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Redesign of UHS websites and Comparison of Usability of both websites

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Abstract

This study conducted a usability testing of Penn State University's UHS website and redesigned website to inform modifications and to identify common usability themes that should be addressed by administration developing or maintaining the UHS website. A combination of qualitative and quantitative techniques was used in the usability testing procedure to gather data from novice and expert users while completing 9 tasks on both websites. Techniques included performance measures (completion time), direct observation and subjective user preferences (interview).

Improvements in terms of reduced number of problems, reduced completion time and increased preference were measured. Six usability themes emerged from the data: design, format, navigation, terminology, uniformity and learnability and they could be used as a framework for testing and modification of UHS website.

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1. Introduction

According to Nielson, usability "applies to all aspects of a system with which a human might interact".[1] An evaluation of the usability of a system involves the implementation of a variety of methods that examine how users interact with the system and assess whether the system's performance is acceptable.[2,3] It is imperative that health promotion websites conduct usability testing to examine whether their users can effectively and efficiently complete required tasks. [4]

It has been reported that testing does not have to be elaborate and expensive to be successful.[5] There are many studies that highlight how testing can dramatically improve a website.[7,8] To date, the usability studies for health promotion websites have varied from focusing on specific testing for target populations[9] to testing for specific usability attributes such as aesthetics.[1]

1.1 The UHS website

As a secure, online server for access and managing health care needs with University Health Service, UHS (University Health Services) websites provide many health services online including appointment scheduling, secure communicate with University Health Services and advice nurse, billing statements, immunization records, health history information, Lab results and so on[14]. There are two access: Penn State student or employee affiliate, non-student affiliate or have a oneid access account. As the researcher is student of Penn State, this project is focused on Penn State student account.
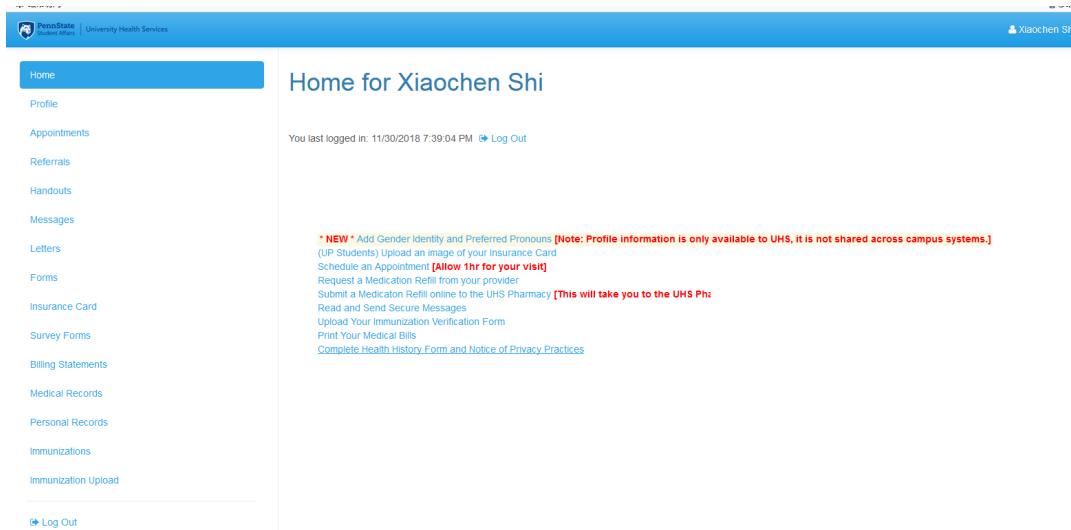

Figure 1. Homepage of UHS website

1.2 Purpose

The purpose of this study was to employ usability testing of an existing health service website (www.uhsonline.psu.edu) (see Figure 1) and a redesigned prototype of this website to inform modifications to the website and to identify common usability themes in the redevelopment of this site that may serve to guide future website development and maintenance in the field of University students' health promotion.

