USABILITY OF PHR SYSTEMS

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USABILITY OF PHR SYSTEMS

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ABSTRACT

USABILITY OF PHR SYSTEMS

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It is a fact that Personal Health Record (PHR) systems are vital for people to track their health status. At present, developing countries, such as Turkey, have been established PHR systems to make the service available to their citizens. However, despite the extensive worldwide distribution of PHR systems, their usage is very limited. This is in spite of the importance of the usability of these PHR systems since their usability supports error prevention and improvement in efficiency and makes systems understandable to potential users. Likewise, usability is the key factor for a system to be used widely, and therefore it is important to develop PHR systems that interact better with the users and thus increase usage of them. In this study, the newly introduced E-Nabız and the well-established HealthVault systems are compared at the levels of efficiency, effectiveness and satisfaction to analyze their usability. The research methodology consisted mainly of usability experiments, questionnaires and interviews, while the obtained results are analyzed qualitatively and quantitatively. The research findings are expected to enrich and contribute to the usability of PHR systems and Human Computer Interaction literature.

Keywords: Usability, PHR Systems.

ÖZ

KİŞİSEI SAĞLIK KAYDI SİSTEMLERİNİN KULLANILABİLİRLİK

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Kişisel Sağlık Kaydı (KSK) sistemleri kişilerin kendi sağlıklarının takibini yapmaları açısından büyük önem taşımaktadır. Günümüzde içinde Türkiye'nin de bulunduğu gelişmekte olan ülkeler kendi KSK sistemlerini geliştirip vatandaşlarına hizmet sağlamaktadırlar. Her ne kadar KSK sistemleri dünyada geniş çapta yer alsalar da, bu sistemlerin kullanım oranları çok düşüktür. Bu KSK'ların kullanılabilirliği sistemlerdeki hataları önlemeyi, verimi artırmayı ve sistemleri herkes için anlaşılabilir kılmayı sağladığı ve bunların sonucu olarak KSK'ların kullanım oranlarını artırmaya yardımcı olduğu için büyük önem taşımaktadır. Kullanılabilirlik testleri bir sistemin geniş çapta kullanılması ve insan-sistem etkileşim problemlerinin ortaya çıkartılması için anahtar faktördür, son kullanıcılarla daha iyi etkileşen KSK sistemleri geliştirmek, KSK'ların kullanım oranını artırmak için önemlidir. Bu çalışmada yeni kurulmuş olan E-Nabız ve daha köklü olan HealthVault sistemleri, verimlilik, etkililik ve memnuniyet açısından karşılaştırılmıştır. Çalışma kullanılabilirlik testleriyle sürdürülmüş, sonuçlar nitel ve nicel yöntemler ile analiz edilmiştir. Sonuçların, KSK'ların kullanılabilirliğine ayrıca İnsan-Bilgisayar Etkileşimi literatürüne katkı sağlayacağına inanılmaktadır.

Anahtar Kelimeler: kullanılabilirlik, kişisel sağlık kayıt sistemleri.

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LIST OF ABBREVIATIONS

HCI	Human Computer Interaction
PHR	Personal Health Record
ISO	International Standard for Organization
UEM	Usability Evaluation Methods
GUI	Graphical User Interface
EHR	Electronic Health Record
MHR	Medical Health Record
SD	Standard Deviation

CHAPTER 1

INTRODUCTION

Personal Health Record (PHR) systems are used for keeping track of private health information by the individuals themselves. With the information incorporated into PHRs, users can control their own health status, which would enhance diagnosis and treatment of diseases using the historical data. PHRs' existence greatly depends on their usability. Google's PHRs ceased in 2012 because of such problems [48].

This study aims to find out the usability problems in E-Nabız and HealthVault systems by comparing both systems. E-Nabız is a newly developed system, while HealthVault has been in service for more than eight years. To discover these problems this study has raised research question and sub-questions about the *difference between E-Nabız and HealthVault in terms of their usability with efficiency, effectiveness, and satisfaction*.

The usability of E-Nabız and HealthVault has been analyzed through usability tests, interviews and questionnaires. It is believed that the results would provide valuable insights into the improvements of PHR systems.

This thesis is separated into five chapters. The first chapter is about the objective of the thesis and information about PHR systems. The second chapter is about literature review of usability problems with PHR systems. The third chapter explains information about the methodology that is followed in this thesis. Fourth chapter provides analysis of the data gathered, which contains three main parts: quantitative, qualitative results and interview questions. Finally the last chapter elaborates conclusions, suggestions and future research in the area.

CHAPTER 2

LITERATURE REVIEW

2.1 Fundamental Concept of Usability

Usability is a key term within the human computer interaction domain (HCI) [1]. HCI allows people to evaluate the usability of user oriented systems with procedures and techniques. These techniques are grouped as inspection, research and testing [2] [3]. HCI aims to improve usability of such systems as much as possible by detecting what users need and what they expect [4] [5]. The term indicates that design is the most important aspect to achieve more usable systems in terms of usability, hence, HCI researchers' and practitioners' main focus is this [6]. Numerous studies have attempted to explain usability in different ways in the literature. There is no in agreement definition of usability and ease of use surely cannot be expressed in an objective measure. Many authors have offered numerous definitions and classifications of usability and because of that, today, even though there are disagreements at certain levels, but there is an agreement on the meaning of usability. Usability is a non-functional emergent property which can be described as the reflection of how easy it is to use the system. It relates to the behavior of the system in its operational environment [7]. Shackel defines it as the capability in human functional terms for use with ease and effectively by the precise range of customers, given special training and consumer aid, to satisfy the distinctive range of tasks, within the detailed variety of environmental scenarios [8]. Bevan says that usability is the quality in use, so that the product can be utilized in the real world [9]. One of the well-known definitions is by the king of usability, Jakob Nielsen [10], which state:

''Usability is a quality attribute that assesses how easy user interfaces are to use. The word usability furthermore refers to ways of making improvements to ease-of-use throughout the design process".

Moreover, according to him usability outlined as a user experience quality measurement when interacting with a design. He specifies five attributes of usability as [11] [12]:

a. Learnability: The design has to be not complicated to learn. Using the design have to be fast when users working on it.
b. Efficiency: The design has to be efficient to use. The output of productivity will upward thrust when the user has totally educated the design.
c. Memorability: The design should be easy to memorize. The user does not have to learn the design again when, after some period does not use it.
d. Errors: The design should have a low error ratio, which makes it possible for users to make just a few errors during using the design. After they make errors they can easily recover from these errors.
e. Satisfaction: The design has to be pleasing to use that makes users satisfied.

There are other definitions of usability as well, the International Standard for Organization (ISO 9241-11), which defines usability as: *"It is the effectiveness (refers to the ability to complete a task), efficiency (refers to amount of effort required to complete a task), and satisfaction (refers to the degree to which the user is completely happy with his/her experience) with which the intended users can attain their tasks within the supposed context of product use"* [13]. This definition is closer to the human interaction perspective which means we are able to make the product easier to use and develop it more closely to the user requirements [14].

2.2 Usability Evaluation Methods

Usability evaluation reaches back to the starting of HCI, usability evaluation methods (UEM) returned back to more than 10 years ago [15] [16], and studies for comparing UEMs have also performed for some time [16]. Nowadays, a large variety of UEM have been developed and utilized in practice to check whether the product is usable or not. A usability evaluation method can be defined as a sequence of

activities for collecting information about the interaction of the user with the system itself, to be able to determine what features of the product could contribute to a certain measure of usability. The data gathered can be used as specific measures, such as task completion time, error frequency or user preference, that will reflect the usability of the product. These methods allow the identification of usability problems by means of an in-depth analysis of the Graphical User Interface (GUI) [17] [18]. UEMs had been previously improved to particularly evaluate WIMP (Window, Icon, Menu, Pointing device) interfaces, that are the most specific for desktop applications. Since Web-based interfaces have grown in significance after the popularization of the internet and the websites, new and adapted UEMs have emerged to deal with this new style of user interfaces. UEMs can also be applied through any phase of the software development process. It is not mandatory to release a functional component in order to perform a usability study. These evaluation procedures can also be performed on prototypes. Although it is preferred the ultimate product, a usability test during early stages helps to decrease the impact on costs since changes would not be difficult to implement in the early stages of the development process [17].

In the literature, there are many methods of usability evaluation that are relevant to interactive software systems. Most of them are also appropriate to evaluate the usability of web applications. Whitefield et al. [19] and Holzinger [20] provide a classification of usability evaluation methods depending on the kind of user that interacts with the software throughout the test. According to them, these methods can be categorized into two groups: usability inspection methods (involving only usability professionals) [3] and usability experiment methods (involving test users) [12].

The main attribute of inspection methods is the participation of usability specialists (based on the analysis instead of the experience). This set of methods is based on the inspection of GUIs by experts who are identifying mistakes and design problems. The most representative methods in this field are [3] [21]:

- Heuristic Evaluation: A team of evaluators inspect the interface design based on the usability standards (heuristics).
- Cognitive Walkthrough: A task oriented walkthrough based on a formal cognitive model of beginner user behavior (learning easy analysis).
- Action Analysis: A quantitative analysis of actions necessary to predict the time required for tasks, based on time estimated for typical interface actions of experimented users (an efficiency analysis).

On the other hand, usability experiment is a usability evaluation method which involves the participation of end users. In this kind of method, usability problems are recognized by observing the user. Number of users are requested to interact with the system voluntarily. During this test, users have to perform a set of predefined tasks using the software product to be tested. While users are using the system, usability specialists can identify usability problems through user observation. This process allows a usability specialist and end users to find usability problems since these are reflected in comments, notes, ideas, recommendations, interviews, questionnaires and gestures. That means the testing provides quantitative and qualitative data from real users who have performed the real tasks with the product [21] [8]. The main methods of usability experiment are [22] [23]:

- Thinking Aloud: Test users express ideas while performing test tasks.
- Co-Discovery: Two test users explore the system of software together. Insight is gained from their conversation while performing specific tasks.
- Field Observation: Controlled experiments, measurements, and statistical analysis.
- Query Techniques: Questionnaires and interviews.
- Usage Studies: Usage data is gathered from a small number of users working on their own particular tasks in their natural environment for a longer period.

To perform the usability experiment successfully, there are common usability experiment characteristics that will result with the best practices. The characteristics are [23] [24]:

- Specific objectives for each test.
- The individuals representing real users.
- The users doing real tasks.
- The usability researcher observing users and take notes on what they do and say.
- Usability researcher doing the data analysis, diagnoses the problems, and suggests changes.

According to the king of usability, Jakob Nielsen, on the web, for survival usability is an important condition. Users will abandon the website if it is complicated, unclear, has bad navigation, tough to read and does not meet the user's needs.

Many users are not able to spend much time trying to investigate how the website works. Since there are other websites that are accessible, leaving the website is the first thing that the user thinks about when the user finds it difficult to deal with the website [10].

High level of usability usually benefits to profit in the business which is generally the main focus of companies and stakeholders. It leads to happier and satisfied users. If the user is satisfied, then the user will be a loyal customer and probably recommend company's service or product to other people as well. Usability also brings many advantages such as increased productivity and enhanced quality of work by reducing the amount of user errors [25] [26].

2.3 Personal Health Record Systems

A Personal Health Record (PHR) can be simply described as any system or set of tools used by a patient or user to manage or monitor their health [27]. Functions of the PHR can include information collection, storage, sharing, patient-provider communication, health education, and health self-management [28]. Information included in the PHR can involve: private information, situation lists, illnesses, diagnoses, allergies, immunizations, household history, social history, procedures,

hospitalizations, preventative health recommendations, medications, supplier list, laboratory test results, appointments, and home monitor data [28]. Data can be objective, such as clinical test results, or subjective, such as questionnaire responses [29]. It is important to confirm that a PHR is managed by the individual, in contrast to an electronic health record (EHR) or electronic medical record (EMR), which is managed by a health institution or a health care professional [29].

According to M. S. Housh et al. [30], PHR is defined as:

"An electronic application through which individuals can access, manage and share their health information, and that of others for whom they are authorized, in a private, secure, and confidential environment".

There are two distinct types of PHRs [31]:

1. Tethered, which is a PHRs that is connected to a medical service provider EHR such as My HealtheVet. My HealtheVet is a proprietary tethered PHR that is connected to the Veterans Affairs EHR.
2. Untethered, which is not connected to an EHR. Patients enter and maintain their own data. Microsoft HealthVault is an example of an untethered PHR.

There are multiple formats of PHR such as paper based PHR, standalone PHRs where health records are kept on a personal computer or other medium such as USB flash drive [32], and the majority of PHRs are web-based. This thesis focuses on specifically on the use of web-based PHRs.

There are multiple ways for a patient or user to use PHRs:

1. Some insurance companies provide PHRs.
2. A medical service provider might sign the patient up for a PHR.
3. Publicly available independent PHRs are available in the market such as Microsoft HealthVault or the discontinued Google Health [32].

In order for PHRs to be completely adopted and give stakeholders with their optimal features that are requested, stakeholders need to get rid of many barriers. Some of

these include policies, infrastructure, training, access, availability, and cost. Each barrier affects the adoption of PHR individually. Policy barriers may involve state and national laws restricting the amount of information a health entity that can be shared with different organizations. Internal policies within a health organization may additionally affect how much information is made available to the stakeholders, consequently affecting the usefulness of the PHR [28].

One of the main challenges to fully realize the benefits of the PHRs is its low level of adoption among the general public. At present, the total number of PHR users is not well known. PHR adoption is estimated to be lower than 2% of the U.S. population [33]. Other authors believe that this number is much greater. Kaelber, Jha, Johnston, Middleton and Bates estimate 70 million people in the U.S. have access to some form of PHR, generally through their health insurer [34]. Even though these providers service a large number of people and provide their own PHRs to their members, the total number of people using their PHR is small. Thus, it is obvious that the adoption rate of PHRs is extremely low currently.

The barriers to entire PHR adoption are numerous. There are many factors that could explain why even though they have a PHR option available by their provider, they choose not to use it. They may not understand what it is or know that this option is there, existing for them to use. Even if they know what it is, they may find it difficult to use or do not see any worth in using it. Additionally, it might be that they do not want to manage their health, however, instead prefer their physician to do it for them [28].

Early experiences with PHRs by Halamka, Mandl, and Tang showed that some states have regulations limiting the distribution of specific health information [35]. Unless states change law on health information access, certain information from an individual health record cannot be made available to their PHR. Similarly, such restrictions are placed by hospitals where clinicians are responsible for authorizing health record access to the others. While there are many benefits of offering a PHR, no studies have quantified the financial benefits to providers who offer PHRs to their

patients, probably an additional reason for the slow launch process of PHRs by providers [36]. Tang et al. [29] points out additional barriers affecting PHR adoption. They include connectivity to EHR systems and legal challenges (i.e. liability, medical errors) in making PHRs widely available. These authors also highlight a lack of understanding issues related to PHR interface design, individuals' PHR needs, and information access.

Health information of PHRs may not just come from providers, but from individuals themselves. For this reason, individuals must collect and populate their own PHRs with the data that is provided by themselves. Most of the time, this is carried out by manual data entry which is a tiring task for individuals, especially for those with physical or mental disabilities or lack of training. Loberet et al. indicate other PHRs' barriers which include access to PHR systems, access to computers or devices, mental disabilities, physical disabilities, low computer or reading literacy, and low health literacy [37].

PHRs have many benefits to both patients and providers which involve [38]:

- Store information with measurements that are measured at home such as blood pressure level and blood glucose levels.
- Store data to the individual in a way which can be understood.
- Offers a large body of healthcare information related to the interpretation of the results and actions that should be performed.
- Encourage individuals to take extra active role in the management and prevention of illnesses.
- Include alerts, including the need to refill a prescription for schedule a physician's appointment.
- Minimize the missing information in verbal interactions between users and stakeholders.
- Reduce health care costs.
- Improve health care quality that is provided and safety of users in general.

In this research, two PHR systems were examined for their usability, Microsoft HealthVault and E-Nabız.

Microsoft's HealthVault is a personal data platform that allows a user to record, collect, and share all health information in a central location. Launched on October 4, 2007. It is aimed both at individuals and health experts. HealthVault consists of two separate parts (an electronic section for health data and a specialized search engine for health information on the World Wide Web) each free to customers. HealthVault differs from the other PHR providers by an extensive partner network, specifically in the area of medical and fitness devices. HealthVault actually supports more than 300 applications and 80 devices. Some devices connect to HealthVault through the HealthVault Connection Center, a complimentary client application that allows for devices to upload information directly to HealthVault through a Windows PC [39].

E-Nabız is a new and free Turkish PHR system, It is established on February 5, 2015. It is for people to access their own digital health records by keeping the information secure and safe. The purpose of the system is to prevent unnecessary examinations and treatments by making people manage their own health status. Therefore, lowering the costs for examinations and treatments that people pay. Currently, even though not all the functions are available, there are some that matters most. For example, data about blood pressure and medication usage can be stored in E-Nabız. Also, doctors and patients can share information with each other through the system. E-Nabız is available on any browser, it is also accessible from Apple and Android devices [40].

