



# Usability Test Report

Kantime Health V1.0



Report based on NISTIR7742 Format for Usability Test Reports

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## Executive Summary

A usability test of Kantime Health, Version 1.0, was conducted virtually by Kanrad Technologies during a 3-day time window in January 2023. The purpose of this study was to test and validate the usability of the current user interface and to provide evidence of usability in the EHR Under Test (EHRUT).

Kanrad Technologies incorporates User Experience into our Software Development Lifecycle (SDLC) by collaborating with our UX (User Experience) team and with our clients. Together, we work towards a safety-enhanced design that is core to patient safety, increased individual effectiveness and efficiency, and decreased user errors. Our user centered design process is integrated into the SDLC to ensure a safety-enhanced design. The User Centered Design process that is utilized at Kanrad Technologies Kantime Health solution is NISTIR 7742. This standard is the common industry standard for usability test reports. This format includes the following steps: description of the product, goals of the test, test participants, tasks the users were asked to perform, experimental design of the test, the method or process by which the test was conducted, the usability metrics and data collection methods, and the numerical results. This process is used because it very closely aligns with the requirements for safety-enhanced design. It also provides the most clarity on what the best practice is for execution of each step.

Ten participants of varying experience levels completed the following tasks, which were reflective of frequently used tasks in the application:

- Record CPOE Medication Order
- Change CPOE Medication Order
- Access CPOE Medication Order
- Record Lab order via CPOE
- Change Lab order via CPOE
- Display changed CPOE Lab order
- Record Imaging order via CPOE
- Change imaging order via CPOE
- Display changed CPOE imaging order
- Using CPOE, trigger a drug-allergy interaction by entering a new medication order
- Using CPOE, trigger a drug-drug interaction by entering a new medication order
- Adjust the severity level of a displayed drug-drug interaction
- Add a CDS intervention and/or reference resource for each of the required elements: Problem List, Medication List, Medication Allergy List, at least one Demographic, Laboratory Test, Vital Signs, and a Combination of at least 2 of the elements above
- Trigger the CDS interventions/resources added using the applicable data elements from each of the required elements
- View the intervention/resource information using the Infobutton standard for data elements in the problem list, medication list, and demographics
- Trigger the CDS interventions/resources based on data elements in the problem list, medication list, and medication allergy list by incorporating patient information from a transition of care/referral summary

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- Access the following attributes for one of the triggered CDS interventions/resources: bibliographic citation, developer, funding source, release/revision date
  - Record a patient's demographics
  - Change a patient's demographics
  - Display a patient's demographics
  - Incorporate a CCDA and conduct reconciliation of the medications, medication allergies, and problems in the CCDA with the information currently in the patient's record
  - Generate a new CCDA with reconciled data
  - Record UDI
  - Change UDI status
  - Access UDI, Device Description, Identifiers and Attributes
  - E-prescribe New Prescription
  - Change Prescription (dosage or duration)
  - Cancel Prescription
  - Refill Prescription
  - Receive Fill Status Notification
  - Request and Receive Medication History Information

The test sessions were recorded to assist in measuring results. Experienced usability specialists conducted the unmoderated exam and compiled the metrics. Key metrics that were tracked include task success, task errors, path deviations, task time, task rating, and SUS score. With an average 94% task completion rate, a less than 1 minute (58 secs) average task time, and very easy to use task ratings, we concluded that Kantime Health is indeed built with safety-enhanced design based on the three criterias: Efficiency, Effectiveness, and Satisfaction.

## Introduction

The EHRUT tested for this study was Kantime Health V1.0. Designed to present medication, laboratory, radiology, ePrescribe, demographics, clinical decision support, implantable device, and clinical reconciliation to healthcare providers in outpatient settings, Kantime Health provides our users with an efficient workflow to review, add, and change medical information. The usability testing attempted to represent realistic scenarios and conditions. The purpose of this study was to test and validate the usability of the current user interface, and to provide evidence of usability in the EHRUT. To this end, measures of effectiveness, efficiency, and user satisfaction, such as were captured during the usability testing.

## Method

### Participants

Ten users participated in this study. We targeted users with clinical backgrounds in our recruitment emails, which can be seen in Appendix [1]. Our target users had clinical backgrounds



so that we could be confident that the results are accurate and aligned with real-world end users. Additionally, our target users were not directly involved in the development of the EHRUT, and these participants were not compensated. We used participants with varying professional experience and licenses, computer experience levels, and experience with the product. We used these varying experience levels because we understand that in a real-world setting, users would have varying computer and product experience levels. The table in Appendix [2] represents the demographics that were collected from each participant.

## Study Design

Overall, the objective of this study 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 one EHR. Each participant used the system under similar conditions and were provided with the same instructions. The system was evaluated for effectiveness, efficiency, and satisfaction as defined by measures collected and analyzed for each participant:

- Task success rate
- Task errors
- Path deviation
- Task time
- Participant verbalizations
- Task rating
- SUS score

Participants were given instructions for the testing (available in Appendix [4]) and a short explanation of what the scenarios entail. They were also given the ability to ask questions before the testing window began. The instructions were recorded and were made available for participants to reference. This usability study was unmoderated and conducted in one session. Participants leveraged Google Meet, a tool for web conference meetings. Since the study was unmoderated, the participants were given a 3-day timeframe to complete the study. As an unmoderated study, participants were given the opportunity to ask clarifying questions within a Google group Chat.