2. Methods

2.1 Experiment Design

All usability testing was conducted in a research laboratory at the Penn State University to standardize Internet speed. Participants were asked to complete a set of tasks using UHS website. The 9 tasks were selected as being representative of common activities in the use of the UHS website. Participants were informed of the object of the research and several tasks would be undertaken on both website. A combination of usability testing techniques was used to collect both qualitative and quantitative data during the testing sessions.[12-14]They were performance measures, direct observation and subjective user preference which were classified below.

Performance measure

During the session the researcher recorded time to complete each task, taken by a stopwatch. Time was taken from the time the task was read aloud, until the specific task was completed. All timing was done by the same researcher.

Direct observation

Participants were required to think aloud while completing the tasks. This method provides rich qualitative data and is described by Nielson as "the single most valuable usability engineering method".[1] It allows the user to effectively comment on how they are interacting with the website, what they are attempting to do, how they feel and when they encounter problems. This method is also beneficial as it occurs simultaneously while the user interacts with the website and does not rely on self-report measures, which can lead to incorrect or incomplete accounts of users' actions.[4]

Subjective user preference

Immediately following the completion of the tasks on the website, participants were required to record their perception of each website and their preference. During the interview, the user was asked to provide additional feedback on their experience with the website, to elaborate on any problems and to provide any suggestions or recommendations.

2.2 Participants

A sample of 8 users was involved in the usability testing sessions. It has been reported that usability testing with five users will reveal 85% of usability problems. [1,11] The test users were chosen as they reflected the general demographic of the real users of the UHS website. The users included four females and four males. Four of the 8 users reported that they have used the website while the other four users never used the website. So, according to their experience of UHS website, participants were divided into two groups: expert users and novice users. The expert user criterion is experience with UHS website for more than one month. All the participants were experimented in random order with UHS and redesigned website.

Table 1. Group of Participants

	Novice	Expert
Female	A:new+old B:old+new	C:new+old D:old+new
Male	E:new+old F:old+new	G:new+old H:old+new

2.3 Redesign of UHS

2.3.1 Reference Websites

In terms of figure out better layout and framework of website, the researcher referred to some other health care website and they are: a) Mount Nittany Health website, and b) UnitedHealthcare StudentResources website. Figure 2a. and 2b. shows their homepage respectively.
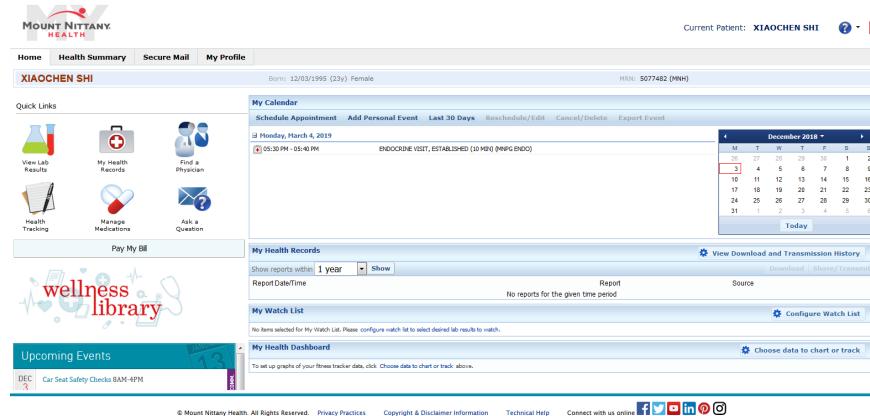
Figure 2a. Home page of Mount Nittany Health website
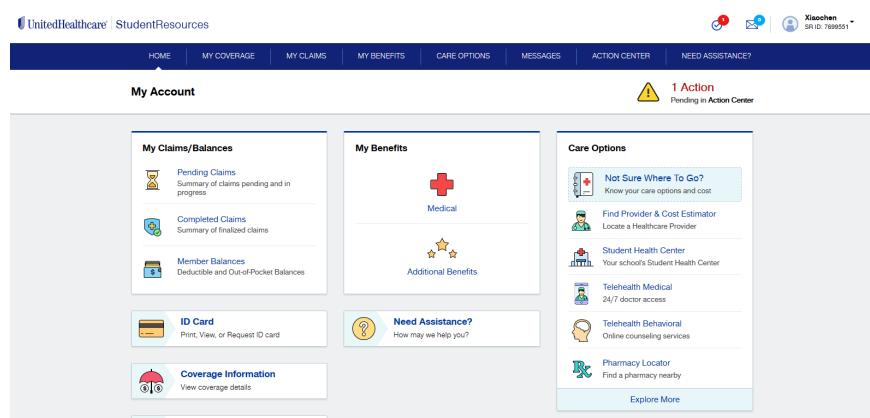
Figure 2b. Home page of UnitedHealthcare StudentResources website

