Usability Testing of Diabetes.org

By Daniel Bays

HI 656: Human Factors in Healthcare IT Systems

University of Alabama at Birmingham

1720 2nd Ave South Birmingham,

AL 35294-0113

Year 2021

Contents

Introduction 3
Objectives 4
Research Questions 4
Methods 5
Participants 5
Data Collection 5
Scenarios 6
Measurements 7
Results 8
  Task Analysis 8
  SUS Analysis 9
  Post Interview Questions 9
  User Experience 9
Discussion 10
Recommendations 10
Conclusion 11
Appendix 12
Works Cited 17

Introduction

Diabetes is the third most prevalent chronic diseases in the United States impacting more than 34 million individuals of all ages or nearly 10.5% of the population.[1] Diabetics develop life changing morbidities such as cardiovascular disease, kidney disease, retinopathy with blindness, and peripheral neuropathy cause untold suffering. Patient care for diabetic patients costs the U.S. healthcare system an estimated 327 billion dollars per year[2]. Websites and apps help people with diabetes better understand and manage their disease. The diabetics practice healthier behaviors representing a novel technological approach to mitigating these enormous burdens and improving health outcomes.

Diabetes.org is made available by the American Diabetes Association (ADA) and offers multiple features to support those looking to gain a greater understanding of their diabetes and reduce the negative impacts on their health. The mission statement of the ADA reads “No matter where you are in your fight, here’s where you need to be.”[2] This statement emphasizes the importance and responsibility of researching one’s own health condition and using the knowledge to live a healthier lifestyle. Diabetes.org provides access to multiple educational articles providing readers with a rich understanding of diabetes. There are also tools for managing nutritious diets, fitness, and medications. The website provides an opportunity to discover local community resources and network within the Diabetes.org community. Children and their family can attend summer camps to learn how to manage their diabetes in a family-based approach.

Objectives

The purpose of this study was to apply evidence-based user testing methods to evaluate user interaction with the Diabetes.org website. The testing methods are based on ISO criteria of effectiveness, efficiency, and satisfaction to identify strengths and weaknesses in the site's interface and user experience (UX). The study has the potential to generate ideas for UX improvements for the website to accomplish their mission of improving health outcomes and quality of life in people with diabetes. The study's scope was limited to three core functionalities of the app: finding information about blood glucose testing and control, finding community resources and events, and locating information on healthier living via diet, exercise, and mental health. The objectives will be utilized to answer three research questions.

Research Questions

1. How accurately, quickly, and easily (effectiveness, efficiency, satisfaction) can a user register for an account and find information about what factors make their blood sugar rise and fall and what their hemoglobin A1c level means?

2. How accurately, quickly, and easily (effectiveness, efficiency, satisfaction) can a user locate information about community resources and upcoming events in their area?

3. How effectively and efficiently can a user navigate Diabetes.org to gather information about exercise plans, meal planning and mental health?

Methods

This study followed the summative format because Diabetes.org is a fully interactive and published website. The study design was informed by the Staggers' Health Human Computer Interaction (HCI) model (Figure.4) in which users (providers, patients, or both) exchange information with technology by initiating specific tasks and responding to outputs within the system. The exchange was influenced by both the characteristics of the users and the functionalities and representations of the system. The researcher recorded all participants' behaviors as they interacted with the Diabetes.org website through realistic user case scenarios. The participants completed common tasks by entering information into the app and using any output or feedback from the technology to inform future decisions and achieve goals. The understanding of the context in which users search for information on Diabetes.org is critical to the understanding the outcomes from this study.

Participants

Three participates were recruited as a convenience sample from the researcher's friends and family. All reasonable efforts consistent with the study's scope will be made to achieve a balance of major demographic characteristics within the participant group. The participants are not required to have a diagnosis of diabetes or prediabetes. No financial or other incentive will be offered.