## Tasks

Each participant was given the set of tasks below, which reflect tasks that a user of the application would complete. The tasks were chosen because of their importance with regards to safety and frequency of use in the application. The participants were welcome to ask questions and to refer to the recorded instructions. Below are the scenarios that were given to participants:

## Scenario 1:

### **Record Demographics (§170.315(a)(5))**

User records Patient Demographic as follows:

1. First Name - Edward
2. Last Name - Harrison
3. Middle Name - A
4. Suffix - Jr
5. Previous Name - Rema
6. Gender - Male
7. DOB - 01/08/1965
8. SSN - 234-43-8013
9. Marital Status - Married
10. Race Category - American Indian or Alaska Native
11. Race - Apache
12. Ethnicity Group - Hispanic or Latino
13. Ethnicity - Gallego
14. Preferred Language - Avestan

### **Change Demographics (§170.315(a)(5)),**

User changes Patient Demographic as follows:

1. First Name - Eddy
2. Last Name - Harry
3. Middle Name - C
4. Suffix - Sr
5. Previous Name - Rocky
6. Gender - Unknown
7. DOB - 01/08/1958
8. SSN - 123-47-6543
9. Marital Status - Annulled
10. Race Category - Asian
11. Race - Abenaki
12. Ethnicity Group - Unknown
13. Ethnicity - Asturian
14. Preferred Language - Acoli

### **View Demographics (§170.315(a)(5))**

User accesses Patient Demographic as follows:

1. First Name - Eddy
2. Last Name - Harry
3. Middle Name - C
4. Suffix - Sr
5. Previous Name - Rocky
6. Gender - Unknown
7. DOB - 01/08/1958
8. SSN - 123-47-6543

9. Marital Status - Annulled
10. Race Category - Asian
11. Race - Abenaki
12. Ethnicity Group - Unknown
13. Ethnicity - Asturian
14. Preferred Language - Acoli

### Scenario 2:

#### **Record diagnostic imaging order (§170.315(a)(3))**

- MRI chest w/o contrast material

#### **Change diagnostic imaging order (§170.315(a)(3))**

- MRI chest w/o & w/contrast material

#### **View diagnostic imaging order (§170.315(a)(3))**

- MRI chest w/o & w/contrast material

### Scenario 3:

#### **Record lab order (§170.315(a)(2)),**

- Cholesterol in HDL in serum or plasma

#### **Change lab order (§170.315(a)(2)),**

- Cholesterol in LDL in serum or plasma by direct assay

#### **View lab order (§170.315(a)(2)),**

- Cholesterol in LDL in serum or plasma by direct assay

### Scenario 4:

#### **Record UDI (§170.315(a)(14)),**

The UDI recorded is as below:

UDI - (01)10884521062856(11)141231(17)150707(10)A213B1(21)1234

#### **Access UDI, device description, identifiers, and attributes (§170.315(a)(14)),**

The parsed results are as follows:

1. Issuing Agency - GS1
2. Lot Number - A213B1
3. Serial Number -
4. Date of Manufacturing - 12/31/2014
5. Date of Expiry - 07/07/2015
6. HCT/P Code - Doesn't have HCT/P Code
7. Brand Name - Viva™ Quad XT CRT-D

8. Version Number - DTBA1QQ
9. Company Name - MEDTRONIC, INC
10. Labeled as containing rubber/latex - No
11. MRI Safety Information - Labeling does not contain MRI Safety Information
12. Snomed Code - 704708004
13. GMDNPT Name - Doesn't have GMDNPT Name

#### **Change UDI Status (§170.315(a)(14))**

User changes UDI status to INACTIVE.

Status - Inactive

#### Scenario 5:

#### **Record medication/medication list (§ 170.315(a)(1)),**

User records medication orders as follows:

- cefTRIAxone 250 mg injection twice daily

#### **Change medication (§ 170.315(a)(1)),**

User changes medication orders (highlighted in **bold**):

- Ceftriaxone 500 MG/ML **twice daily**

#### **View medication/medication list (§ 170.315(a)(1)),**

User accesses medication orders:

- Ceftriaxone 250 MG/ML **twice daily**

#### Scenario 6:

#### **View drug drug interactions (§170.315(a)(4)),**

User records medication orders as follows:

- Digoxin
- Amiodarone
- Verapamil

#### **Under Review Drugs check drug drug interactions.**

It should show all the interactions severity levels

- Mild
- moderate
- severe



### **Change severity level for drug-drug interactions (§170.315(a)(4))**

Modify the severity to show only severe drug interactions

Verify that Review drugs only show severe drug interactions.

### **View drug-allergy interactions (§170.315(a)(4))**

Add an allergy for “**Valproic acid-like drug**” in KRX, which causes allergy for the particular patient, along with the severity and save

Add “depkote” as a medication medication from the “Add Medication” tab, user will get a pop-up which displays the allergy information.