While Mount Nittany Health website focuses more on healthcare services with poor design of website, the UnitedHealthcare StudentResources website focuses more on healthcare policy with fancy, well-organized layout. Moreover, the latter website is more similar to the whole style of Penn State University websites.

2.3.2 Analysis of Framework

The framework of UHS website is shown in Figure 3. Although this in-width page makes it easier to find objects one by one, and a previous research exploring the usability of a nutrition-based website indicating that participants preferred a broad, shallow website rather than one with a deep hierarchy of functions,[5] 15 categories on the homepage seems quite overwhelmed for users with single function of each category. The connection between different categories means unidirectional jump connection.
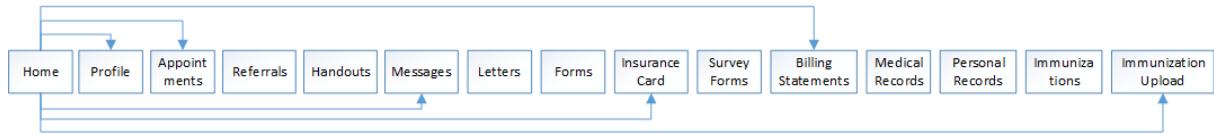
Figure 3. Framework of UHS website
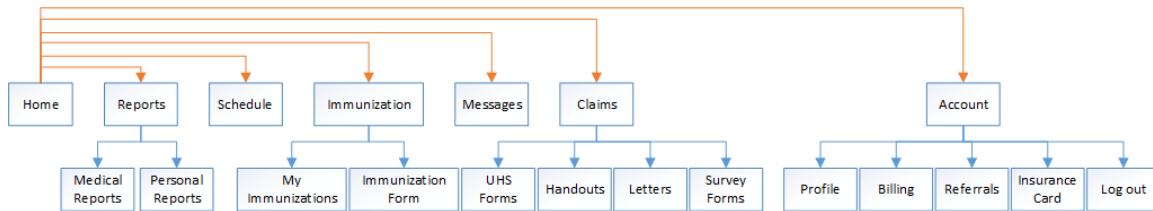
Figure 4. Comparison of two interfaces' framework

An optimized framework is shown in figure 4. Several changes are: Medical Reports and Personal Reports are grouped into Reports, My Immunizations and Immunization From are grouped into Immunization, and UHS Forms, Handouts, Letters and Survey Forms are grouped into Claims, Profile, Billing statement, Referrals, Insurance Card and Log out are grouped into Account. While Home, Report, Schedule, Immunizations, Messages and Claims are placed on homepage as they are common functions, personal information such as profile are placed on the top right corner. Similarly, homepage provides blocks that can jump to all other functions.

2.3.3 Pilot Study

Before formal experiment, a pilot study was operated to evaluate if the whole experiment procedure is reasonable. According to responses of one participant, several changes were made to make the session smoother, including change of sequence of tasks, correction of certain word in the task ("please find new messages" is replaced by "please find new tasks"), several modifications of icon in color, location and size.

2.4 Tasks

These 9 tasks were selected as being representative of common activities in the use of the UHS website and table 1 shows these tasks.

Table 2. Tasks used for testing UHS websites

- Please **log in** the website (12.03.1995)

- Please find **new tasks** and go to the corresponding page

- Please **schedule** a new appointment

- Please upload your **Immunization Form**

- Please read your **Labs Report** of 9/28/2018

- Please check out your **billing statement** and view details

- Please find your **referrals**

- Please change your local phone number

- Please log out

3. Analysis and Results

3.1 Analysis

For both websites, each participant's comments were recorded and interview was then transcribed and systematically scanned for critical episodes identifying any positive comments, recommendations or confusion, misunderstandings, difficulties the participant experienced. The critical episodes and researcher's note were compared and then extracted usability themes. A comparation between two websites was made of number of problems, task completion time and subjective user preference data to indicate if the modifications to the website had improved the usability. Number of problems and completion time are analyzed by descriptive statistics. Independent sample t-test were conducted to compare task completion time.