Data Collection

Testing was administered individually to each of the three participants. Remote real time moderated testing was conducted using Zoom, and participants will be asked to test in a quiet,

private location. At the start of each session, the researcher provided information about the purpose of the study and the general testing methods. Participants will then be asked to provide demographic information and give verbal informed consent to participate in the study and to allow audiovisual recording of the session. Details of the instructions and informed consent processes are contained in the moderator script shown in Figure.7. The participants will be given access to Diabetes.org and provided three scenarios a typical user might perform. Each participant will then be asked to complete a series of tasks needed to achieve the goal of each scenario. The tasks and workflows were pretested by the researcher to determine optimal task flow and estimated time needed by an experienced user to complete the tasks. The scenarios and tasks were as follows:

Scenarios

- You have been recently diagnosed with diabetes. You are given a glucometer to take home and test your sugar every 6 hours. Please use Diabetes.org to:
    - Register for an account
    - Search Diabetes.org for information on the best practice to test one's own blood sugar and show it to the moderator.
    - Find the upper and lower limits of the normal range for an A1C blood test.
    - Find information on what to do if your blood sugar is too low or too high
- You and your child both have diabetes and want to connect with other families whose members are diagnosed with diabetes.
    - Find where to request information about annual summer camps for children

    - Find the event “Ask the Experts: Support During the Holiday Season” in Alabama as the State
    - Find the symptoms of low testosterone caused by diabetes
- You are diagnosed as having prediabetes and are looking for ways to live a healthier life to prevent progression to active diabetes.
    - Locate tips for meal planning and find the Herbs de Provence Roasted Chicken Breast meal.
    - Find two exercises that are best suited to improve cardiovascular fitness and help prevent heart disease.
    - Find a mental health provider within 50 miles of the zip code, 35211.

Measurements

During the completion of the designated tasks, qualitative and quantitative data will be collected including time to complete individual tasks, time to complete scenario group tasks, and completion status all assigned tasks. Task success will be categorized into three groups: completed without help, completed with help, or failed to complete. The “concurrent think aloud” method will be encouraged by the moderator to gauge the participant’s thoughts as they worked through the testing. Think aloud is a method that “ask participants to verbalize their thoughts while performing a task.”[3] After all tasks are completed, each participant will fill out a System Usability Scale (SUS) (Figure.1) to numerically rate their overall satisfaction with the site. A Following completion of the SUS, each participant will undergo a brief (5-15 minute) semi-structured interview to further gauge their subjective thoughts on using the system (Figure.3). They will also be asked for suggestions for improvement of the site. All qualitative

data that was obtained during the session, including recordings, moderator observations, responses from questionnaires, and interview results will also be analyzed.

Results

In this study, we identified ten tasks to evaluate the Diabetes.org website for usability. Three users were selected to complete each task and timed for quantitative analysis. The table in Figure.2 breaks down the participants demographic information and their background experience with technology. The three participants included one male and two females aging from 25 to 55. All three participants have an advanced degree from college. Only the male participant described himself as having a high level of experience with technology while the two female participants described their technological experience as low.

Task Analysis

Each participant was able to complete each task. A table located in Figures.6 provides quantitative data and breakdown of each task. Each participant required help for two tasks. Participant 1 and 2 requested help on task 3 and 8. Participant 3 requested help on task 2 and 10. Participant 3 had the longest total time to complete all 10 tasks at a time of 18 minutes and 42 seconds. This was followed by participant at a total time of 13 minutes and 50 seconds. Participant 1 finished with the fastest time of 11 minutes and 48 seconds. Task 2, 3 and, 9 took the longest on average to complete. Scenario one and the associated tasks challenged the participants most and accumulated the longest scenario time at 20 minutes and 21 seconds.

SUS Analysis

After the completion of all the tasks, participants were asked to complete the System Usability Scale located in Figure.1 Of the three participants, only participant 3 scored Diabetes.org highly with an 88. Both participant 1 and 2 scored Diabetes.org below average with scores of 43 and 63.

Post Interview Questions

All participants were asked six questions (Figure. 3) about their experience and general thoughts after using Diabetes.org. The participants were asked their favorite and less favorite aspects of the website. The positives were the color scheme, the location of the search bar/navigation menu, and the formation. The negatives included complex wording, no search suggestions or auto filling, and poor description of the context inside a page. We asked each participant if they would recommend Diabetes.org to a friend or family member who was diagnosed with diabetes. Participant 1 stated she would not, and this was due to the complex wording and difficulties in finding specific information. Participants 2 and 3 stated they would recommend Diabetes.org due to the quality of information, tools, and tips for those affected by diabetes.

