.6	9.01	20	10	0.3	4.5	0.67
a.14-2 Implantable Device List – Change Status	100	0	0	0	21.3	4.31	15	0	0	4.6	0.49
b.2-1 Clinical Reconciliation – Reconciliation	100	0	0.6	0	71.1	18.37	60	0	0	4.1	0.7
b.2-2 Clinical Reconciliation – Generate CCDA	100	0	0	0	25	4.29	20	0	0	4.7	0.46
b.3-1 Electronic Prescription – Transmit Prescribing	100	0	0.4	0	64.2	23.89	50	0	0	4.5	0.5
b.3-2 Electronic Prescription – Change Medication and Fill Status	100	0	0.2	0	61.1	8.96	50	0	0	4	0.63
b.3-3 Electronic	100	0	0	0	42.4	8.32	30	0	0	4.8	0.4



Prescription – History											
b.3-4 Electronic Prescription – Cancel Prescription	100	0	0	0	24.9	3.36	20	0	0	4.7	0.46
b.3-5 Electronic Prescription – Renew Prescription	100	0	0.2	0	23.4	3.88	15	0	0	4.8	0.4

4.2 DISCUSSION OF FINDINGS

Effectiveness

For all the tasks percentage task success is 90-100%. Path deviation is low deviation or none for most of the tasks with no or very few errors.

Efficiency

Path deviation is low for most of the tasks. However participants had a feedback of too many clicks to complete few tasks like CPOE – Labs, CPOE – Imaging, Demographics etc. Few tasks took longer to complete for some users as they have not used these frequently in their day-to-day use.

Satisfaction

With given statics by participants, they have expressed higher satisfaction rating between (averaging from 4.1 to 5) for each task.

The results from the SUS (System Usability Scale) scored the subjective satisfaction with the system based on performance with these tasks to be: 84

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

Risk Analysis

As listed in “Section 3.3: Tasks” above, the tasks selected for testing were prioritized/assessed for patient safety risk based on impact of user errors. Any task that updates patient medical information carries high risk, the task that has no or very low impact on patient medical information is rated at low risk.



As presented in “Section 4.1: Data analysis and reporting” above, all tasks done by participants had success rating of 90%-100%, this shows high performance for the tasks.

Error rate observed was nil except for “add implantable device” task where the rate was 10% as one user was not able to complete the task. Considering the population size of participants the error rate is low which indicates that likely hood of occurrence of errors during the critical tasks is low.

The satisfaction ratings and SUS scores by participants indicate that participants found system to be user friendly and easy to use.

This analysis indicates that system has very low risk of patient safety related errors for the areas and tasks selected for the usability study and the EHR is easy to use for users.

Summary of Major Findings

Participants found Nexus EHR easy to use and navigate for completing their day to day tasks. User interface is friendly, intuitive, unambiguous and easily adaptable. There are some areas of improvements as discussed in later section based on user feedback. These improvements will make software even more efficient and intuitive. Some of the deviation and time lags observed during testing can be reduced by training users on new and/or less used modules.

Areas of Improvement

1. Improve Race and Ethnicity selection on demographics screen
2. Improve Order Superbill screen to reduce number of clicks to place lab/radiology order.
3. Improve workflow of clinical data reconciliation procedure.
4. Better visibility of fill status in ePrescription module

5 APPENDICES

5.1 RECRUITMENT SCREENER

Demographic Information

1 User ID:

2 Credentials:

3 Highest Level of Education:

a) High school graduate/GED



- b) Some college
- c) College graduate
- d) Postgraduate
- e) Other

4 Organization:

5 Primary Work Location:

6 Contact method (please provide one of the following):

- a) Work phone
- b) Cell phone
- c) E-mail

7 What is your gender?

- a) Male
- b) Female
- c) Other / decline to answer

8 Which of these best describes your current age?

- a) <20
- b) 20-29
- c) 30-39
- d) 40-49
- e) 50-59
- f) 60-69
- g) 70-79
- h) >80