2.4 Usability of PHR systems

In the literature, main studies of PHRs focus on outcomes like hospital readmission rates or death rates instead of focusing on the usability of the system from the user's point of view [41] [42]. Usability experiment is a research method which focuses on the usage of technological systems. This research approach is essential to the design of effective interactive health care systems [43], however, currently, there is a lack of

understanding of optimal usability [28] [44]. In a usability experiment, target users participate in the evaluation of a system [45]. This evaluation identifies the certain factors affecting the success or failure to use, including characteristics of the technological interface and personal characteristics of the user [44]. There have been usability differences between older and younger adults within the use of an online website for health recording [46]. However, research on how physical and mental limitations affect the usability of web interfaces for health has been limited [27] [46] [47].

Keeping the balance between usability and other systems, developing properties and requirements is the key factor to the success and failing to do so could lead to a catastrophic adoption and finally mass user rejection and failure of the system as it can be seen the literature with proofs.

Google Health was a free Web-based PHR service from Google company which launched in 2008 and was discontinued early 2012 [48]. In four years of service Google was not ready to engage and keep users for this service and had terminated because of several reasons. In 2014, Spil and Klein [48] conducted interviews with 51 participants for both systems. Google Health had 27 participants and Microsoft HealthVault had 24, to compound the user perspective of both services and research the reason why Google stopped providing the service. The study points out that more than half of the Google Health users reacted negatively about usability problems. For instance, the system's use a lot of medical terminology which was one of the reasons that made users stop using the service.

Ozok et al. [49] offered another study of usability and results have shown that user's point of view of the usefulness was really high and users gave positive feedbacks about their awareness of preventative health care after using the system. The research used a particular PHR called myself-T.Net which aims to improve preventative care, preventive screening, and serve as health repository for the patients. The study has shown that altered and personalized information could lead to problems with the system, especially understandability of medical terminology and not considered

cases like recently changed factors for a patient such as cholesterol levels from year to year [49]. Segall et al. [42] evaluated the functionality and usability of HealthView the PHR of Duke University. The research asked 20 chronically ill participants who most likely will use the system often because of their chronical problems. They are requested to "think aloud" or describe their ideas and thoughts in the process of completing tasks that are given to them and asked to be completed in the random order. Upon completion, the participants have been requested to rate HealthView usability on a scale of 1 to 5. HealthView obtained an average of 3.9 on characteristics such as consistency, clarity of messages, learnability, and information organization. The observation of the think aloud sessions showed that 30 to 60 percent of participants experienced difficulty discovering the lab test results, vital signs, allergies, payment history, add kids' page. The authors as it is indicated before, encourage system designers and developers to improve both system acceptance and user satisfaction via applying changes to their systems according to the outcomes of usability tests [42].

In this thesis, two PHR systems were explored through usability experiment methods by making participants use a PHR system. Usability of Microsoft HealthVault and E-Nabız systems researched through experiments dependent on qualitative and quantitative results, aiming to achieve improvements in PHR systems. Such improvements will make PHR systems closer to user requirements.

CHAPTER 3

METHODOLOGY

In this chapter, the methods employed for the research are explained. The research question is set, research flow is explained, documents and materials to conduct the experiment are explained.

3.1 Research Design and Questions

This study aims to reveal usability problems in E-Nabız and HealthVault systems by comparing both systems. To reveal these problems following research question and sub-questions are studied:

Research Question*: Is there a difference between E-Nabız and HealthVault in terms of usability of the systems?*

a) Is there a difference between E-Nabız and HealthVault in terms of efficiency?
b) Is there a difference between E-Nabız and HealthVault in terms of effectiveness?
c) Is there a difference between E-Nabız and HealthVault in terms of satisfaction?

To answer the research question and sub-questions about efficiency and effectiveness and define relations between E-Nabız and HealthVault two null hypothesis were defined:

H_{0a}: There is no difference in performances of users in terms of completion durations.

H_{0b}: There is no difference in performances of users in terms of completion percentages.

The research design used in this study is composed of qualitative and quantitative research which is described as a mixed method to provide a better and clearer understanding of the research question. The main phases of the research consist of data gathering, data analysis, results interpretation. The result after going through all the phases is used to support each research question. In this study triangulation method was used which combines data obtained from questionnaires, interviews and task performances [55].

Mixed methods provide more than one perspective to the study, which are explained as tools that allows researchers to describe and analyze their research questions in more detail [56]. In this study, experiments done through following triangulation method. Participants were asked to complete set of tasks to measure completion times, which is a quantitative measure, then, participants were asked to complete set of questionnaires which is a qualitative measure, then some of the participants were interviewed for further details and more insightful feedbacks.

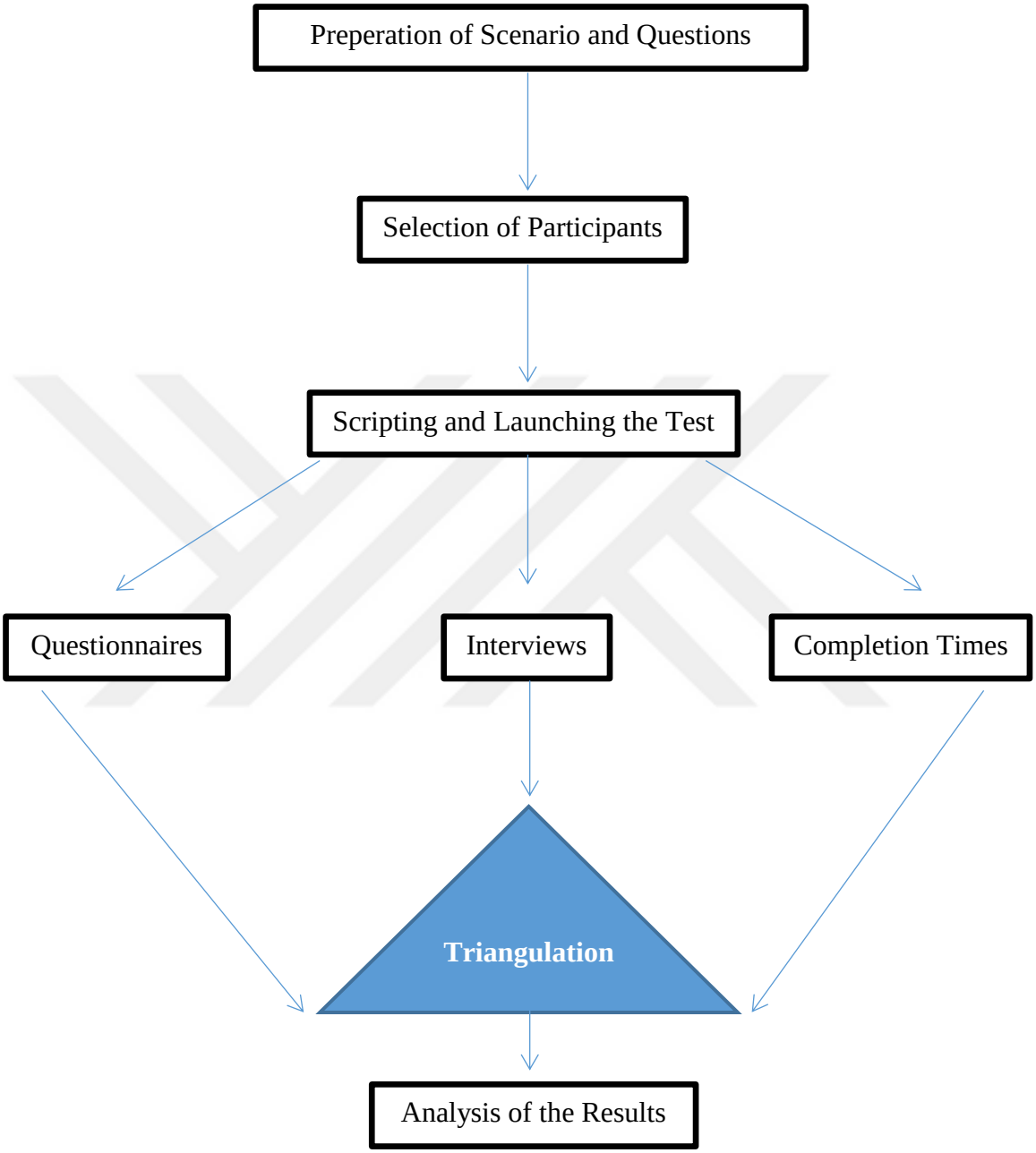

Figure 1 - Research Flow

Figure 1 displays the flow of the research. A scenario [50] for HealthVault was modified to be used in E-Nabız according to their cognitive loads. Cognitive load is the total amount of effort put on some task by a user. To calculate the cognitive loads, open source program coagulator is used [51]. In the end, both scenarios for HealthVault and E-Nabız were modified to have close cognitive loads.

These scenarios were given to users and expected to complete each task separately and in order. Afterwards, they were asked questions about the usability of the system and they were interviewed about the system itself. Even though written results are meaningful, verbal results acquired from interviews can enhance our understanding about the systems, since people tend to talk instead of writing.

Participants of this study were selected among computer literate people who are studying at Çankaya University in order to be able to point out the problems with the systems faster and more clearly. The experiments were performed in a laboratory environment with each participant separately.

In order to validate and support the findings of the usability experiment, triangulation method was used. Triangulation method gathers data from various types of research methodologies like quantitative and qualitative data to validate results by the correlation of the results of each methodology [55]. In order to achieve this, participants were interviewed, recorded during the experiment and asked to complete questionnaires as well.

3.2 Experiment Settings and Materials

A usability experiment has been conducted in a laboratory environment. After gathering information about the websites of the PHR systems and what was usable at the time, dimensions of testing were identified.

The experiment was to be conducted in the laboratory, participants were to be observed by two people, one can speak Turkish to understand and answer the questions of the participant, one another to observe the experiments. Notes were to be taken during the experiment about the participant's experience on the website, participants were to be recorded using the website, they were to be asked questions about the effectiveness, efficiency and level of satisfaction after the experiment is done.

Usability experiments have been performed by each participant separately in a lab environment. During the experiment each participant has been observed by two experimenters. They have taken notes and answered the questions of the participant during the experiment. Participants were recorded during their usage of the website, then they were asked questions about the effectiveness, efficiency and level of satisfaction of the PHR system. After performing experiments, triangulation method was used to analyze the data.

Several data collection methods have been utilized. The materials used during the study are listed and explained below:

- *Voluntary Participant Form:* It is an agreement between participants and the testers, stating results will be used only for scientific purposes. Also, all of the data gathered will be kept in secret for the privacy. Appendix E contains a voluntary participant form.
- *Pre-test Survey – Participant Information:* It is a set of questions to get information about the profile of the user. Appendix A contains a participant information form.
- *Post-test Survey - Feedback and Comments About The Website:* It is a set of questions to get feedback and comments about the system. Appendix B contains feedback and comments survey.
- *Post-test Survey – Interview Questions:* It is a set of questions to be answered verbally to get feedback about the system in more detail. Appendix C contains interview questions form.
- *List of Tasks – E-Nabız Scenario:* It is a set of tasks that the participant needs to complete in order to measure the usability of the system and compare it with HealthVault. Appendix F contains E-Nabız scenario.
- *List of Tasks- HealthVault Scenario:* It is a set of tasks that the participant needs to complete in order to measure the usability of the system and compare it with E-Nabız. Appendix G contains HealthVault scenario.

- *Camtasia Screen Recorder 8.6:* It is a screen recording program which is used to record participant using the PHR system from the desktop point of view.

The tasks of the scenario were divided into parts according to their cognitive loads, hence, their weights within the scenario were proportional to their cognitive loads. Recorded videos of users using the system were later on used to gather data on how long a task took to complete for each person, and each task was also divided into sub parts to get a clear view of completeness of a task. Observation and interview results were gathered to validate survey results and the experiment results of completion tasks.

The equipments needed for the recording were a computer, to perform tasks and record participant's screen, a video camera, to capture facial expressions and gestures of the subject, a microphone, to capture sound in the environment, a screen recording software, Camtasia version 8.6, to determine on the measures of task completion times [52].

3.3 Participants

Participants were chosen randomly from the Cankaya University, Engineering and Formal Sciences Faculty's students, aging between 20-24. Table 1 depicts the gender average ages. All the participants were computer literate. Appendix G shows the result of the survey applied to the participants to collect demographic data. The results show that, 50% of the participants were familiar with PHR systems. 75% of the participants were using e-Government services. All of the participants except one, were confident that they could use a website in their native language on the first try. 95% of the participants hadn't had enough information about these PHR systems before, even though 50% of them were familiar with PHR systems. The usability experiments have been performed by young users, as, if a system is hard to use with them, the usability problems revealed will most probably be more challenging to older adults.

Table 1 - Proportions of Participants by Gender and Age

Participant Groups	Female	Male	Age Average
E-Nabız	9	6	21.33
HealthVault	6	9	21.08
TOTAL	15	15	

3.4 Conducting the Test

Before conducting the experiment the purpose and the setting of the experiment was carefully explained to the participants. They were asked to read and sign Voluntary Participant Form because the results were going to be used for scientific purposes and recordings of the desktop and participants' visual appearance were going to be used for analysis.

During the experiment scenarios were given to the participants and asked them to complete tasks in order one by one using the PHR system. Participants were also encouraged to express their thoughts and feedbacks about the system verbally during the experiment. Recordings of their screen were used to calculate durations of each task and correctness of the tasks. One of the experimenters recorded all verbal comments and expressions on the task. On the other hand other experimenter observed the experiment from a third point of view and took notes.

Participants completed all of the tasks without any interruption. They were asked to focus only on the tasks, they also were asked to remove their phones to prevent any possible interruptions. Participants were asked to keep their knowledge and information about the system for themselves after completing the tasks to prevent influence on other participants [25].

Upon the completion of the scenario, participants were asked to answer a questionnaire about the usability of the system. Some of the participants were asked

further questions to let them explain their thoughts more. Their feedback and comments were listed to understand how the participant feels about the system.

Nielsen's study shown that five people are enough to determine the usability problems with the system within 80% of the all problems [25]. Thus, the results concluded from this experiment are expected to be enough to reveal the most important usability problems of the systems under investigation.

3.5 Limitations

For this study, the following validity of the results is limited to:

- Participants' honesty about the answers to the questions asked.
- The instruments that were used to gather information.
- The PHR systems that were inspected. Results may not be generalizable to different PHR systems.
- The first time usage of the systems. Results may differ on a usage of the systems for a long time.
- Turkish users that agreed to participate in the study because E-Nabız had no support for foreign languages.
- New papers and articles are being published frequently on PHRs, because of the duration of the study some of the newly published articles or papers may be missed.

CHAPTER 4

ANALYSIS AND RESULTS

The data collected from participants through surveys and recordings are analyzed through quantitative and qualitative measures. Results are used to answer research questions. Results are analyzed using SPSS version 22.0 and MS Excel 2013.

4.1 Task Based Analysis

Recordings of the participants' usage of the system were analyzed to get completion durations of each task. Timestamps are recorded in a file and then all are converted into seconds by taking the difference between each two timestamps. If a participant could not complete a task fully, his/her completion time is calculated through normalization for the whole test. Moreover, each task's completion percentages recorded to analyze effectiveness of the system.

Task 1 asks users to enter an allergy information into the system from correct sections on the website.

Task completion time and completion percentage results of the E-Nabız system are shown in Table 2 below:

Table 2- Descriptive Statistics of Task 1 - E-Nabız

Metric	Task1Seconds	Percentage
Mean	138.4	95.7
Std. Deviation	101.6	13.2

Participants who used E-Nabız completed Task-1 with a mean of 138.4 and standard deviation of 101.57. Overall, almost 96% of the task is completed.

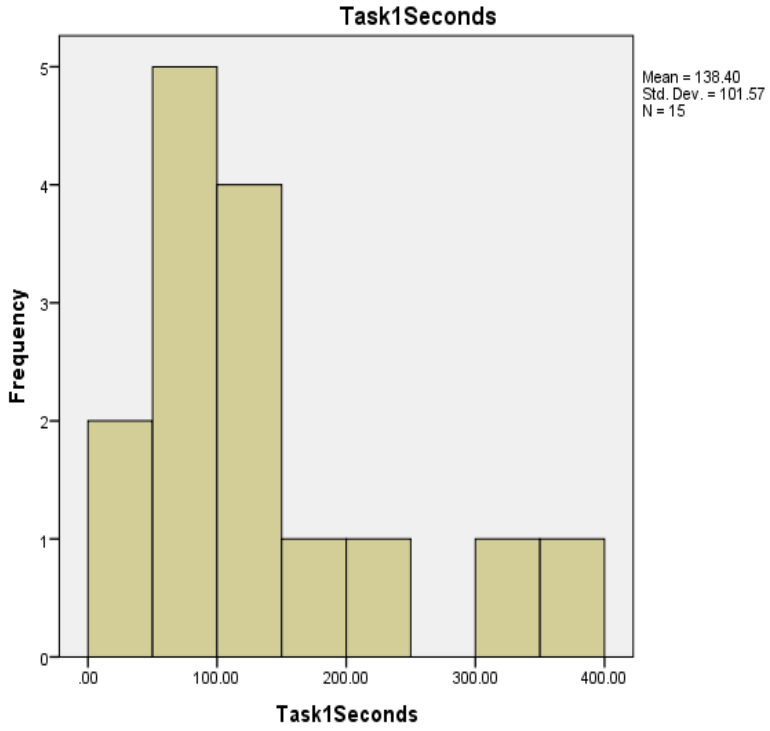

Figure 2 - Histogram of Task-1 in E-Nabız

Figure 2 shows that 13 participants completed Task 1 in less than 250 seconds, and only 2 participants completed Task 1 in more than 300 seconds in E-Nabız.