Click on “I agree to continue with selected medication” and click on “continue” button, finish entering the RX and save

By clicking on the “Show interactions” button, will be able to see the Drug-allergy interactions.

### **Scenario 7:**

#### **New, cancel, change, fill e-prescribe (§170.315(b)(3)).**

Transmit new e-prescription

**Lisinopril 20 mg tablet oral** (NDC/RxNormCode - 00093-1114-01/104378)

1 Tablet oral daily in the morning

Once you add this medication, it will appear in pending medication. Select and transmit Rx.

The transmitted medication will appear in the queue.

#### **Cancel Prescription §170.315(b)(3),**

- Transmit new e-prescription

**Lisinopril 20 mg tablet oral** (NDC/RxNormCode - 00093-1114-01/104378)

1 Tablet oral daily in the morning

1. Once you add this medication, it will appear in pending medication. Select and transmit Rx.
2. The transmitted medication will appear in the queue.

**Refill Prescription §170.315(b)(3),**

Send a Renewal request from Pharmacy and click on the “Rx” icon on the respective medication.

To send the Renewal response, go to the Fill status section and click on the respective medication.

Scroll to the bottom of the window, enter the “Total Number of Refills approved” and click on the “Approve” button

**Receive Fill Status Notification §170.315(b)(3),**

Send a Rx Fill request from Pharmacy and click on the “Rx” icon on the respective medication

Scroll down to Fill Details to view the Fill status and status description

**Request and Receive Medication History Information §170.315(b)(3)**

User go to “MHR” tab and scroll down to “Medication History from Other Sources: Surescripts”

Select History duration and click on the “Fetch from Surescripts” to view the Medication History

**Scenario 8:****Incorporate a CCDA and conduct reconciliation of the medications, medication allergies, and problems in the CCDA with the information currently in the patient's record (§170.315(b)(2)),**

Data added by user in the CDA Application are as follows:

1. Medication - Acne Medication 5% gel topical (RxNorm : 1020030 | NDC : 00536-1055-56)
2. Allergy - Nitrogen mustard derivative
3. Problem - H05.111 - Granuloma of right orbit
4. IMD - Cardiac resynchronization therapy implantable defibrillator

Data added by user from the Reconciliation list by importing a CCD File are as follows:

1. Medication -
  - a. Tylenol Extra Strength 500 mg oral tablet (RxNorm : 209459)
  - b. Acne Medication 5% gel topical (RxNorm : 1020030 | NDC : 00536-1055-56)
2. Allergy -
  - a. Penicillin G Procaine
  - b. Ampicillin
3. Problem -
  - a. E66.3 - Overweight
  - b. R50.9 - Fever, unspecified



### **Generate a new CCDA with reconciled data (§170.315(b)(2))**

Data populated in CCD file generated after adding data from Reconciliation list and from the application are as follows:

1. Medication -
  - a. Tylenol Extra Strength 500 mg oral tablet (RxNorm : 209459)
  - b. Acne Medication 5% gel topical (RxNorm : 1020030 | NDC : 00536-1055-56)
  - c. Acne Medication 5% gel topical (RxNorm : 1020030 | NDC : 00536-1055-56)
2. Allergy -
  - a. Penicillin G Procaine
  - b. Ampicillin
  - c. Nitrogen mustard derivative
3. Problem -
  - a. E66.3 - Overweight
  - b. R50.9 - Fever, unspecified
  - c. H05.111 - Granuloma of right orbit
4. IMD -
  - a. Cardiac resynchronization therapy implantable defibrillator

### **Scenario 9:**

#### **Add a CDS intervention (§170.315(a)(9)),**

Under the Setup tab we have CDS Rules where you can set up these rules. Change Roles to see how they are saved.

#### **Triggered CDS interventions (§170.315(a)(9))**

Choose a patient and see the recommendations under the Clinical recommendation button. Should be age appropriate triggered by the health issue assigned.

#### **Trigger the CDS interventions/resources by incorporating patient information from a transition of care/referral summary (§170.315(a)(9)),**

Once the health issue E66.3 - Overweight from the example above is incorporated then we should be able to see additional recommendations

#### **View the intervention/resource information using the Infobutton standard (§170.315(a)(9))**

#### **Access attributes (§170.315(a)(9))**

Click on the hyperlink to launch information related

## Risk Analysis Framework

Risk Analysis Framework Risk assessment for each task involves assessing the Likelihood of Risk Occurrence and the Significance of Risk Materialization (referred to as Likelihood and Significance, respectively). Overall risk for each task is then categorized as High, Moderate, or Low.

Likelihood is determined by a combination of two factors: Frequency of Workflow and Possibility of Alternative Outcome. Frequency of Workflow reflects the general prevalence of a specific or closely analogous workflow. Possibility of Alternative Outcome is an assessment of the likelihood that a variation might occur during a specific or closely analogous workflow.