The 9 tasks revealed a total of 47 problems (see Table 1) of UHS website and 11 problems of redesigned website in total. Among these questions, six themes emerged and were used to categorize the episodes and problems identified in both websites. The themes were: design, format, navigation, terminology, uniformity and learnability. The themes are presented in Table 2 with a description of themes and example quotes from participants.

Table 3. Number of Problem

Themes	Old version website			Themes	Redesign website		
	No. total problems	$\bar{X}$ problems /Expert n=4	$\bar{X}$ problems /Novice n=4		No. total problems	$\bar{X}$ problems / Expert n=4	$\bar{X}$ problems /Novice n=4
Design	14	2	1.5	Design	4	0.75	0.25
Format	11	2	0.75	Format	2	0	0.5
Navigation	7	1.5	0.25	Navigation	3	0.5	0.25
Terminology	9	1.75	0.5	Terminology	2	0.25	0.25
Uniformity	4	0.75	0.25	Uniformity	0	0	0
Learnability	2	0	0.5	Learnability	0	0	0
Total	**47**	**8**	**3.75**	**Total**	**11**	**1.5**	**1.25**

Table 4. Usability themes from problems

Themes	Definitions	Examples from two websites
Design	General page design and layout, including consistency, what is located on the page and how it is located. Includes content, font, color, density, placement, images	"I think it's better to let the top alert banner smaller, so it doesn't cover so much of the information below the dash board." "The size of this icon can be bigger, not so much, but to make it clearer."
Format	Effective use of general features throughout site such as entering online forms, the date format show, logical order and use of drop down menus.	"I thought it was below the account menu, but there is only a log out." "
Navigation	The way a user navigates throughout the website to complete tasks. Includes clear menus, link recognition, users to know where they are within the site at all times and how to get back to where they came from	"These links are too difficult to read. They are grouped together closely, and too many words makes me confused about the functions." "How to get back to that page?"

Terminology	Reflect the users' language, tasks and intentions on the website. User should not have to think about what might be within a link – but be able to easily identify their desired link. Including link names.	"I thought labs report is a report you write after you do an experiment." "What does referrals mean? Is that common to use?" "I don't know where to find, so I just go back to the beginning and just randomly click…Labs Report is hard to find."
Uniformity	All the features of website are consistent with outer environment, which is websites of department of University, include design, format, navigation.	"This blue is odd. The color should be darker." "I have never used this web site, is this really our university's website?" "I think it needs improvements."
Learnability	The ability to easily learn a website	"For a beginner this is quite confused to use".

3.2 Results

3.2.1 Number of problems

Comparing the number of problems, Table 1 provides an overview of the problems found in both websites, and it showed a significant decrease in the number of problems (t_5=4.65, p=0.005).

3.2.2 Completion time.

The mean time taken to complete the 9 tasks in UHS website was 19.22 seconds (SD±23.53)　 and in redesigned website was 16.66 seconds (SD±17.64). Overall, the modifications to the website resulted in the mean time to complete the tasks decreasing by 13.32% (2.56 seconds). An independent sample t-test showed this as not a significant decrease in time (t_8=1.99, p=0.23).

3.2.3 Subjective user preference

Comparing the website preference, 7 out of 8 participants showed their preference on redesigned website while 1 participant thought both websites are okay in terms of performance on finishing tasks.

4. Discussion

The purpose of this study was to evaluate an existing health care website and a redesigned website with the intent of applying usability testing to find if the redesigned website performed better. A number of usability testing techniques were used to gather data. Comparisons highlighted the improvement made to the website including number of problems, completion time and user preference. To test the overall

website, participants were asked to complete 9 tasks. From the process, six usability themes emerged and were used to categorize problems. Then modifications were able to improve the usability of the whole websites. It is recommended that the Student Health Center or administration developing or maintaining the UHS website consider the six themes to guide, but not limit, their testing and redesigning.