Task completion time and completion percentage results of HealthVault systems are shown in Table 3.

Table 3 - Descriptive Statistics of Task 1 - HealthVault

Metric	Task-1 Seconds	Percentage
Mean	151.9	84.7
Std. Deviation	73.2	13.6

Participants who used HealthVault completed Task-1 with a mean of 151.9 and standard deviation of 73.2. Overall, almost 85% of the task is completed.

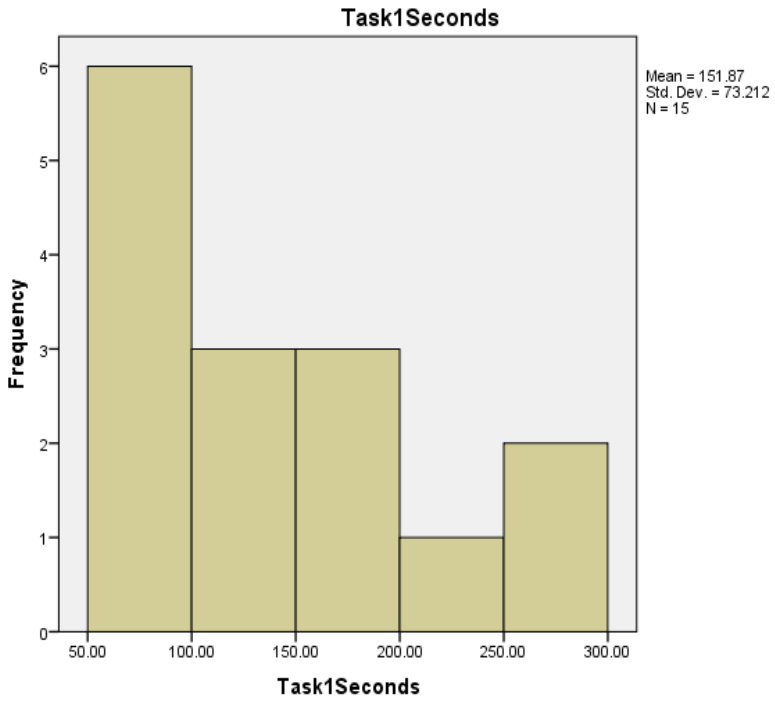

Figure 3 - Histogram of Task 1 in HealthVault

Figure 3 shows that, 9 participants completed Task 1 less than 150 seconds, and 6 participants completed Task 1 more than 150 seconds in HealthVault.

Based on the observations and user comments some problems are listed below:

- Dark colors used in E-Nabız makes it harder to focus on words, thus people tend to miss sections that they need to enter. Participant 2 stated her opinion about the first thing she paid attention on the website as *"Colors used in the website, since it's dark it is attention grabbing".* Also participant 6 stated his opinion on the same matter as *"Colors are too dark, it's suffocating".*
- Complicated view of E-Nabız and the cluttered menu bar makes it harder to find what is needed. Participant 5 stated that *"I think that menu bar on the left is too long and it decreases the accessibility to the menus."*
- The icon used in E-Nabız for allergies section is generally used as "search icon", thus letting people think that the section is not about the allergies. Participant 6 stated that *"People tend to read after seeing related icon. Which is missing in the E-Nabız, search icon is used for "Allergies" section which led people to miss what is written below."*

Task 2 asks users to enter medication information into the system along with starting date of the medicine.

Task completion time and completion percentage results of the E-Nabız system are shown in Table 4 below:

Table 4 - Descriptive Statistics of Task 2 - E-Nabız

Metric	Task2Seconds	Percentage
Mean	146.9	89.3
Std. Deviation	76.9	18.3

Participants who used E-Nabız completed Task-2 with a mean of 146.9 and standard deviation of 76.9. Overall, almost 89% of the task is completed.

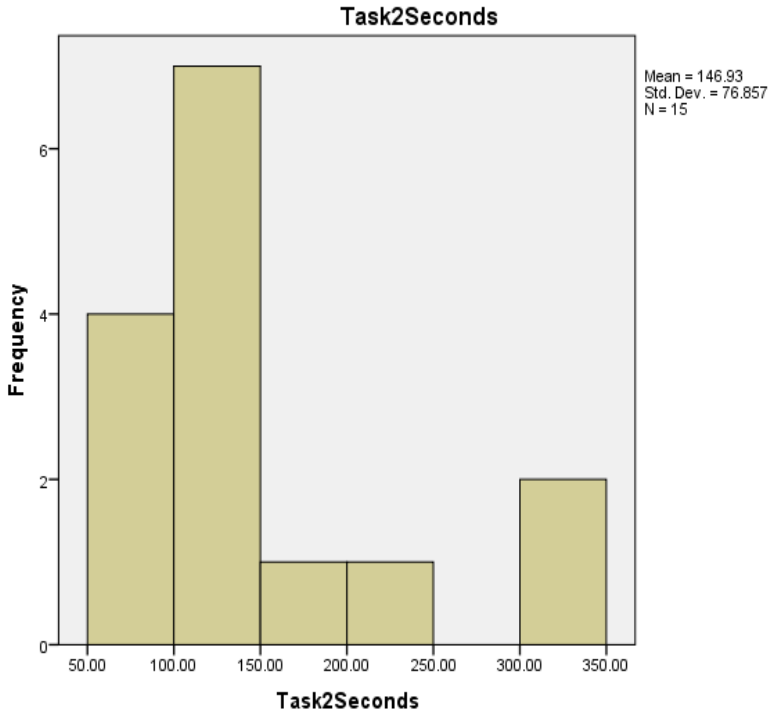

Figure 4 - Histogram of Task 2 in E-Nabız

Figure 4 shows that, 13 participants completed Task 2 in less than 250 seconds, and 2 participants completed Task 2 in more than 300 seconds in E-Nabız.

Task completion time and completion percentage results of HealthVault systems are shown in Table 5.

Table 5 - Descriptive Statistics of Task 2 - HealthVault

Metric	Task2Seconds	Percentage
Mean	119.2	74.0
Std. Deviation	30.0	15.0

Participants who used HealthVault completed Task-2 with a mean of 119.2 and standard deviation of 30.0. Overall 74% of the task is completed.

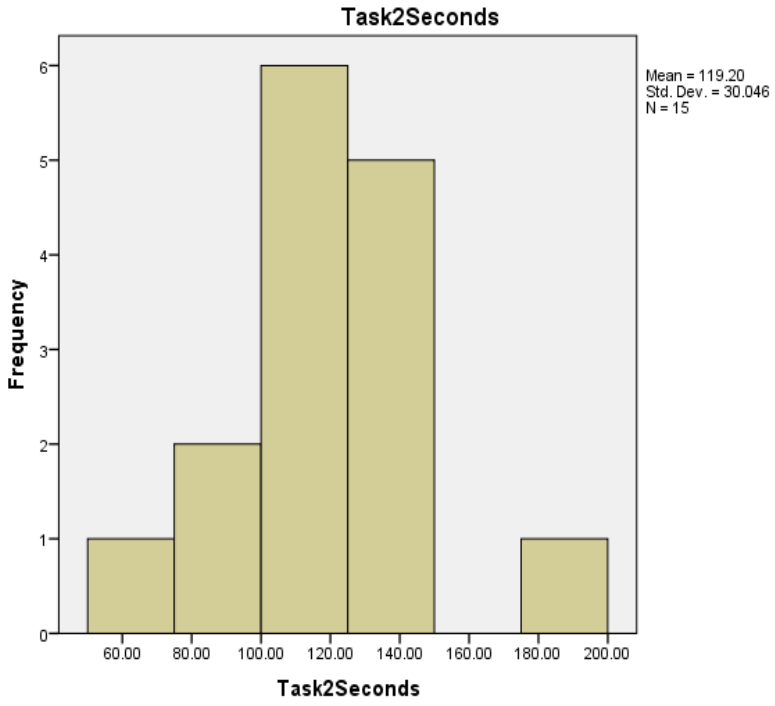

Figure 5 - Histogram of Task 2 in HealthVault

Figure 5 shows that, 14 participants completed Task 2 in less than 150 seconds and 1 participants completed Task 2 in more than 180 seconds in HealthVault.

Based on the observations and user comments some problems are listed below:

- Selecting the date in E-Nabız is problematic for most of the participants in terms of completion times, this sub-task either not completed correctly or wasted most of the time of this task relative to other sub-tasks. Instead of trying to select first year, then month and lastly day, the majority is trying to reach 01.01.2011 by changing the month. Since most obvious way is clicking button on the left, it takes too long to select correct date. Participant 5 stated that *"…Users must be able to enter the date, hour and other numerical values via keyboard."*
- Accessing some of the sections was not easy for participants of E-Nabız. Participant 10 stated that *"I had trouble with finding some sections. It would be better and easier to see if placed on the left menu."*

Even though HealthVault has a lower mean than E-Nabız, there are some problems with HealthVault as well:

- Deciding on the dosage of the medicine is complicated, 9 out of 15 people who used HealthVault could not enter dosage of the medicine because 2 different drop down menu have same/similar attributes inside.

Task 3 asks users to enter information about measurement of blood pressure and pulse along with measurement date and time.

Task completion time and completion percentage results of the E-Nabız system are shown in Table 6 below:

Table 6 - Descriptive Statistics of Task 3 - E-Nabız

Metric	Task3Seconds	Percentage
Mean	320.7	82.3
Std. Deviation	146.5	34.7

Participants who used E-Nabız completed Task-3 with a mean of 320.7 and standard deviation of 146.5. Overall, almost 82% of the task is completed.

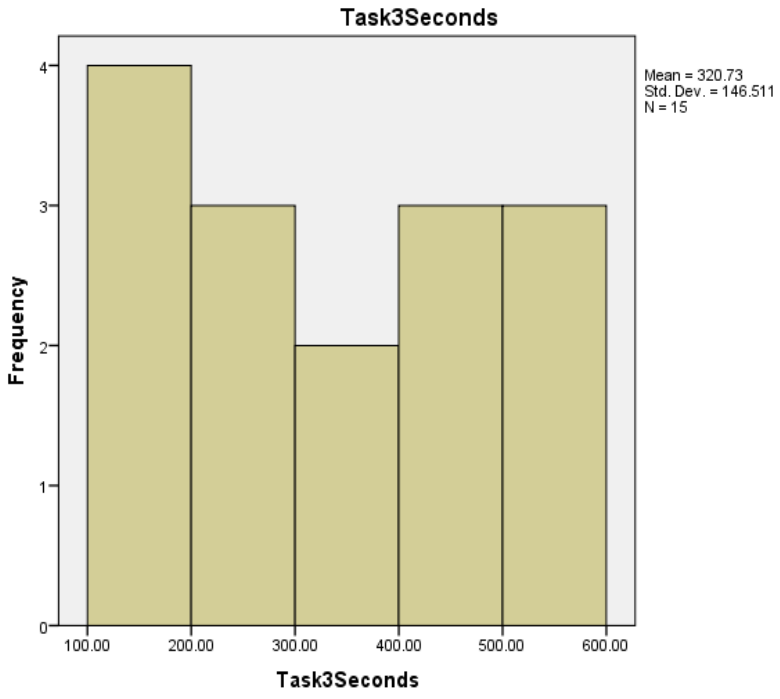

Figure 6 - Histogram of Task 3 in E-Nabız

Figure 6 shows that 9 participants completed Task 3 in less than 400 seconds and 6 participants completed Task 3 in more than 400 seconds in E-Nabız.

Task completion time and completion percentage results of HealthVault systems are shown in Table 7.

Table 7 - Descriptive Statisics of Task 3 - HealthVault

Metric	Task3Seconds	Percentage
Mean	90.5	96.3
Std. Deviation	53.2	6.9

Participants who used HealthVault completed Task-2 with a mean of 90.5 and standard deviation of 53.2. Overall, 96% of the task is completed.

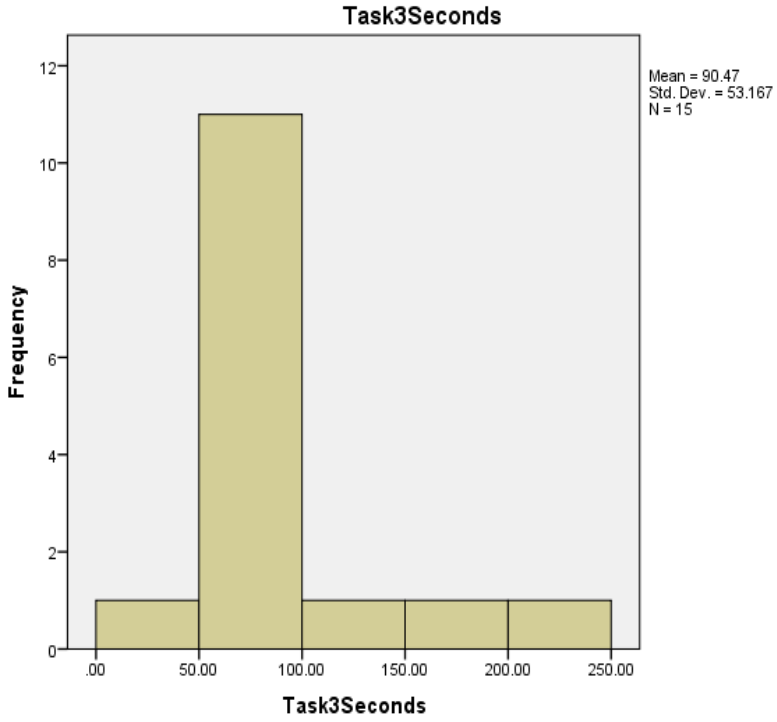

Figure 7 - Histogram of Task 3 in HealthVault

Figure 7 shows that 12 participants completed Task 3 in less than 100 seconds and 3 participants completed Task 3 in more than 100 seconds in HealthVault.

Task 3 was the most problematic task for E-Nabız users. Based on the observations and user comments, problems are listed below:

- The biggest problem with E-Nabız is that interface elements for entering measurements of blood pressure and pulse is not on the menu on the left. Users first try to find the related information on the left menu, then they try to check top bar. There also is no indication about such section. The only related section is located on the home page of the E-Nabız which can be accessed either by logging into the website or clicking on the homepage. Participant 7 stated that *"In general website is easy to use, however, I found website complicated in some sections"* also participant 10 stated that *"I had trouble with finding some sections. It would be better and easier to see if placed on the left menu"* on the questionnaires.
- After spending most of the time, E-Nabız users, some of them luckily, and others by trying every other option they have left, found the measurement addition section. Date selection and hour selection are problems here as well.
- E-Nabız users tried to re-enter hour or date by deleting the current value, however, this action results in going to the previous page. If the user has completed some other parts in the task, one gets frustrated by this action since it removes all previously entered data.
- Blood pressure and pulse are 2 different interfaces in the E-Nabız, which sometimes creates an ambiguous situation. Some users try to enter pulse values into the blood pressure values and vice versa.
- Buttons used for this entire interface in E-Nabız are fairly small, this also creates a difficulty for people to see where to click.

Task 4 asks users to enter information about measurement of blood pressure and pulse along with measurement date and time for the second time with different values.

Task completion time and completion percentage results of the E-Nabız system are shown in Table 8 below:

Table 8 - Descriptive Statistics of Task 4 - E-Nabız

Metric	Task4Seconds	Percentage
Mean	97.5	77.7
Std. Deviation	40.2	37.0

Participants who used E-Nabız completed Task-4 with a mean of 97.5 and standard deviation of 40.2. Overall, almost 78% of the task is completed.

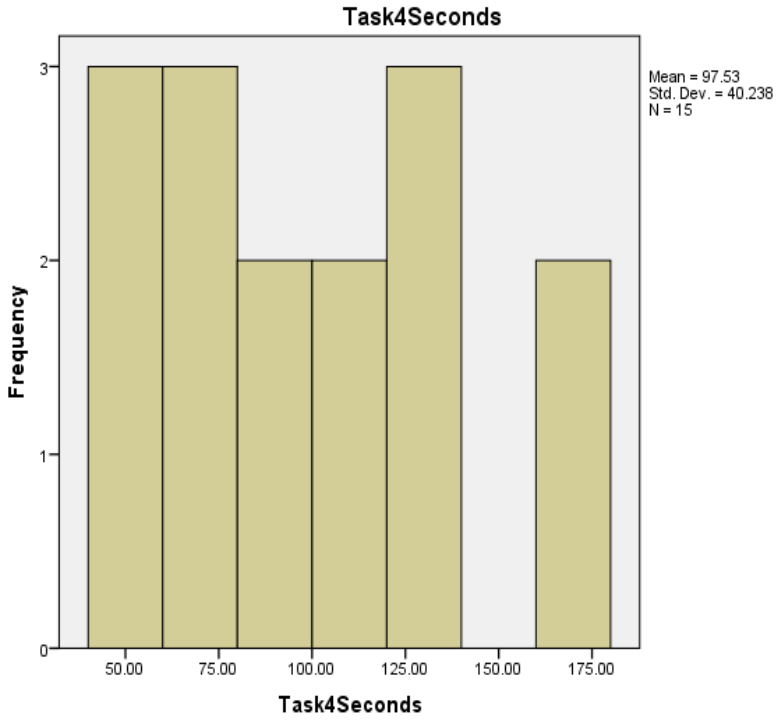

Figure 8 - Hisogram of Task 4 in E-Nabız

Figure 8 shows that 13 participants completed Task 4 in less than 150 seconds and 2 participants completed Task 4 in more than 150 seconds in E-Nabız.