Significance is the measurement of the impact of possible outcomes that result from a variation from an expected task workflow. Impact of possible outcomes of each task was determined in consultation with clinicians and other subject matter experts.

A comprehensive table of factors used to evaluate Likelihood and Significance is available in Appendix [6].

## Risk Based Scenario Creation

Scenarios were created to emphasize moderate to high-risk tasks. Table [1] illustrates how Likelihood and Significance contribute to overall risk

		Significance		
		Low	Moderate	High
Likelihood	High	Moderate Risk	Moderate Risk	High Risk
	Moderate	Moderate Risk	Moderate Risk	High Risk
	Low	Low Risk	Moderate Risk	Moderate Risk

**Table [1] Overall Risk Assessment**

Risk Analysis of tasks was prepared in advance of the study and is summarized in Table [2] below.

Scenario	Risk Level	Task
Scenario 1	Moderate	Record Demographics (§170.315(a)(5))
Scenario 1	High	Change Demographics (§170.315(a)(5))

Scenario 1	Low	View Demographics (§170.315(a)(5))
Scenario 2	Moderate	Record diagnostic imaging order (§170.315(a)(3))
Scenario 2	High	Change diagnostic imaging order (§170.315(a)(3))
Scenario 2	Low	View diagnostic imaging order (§170.315(a)(3))
Scenario 3	Moderate	Record lab order (§170.315(a)(2))
Scenario 3	High	Change lab order (§170.315(a)(2))
Scenario 3	Low	View lab order (§170.315(a)(2))
Scenario 4	Moderate	Record UDI (§170.315(a)(14))
Scenario 4	Low	Access UDI, device description, identifiers, and attributes (§170.315(a)(14))
Scenario 4	Moderate	Change UDI Status (§170.315(a)(14))
Scenario 5	High	Record medication/medication list (§ 170.315(a)(1))
Scenario 5	Moderate	Change medication/medication list (§ 170.315(a)(1))
Scenario 5	Low	View medication/medication list (§ 170.315(a)(1))
Scenario 6	Moderate	View drug drug interactions (§170.315(a)(4))
Scenario 6	Low	Change severity level for drug-drug interactions (§170.315(a)(4))

Scenario 6	High	View drug-allergy interactions (§170.315(a)(4))
Scenario 7	Moderate	New Prescription (§170.315(b)(3))
Scenario 7	High	Cancel Prescription §170.315(b)(3)
Scenario 7	High	Refill Prescription §170.315(b)(3)
Scenario 7	Low	Receive Fill Status Notification §170.315(b)(3)
Scenario 7	Low	Request and Receive Medication History Information §170.315(b)(3)
Scenario 8	High	Incorporate a CCDA and conduct reconciliation of the medications, medication allergies, and problems in the CCDA with the information currently in the patient's record (§170.315(b)(2))
Scenario 8	Moderate	Generate a new CCDA with reconciled data (§170.315(b)(2))
Scenario 9	Moderate	Add a CDS intervention (§170.315(a)(9))
Scenario 9	Moderate	Triggered CDS interventions (§170.315(a)(9))
Scenario 9	Low	Trigger the CDS interventions/resources by incorporating patient information from a transition of care/referral summary (§170.315(a)(9))
Scenario 9	Low	Access attributes (§170.315(a)(9))
Scenario 9	Low	View the intervention/resource information using the Infobutton standard (§170.315(a)(9))

## Procedure

Participants gathered in advance of the test wave to obtain instructions and training from the moderator. Each participant reviewed and signed a Non-Disclosure Agreement and Informed Consent Form (See Appendix [3]) via normal and electronic signature both. To ensure the test ran smoothly, staff members and the moderator were available to answer questions during each of the 3-day testing windows. Participants were told to plan for approximately 45 minutes of uninterrupted time to conduct all tasks in the meeting. Moderator used google sheet for updating data related to task success, path deviation, task error, task time, task rating, and SUS score.

Participants were instructed to perform the tasks (see specific instructions below):

- During the 3-day window that the study is available
- In one sitting and without interruption
- Without assistance, but the moderator could give immaterial guidance and clarification on tasks

Directions were provided step-by-step via google group chat. The test consisted of 3 components:

- The opening demographics questionnaire
- The study itself
- Post-test questionnaire (Appendix [5]) uploaded on google drive for accessibility by all participants

## Test Location and Environment

The EHRUT testing was conducted remotely over google meeting webconference and google group chat. Participants were asked to use google chrome browser or any browser of their choice. Participants completed the test from their remote office workspaces.

For testing, the computers used were Windows systems and Apple Macbook. Participants accessed a testing environment provided to them, and worked with their own individual test patient. Each test patient was set up identically to ensure accurate data results. The system performance (i.e., response time) was representative to what actual users would experience. Additionally, participants were unable to change any of the default settings for the application.

## Test Forms and Tools

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

1. Non-Disclosure Agreement and Informed Consent Form (Appendix [3])
2. Moderator's Guide (Appendix [4])
3. Post-Test Questionnaire (Appendix [5])
4. Google meet - <https://meet.google.com/>

The participant's interaction with the EHRUT was captured and recorded online with google meeting. The test sessions were recorded and made available to all the participants for reference purposes.