The fact that there is no significant difference in completion time relied on many reasons. When participants cannot find target object at first glance, they would start to click randomly and scan all the information on the website. As time went by, participants (especially novice users) would feel anxiety and ignore the right object.

One interesting finding about novice users' performance on completion time. For novice users, the mean time taken to complete the 9 tasks in UHS website was 24.37 seconds (SD±24.08) and in redesigned website was 28.06 seconds (SD±28.27). Compared to expert users' mean time in UHS website 9.17 seconds (SD±5.87) and 10.90 (SD±8.45), it is apparent that novice users performed better in UHS website as they can search every catalog one by one in the shallow website. The reason for this phenomenon needs more exploration. According to Cagla Ozen Senelar, Nuri Basoglu and Tugrul Daim (2004), among five product design features: customization, adaptive behavior, memory load, content density and speed on user preference, speed is the most important features that affect user preference, followed by workload and content density[6]. Some of user interface characteristics such as menu structures, screen layout, etc. have influence on memory load. Carefully designed interfaces can support users to use systems more easily and efficiently by reducing user memory load. Reducing a user's memory load relies on interface ability to recognize information rather than forcing users to recall it. The shallow UHS's website, one function in one menu and lots of menus in one page, allows users to just recognize information without any recalling. So even if UHS has higher content density, users still performed better at the speed of finding certain information.

5. Conclusion

This project compared UHS website's and redesign website's usability problems and leaded to improvements on the website from end-user's perspective. This usability test provides not only major themes and smaller problems that needed modifying, but also a redesign website with better performance on completion time and subjective user preference. The identification of the six usability themes can be used to guide future research and development of the UHS website.

6. Limitations

It is acknowledged that this study has its limitations. The researcher was the only observer

during the testing procedures. It is recommended a minimum of two observers should be used to decrease the risk of observer bias and more participants to increase the credibility of the findings.

7. References

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Appendix A.