Task completion time and completion percentage results of HealthVault systems are shown in Table 9.

Table 9 - Descriptive Statistics of Task 4 - HealthVault

Metric	Task4Seconds	Percentage
Mean	62.2	99.3
Std. Deviation	33.3	2.6

Participants who used HealthVault completed Task-4 with a mean of 62.2 and standard deviation of 33.3. Overall, almost 99% of the task is completed.

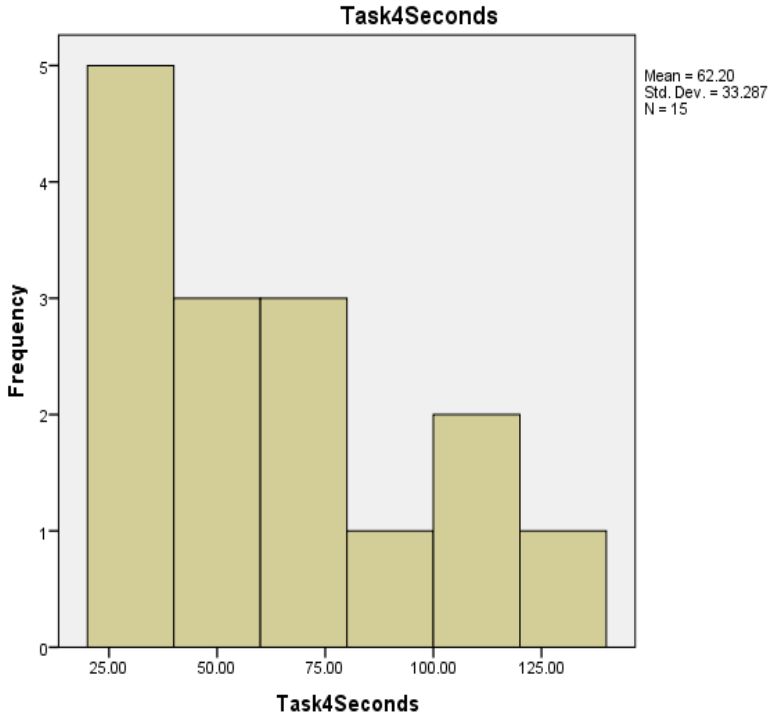

Figure 9 - Histogram of Task 4 in HealthVault

Figure 9 shows that 11 people completed Task 4 in less than 75 seconds and 4 people completed Task 4 in more than 75 seconds in HealthVault.

Task 4 is the same as Task 3 with different values, however, since it comes after Task 3 and Task 3 was very problematic for E-Nabız users to complete, in Task 4 it can be analyzed how the functions of the Task 3 works, because finding the section part is done already in this step meaning Task 3 and Task 4 are based on same structure which asks user to enter tension and pulse information, yet since Task 3 comes before Task 4 and participants were asked to complete tasks in an order, they wasted time finding related section in Task 3, when they come to step Task 4 they were already on tension, pulse addition section. Thus, Task 4 results indicate what would happen if users could be able to find related section quickly enough. Based on testers observations and user comments, problems are listed below:

- In E-Nabız after completing Task 3, if the participants did not refresh the page, data that was entered previously stay as they were. This wasted a lot of time for participants of E-Nabız's time because of the problems that were previously mentioned in the Task 3 with date and hour entering.
- In HealthVault there was a button for saving the information and adding a new entry in one step. Thus, people easily recognized what to do in the related page. Participants 1, 6 and 8 stated in their interviews that website is very simple to use.

Task 5 asks users to upload a file to the website.

Task completion time and completion percentage results of the E-Nabız system are shown in Table 10 below:

Table 10 - Descriptive Statistics of Task 5 - E-Nabız

Metric	Task5Seconds	Percentage
Mean	98.9	100.0
Std. Deviation	49.8	.0

Participants who used E-Nabız completed Task-5 with a mean of 98.9 and standard deviation of 49.8. Overall, 100% of the task is completed.

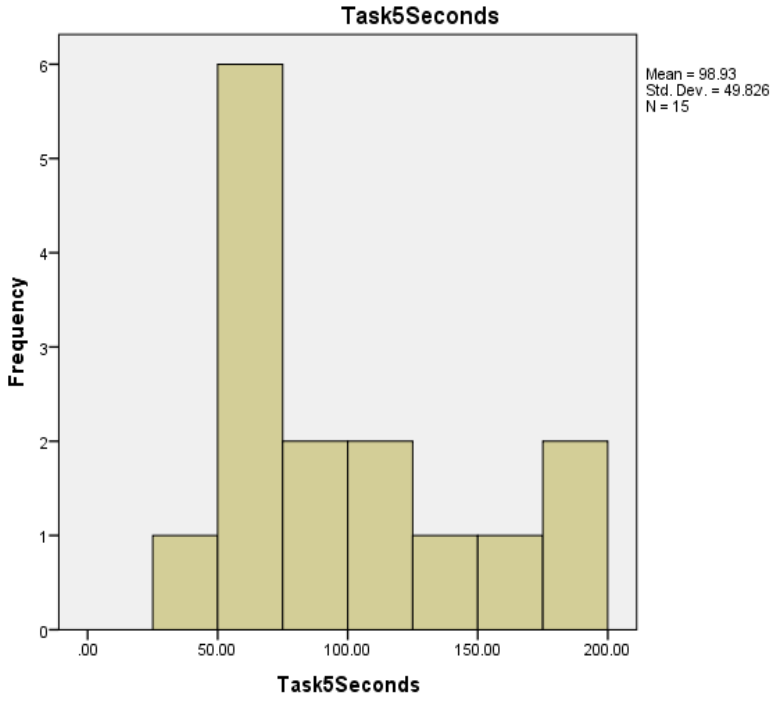

Figure 10 - Histogram of Task 5 in E-Nabız

Figure 10 shows that 9 participants completed Task 5 in less than 100 seconds and 6 participants completed Task 5 in more than 100 seconds in E-Nabız.

Task completion time and completion percentage results of HealthVault systems are shown in Table 11.

Table 11 - Descriptive Statistics of Task 5 – HealthVault

Metric	Task5Seconds	Percentage
Mean	185.2	80.0
Std. Deviation	113.2	41.4

Participants who used HealthVault completed Task-5 with a mean of 185.2 and standard deviation of 113.24. Overall 100% of the task is completed.

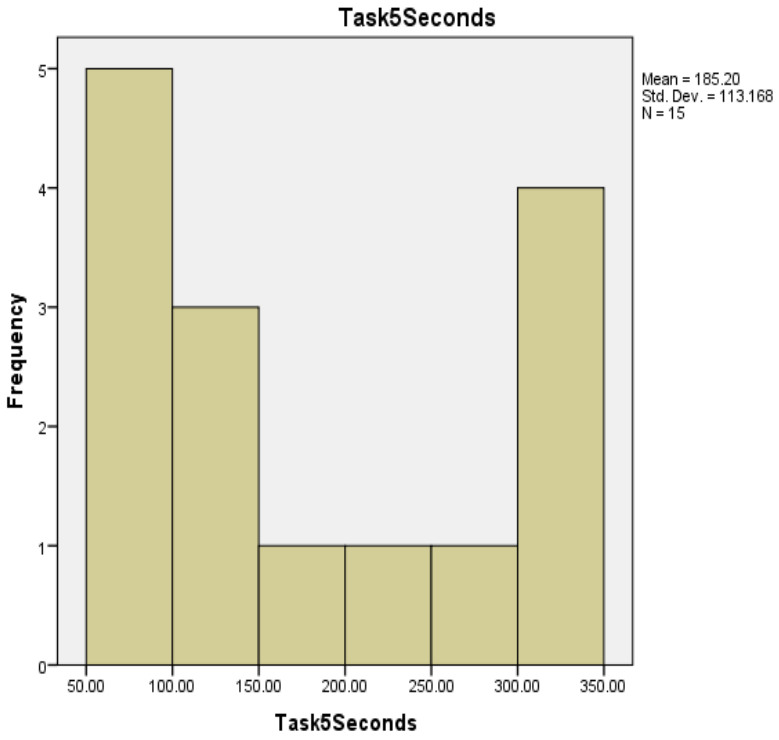

Figure 11 - Histogram of Task 5 in HealthVault

Figure 11 shows that 9 participants completed Task 5 in less than 200 seconds and 6 participants completed Task 5 in more than 200 seconds in HealthVault.

Task 5 was the most problematic task for HealthVault users. Based on the observations and user comments, problems are listed below:

- The HealthVault's homepage does not include file uploading section. Thus, people who navigate from the homepage since it has all the easy access buttons wasted most of their time to find the correct part to upload a file. Participant 8 stated that *"I had trouble with finding the file uploading section"*.
- Add button on the top menu of HealthVault was not distinguishable to the majority of the people at first which easily navigates the user to any section that was needed.
- Menu on the left for HealthVault was a simple text based, indented menu which generally does not grab attention as quickly. Even after grabbing attention from users, left menu use other synonyms than top section which makes it harder for people to access the correct section. Participant 7 stated that *"Website is definitely is good, yet menu on the left has too many options and it may cause problems for people to find whatever they are looking for."*

Task 6 asks users to update the information that was entered back in Task 3.

Task completion time and completion percentage results of the E-Nabız system are shown in Table 12 below:

Table 12 - Descriptive Statistics of Task 6 - E-Nabız

Metric	Task6Seconds	Percentage
Mean	75.3	80.0
Std. Deviation	39.1	41.4

Participants who used E-Nabız completed Task-6 with a mean of 75.3 and standard deviation of 39.1. Overall, 80% of the task is completed.

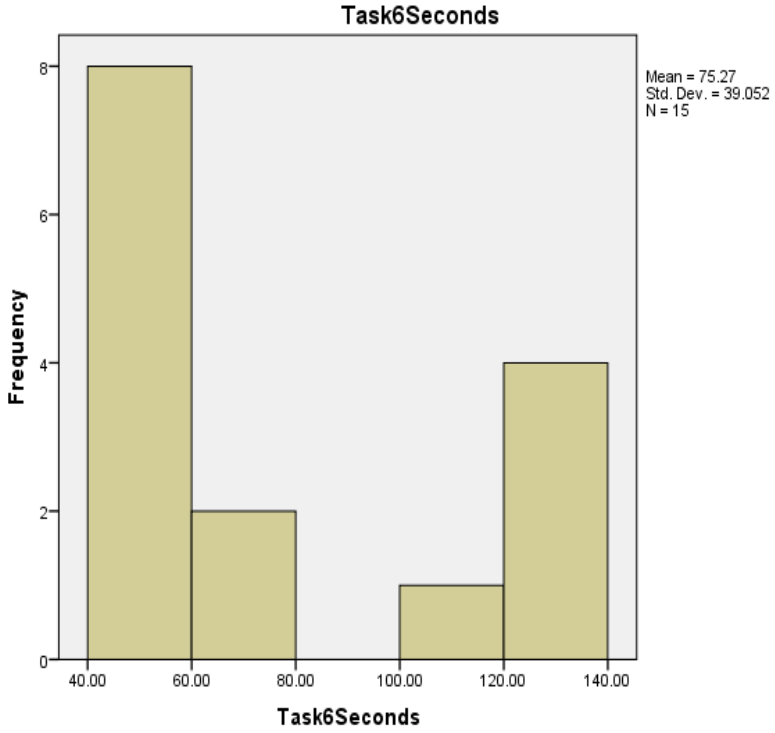

Figure 12 - Histogram of Task 6 in E-Nabız

Figure 12 shows that 10 participants completed Task 6 in less than 80 seconds and 5 participants completed Task 5 in more than 100 seconds in E-Nabız.

Task completion time and completion percentage results of HealthVault systems are shown in Table 13.

Table 13 - Descriptive Statistics of Task 6 - HealthVault

Metric	Task6Seconds	Percentage
Mean	69.1	100.0
Std. Deviation	50.6	.0

Participants who used HealthVault completed Task-6 with a mean of 69.1 and standard deviation of 50.6. Overall, 100% of the task is completed.

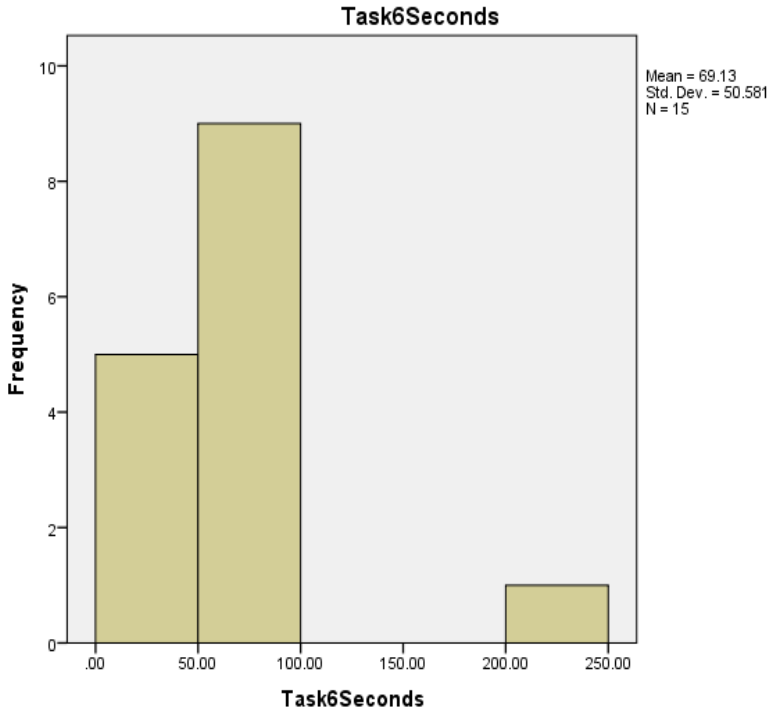

Figure 13- Histogram of Task 6 in HealthVault

Figure 13 shows that 14 people completed Task 6 in less than 100 seconds and 1 participant completed Task 6 in more than 200 seconds in HealthVault.

Tasks 7 asks users to go through all the steps that were completed previously and locate each section with information entered.

Task completion time and completion percentage results of the E-Nabız system are shown in Table 14 below:

Table 14 - Descriptive Statistics of Task 7 - E-Nabız

Metric	Task7Seconds	Percentage
Mean	99.4	81.7
Std. Deviation	29.8	22.1

Participants who used E-Nabız completed Task-7 with a mean of 99.4 and standard deviation of 29.8. Overall, almost 82% of the task is completed.

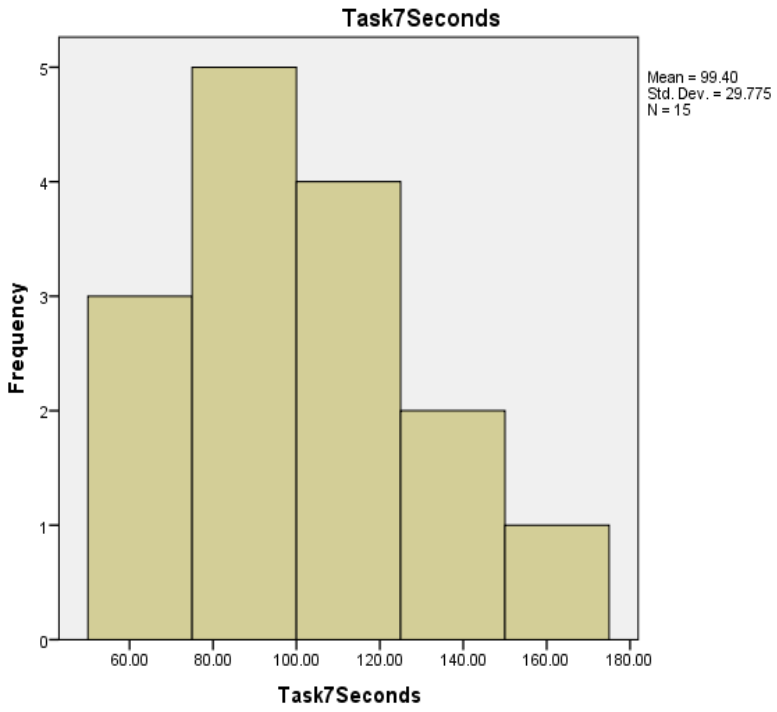

Figure 14 - Histogram of Task 7 in E-Nabız

Figure 14 shows that 8 participants completed Task 7 in less than 100 seconds and 7 participants completed Task 7 in more than 100 seconds in E-Nabız.

Task completion time and completion percentage results of HealthVault systems are shown in Table 15.

Table 15 - Descriptive Statistics of Task 7 - HealthVault

Metric	Task7Seconds	Percentage
Mean	66.9	83.3
Std. Deviation	26.3	15.4

Participants who used HealthVault completed Task-7 with a mean of 66.9 and standard deviation of 26.3. Overall, almost 83% of the task is completed.