## Participant Instructions

The moderator read and presented instructions to the group of participants during a training meeting held prior to the start of testing. The instructions and recorded meetings were then sent by email and google drive folder links to the participants. The written instructions are available 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:

- Effectiveness of Kantime Health by measuring participant success rates and errors
- Efficiency of Kantime Health by measuring path deviations and task time
- Satisfaction with Kantime Health by measuring ease of use ratings and SUS score

## Data Scoring

The following table [3] details how we scored tasks, evaluated errors, and analyzed time data.

	Measures	Rationale and Scoring
Effectiveness	Task "Success"	A task was counted as a "Success" if the participant was able to achieve the correct outcome, within the target task time, and without assistance. 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. Optimal task performance time, as benchmarked by expert performance under realistic conditions, is recorded when constructing tasks. Target task times used to determine task success were defined by taking multiple measures of optimal performance and multiplying by a factor of 1.25. This factor allows some time buffer because the participants are presumably not trained to expert performance.
	Task "Errors"	If the participant arrived at success but made mistakes along the way by selecting the wrong option or clicking the wrong tab, then that was

		counted as an “Error.” The total number of errors was calculated for each task and then divided by the total number of participants. This should also be expressed as how error prone the task is.
<b>Efficiency</b>	<b>Path Deviations</b>	The participant's path (i.e., clicks) 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 steps in the optimal path to provide a ratio of path deviation.
	<b>Task “Time”</b>	Each task was timed from when the participant clicked the “Start Task” button until the participant marked the task as “Complete” in the tool. Only tasks that were successfully completed were recorded in the average task time analysis. Optimal task time, as benchmarked by expert performance under realistic conditions, was recorded when constructing tasks. The task completion time of the observed task recordings was divided by the optimal task performance time to provide a ratio of the task time.
<b>Satisfaction</b>	<b>Task “Rating”</b>	Participants' subjective impression of the ease of use of the application was measured by administering a simple post-task questionnaire. After each task, the participant was asked to rate “Overall, this task was:” on a scale of 1 (Very Difficult) to 5 (Very Easy). This data was averaged across participants for each task. Common convention is that average ratings for systems judged “easy to use” should be 3.3 or above.
	<b>SUS Score</b>	To measure participants' confidence in and likeability of the EHRUT overall, the testing team administered the System Usability Scale (SUS) post-test questionnaire. Questions included, “I think I would like to use this system frequently,” “I thought the system was easy to use,” and “I would imagine that most people would learn to use this system very quickly.” See full System Usability Score questionnaire in (Appendix [5]) Broadly interpreted, scores under 50 represent systems with poor usability; scores over 68 would be considered above average.

**Table [3] Details of Rationale and Scoring**



## 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 the EHRUT are detailed below (see Table [4]). 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 material, positive impact on user performance.

Task	N	Effectiveness				Efficiency						Satisfaction	
		Task Success		Task Errors		Path Deviation		Task Time				Task Rating	
Task Description		Mean	SD	Mean	SD	Observed	Optimal	Mean	SD	Observed (sec)	Optimal (sec)	Mean	SD
Record CPOE Medication Orders	10	80%	42%	100%	216%	6	6	92	42	160	120	4.4	1.26
Change CPOE Medication Orders	10	100%	0%	0%	0%	4	4	53	16	80	80	5	0
Access CPOE Medication Orders	10	100%	0%	0%	0%	4	4	40	12	60	60	5	0
Record CPOE Laboratory Orders	10	90%	32%	50%	158%	4	4	43	20	80	60	4.7	0.95
Change CPOE Laboratory Orders	10	100%	0%	10%	32%	2	2	23	10	30	30	4.7	0.48
Access CPOE Laboratory Orders	10	100%	0%	0%	0%	2	2	22	11	30	30	4.9	0.32
Record CPOE Imaging Orders	10	80%	42%	100%	216%	5	4	52	20	80	60	4.5	1.08
Change CPOE Imaging Orders	10	100%	0%	0%	0%	2	2	27	10	40	30	4.8	0.42
Access CPOE Imaging Orders	10	100%	0%	0%	0%	2	2	22	11	30	30	4.9	0.32
Using CPOE, trigger a drug-drug interaction by entering a new medication order	10	100%	0%	0%	0%	6	6	79	29	120	120	4.8	0.42
Using CPOE, trigger a drug-allergy interaction by entering a new medication order	10	100%	0%	0%	0%	6	6	88	36	155	120	4.7	0.48
Adjust the severity level of a displayed drug-drug interaction	10	80%	42%	120%	253%	9	8	101	46	160	140	4.2	0.92
Record Demographics	10	90%	32%	40%	126%	3	2	57	21	105	60	4.5	0.97
Change Demographics	10	80%	42%	60%	135%	3	2	50	21	85	60	4.5	1.08
Access Demographics	10	100%	0%	0%	0%	2	2	23	10	30	30	5	0
Add a CDS intervention and/or reference resource for each of the required elements	10	100%	0%	0%	0%	4	4	90	24	120	120	5	0
Trigger the CDS interventions/resources added using the applicable data elements from each of the required elements	10	90%	32%	40%	126%	4	4	92	22	120	120	4.8	0.63
View the intervention/resource information using the Infobutton standard for data elements in the problem list, medication list, and demographics	10	90%	32%	20%	63%	2	2	43	15	70	60	4.8	0.63
Trigger the CDS interventions/resources based on data elements in the problem list, medication list, and medication allergy list by incorporating patient information from a transition of care/referral summary	10	100%	0%	0%	0%	4	4	90	24	120	120	5	0