Additional Information

9 Is English your first language?



- a) Yes
 - b) No
- 10 Are you a fluent English speaker? [if No, disqualify]
- a) Yes
 - b) No
- 11 Due to logistical restraints and the parameters of this study, we cannot provide assistive technologies during the testing session. Do you require any assistive technologies to disqualify use a computer? [If yes, disqualify]
- a) Yes
 - b) No
- 12 "Do you, or does anyone in your household, have a commercial interest in an electronic health record software or consulting company? [If yes, disqualify]"
- a) Yes
 - b) No
- 13 How many years of experience do you have using computers for personal and professional activities (such as email, shopping, record keeping, etc.)?
- a) <5 years
 - b) 5-10 years
 - c) 10-20 years
 - d) >20 years
- 14 What is your current role? [if not Physician, Nurse, or MA, disqualify]
- a) Admin Staff
 - b) Licensed Practical Nurse (LPN)
 - c) Medical Assistant (MA)
 - d) Nurse
 - e) Nurse Practitioner (NP)
 - f) Physician



- g) Physician Assistant (PA)
 - h) Front Desk
 - i) Other (please specify)
- 15 Do you currently provide direct patient care? [if No, disqualify]
- a) Yes
 - b) No
- 16 Do you work primarily in an Ambulatory, Emergency Department, or Inpatient setting? [if Inpatient or Emergency Department, disqualify]"
- a) Ambulatory
 - b) Emergency Department
 - c) Inpatient
- 17 What is your specialty? [if role is Physician and specialty is Radiology, Ophthalmology or Pathology, disqualify]
- 18 How many years have you been working in your field?
- a) <5 years
 - b) 5-10 years
 - c) 10-20 years
 - d) >20 years
- 19 Have you participated in Nexus Clinical EHR usability testing previously?
- a) Yes
 - b) No
- If yes, please describe.
- 20 How do you capture patient data in your organization? [if Primarily on paper, disqualify]
- Primarily on paper
 - Primarily electronically
- 21 Is Nexus Clinical the EHR you use most often in your organization? [if No, disqualify]



a) Yes

b) No

22 How long have you been using Nexus Clinical? [if <3 months, disqualify]

23 How frequently do you use Nexus Clinical? (daily, weekly, monthly)

5.2 PARTICIPANT DEMOGRAPHICS

Gender	
Male	2
Female	8
Total	10

Occupation/Role	
Administrator	5
LPN	1
MA	2
MD	2
Total	10

5.3 MODERATOR GUIDE

Participant ID:

Date:

Time:

Location:

Prior to testing:

- Confirm schedule with participant



- Ensure test environment is working properly
- Setup RingCentral Meeting for the test duration

Pre-test checklist:

- Access Nexus EHR V7.0
- Login to Nexus EHR
- Make sure dummy data is correct
- Start RingCentral Meeting
- Welcome participant when he/she arrives
- Record participant demographics

Method

- Remove RingCentral Meeting

Environment:

- Dell Laptop PC for Moderator
- Participants own computer
- Dummy practice credentials for testing on Nexus EHR V7.0 environment



5.4 SYSTEM USABILITY TEST QUESTIONNAIRE

System Usability Scale			
Rate the Functionality			
<i>This scale measures your overall impression of the functionality you tested today.</i>			
1 - Strongly Disagree 2 – Disagree 3 – Neutral 4 – Agree 5 – Strongly Agree			
I think that I would enjoy using this system if I had to use it frequently	<input type="text"/>		
I found the system unnecessarily complex	<input type="text"/>		
I thought the system was easy to use	<input type="text"/>		
I think I would need the support of a technical person to be able to use the system	<input type="text"/>		
I found the various functions in this system were well integrated	<input type="text"/>		
I thought there was too much inconsistency in this system	<input type="text"/>		
I would imagine that most people would learn to use this system very quickly	<input type="text"/>		
I found the system very cumbersome to use	<input type="text"/>		
I felt very confident using the system	<input type="text"/>		
I need to learn a lot about this system before I could effectively use it	<input type="text"/>		