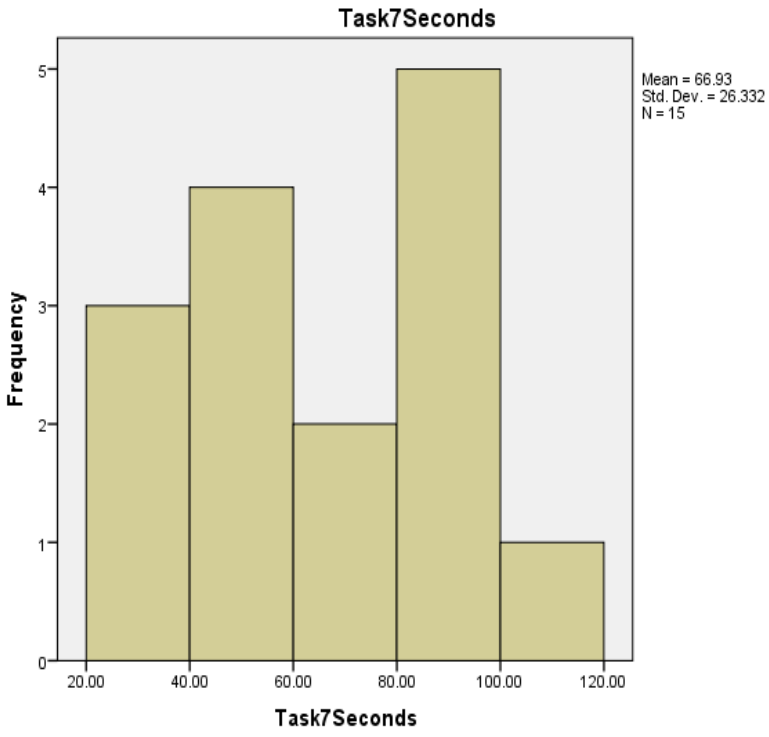

Figure 15 - Histogram of Task 7 in HealthVault

Figure 15 shows that 9 participants completed Task 7 less than 80 seconds and 6 participants completed Task 7 more than 80 seconds in HealthVault.

Since HealthVault had a feature that let users to see what they have done with the system previously, simple scrolling down in the home page lets HealthVault users to complete Task 7 in a matter of seconds. However file uploading was not included in the homepage, this resulted mostly incomplete yet fast completion of Task 7 for HealthVault users.

Effectiveness and efficiency are two of the dimensions of system usability. Effectiveness of the system can be analyzed through completion percentages of the tasks and efficiency of the system can be concluded through completion durations of the tasks. Hence, below in Table 16, we have a mean of the completion time durations and percentages of both systems.

Table 16 - Comparison of the Systems in terms of Completion Duration and Percentage

System Means	**E-Nabız**		**HealthVault**	
	Total Duration	Completion Percentage	Total Duration	Completion Percentage
Task-1	138.4	95.7	151.9	84.7
Task-2	146.9	89.3	119.2	74.0
Task-3	320.7	82.3	90.5	96.3
Task-4	97.5	77.7	62.2	99.3
Task-5	98.9	100.0	185.2	80.0
Task-6	75.3	80.0	69.1	100.0
Task-7	99.4	81.7	66.9	83.3
Total	977.1	86.7	744.9	88.1

Participants who used E-Nabız completed all the tasks with a mean of 977.1 and standard deviation of 253.9. Overall, almost 87% of the task is completed.

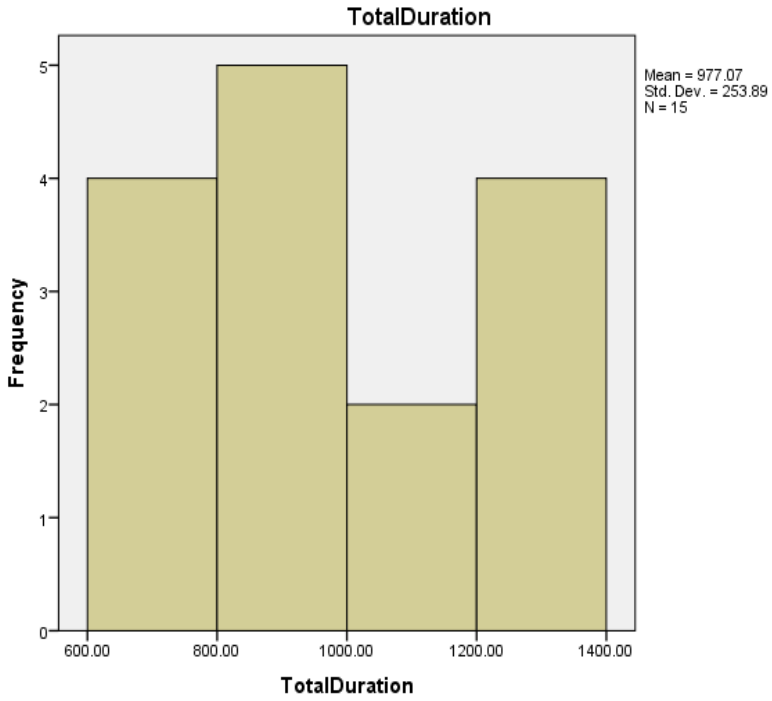

Figure 16 - Histogram of Total Completion Durations in E-Nabız

Figure 16 shows that 9 participants completed all of the tasks in less than 1000 seconds and 6 participants completed all of the tasks in more than 1000 seconds in E-Nabız.

Participants who used HealthVault completed all the tasks with a mean of 744.9 and standard deviation 118.0. Overall, almost 87% of the task is completed.

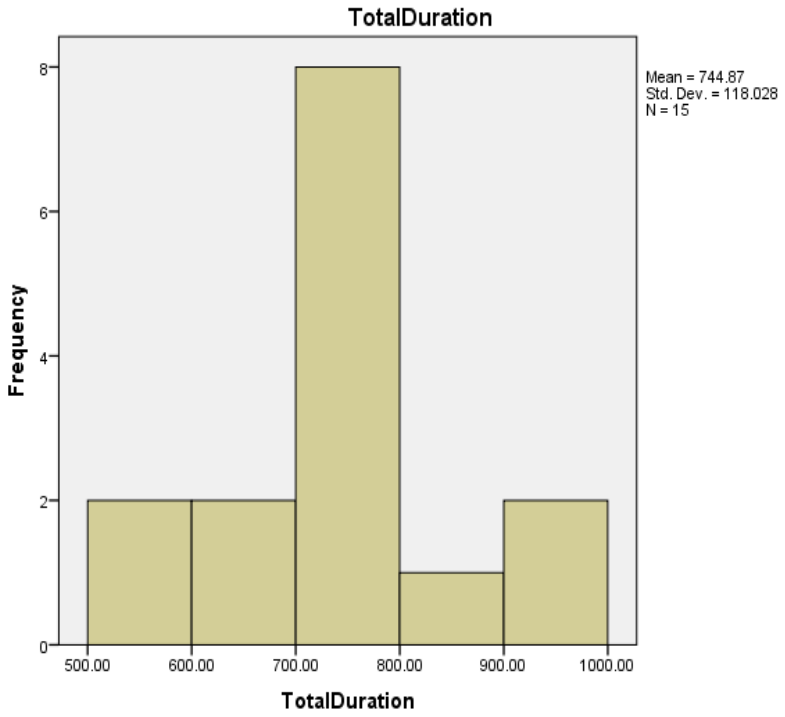

Figure 17 - Histogram of Total Completion Durations in HealthVault

Figure 17 shows that 12 participants completed all of the tasks less than 800 seconds and 3 participants completed all of the tasks more than 800 seconds in HealthVault.

Overall, in tasks 1,2,3 E-Nabız has worse results than HealthVault. In Task 5 HealthVault has worse than E-Nabız. On Tasks 4,6 and 7 E-Nabız and HealthVault are close to each other.

4.2 Questionnaire Results

There were 21 questions in the questionnaire and 8 questions in the interview, 3 of the questions were exactly the same to be able to cross check the results, since answers to these questions are almost the same they are omitted from the tables.

The answers of the questions are grouped below to understand users' views on efficiency, effectiveness and satisfaction of the systems. In order to determine whether a result is positive or negative, answers to questions are assigned points from 1 to 5, in which 1 means strongly agree and 5 means strongly disagree. The median of these points is 3, thus, positivity and negativity of the answer to a question is determined with the statement of the question and whether the answer is lower than 3 or not.

4.2.1 Efficiency Related Questions

The following questions were used to reveal the participants' views on efficiency.

- Question 2: This website is easy to use
- Question 3: I found everything I need easily on this website.
- Question 5: I could go everywhere I want easily on this website.
- Question 15: I think there were too many contradictions in this website.

Table 17 shows that HealthVault got a higher percentage on each efficiency related question. Which can be supported by Task based results, since task completion times on E-Nabız was much higher than HealthVault.

Table 17 - Percentage of positivity of the results depend on efficiency

	E-Nabız		**HealthVault**	
	Positive	Negative	Positive	Negative
Q2	53.33%	46.67%	66.67%	33.33%
Q3	46.67%	53.33%	60.00%	40.00%
Q5	46.67%	53.33%	66.67%	33.33%
Q15	80.00%	20.00%	100.00%	0.00%

According to interview and survey results, participants thought E-Nabız did not need more empty space yet it was highly complicated. Participants of E-Nabız answered question 3 with (Mean: 2.87 and SD: 1.13). Even though E-Nabız was superior in terms of uploading a file to the website, mean to question 3 is high because people

had problems in Task 3. Results of question 5 (Mean: 2.73 and SD: 1.28) indicated that finding sections were highly complicated. Date selection in E-Nabız frustrated most of the participants because of the unpredicted behavior of the functions. Thus, participants answered question 2 in a more negative way for E-Nabız with (Mean: 3.0 and SD: 1.46), on the other hand HealthVault with (Mean: 2.4 and SD: 0.83). Also question 15 brings more insightful results with (Mean: 3.33 and SD: 1.24) because tasks 3 and 4 do not differ, participants think that the website was consistent and there were no contradictions within the website.

The same questions were asked to participants of HealthVault as well. According to the results, most of the participants agreed that HealthVault does not need more empty space and it is not complicated. Survey results of question 5 (Mean: 2.47 and SD: 0.92) correlate with the interview results. Accessing sections in HealthVault were faster than E-Nabız because HealthVault was not complicated. The difference between means of question 15 clearly shows the superiority of HealthVault compared to E-Nabız in terms of contradictions within the website with (Mean: 4.07 and SD: 0.80). According to the results participants were satisfied with the system's ability to navigate users with (Mean: 2.53 and SD:0.92) even though Task 5 was completed faster in E-Nabız.

4.2.2 Effectiveness Related Questions

The following questions were used to reveal the participants' views on effectiveness.

- Question 1: I have completed tasks easily.
- Question 9: I found this website plain and simple.
- Question 11: I found this website unnecessarily complicated
- Question 13: I think one must get help from someone with technical knowledge to use this website.
- Question 14: I think functionality and productivity of this website is at a very high level.
- Question 16: I think people can easily use this website.

Table 18 shows that HealthVault got a higher percentage on each effectiveness related questions, though question 11 and question 14 are similar. However, completion percentages of tasks are almost the same on each system. This indicates that people's perception about the website in terms of effectiveness not as good as their completion percentages on tasks. Moreover, this will probably affect satisfaction of the system in the long term in a negative way.

Table 18 - Percentage of positivity of the results depend on effectiveness

	E-Nabız		**HealthVault**	
	Positive	Negative	Positive	Negative
Q1	73.33%	26.67%	93.34%	6.66%
Q9	40.00%	60.00%	80.00%	20.00%
Q11	73.34%	26.66%	80.00%	20.00%
Q13	53.34%	46.66%	73.34%	26.66%
Q14	46.66%	53.34%	53.34%	46.66%
Q16	20.00%	80.00%	46.66%	53.34%

According to interview and survey results, question 16 (Mean: 3.47 and SD: 1.13) saying it will be hard for other people to use the website. Mean of question 16 is the highest mean which results with disagreeing with the statement of the question. E-Nabız users answered question 1 with (Mean: 2.47 and SD: 1.19), this result shows that participants that used E-Nabız were in between in terms of how easy website was to use. Because of that, results of question 13 with (Mean: 3.2 and SD: 1.32) show that people think that others will not probably need help from someone with technical knowledge to use the website. Participants of E-Nabız answered question 9 with (Mean: 3 and SD: 1.47) as other tasks have already shown, Task 4 which is the same as Task 3 does not differ in terms of simplicity of the website. Even though participants of E-Nabız spent most of their time finding the related section in Task 3, it is obvious that the functionality of the measurement adding section is not as good as HealthVault's. This can be obtained with the results of question 14 as well with (Mean: 2.8 and SD:1.21) agreement among participants that the functionality of the website is not very good. According to interview results, most of the participants that

used E-Nabız answered the question with yes, to go over the data that had been entered previously entered require a simple and easy to remember interface. This also comes to the simplicity of the E-Nabız. Answers to question 11 with (Mean: 3.27 and SD: 1.33) agreeing the statement in question 11 supports longer completion durations of Task 7.

The same questions were asked to participants of HealthVault as well. According to the results, participants answered question 3 mostly with no. Because of the simpler interface of HealthVault with answers to question 11 (Mean: 3.47 and SD: 0.98) participants that used HealthVault managed to complete Task 7 faster than participants of the E-Nabız. Their answers to question 16 were more optimistic (Mean: 2.87 and SD: 1.13) because of the simplicity of HealthVault. HealthVault at question 9 also supports the results that have been derived in previous sections about HealthVault was being simpler than E-Nabız. Answers to question 14 with (Mean: 2.6 and SD: 0.99) do not differ too much than E-Nabız, yet there is a positive difference in HealthVault in terms of functionality. According to the results, easiness of tasks gets better in HealthVault with (Mean: 1.93 and SD: 0.46). Accordingly, their ideas about others using the website gets better in terms of means with (Mean: 3.47 and SD: 1.13) indicating others also won't need help to use the website.

4.2.3 Satisfaction Related Questions

The following questions were used to reveal the participants' views on satisfaction.

- Question 4: I enjoyed using this website.
- Question 6: This website was informative for me.
- Question 7: I would suggest this website to my acquaintance.
- Question 8: I found this website useful for personal health record.
- Question 10: I will use this website regularly in the future.
- Question 17: This website looks like other websites I have used.
- Question 18: I must be more familiar with the website to use it.

- Question 19: I think this website help me increase my prudential quality of health care.

Table 19 shows that HealthVault and E-Nabız are accepted as good PHR systems since some questions are answered with the same or the similar percentages.However, the dominance of HealthVault cannot be denied. HealthVault in general, offer better user experience and satisfaction to the user than E-Nabız.

Table 19 - Percentage of positivity of the results depend on satisfaction

	E-Nabız		**HealthVault**	
	Positive	Negative	Positive	Negative
Q4	46.66%	53.34%	46.66%	53.34%
Q6	60.00%	40.00%	73.33%	26.67%
Q7	60.00%	40.00%	73.33%	26.67%
Q8	80.00%	20.00%	100.00%	0.00%
Q10	20.00%	80.00%	40.00%	60.00%
Q17	40.00%	60.00%	40.00%	60.00%
Q18	40.00%	60.00%	26.67%	73.33%
Q19	73.33%	26.67%	80.00%	20.00%

According to interview and survey results, most of the participants did not enjoy using the website because of the features and their functionality their answers to question 4 resulted in (Mean: 3.07 and SD: 1.53). Results of question 6 shows that even though E-Nabız had some usability problems it was okay in terms of informing the user about PHRs (Mean: 2.47 and SD: 1.46). The satisfaction of a system can be derived from how much it is offered to other people to be used as well, results to question 7 (Mean: 2.6 and SD: 1.35) indicated people were indifferent to choose a side. Being more effective for a system would lower the mean. Question 8 is answered with the lowest means in both systems favoring the statement in question 8 with (Mean: 1.87 and SD: 1.06). PHRs in general were accepted as useful to the participants of E-Nabız. Interestingly, even though participants agreed that PHR is useful, they answered question 10 with (Mean: 3.4 and SD: 1.06) disagreeing the statement made in question 10. Question 17 is asked along with these to support

other questions' results, as expected, question 17 resulted with (Mean: 3.13 and SD: 1.25) saying the website was not like other websites, which is significant because most of the participants did not have any similar hour and date entering features in their highly used websites and participants had not had experience with PHR systems. Even though simplicity was not the positive side of the E-Nabız, participants were in the middle when deciding whether they need more familiarity with the website to use it or not with (Mean: 2.53 and SD: 1.41). Participants also think that the PHR system of E-Nabız will increase their prudential quality of health care with (Mean: 2.67 and SD: 1.49).