Access the following attributes for one of the triggered CDS interventions/resources: bibliographic citation, developer, funding source, release/revision date	10	100%	0%	0%	0%	2	2	39	13	60	60	5	0
Record UDI	10	100%	0%	10%	32%	4	4	46	10	60	60	4.1	0.32
Change UDI Status	10	100%	0%	0%	0%	4	4	30	21	60	60	4.2	0.42
Access UDI, device description, identifiers, and attributes	10	100%	0%	0%	0%	2	2	25	9	30	30	4.2	0.42
Incorporate a CCDA and conduct reconciliation of the medications, medication allergies, and problems in the CCDA with the information currently in the patient's record	10	80%	42%	100%	216%	7	6	111	40	180	120	4.4	1.26
Generate a new CCDA with reconciled data	10	100%	0%	0%	0%	4	4	41	12	60	60	4.9	0.32
Create new prescription	10	100%	0%	0%	0%	6	6	78	29	120	120	5	0
Change prescription (dosage or duration)	10	70%	48%	160%	263%	5	4	71	37	140	80	4.4	0.97
Cancel prescription	10	100%	0%	0%	0%	4	4	49	17	80	80	5	0
Refill prescription	10	100%	0%	0%	0%	4	4	49	17	80	90	5	0
Receive fill status notification	10	100%	0%	0%	0%	4	4	103	14	130	120	4.7	0.5
Request and receive medication history information	10	78%	44%	89%	176%	5	4	100	20	140	120	4.3	1.12

**Table [4] Results of Each Measure**

The results from the SUS (System Usability Scale) scored the subjective satisfaction with the system based on performance with these tasks to be [69].

## Discussion of the Findings

The sections below represent the results of all the three components we studied in this report, namely - Effectiveness, Efficiency and Satisfaction. Hereby we summarize our major findings and areas of improvement.

### Effectiveness

We saw that the overall success rate is close to 100%. The following factors were responsible for the error rate:

- User errors rising from not following the instructions
- User not accurately doing the steps
- Unfamiliarity with using the application took them more time than optimal time, thus bringing down the success rate

We found that the most common issue encountered was adding UDI implantable devices which was caused due to a glitch in the system which was fixed at a later point of time to ensure the functionality worked as expected.



Also adding new medication and changing the severity level of the interactions seemed challenging for some users. It could be seen as a lack of complete understanding of the instructions and at the same time we see this as room for improvement in the system design. Refill, change prescription and medication history pull records for patient scenarios were also not completely possible to be executed end to end because of placeholder data and system limitations to obtain real time data.

Record demographics scenario also encountered some error, namely some users were not able to find their patients entered but after following the same steps again they were successful and didn't face any further problems.

## Efficiency

In our data analysis we found that most of the users were able to complete the tasks in less than the optimal task time. And average task time for all the tasks was recorded as 58 seconds which is less than a minute. This is something we find quite acceptable for our end users.

## Satisfaction

Two rating methods were used to evaluate the overall satisfaction of the product:

- Individual Task Ratings
- System Usability Scale (SUS)

A post task questionnaire was filled out by each participant after this study to gauge the usability of the application. Scoring was on a scale of 1-5, 1 representing very difficult to use and 5 representing very easy to use. None of the tasks had a rating of 2 or below. This leads us to conclude that our application Kantime Health is fairly user friendly and easy to use.

As for the system usability scale (SUS) to gauge participant satisfaction we found that to be a SUS score of 69 for all the participants which can be considered above average.

## Major Findings

We found that the average task completion rate of 94% and average task time being less than a minute, this makes our application Kantime Health user friendly as defined by the three criterias of Efficiency, Effectiveness, and Satisfaction. Based on receiving less than 100% success rate we conclude the following:

**Record CPOE Medication Order:** This is a high risk scenario which has an average success rate of 80%. We concluded that this may be due to the confusion with the wide range of medications available for selection that lead to wrong strength of medication selected initially which resulted in users to re-enter medication. Participants who don't regularly prescribe medicine were hesitant in selections and some spent extra time searching the screen for the appropriate values.



**Record CPOE Imaging Order:** This is a high risk scenario which has an average success rate of 80%. Some participants commented on clearer labels for Labs vs. Imaging as the resulting combination left took them some additional time to designate the correct item.

**Adjust the severity level of a displayed drug-drug interaction:** This task has an average success rate of 80%. And this could be due to the complicated workflow with increased steps causing it to be cumbersome and resulted in more average time taking to complete.