User Experience

Participants came into the study excited and ready to traverse Diabetes.org for this study. It became apparent after the first couple of tasks the participants were starting to get frustrated. Tasks were designed to have the participants navigate through Diabetes.org to find specific information that would be helpful to target audience. The issue that arose was due to Diabetes.org having a copious amounts of information. When the participants were given a single task to find one piece of information, they were overwhelmed due to the information on

the navigation menu and the pages themselves. The participants wanted the information right away and easy to locate. Participant 2 states, “I could find this right away on google.”

when utilizing the search bar and irrelevant results appeared.

Discussion

The results demonstrated that a person could utilize Diabetes.org to find specific information surrounding diabetes. Diabetes.org and the American Diabetes Association provide the useful and up to date information. The underlying problem with Diabetes.org is information saturation and traversing the site. From the timed tasks, we see that it takes a considerable amount of time to locate readily available information. Another usability concern is the navigation menu. Participant 3 navigated Diabetes.org by using the side navigation menu. This significantly increased her time as the participant had to continually search through all the menu options to find a relevant topic for the task. Participants 1 and 2 utilized both the search bar and navigation menu. Both participants experienced inadequate search results and relied on randomly jumping from page to page.

Recommendations

The usability testing showed that there are multiple usability concerns that need to be addressed. Figure.5 describes the usability problems, categories, and the severities. It is recommended that Diabetes.org revamps their navigation menu. The navigation menu contains over 100 different tabs. Participants struggle to navigate the menu when too many options are available. It is suggested that Diabetes.org consolidates these tabs and pages and incorporate a common theme. The use of complex medical terminology in Diabetes.org is extensive and causes confusion to

the users of the website. The use of more laymen's terms will improve users understanding of their health conditions. On the "Create Account" page, the cancel button misleads user to thinking the page will close when clicked. The cancel button clears the text fields and should be titled differently to represent that function.

An additional function that Diabetes.org would benefit from is the use of a tutorial for those newly diagnosed with diabetes. This tutorial should provide basic information about what diabetes is, how to test your blood sugar, a clear definition of the results, and how to maintain a healthy lifestyle to prevent the progression of diabetes complications.

Conclusion

Diabetes.org offers users access to an incredible amount of educational material concerning diabetes and additional resources to expand the user's knowledge. This study conducted usability testing for Diabetes.org through timed tasks and errors. The usability testing surfaced multiple usability problems that go against Nielsen's Heuristics. These problems manifested as additional time spent on tasks and confusion to the participants. The article offers solutions to these problems and suggests a new tutorial function to help show users how to effectively navigate Diabetes.org.

Appendix

System Usability Scale	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	Score		
I think I would like to use this website frequently		x				2	1	1
I found this website unnecessarily complex			x			5	3	2
I though the website was easy to use				x		4	1	3
I think that I would need assistance to use this website		x				4	2	2
I found the various functions in this website were well integrated		x				2	1	1
I thought there was too much inconsistency in this website				x		5	4	1
I would imagine that most people would learn to use this website very quickly		x				2	1	1
I found this website very cumbersome / awkward to use				x		5	4	1
I felt very confident using the website		x				2	1	1
I needed to learn a lot of things before I could get going with this system.		x				5	2	3
P.1 Total							**43**	

System Usability Scale	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	Score		
I think I would like to use this website frequently				x		4	1	3
I found this website unnecessarily complex		x				4	2	2
I though the website was easy to use				x		4	1	3
I think that I would need assistance to use this website		x				4	2	2
I found the various functions in this website were well integrated				x		3	1	2
I thought there was too much inconsistency in this website				x		4	3	1
I would imagine that most people would learn to use this website very quickly		x				2	1	1
I found this website very cumbersome / awkward to use		x				5	2	3
I felt very confident using the website				x		4	1	3
I needed to learn a lot of things before I could get going with this system.		x				5	2	3
P.2 Total							**63**	

System Usability Scale	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	Score		
I think I would like to use this website frequently				x		5	1	4
I found this website unnecessarily complex	x					5	2	3
I though the website was easy to use				x		4	1	3
I think that I would need assistance to use this website		x				5	3	2
I found the various functions in this website were well integrated				x		5	1	4
I thought there was too much inconsistency in this website	x					5	1	4
I would imagine that most people would learn to use this website very quickly				x		5	1	4
I found this website very cumbersome / awkward to use	x					4	1	3
I felt very confident using the website				x		4	1	3
I needed to learn a lot of things before I could get going with this system.	x					5	1	4
P.3Total							**88**	