The same questions were asked to participants of HealthVault as well. According to the results, most of the participants agreed that HealthVault was easy to use. Especially compared to E-Nabız there is a major difference between means (Mean: 90.47 and SD: 53.17). Most of the users agreed scrolling up and down was not needed in HealthVault because of well structured homepage design with the most needed functions and feature placed right in front of the user. On the contrary, with question 4, participants of HealthVault did not give negative feedback about the enjoyment of the website (Mean: 2.6 and SD: 0.83). According to the results, participants' main thoughts on the system's color and design was HealthVault's simplicity, most of the users stated that the design and colors were good and not tiring the eyes. Answers to question 6 are better than E-Nabız with (Mean: 2 and SD: 0.93) still favoring the statement about the system. Because of the better interactions of HealthVault participants had with the system, answers to question 7 were also better than E-Nabız with (Mean: 2.2 and SD: 0.78). Thus, the satisfaction of the HealthVault was better than E-Nabız. As it is derived in participants of the E-Nabız's answer to question 8, both system's participants agreed that PHRs are useful, HealthVault's better impression made it get lower mean with (Mean: 1.67 and SD: 0.49). Interestingly, even though participants agreed that PHR is useful, they answered question 10 with (Mean: 3.4 and SD: 1.06) disagreeing the statement made in question 10. This result shows that lower adoption rate of PHRs continue within the young generation. Question 17 did not differ to much from E-Nabız in terms of

the means, even though HealthVault is a product of highly known company Microsoft, which has many users including most of the participants, since a PHR system is new to the participants generally, their answers to question 17 were slightly better than E-Nabız (Mean: 3 and SD: 1.07). Answers to question 18 are very close to the E-Nabız with (Mean: 2.67 and SD: 1.18), it is believed that even though HealthVault is a superior PHR system compared to E-Nabız, participants cannot decide whether they need to be familiar with the website or not, this is because PHR systems are new to the participants in general. Consequently, participants of HealthVault agree more that the website will help them to increase their prudential quality of health care with (Mean: 2.07 and SD: 0.80). The third dimension of usability is satisfaction of users in interacting with the system. Results show that participants who used E-Nabız were not satisfied as much as participants who used HealthVault. In general, the problems addressed previously are the main reasons.

4.3 Interview Results

- Question 1: What is the first thing you paid attention on this website?
- Question 2: Does the website complicated? Does it require more empty space?
- Question 3: Did you have a hard time finding information about the website?
- Question 4: Does the website feel organized?
- Question 5: Do you need to scroll up and down too much to access data on the website?
- Question 6: Does the website too slow for you?
- Question 7: What do you think about design, shape, colours and general style of the website?

According to the interview results, participants that used E-Nabız did not pay attention to the allergies section as they supposed to, to complete Task 1, instead E-Nabız's complicated view and dark colors grabbed all the attention. Also, most of

the participants had problems finding related information about the website. Only a few people managed to get help from the info section. In addition to these, most of the participants agreed that the website does not feel organized for them, resulting a distracted start to tasks. According to interview and survey results, participants thought E-Nabız did not need more empty space yet it was highly complicated. Moreover, Participants of E-Nabız answered interviews negatively because the system was complicated for them, participant 4 stated that *"It has a complicated view"* during the interviews and also participant 6 stated that *"Colors are too dark, it is suffocating"* indicating interface of the system was not good enough. They also stated that system was working on a normal speed which is slower than what HealthVault participants think of their system's speed.

Participants that used HealthVault were interviewed with the same questions. According to the interview results, simplicity of HealthVault was the first thing to focus on. This simple interface led participants to focus on what was asked in the task and start completing it. Participants reacted similar to their own PHR system. HealthVault users' general opinion was that HealthVault has a simple and efficient graphical user interface for example participant 1 stated *"Simple interface was the first thing that I noticed"* and also participant 6 stated that *"Website being too simple was the first thing that I noticed"*. Most of the participants answered with simplicity of the system were catchy when they were asked what the first thing they noticed on the website was. Participants of HealthVault also thought design and sketch was pleasant and the system was fast enough for them. Also, in the contrary to the E-Nabız's results, participants of HealthVault did not have a hard time finding information about the website, even though none of the participants opened up the info section directly, because of the simplicity, good organization and good divisions of sections, they could access related sections faster than E-Nabız users.

4.4 Hypothesis Testing Through Independent Sample T-Test

Independent samples t-test is chosen to be applied in this study to test the differences between two groups which are E-Nabız participants and HealthVault participants. Since independent samples t-test is strong when sample sizes are equal or close, robustness of the test is acceptable for this study, which consists of 15 participants of each sample [54].

Independent sample t-test applied to the total completion time of tasks for both systems with the null hypothesis H_{0a}.

H_{0a}: There is no difference in performances of users in terms of completion durations.

Table 20 - Results of Sample T-Test for Completion Durations

T-test for Equality of Means						
t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
					Lower	Upper
-3.212	28	**.003**	-232.20000	72.29136	-380.28215	-84.11785
-3.212	19.781	**.004**	-232.20000	72.29136	-383.10415	-81.29585

Table 20 shows that the test result is statistically significant within 0.95 confidence interval and p value less that 0.05 (Sig. (2-tailed)), hence we reject the null hypothesis H_{0a}.

This result shows that the participants that used E-Nabız (Mean: 977.07 and SD: 253.89) compared to participants that used HealthVault (Mean: 744.87 and SD: 118.03) spent more time completing tasks.

HealthVault users gave more positive feedbacks than E-Nabız users, thus it can be concluded that both methods support each other and there actually is a difference between usability of the systems in terms of completion durations.

Independent sample t-test applied to the total completion percentages of tasks for both systems with the null hypothesis H_{0b}.

H_{0b}: There is no difference in performances of users in terms of completion percentages.

Table 21 - Results of Sample T-Test for Completion Percentages

T-test for Equality of Means						
t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
					Lower	Upper
-.293	28	**.772**	-1.46667	5.01002	-11.72923	8.79590
-.293	20.544	**.773**	-1.46667	5.01002	-11.89969	8.96636

Table 21 shows that the test result is statistically significant within 0.95 confidence interval and p value higher than 0.05 (Sig. (2-tailed)). Hence, we accept the null hypothesis H_{0b}.

This result shows that the participants that used E-Nabız (Mean: 86.67 and SD: 17.37) compared to participants that used HealthVault (Mean: 88.13 and SD: 8.65) completed tasks with very close percentages. Thus, hypothesis H_{0b} is satisfied, resulting there is no significant difference in performances of users in terms of completion percentages.

CHAPTER 5

CONCLUSIONS AND SUGGESTIONS

5.1 Conclusion

The objective of this study was to compare the usability of HealthVault and E-Nabız PHR systems. Compared to Health Vault, E-Nabız was a newly established system, and before its introduction, Turkey had lacked a secure and well-driven PHR system. For this reason, performing the usability test on this newly established government website appeared to be helpful in terms of investigating adaptation and enhancement issues.

To this end, the study raised research question and sub-questions about the *difference between E-Nabız and HealthVault in terms of their usability with efficiency, effectiveness, and satisfaction*.

In order to answer the research questions and understand the differences between usability of the two systems, a mixed research methodology has applied. The data were collected through usability experiments, questionnaire and interviews. The usability experiment was conducted in a laboratory environment in which participants were chosen from Çankaya University students through random sampling. During the experiment, participants were given a scenario that consisted of several tasks to be completed using one of the PHR systems. During the experiments, task completion durations and percentages were recorded for analysis. Moreover, to support the data collected, a questionnaire and an interview were conducted with each participant.

The first sub-research question has been answered through independent samples t-test of completion durations. It has shown that the two systems are different in terms of efficiency.

The second sub-research question has been answered through independent samples t-test of completion percentages. It has shown that the two systems are not different in terms of effectiveness.

The third sub-research question has been answered through questionnaires and interviews. It has shown that the two systems are different in terms of satisfaction.

The usability test has revealed the usability problems of both systems. Quantitative and qualitative results are merged to verify gathered results in the experiment.

Some of the participants completed some tasks faster than others because of some features that are not obvious to the majority of the participants. If such features can be advertised, the total means of completing times can be lowered. Some of the obvious ways to complete tasks include the following:

- Selecting year, month and day in E-Nabız: Most of the users tried to select the date by clicking 50 to 60 times on the previous month button to go back to 01.01.2011 on Task 3. However, some participants clicked on month first, then year, and selected the correct date in 3 to 4 steps.

- Accessing each section in HealthVault: Most of the users used homepage to navigate themselves to the sections that they were required to access. However, one of the participants used "+Add" button in the header section to access all parts, which was way faster than general accessing.

The comments and observations of users have provided the basis for the following suggestions for enhancing the usability of the two systems featured in the study.

First, suggestions for enhancing the usability of E-Nabız (Appendix I contains screenshots about these issues):

- Using unrelated icons above text may distract people and lead them to skip the text. For this reason, it is better to put icons related to the texts.
- E-Nabız should allow users to enter values of dates and hours via keyboard, instead of forcing them to click buttons that arranges values.
- E-Nabız is cluttered, according to most of the users. Therefore, it would be more helpful to arrange menu items and put a more empty space.
- It is hard to access sections because scrolling down and up on the website needed a lot of time. Better menus are needed to eliminate this problem.
- Lighter colors should be used in the design of the E-Nabız. HealthVault's simple yet efficient menu got a lot of positive feedback about the simplicity of its appearance.

Second, suggestions for enhancing the usability of HealthVault (Appendix J contains screenshots about these issues):

- The"Add" button placed in the header of the website should be more visible.
- Some sections in the "Add" button should be more attention-grabbing, because even if people click on the button, they skip parts that are either necessary or can be used to access sections easily.
- The text-based menu on the left should be more visible so as to indicate that sections are accessible from that menu as well.
- The amount of sections that can be accessed from the menu on the left should be decreased. Similarly, the amount of sections on the homepage should be decreased to the minimum.
- The file uploading section should be accessible from the homepage like other functions.

Apart from problems with the systems, there was some positive users' feedback about the systems. Most of the users pointed out the user-friendly quality of the Health Vault, and similar users pointed out the loading screen animation for E-Nabız. After completing the experiment, almost every user was happy to know about PHR systems and their usage. Moreover, since this study was aimed at young university students, the usability problems revealed will most probably be more challenging to older users. Thus, the insights gained from this study will provide help and guidance for people interested in PHRs.

5.2 Limitations

The study has a number of limitations. First of all, the study consisted of thirty voluntary participants, hence, the results are limited to this sample size. Secondly, the honesty of the participants represents another limitation of the study, since the answers to the questionnaire and interview questions cannot be validated except on the basis of the honesty of the participants. Only two of the PHR systems were inspected in this study, thus the results are limited to E-Nabız and HealthVault, which means that the results could be different with other systems. Moreover, participants used these systems for the first time in their life, and therefore the results are limited with first time usage because on the long-term basis the results could be different. In addition, since E-Nabız had a Turkish user interface only, participants were chosen from ethnic Turks, and hence the results are limited to Turkish users. Finally, due to the relatively long time it has taken to complete, it is possible that the study has missed some insights from new research articles and papers on PHRs.

5.3 Future Research in the Area

In this study, a relatively small sample of thirty participants were involved in the comparison of two PHR systems. In future studies, more participants with more PHR systems can be used to generalize the PHR systems and investigate results even further.

In the future, with the newly added features to E-Nabız, the comparison between HealthVault and E-Nabız can be repeated to reveal the fixed usability problems and those that are left with the users. As newly added functionalities may change cognitive loads of tasks, new scenarios that are modified accordingly can be used for further investigation of the issues.

It is also hoped that future studies focusing on similar concepts will benefit from this thesis in order to reach better understanding of PHRs and related usability problems.

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APPENDIX A

Survey 1 Participant Information

Survey 1

Çankaya University

In this survey, you'll be asked a set of questions to evaluate your predisposition in technology. Please mark your answers accordingly. You can use your initials instead of signature. Also instead of your real name you can use a nickname.

Participant: _____

Gender:
Female ☐
Male ☐

Job: _____

Educational status(last graduated academic rank): _____

Age: _____

Signature:

1. Do you have predisposition on technology and computers?

☐ Yes ☐ No

2. Do you benefit from online banking services?

☐ Yes ☐ No

3. Do you benefit from E-Devlet service?

☐ Yes ☐ No

4. I have a smart phone.

☐ Yes ☐ No

Thank you for taking the survey. 1

5. I was familiar with personal health recording systems.

☐ Yes ☐ No

6. I am using social media over internet.

☐ Yes ☐ No

7. I can use a website is in my native language on the first time that I enter the website without any help from others.

☐ Yes ☐ No

8. Do you have chronic disease?

☐ Yes ☐ No

9. Did you get enough information about personal health recording systems before?

☐ Yes ☐ No

10. For how long have you been using computers?

□ Less than 6 months
□ Between 6 months and 1 year
□ Between 1 and 2 year
□ Between 2 and 3 year
□ Between 3 and 4 year
□ Between 4 and 5 year
□ More than 5 years

Thank you for taking the survey.

APPENDIX B

Survey 2 Feedback and Comments About the Website

Please fill the survey.

Çankaya University

In this survey, you'll be asked a set of questions about the website you have used during the experiment, purpose of these questions are gathering data about productivity, effectiveness and contentedness of the website. Please mark the answer that you feel drawn to. You can use your initials instead of signature. Also instead of your real name you can use a nickname.

Participant:

_____ Date:_____

Signature:

1. ***I have completed tasks easily.***

☐ Strongly Agree ☐ Agree ☐ I have no idea ☐ Disagree ☐ Strongly Disagree

2. ***This website is easy to use.***

☐ Strongly Agree ☐ Agree ☐ I have no idea ☐ Disagree ☐ Strongly Disagree

3. ***I found everything I need easily in this website.***

☐ Strongly Agree ☐ Agree ☐ I have no idea ☐ Disagree ☐ Strongly Disagree

4. ***I enjoyed using this website.***

☐ Strongly Agree ☐ Agree ☐ I have no idea ☐ Disagree ☐ Strongly Disagree

5. ***I could go everywhere I want easily in this website.***

☐ Strongly Agree ☐ Agree ☐ I have no idea ☐ Disagree ☐ Strongly Disagree

6. ***This website was informative for me.***

☐ Strongly Agree ☐ Agree ☐ I have no idea ☐ Disagree ☐ Strongly Disagree

Thank you for taking the survey. 1

7. I would suggest this website to my acquaintance.

☐ Strongly Agree ☐ Agree ☐ I have no idea ☐ Disagree ☐ Strongly Disagree

8. I found this website useful for personal health recording.

☐ Strongly Agree ☐ Agree ☐ I have no idea ☐ Disagree ☐ Strongly Disagree

9. I found this website plain and simple.

☐ Strongly Agree ☐ Agree ☐ I have no idea ☐ Disagree ☐ Strongly Disagree

10. I will use this website regularly in the future.

☐ Strongly Agree ☐ Agree ☐ I have no idea ☐ Disagree ☐ Strongly Disagree

11. I found this website unnecessarily complicated.

☐ Strongly Agree ☐ Agree ☐ I have no idea ☐ Disagree ☐ Strongly Disagree

12. I think this website was easy to use.

☐ Strongly Agree ☐ Agree ☐ I have no idea ☐ Disagree ☐ Strongly Disagree

13. I think one must get help from someone with technical knowledge to use this website.

☐ Strongly Agree ☐ Agree ☐ I have no idea ☐ Disagree ☐ Strongly Disagree

14. I think functionality and productivity of this website is at very high level.

☐ Strongly Agree ☐ Agree ☐ I have no idea ☐ Disagree ☐ Strongly Disagree

15. I think there were too many contradictions in this website.

☐ Strongly Agree ☐ Agree ☐ I have no idea ☐ Disagree ☐ Strongly Disagree

16. I think people can easily use this website.

☐ Strongly Agree ☐ Agree ☐ I have no idea ☐ Disagree ☐ Strongly Disagree

17. This website looks like other websites I have used.

☐ Strongly Agree ☐ Agree ☐ I have no idea ☐ Disagree ☐ Strongly Disagree

18. I must be more familiar with the website to use it.

☐ Strongly Agree ☐ Agree ☐ I have no idea ☐ Disagree ☐ Strongly Disagree

19. I think this website help me increase my prudential quality of health care.

☐ Strongly Agree ☐ Agree ☐ I have no idea ☐ Disagree ☐ Strongly Disagree

20. I found this website useful for personal health recording.

☐ Strongly Agree ☐ Agree ☐ I have no idea ☐ Disagree ☐ Strongly Disagree

21. I think one must get help from someone with technical knowledge to use this website.

☐ Strongly Agree ☐ Agree ☐ I have no idea ☐ Disagree ☐ Strongly Disagree

22. What are your thoughts on E-Nabiz?

.....

.....

.....

Thank you for taking the survey.

APPENDIX C

Interview Questions

Please fill the survey.

Çankaya University

In this survey, you'll be asked a set of questions about the website you have used during the experiment, purpose of these questions are gathering data about productivity, effectiveness and contentedness of the website. Please mark the answer that you feel drawn to. You can use your initials instead of signature. Also instead of your real name you can use a nickname.

Participant:

_____ Date:_____

Signature:

1. ***What is the first thing you paid attention on this website?***

.....
.....
.....

2. ***Does the website complicated? Does it require more empty space?***

.....
.....
.....

3. ***Did you have hard time finding information about the website?***

.....
.....
.....

4. ***Does the website feel organized?***

.....
.....
.....

Thank you for taking the survey. *1*

5. Do you need to scroll up and down too much to access data in the website?

.....

.....

.....

6. Does the website too slow for you?

.....

.....

.....

7. What do you think about the design, shape, colours and general style of the website?

.....

.....

Thank you for taking the survey.