**Record/Change patient demographics:** This task also has a lower average success rate of 80%. For all fields with an 'Unknown' value, selection of 'Unknown' should automatically remove other values and other values should automatically undo 'Unknown'

**Incorporate a CCDA and conduct reconciliation of the medications, medication allergies, and problems in the CCDA with the information currently in the patient's record:** This task also has a lower average success rate of 80%. Comments included an unfamiliarity with the reconciliation screens, but layout was straightforward, and users easily completed. In practical usage participants asked if they could receive alerts when CCDA files were present in the patient record.

**Change prescription (dosage or duration):** This task has a lower average success rate of 70%. This may have been caused by the inexperience of the users testing this system. Change e prescription requires more training to the user for dosage selection, SIG information

**Request and receive medication history information :** This task has a lower average success rate of 78%. Reconciling the history medications to current medication may be confusing to the user and would require proper training and more instructions.

## Area of improvement

Based on the findings above, there are some obvious changes that will improve the user experience, facilitate faster product education and reduce the possibilities of errors entered into a patient's Orders & Procedures and Medications. Changing the dosage of an existing prescription requires deleting the prescription and re-prescribing the drug using the altered dose. There is already an "Edit" button to change every other aspect of the prescription. Possibly this could be avoided by making the Edit button more visible and highlighted. Medications and Allergies are displayed in a similar fashion on the same page but each uses a different UI to delete an item. A smoother workflow would be to make them look similar even if functionally they perform different actions.

Electronically Transmitting an Rx to a pharmacy requires finding the "Transmit Rx" button. It's in a slightly different location than other action buttons on the page. Grouping all the action buttons together may help. The prescription page uses a tab-like structure across the page. During Rx transmission, the user is automatically switched to a different tab. The layout and color scheme of each tab page is very similar. None of the participants realized this switch during their first few



transmissions making it difficult to move on to the next subtask. Using different colors may help to inform and distinguish to the user that the tab view has changed.

All the above design changes will surely help with user experience however the product Kantime Health is efficient as designed and we feel that with more user training these issues may be addressed.

## Appendices

### Appendix 1: Recruitment Email

In collaboration with our development Team, I am reaching out on behalf of KanTime Health with an opportunity to participate in a usability study! Each of you have been hand-selected by your peers who strongly felt your clinical background will prove to be invaluable for this study.

As you may know, Kanrad Technologies's Kantime Health team is currently in the process of obtaining our ONC Certification. This certification is an industry standard which will assure our client base that our product meets specific requirements aimed at elevating and safe-guarding the end-user experience. This is where we need you!

We need 10 associates, clinical experience is a plus, willing to test out the efficacy and usability of our product via a usability test; The test will be conducted in the second week of January. This includes the following:

- A brief high-level preparatory training session (roughly 30 min)
- Followed by a multi-day window to complete the first usability test at your convenience (roughly 30-60 min)
- The test will begin with an anonymous questionnaire and close with a rating scale questionnaire. That's it!

While familiarity with the KanTime Health platform is helpful, you do not need to be an expert so please don't let that deter you. Your feedback will not only provide insight into the client experience, but it will help to improve our product and get us that much closer to our certification.

If you have any further questions please feel free to reach out.

## Appendix 2: Participant Demographics

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

### Gender

Men	[2]
Women	[8]

### Years of Product Experience

0-1 years	[0]
2-5 years	[3]
6-10 years	[7]
11-15 years	[0]
16-20 years	[0]
21+ years	[0]

### Years of Computer Experience

0-1 years	[0]
2-5 years	[0]
6-10 years	[0]
11-15 years	[5]
16-20 years	[2]
21+ years	[3]

The following is the detailed demographics of the participants in this study.

Participant ID	Occupation	Age	Sex	Education	Computer Experience (YRS)	Product Experience (YRS)	Professional Experience	Assistive Technology Needs
P1	Clinical Content Specialist	50-59	F	Masters	20	5	15	No
P2	Vice President Palliative Hospice Care Products	50-59	F	Associates	20	8	29	No
P3	Director Customer Success Hospice Palliative	30-39	F	Bachelors	24	7	14	No
P4	Director Learning Services	40-49	F	Bachelors	23	8	23	No
P5	VP Implementation Services	40-49	F	Associates	23	9	23	No
P6	Director Implementation Services	30-39	M	Associates	15	6	10	No
P7	Project Director Implementation	30-39	F	No Degree	15	8	10	No
P8	Project Director Implementation	30-39	F	School	15	6	14	No
P9	Project Director Implementation	20-29	F	Masters	15	3	4	No
P10	Product Manager	40-49	M	Masters	15	3	15	No



**Appendix 3: Non-Disclosure Agreement and Informed Consent Forms**  
**Non-Disclosure Agreement and Informed Consent Forms**

**Non-Disclosure Agreement**

THIS AGREEMENT is entered into as of 01.03.23, between (“the Participant”) and the testing organization, Kanrad Technologies, located at 4340 Stevens Creek Blvd #162, San Jose CA 95129.