System Usability Scales (Figure.1)

	P.1	P.2	P.3
Gender	F	M	F
Age	25	55	51
Education	Masters	Bachelors	Bachelors
Experience Level with Technology	Low	High	Low
Has Diabetes?	No	No	No
Used Diabetes.Org before?	No	No	No
What device do you mainly use?	Smartphone	Desktop	Tablet
Computer use	Daily	Daily	Daily

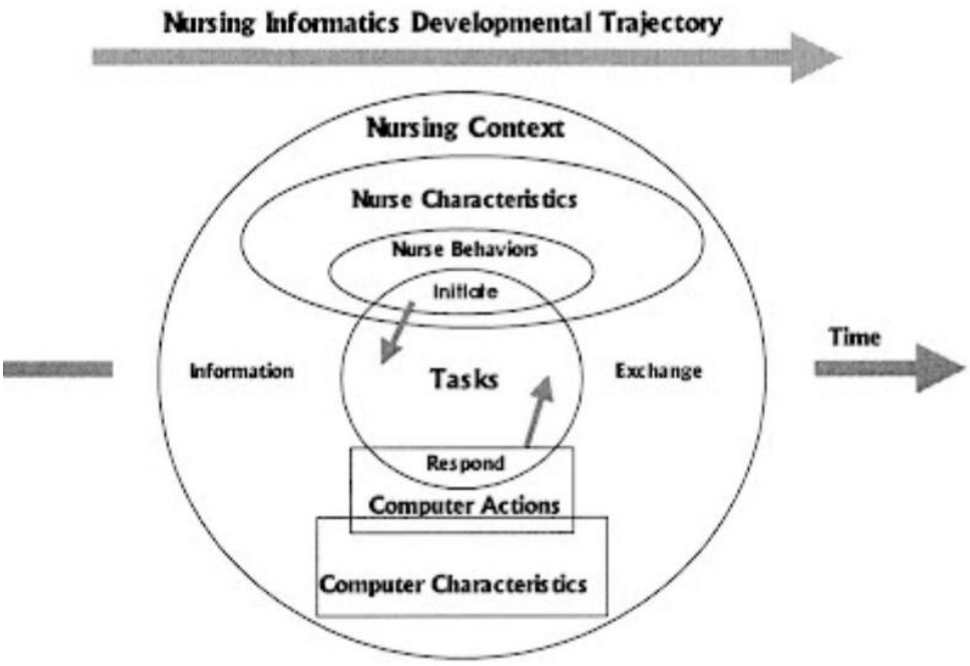
Demographic Table (Figure.2)

Post Interview Questions	Answer
How did you feel when navigating the Diabgetes.org website?	I felt frustrated.
What did you like most about the website?	The color scheme.
What did you like least about the website?	The not so helpful search engine
What is something you would change about the website?	Change the language to have lamen terms and professional terms for example A1C could have a slash that says blood sugar beside it. I would try to make it at the lowest reading level possible due to low literacy and diabetes being related
If you had a friend or family member who was diagnosed with diabetes, would you recommend this website to them?	I would not recommend this website.
On a scale from 1 to 10 (10 being highest) what would you rate your experience using Diabetes.org?	I would rate it a 6.

Post Interview Questions	Answer
How did you feel when navigating the Diabgetes.org website?	I do feel like I need to look around for some information, while other information is more intuitive to find. Maybe they could use more natural language in the
What did you like most about the website?	I do like that the search bar/menu is easy to find at the top right of the page.
What did you like least about the website?	The least favorite feature is that there are several ways to look for information and some information is buried under several links.
What is something you would change about the website?	I would add suggestions under the search menu when someone start typing to help them find the answers quicker.
If you had a friend or family member who was diagnosed with diabetes, would you recommend this website to them?	I would recommend this site because it does have a lot of good, useful data and suggestions for dealing with diabetes.
On a scale from 1 to 10 (10 being highest) what would you rate your experience using Diabetes.org?	7