All screens of redesigned website prototype are included. The Axure link is
https://596edo.axshare.com with password Bcj19usa
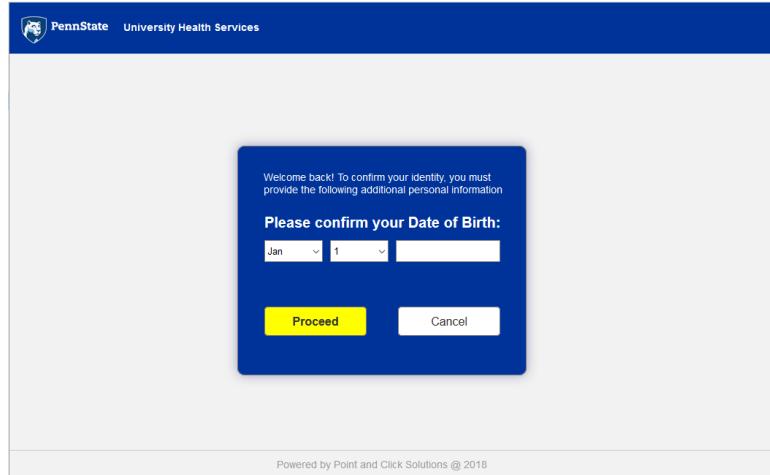
Figure A.1 Log in page of prototype
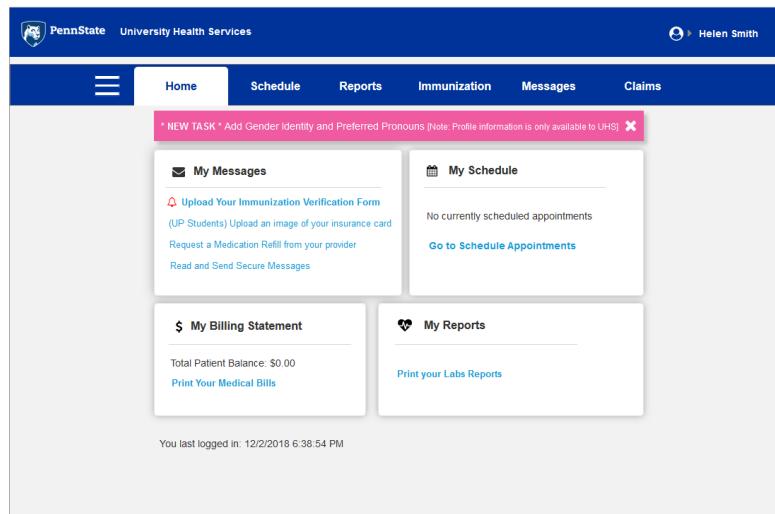
Figure A.2 Homepage of prototype
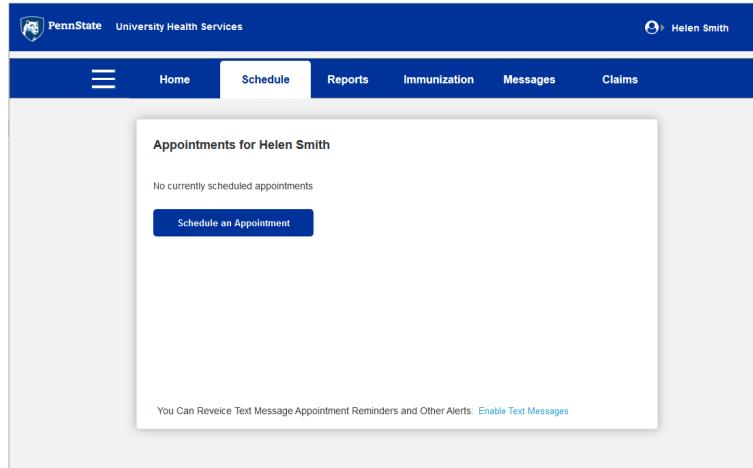
Figure A.3 Schedule page of prototype
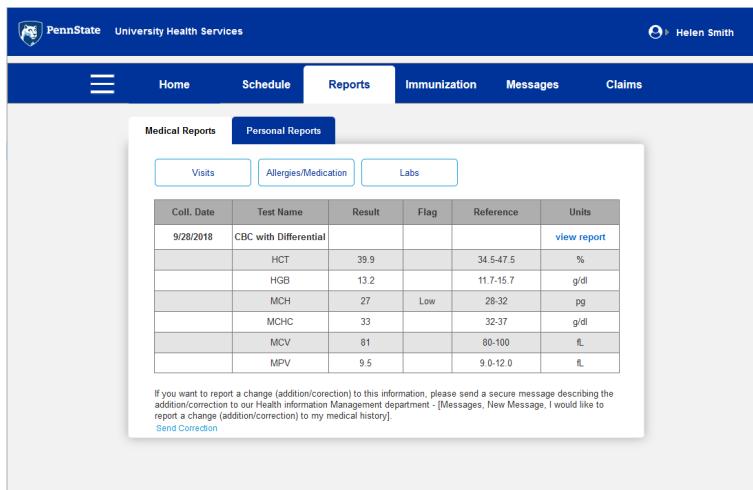
Figure A.4 Reports page of prototype
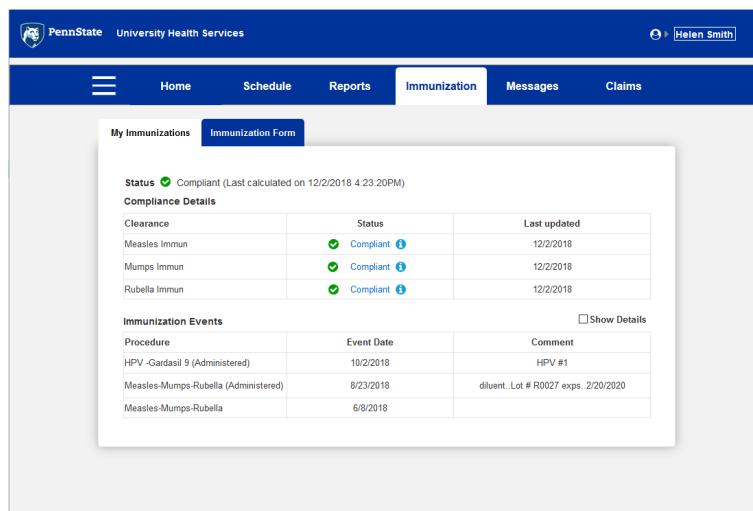
Figure A.5 Immunization page of prototype