The Participants acknowledge his or her voluntary participation in today’s usability study may bring the participant into possession of Confidential Information. The term “Confidential Information” means all Usability Test Report technical and commercial information of a proprietary or confidential nature which is disclosed by Kanrad Technologies, or otherwise acquired by the Participant, in the course of today’s study.

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

Any information the Participant acquires relating to this product during this study is confidential and proprietary to Kanrad Technologies and is being disclosed solely for the purposes of the Participant’s participation in today’s usability study.

By signing this form, the Participant acknowledges that s/he will receive monetary compensation for feedback and will not disclose this confidential information obtained today to anyone else or any other organizations.

Participant’s Printed Name: \_\_\_\_\_

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

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



## **Informed Consent**

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

### ***Agreement***

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

I understand and consent to the use and release of the videotape by Kanrad Technologies. I understand that the information and videotape is for research purposes only and that my name and image will not be used for any purpose other than research.

I relinquish any rights to the videotape and understand the videotape may be copied and used by Kanrad Technologies without further permission.

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

I understand and agree that the data collected from this study may be shared with outside of Kanrad Technologies and Kanrad Technology's client. I understand and agree that data confidentiality is assured, because only de-identified data – i.e., identification numbers not names – will be used in analysis and reporting of the results.

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

### **Please check one of the following:**

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

NO, I choose not to participate in this study.

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

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



## Appendix 4: Moderator's Guide

Moderator's Guide Administrator

Data Logger

Date

Time

Participant #

Location

### Orientation 10 Mins

Thank you for participating in this study.

Our session today will last 60 minutes. During that time you will take a look at an electronic health record system. I will ask you to complete a few tasks using this system and answer some questions. We are interested in how easy (or how difficult) this system is to use, what it would be useful to you, and how we could improve it. You will be asked to complete these tasks on your own trying to do them as quickly as possible with the fewest possible errors or deviations. Do not do anything more than asked. If you get lost or have difficulty I cannot answer to help you with anything to do with the system itself. Please save your detailed comments until the end of a task or the end of the session as a whole when we can discuss freely. I did not have any involvement in its creation, so please be honest with your opinions. The product you will be using today will describe the state of the application, i.e., production version, early prototype, etc. Some of the data may not make sense as it is placeholder data. We are recording the audio and screenshots of our session today. All of the information that you provide will be kept confidential and your name will not be associated with your comments at any time.

Do you have any questions or concerns?

### Preliminary Questions

What is your job title / appointment?

How long have you been working in this role?

What are some of your main responsibilities?

Tell me about your experience with electronic health records.

### Final Questions

What was your overall impression of this system?

What aspects of the system did you like most?

What aspects of the system did you like least?

Were there any features that you were surprised to see?

What features did you expect to encounter but did not see? That is, is there anything that is missing in this application?

Compare this system to other systems you have used.

Would you recommend this system to your colleagues?

Administer the SUS

### Appendix 5: System Usability Scale Questionnaire

Strongly Disagree

Strongly Agree

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

## Appendix 6: Factors Used to Evaluate Likelihood and Significance

	Likelihood Factors	Significance Factors
<b>Increasing Factors</b>	<p>Frequency of Workflow</p> <ul style="list-style-type: none"> <li>Task involves a common sequence of events</li> </ul> <p>Possibility of Alternative Outcome</p> <ul style="list-style-type: none"> <li>Clinician must make a decision that requires an increased cognitive load(i.e. the clinician must find information in multiple locations and must synthesize or remember high volumes of information to complete the workflow)</li> <li>Clinician is limited in ability to recover from an issue in documentation or action</li> <li>Workflow completes an event or otherwise closes an instance of care to any further documentation</li> <li>High intrinsic complexity of information or information management</li> <li>Clinician is likely to experience an interruption during the workflow</li> </ul>	<ul style="list-style-type: none"> <li>Clinician is likely to take inappropriate action after the issue occurs</li> <li>Issue affects mostly high-acuity patients, high-risk medication, or urgent/critical workflows</li> <li>Affected data directly informs significant clinical decisions</li> </ul>
<b>Decreasing Factors</b>	<p>Frequency of Workflow</p> <ul style="list-style-type: none"> <li>Task involves an unusual sequence of events</li> </ul> <p>Possibility of Alternative Outcome</p> <ul style="list-style-type: none"> <li>Clinician does not make decisions in the course of the workflow or has robust decision-making support within the workflow</li> <li>Clinician finds information in one location or the</li> </ul>	<ul style="list-style-type: none"> <li>Clinician is likely to take appropriate action regardless of the issue</li> <li>Issue affects mostly low-acuity patients, low-risk medications, or non-urgent/noncritical workflows</li> <li>Affected data does not inform significant clinical decisions</li> </ul>



	<p>workflow requires low degree of information synthesis or memory</p> <ul style="list-style-type: none"><li>• Clinician has ample opportunity to recover from an issue in documentation or action</li><li>• Task or workflow occurs in the midst of an event; documentation can easily be edited or added</li><li>• Low intrinsic complexity of information or information management</li><li>• Clinician is unlikely to experience an interruption during the workflow</li></ul>	
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