Post Interview Questions	Answer
How did you feel when navigating the Diabgetes.org website?	It was easy, but I would find it better to navigate if I had time to wonder through the website. I would of liked to ready everything before looking for specific things.
What did you like most about the website?	For me it was nicely formatted, it didn't have a bunch of distracting images on it.
What did you like least about the website?	It was deceiving that the blood sugar results was under the A1c tab.
What is something you would change about the website?	I would split the A1c information and the blood sugar information under two different tabs.
If you had a friend or family member who was diagnosed with diabetes, would you recommend this website to them?	Yes, it has good information and is easy to navigate.
On a scale from 1 to 10 (10 being highest) what would you rate your experience using Diabetes.org?	8

Post Interview Questions (Figure.3)



Staggers HCI Model (Figure.4) [4]

Problem	Category	Severity
Searching engine doesn't give most relevant results	Match between system and the real world:	3
Too many tabs on the navigation menu	Recognition rather than recall/ Aesthetic and minimalist design	3
Need to use lamen terms more often.	Match between system and the real world	2
Had to remember the tabs from navigation menu	Recognition rather than recall	3
Cancel button discards information on setting up an account instead of closing that pop-up	Match between system and the real world	2

List of key usability problems for Diabetes.org (Figure.5)

Participant 1				Participant 2				Participant 3			
	Time	completed?	Needed Help?		Time	completed?	Needed Help?		Time	completed?	Needed Help?
Task 1	00:14.1	Y	N	Task 1	00:26.9	Y	N	Task 1	02:22.2	Y	N
Task 2	00:39.5	Y	N	Task 2	00:59.5	Y	N	Task 2	04:49.0	Y	Y
Task 3	02:28.9	Y	Y	Task 3	02:36.0	Y	Y	Task 3	03:09.2	Y	N
Task 4	00:12.7	Y	N	Task 4	02:10.0	Y	N	Task 4	00:13.4	Y	N
Task 5	00:31.0	Y	N	Task 5	00:13.5	Y	N	Task 5	00:28.9	Y	N
Task 6	00:11.2	Y	N	Task 6	00:16.9	Y	N	Task 6	00:59.2	Y	N
Task 7	00:19.4	Y	N	Task 7	00:20.5	Y	N	Task 7	01:06.6	Y	N
Task 8	01:55.5	Y	Y	Task 8	01:17.3	Y	Y	Task 8	00:43.2	Y	Y
Task 9	05:50.6	Y	N	Task 9	01:50.0	Y	N	Task 9	02:22.1	Y	N
Task 10	01:26.9	Y	N	Task 10	01:37.9	Y	N	Task 10	02:28.2	Y	N
Total	0:13:50	10	2	Total	0:11:49	10	2	Total	00:18.42	10	2

Table of all timed tasks with completion status and help requested (Figure.6)

This study is being conducted to evaluate the website Diabetes.org through user testing. We ask that you be in a quiet location free from distraction. We will provide real life scenarios that the average users experience. With these scenarios, tasks will be read aloud for you to complete. Each task is timed and will be recorded. We ask that you use the think aloud method as you complete each task. This means to speak aloud your thoughts, reasons, and feelings for the decisions you make. If you require assistance completing a task, please inform the moderator. Again, this is a recorded meeting, do you consent to being recorded and your data being collected for this study?

You are free to end the study and leave at any time. If you would like to stop the study please inform the moderator. Thank you.

Moderator's script including instructions and informed consent. (Figure.7)

Works Cited

Centers for Disease Control and Prevention. (2020). *National Diabetes Statistics Report 2020*. Retrieved from CDC.gov: https://www.cdc.gov/diabetes/pdfs/data/statistics/national-diabetes-statistics-report.pdf#:~:text=Detailed%20Methods%29%20Among%20the%20US%20population%20overall%2C%20crude,all%20US%20adults%E2%80%94had%20diabetes%20%28Table%201a%3B%20Table%201b%29.

Diabetes.org. (2021). *Community camp overview*. Retrieved from Diabetes.org: https://www.Diabetes.org/community/camp

Usability.gov. (2021). *Usability.gov*. Retrieved from System Usability Scale (SUS): https://www.usability.gov/how-to-and-tools/methods/system-usability-scale.html