Figure A.6 Messages page of prototype

Figure A.7 Claims page of prototype

Figure A.8 Billing Statement page of prototype
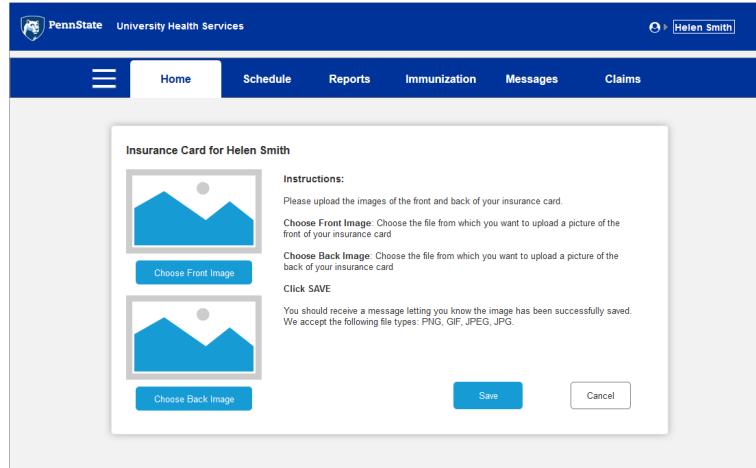
Figure A.9 Insurance card page of prototype
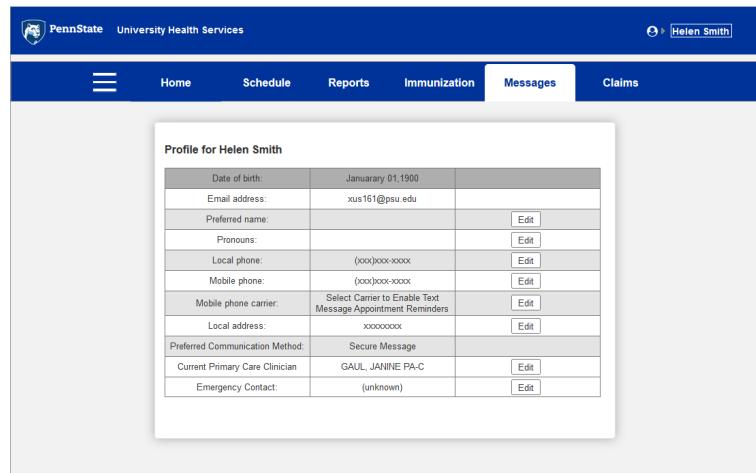
Figure A.10 Profile page of prototype
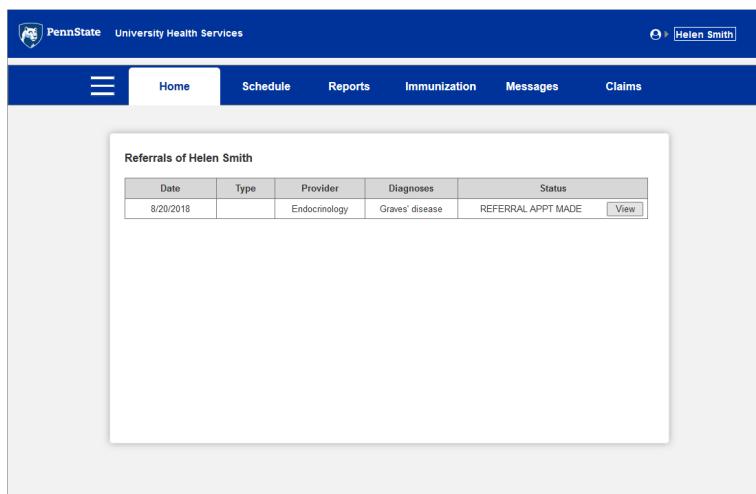
Figure A.11 Referrals page of prototype