APPENDIX D

Volunteer Participant Form

Voluntary Participant Form

The purpose of the experiment is performing usability test on the websites HealthVault and E-Nabiz Personal Health Recording and Information System which are used in the Turkey and in the world. You will be asked to complete some tasks to be evaluated. Your participation in the experiment will be purely on voluntary basis, and there will be no identity determinative questions asked. Your participation to this usability test to evaluate the software is very important and valuable to us to achieve realistic results. Data collected (sound, video) with your valuable participation will be kept in secret and only will be evaluated by researchers in ethical rules. Information gathered from the experiment will be used in scientific journals (assignment, thesis, article etc.) only.

Test process and materials used are not harmful to the health or disturbing. However, if you experience any situation that makes you feel discomfort or if you wish to, you can always leave the experiment. Your questions will be answered in case you'll have any after the experiment completed. Thank you for participating the experiment.

I am voluntarly participating in this experiment and I know that I can leave the experiment whenever I want. I agree that Information that I provide can be used in scientific journals. (Please fill the form and sign it then give it back to the tester).

Name Surname Date Signature

---- /---- /-----

APPENDIX E

Scenario for E-Nabız

Scenario for E-NABIZ	
Task 1	Enter the information that you have pollen allergies (“polen alerjisi”) into the correct section in the website. Symptom : nasal congestion / runny nose (“burun tıkanıklığı / burun akıntısı”). Leave sections that are not mentioned empty if there are any.
Task 2	For the pollen allergy diseases, enter medicine usage of “Zytec” started using from 01.01.2011 into the correct section in the website. “Dosage: 10mg, tablet”. Leave sections that are not mentioned empty if there are any.
Task 3	One day ago at 20:00, we assume you have measured your blood pressure (tension) as systolic 150, diastolic 100 and pulse 85. Enter the information into the correct section in the website. Leave sections that are not mentioned empty if there are any.
Task 4	In the same manner, you have measured your blood pressure during the day and the hour of the experiment (the day and hour you read this) as systolic 160, diastolic 110 and pulse 95. Enter the information into the correct section in the website. Leave sections that are not mentioned empty if there are any.
Task 5	We assume previously recorded electrocardiography examination results which stored in digital format needed to be uploaded to the website. To achieve this go to the correct section in the website and upload “EKG.jpg” file to the website. Enter “EKG” as statement. (The File is located on the Desktop). Leave sections that are not mentioned empty if there are any.
Task 6	Assuming we have made a mistake in Step 3 entering our blood pressure, for the measurement that is done yesterday at 20:00 change the systolic value with 145 and update.
Task 7	Lastly, go over all the steps again and discover where are the information you have entered is located on the website one by one and end the experiment by exiting the E-Nabız website.

APPENDIX F

Scenario for HealthVault

Scenario for HealthVault	
Task 1	Enter the information that you have pollen allergies (“Polen alerjisi”) into the correct section of the website. Symptom : nasal congestion / runny nose (“burun tıkanıklığı / burun akıntısı”). Date : 01.01.2010. Leave sections that are not mentioned empty if there are any.
Task 2	For the pollen allergy diseases, enter medicine usage of “Zytec” started using from 01.01.2011 into the correct section in the website. “Dosage: 10mg, tablet”. Leave sections that are not mentioned empty if there are any.
Task 3	One day ago at 20:00, we assume you have measured your blood pressure (tension) as systolic 150, diastolic 100 and pulse 85. Enter the information into the correct section in the website. Leave sections that are not mentioned empty if there are any.
Task 4	In the same manner, you have measured your blood pressure during the day and the hour of the experiment (the day and hour you read this) as systolic 160, diastolic 110 and pulse 95. Enter the information into the correct section in the website. Leave sections that are not mentioned empty if there are any.
Task 5	We assume previously recorded electrocardiography examination results which stored in digital format needed to be uploaded to the website. To achieve this go to the correct section in the website and upload “EKG.jpg” file to the website. Enter “EKG” as statement. (The file is located on the desktop). Leave sections that are not mentioned empty if there are any.
Task 6	Assuming we have made a mistake in Step 3 entering our blood pressure, for the measurement that is done yesterday at 20:00 change the systolic value with 145 and update.
Task 7	Lastly, go over all the steps again and discover where are the information you have entered is located on the website one by one and end the experiment by exiting the HealthVault website.

APPENDIX G

Results of Survey 1 – Participant Information

E-NABIZ												
USERS	**Age**	**Gender**	**Q1**	**Q2**	**Q3**	**Q4**	**Q5**	**Q6**	**Q7**	**Q8**	**Q9**	**Q10**
Subject 1	20	M	Y	N	Y	Y	N	Y	Y	N	N	7
Subject 2	20	F	Y	N	N	Y	Y	Y	Y	N	N	7
Subject 4	22	F	Y	Y	Y	Y	N	Y	Y	N	N	7
Subject 5	21	M	Y	Y	Y	Y	N	Y	Y	N	N	7
Subject 6	21	F	Y	Y	Y	Y	Y	Y	Y	N	N	7
Subject 7	21	M	Y	Y	N	Y	Y	Y	Y	Y	N	7
Subject 8	20	F	Y	Y	Y	Y	Y	Y	Y	N	Y	7
Subject 9	20	M	Y	Y	Y	Y	Y	Y	Y	Y	N	7
Subject 10	22	F	Y	N	Y	Y	N	Y	Y	N	N	7
Subject 11	22	F	Y	N	N	Y	N	Y	Y	N	N	7
Subject 12	22	F	Y	Y	Y	Y	Y	Y	Y	N	N	7
Subject 13	22	F	Y	Y	Y	Y	N	Y	Y	N	Y	6
Subject 14	21	M	Y	Y	Y	Y	N	Y	Y	N	N	7
Subject 15	21	F	Y	Y	Y	Y	Y	Y	Y	N	N	7
Subject 16	22	M	Y	Y	Y	Y	Y	Y	Y	N	Y	7

HEALTHVAULT												
USERS	**Age**	**Gender**	**Q1**	**Q2**	**Q3**	**Q4**	**Q5**	**Q6**	**Q7**	**Q8**	**Q9**	**Q10**
Subject 1	20	F	Y	N	Y	Y	N	Y	Y	N	N	7
Subject 2	23	M	Y	N	N	Y	N	Y	N	N	N	7
Subject 3	21	F	N	N	Y	Y	N	Y	Y	N	N	7
Subject 5	21	F	Y	N	Y	Y	Y	Y	Y	Y	N	7
Subject 6	24	M	Y	Y	N	Y	Y	Y	Y	N	N	7
Subject 7	22	M	Y	Y	Y	Y	N	Y	Y	N	N	7
Subject 8	21	M	Y	Y	Y	Y	Y	Y	Y	N	N	7
Subject 9	23	M	Y	Y	Y	Y	N	Y	Y	N	N	7
Subject 10	22	F	Y	N	Y	Y	Y	Y	Y	N	N	7
Subject 11	22	F	Y	Y	Y	Y	Y	Y	Y	Y	N	7
Subject 12	22	F	N	N	N	Y	N	Y	Y	N	N	7
Subject 13	22	M	Y	N	Y	Y	N	N	Y	N	N	7
Subject 14	22	M	Y	N	Y	Y	Y	Y	Y	N	N	7
Subject 15	21	M	Y	Y	Y	Y	Y	Y	Y	N	N	7
Subject 16	21	M	Y	N	N	Y	N	Y	Y	N	N	7

APPENDIX H
Total Completion Durations Table

HEALTHVAULT							
USERS	**Task 1**	**Task 2**	**Task 3**	**Task 4**	**Task 5**	**Task 6**	**Task 7**
Subject 1	*93*	*134*	*513*	*64*	*109*	*44*	*70*
Subject 2	*125*	*213*	*513*	*129*	*50*	*131*	*166*
Subject 3	*78*	*113*	*183*	*56*	*68*	*46*	*58*
Subject 4	*109*	*147*	*433*	*114*	*42*	*41*	*92*
Subject 5	*108*	*322*	*211*	*105*	*66*	*46*	*107*
Subject 6	*382*	*91*	*349*	*163*	*141*	*131*	*119*
Subject 7	*340*	*300*	*139*	*136*	*73*	*131*	*104*
Subject 8	*46*	*130*	*119*	*98*	*181*	*44*	*68*
Subject 9	*213*	*187*	*513*	*129*	*80*	*131*	*79*
Subject 10	*62*	*104*	*337*	*70*	*194*	*45*	*103*
Subject 11	*89*	*84*	*456*	*48*	*61*	*51*	*78*
Subject 12	*123*	*111*	*406*	*162*	*62*	*64*	*132*
Subject 13	*42*	*106*	*244*	*43*	*102*	*74*	*85*
Subject 14	*84*	*96*	*266*	*83*	*172*	*110*	*140*
Subject 15	*182*	*66*	*129*	*63*	*83*	*40*	*90*
	All tasks are in seconds						

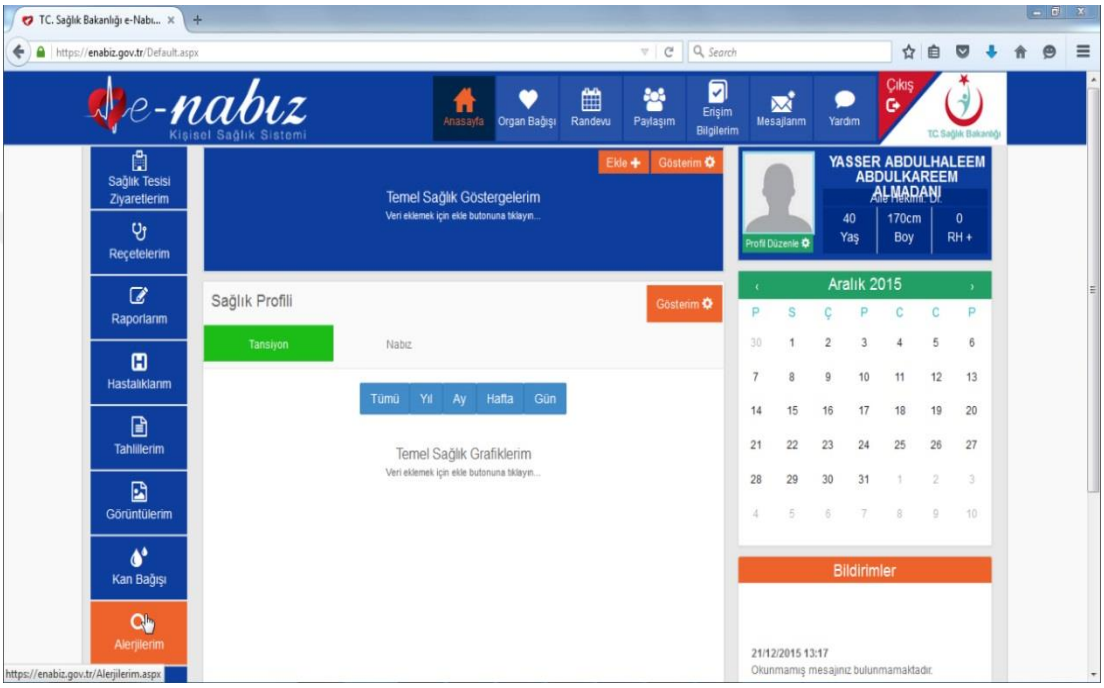
HEALTHVAULT		
USERS	***TOTAL OF TASKS***	***TOTAL PERCENTAGE***
Subject 1	**949**	**78%**
Subject 2	**933**	**71%**
Subject 3	**777**	**93%**
Subject 4	**748**	**88%**
Subject 5	**618**	**91%**
Subject 6	**848**	**81%**
Subject 7	**772**	**96%**
Subject 8	**678**	**93%**
Subject 9	**578**	**91%**
Subject 10	**510**	**100%**
Subject 11	**767**	**72%**
Subject 12	**752**	**93%**
Subject 13	**773**	**92%**
Subject 14	**720**	**89%**
Subject 15	**750**	**94%**

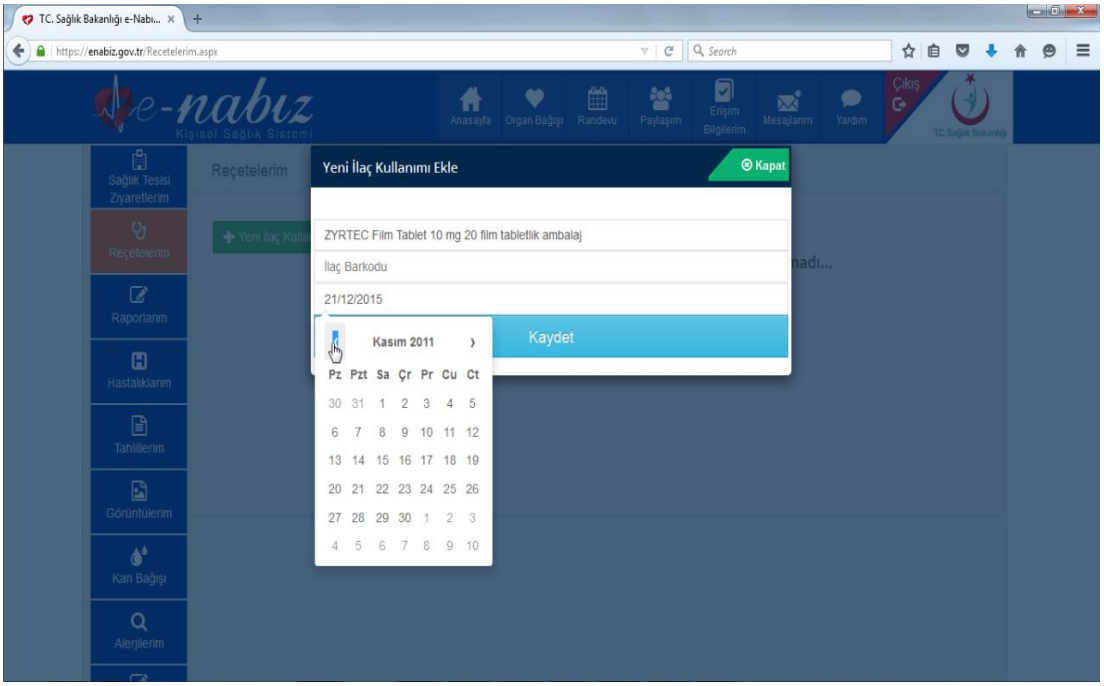
E-NABIZ							
USERS	**Task 1**	**Task 2**	**Task 3**	**Task 4**	**Task 5**	**Task 6**	**Task 7**
Subject 1	*187*	*104*	*167*	*20*	*338*	*45*	*88*
Subject 2	*147*	*142*	*71*	*107*	*338*	*72*	*56*
Subject 3	*177*	*139*	*98*	*133*	*111*	*67*	*52*
Subject 4	*94*	*108*	*244*	*85*	*63*	*57*	*97*
Subject 5	*247*	*124*	*81*	*31*	*64*	*39*	*32*
Subject 6	*279*	*180*	*126*	*33*	*94*	*44*	*92*
Subject 7	*171*	*114*	*56*	*58*	*240*	*56*	*77*
Subject 8	*79*	*79*	*39*	*49*	*338*	*64*	*31*
Subject 9	*99*	*147*	*71*	*23*	*84*	*50*	*105*
Subject 10	*67*	*123*	*51*	*65*	*90*	*71*	*43*
Subject 11	*135*	*59*	*53*	*63*	*338*	*44*	*75*
Subject 12	*126*	*135*	*85*	*105*	*156*	*51*	*94*
Subject 13	*293*	*95*	*70*	*71*	*114*	*89*	*41*
Subject 14	*86*	*100*	*66*	*53*	*287*	*43*	*85*
Subject 15	*91*	*139*	*79*	*37*	*123*	*245*	*36*
	All tasks are in seconds						

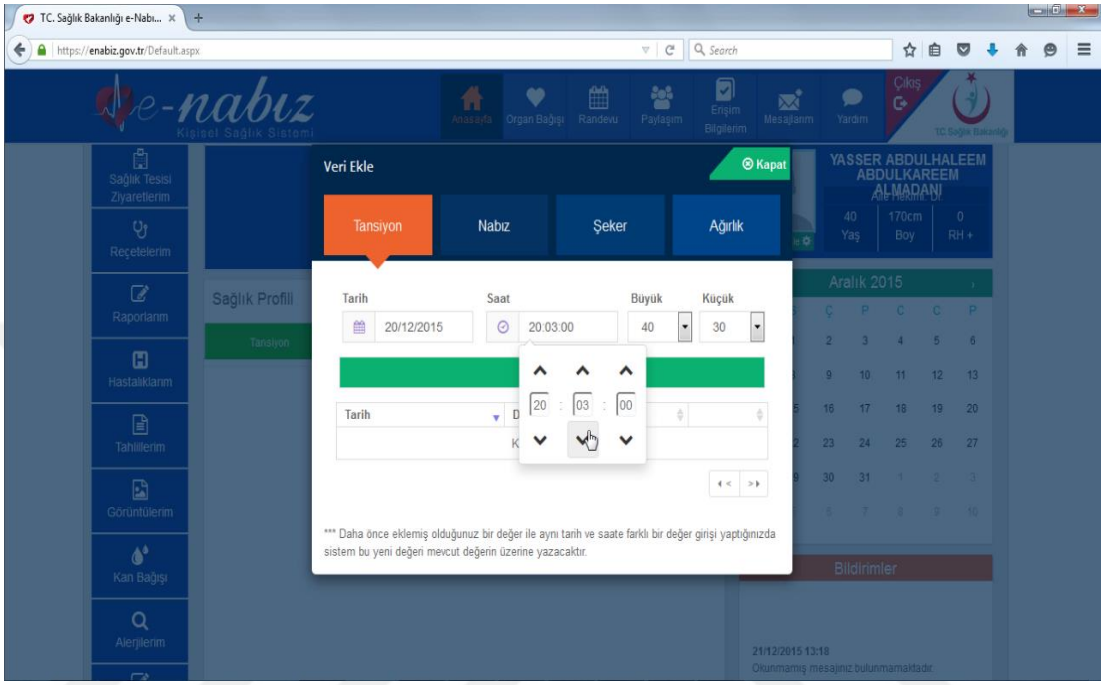
E-NABIZ		
USERS	***TOTAL OF TASKS***	***TOTAL PERCENTAGE***
Subject 1	**1027**	**100%**
Subject 2	**1327**	**50%**
Subject 3	**602**	**100%**
Subject 4	**978**	**97%**
Subject 5	**965**	**94%**
Subject 6	**1376**	**73%**
Subject 7	**1222**	**86%**
Subject 8	**686**	**87%**
Subject 9	**1331**	**46%**
Subject 10	**915**	**100%**
Subject 11	**867**	**97%**
Subject 12	**1060**	**91%**
Subject 13	**696**	**100%**
Subject 14	**951**	**86%**
Subject 15	**653**	**93%**

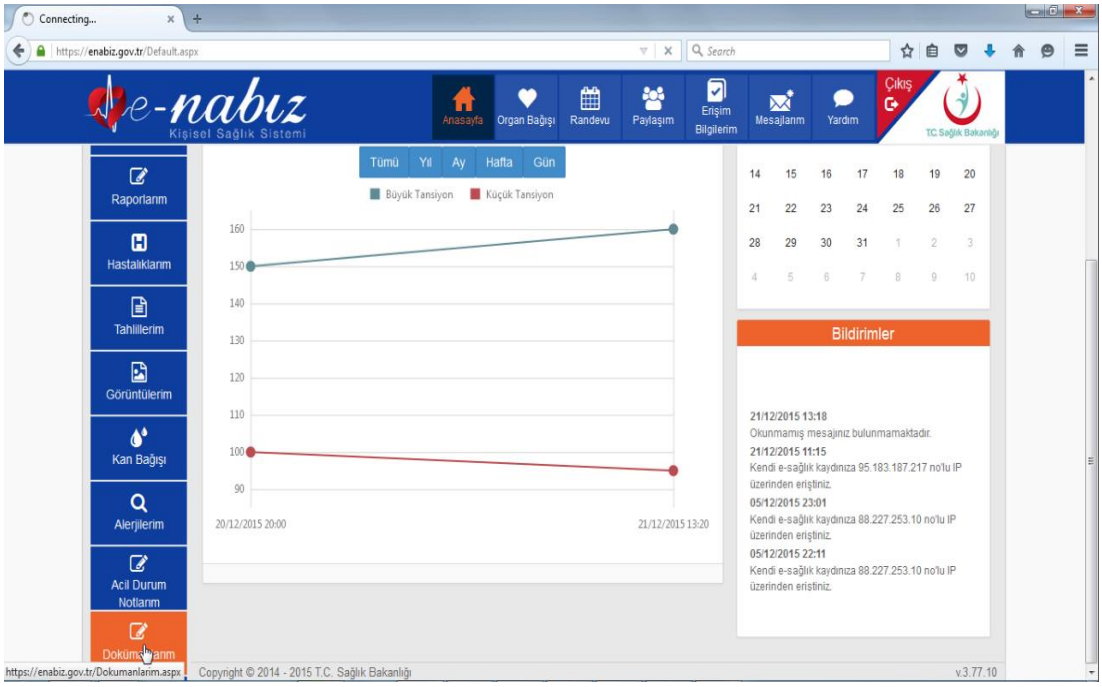
APPENDIX I

Screenshots About Usability Issues of E-Nabız



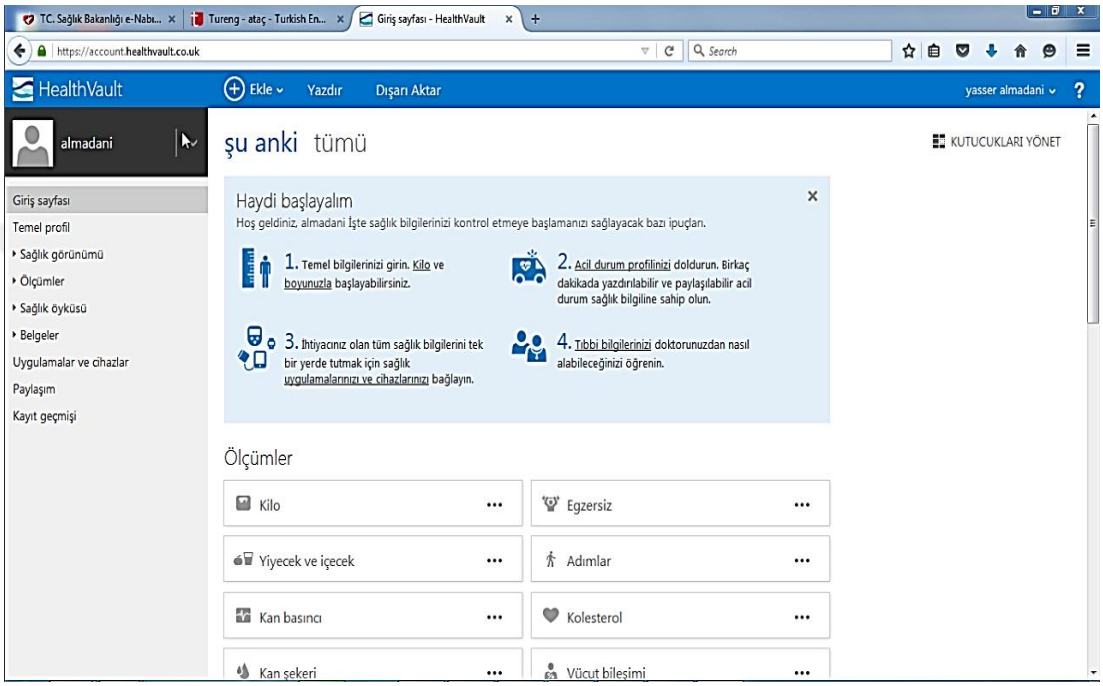


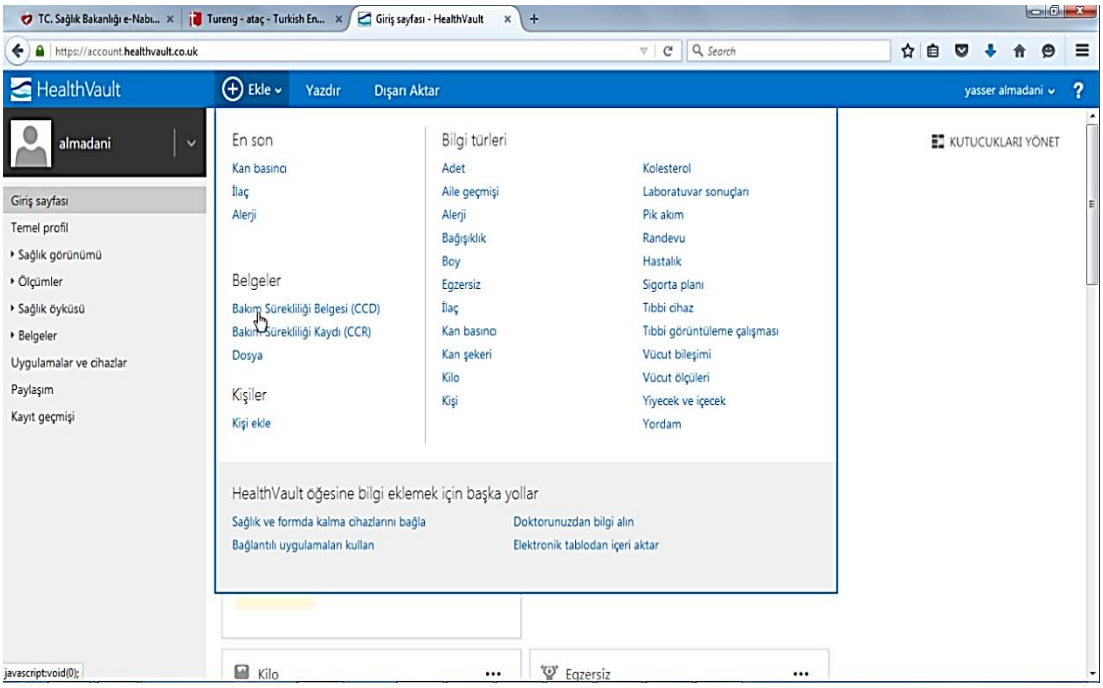

TC. Sağlık Bakanlığı e-Nabı...
https://enabiz.gov.tr/Default.aspx
e-nabız
Kişisel Sağlık Sistemi
Anasayfa
Organ Bağışı
Randevu
Paylaşım
Erişim Bilgilerim
Mesajlarım
Yardım
Çıkış
Veri Ekle
Kapat
Tansiyon
Nabız
Şeker
Ağırlık
Tarih
Saat
Büyük
Küçük
20/12/2015
20:03:00
40
30
*** Daha önce eklemiş olduğunuz bir değer ile aynı tarih ve saate farklı bir değer girişi yaptığınızda sistem bu yeni değeri mevcut değerin üzerine yazacaktır.
YASSER ABDULHALEEM ABDULKAREEM ALMADANI
Sağlık Profili
Aralık 2015
Bildirimler
Sağlık Tesisi Ziyaretlerim
Reçetelerim
Raporlarım
Hastalıklarım
Tahlillerim
Görüntülerim
Kan Bağışı
Alerjilerim

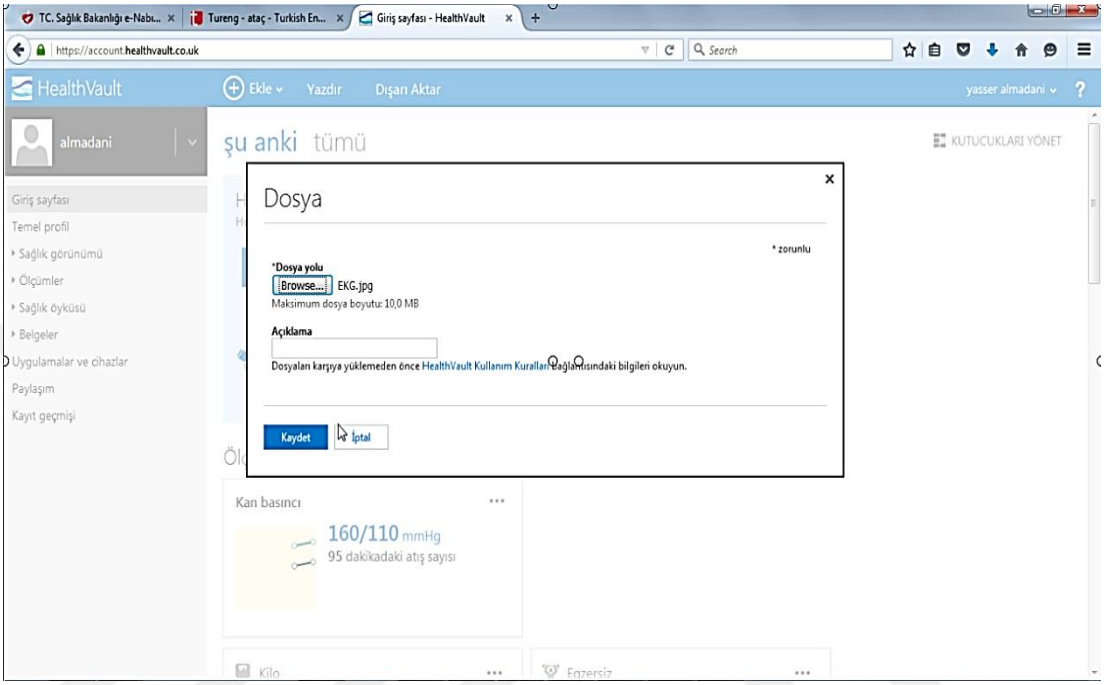

Connecting...
https://enabiz.gov.tr/Default.aspx
e-nabız
Kişisel Sağlık Sistemi
Anasayfa
Organ Bağışı
Randevu
Paylaşım
Erişim Bilgilerim
Mesajlarım
Yardım
Çıkış
Tümü
Yıl
Ay
Hafta
Gün
Büyük Tansiyon
Küçük Tansiyon
160
150
140
130
120
110
100
90
20/12/2015 20:00
21/12/2015 13:20
Bildirimler
21/12/2015 13:18
Okunmamış mesajınız bulunmamaktadır.
21/12/2015 11:15
Kendi e-sağlık kaydınıza 95.183.187.217 no'lu IP üzerinden eriştiniz.
05/12/2015 23:01
Kendi e-sağlık kaydınıza 88.227.253.10 no'lu IP üzerinden eriştiniz.
05/12/2015 22:11
Kendi e-sağlık kaydınıza 88.227.253.10 no'lu IP üzerinden eriştiniz.
Raporlarım
Hastalıklarım
Tahlillerim
Görüntülerim
Kan Bağışı
Alerjilerim
Acil Durum Notlarım
Dokümanlarım
https://enabiz.gov.tr/Dokumanlarim.aspx
Copyright © 2014 - 2015 T.C. Sağlık Bakanlığı
v.3.77.10

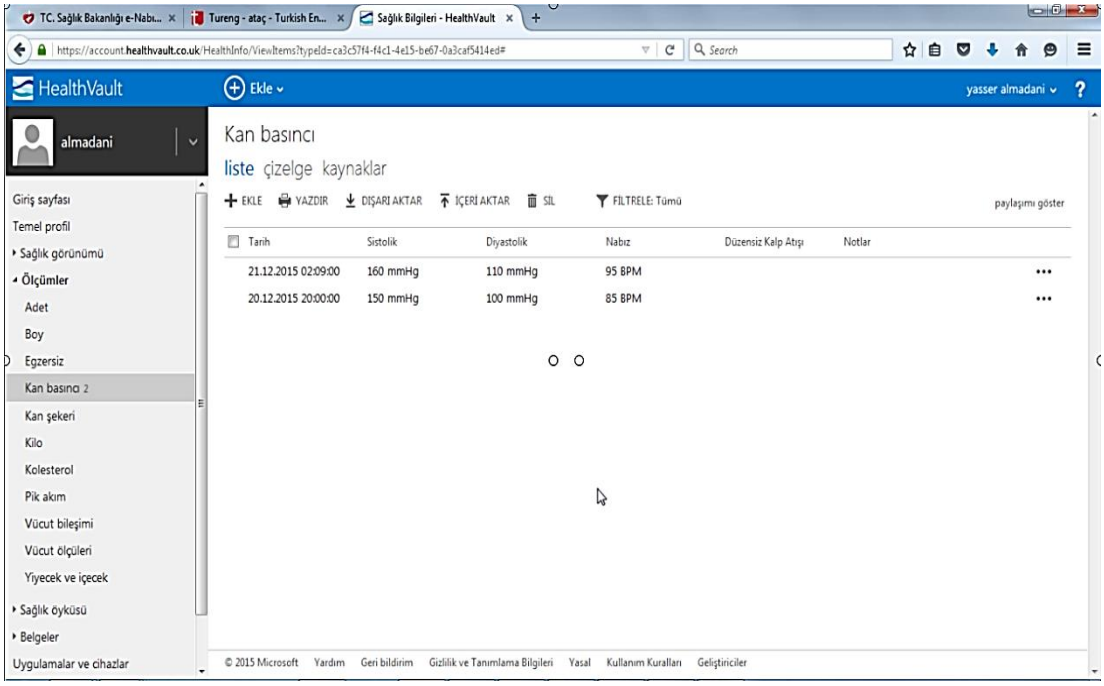
APPENDIX J

Screenshots About Usability Issues of HealthVault






TC. Sağlık Bakanlığı e-Nabı...
Tureng - ataç - Turkish En...
Giriş sayfası - HealthVault
https://account.healthvault.co.uk
HealthVault
Ekle
Yazdır
Dışarı Aktar
yasser almadani
almadani
şu anki tümü
KUTUCUKLARI YÖNET
Giriş sayfası
Temel profil
Sağlık görünümü
Ölçümler
Sağlık öyküsü
Belgeler
Uygulamalar ve cihazlar
Paylaşım
Kayıt geçmişi
Dosya
* zorunlu
*Dosya yolu
Browse...
EKG.jpg
Maksimum dosya boyutu: 10,0 MB
Açıklama
Dosyaları karşıya yüklemeden önce HealthVault Kullanım Kuralları bağlantısındaki bilgileri okuyun.
Kaydet
İptal
Kan basıncı
160/110 mmHg
95 dakikadaki atış sayısı
Kilo
Egzersiz


TC. Sağlık Bakanlığı e-Nabı...
Tureng - ataç - Turkish En...
Sağlık Bilgileri - HealthVault
https://account.healthvault.co.uk/HealthInfo/ViewItems?typeId=ca3c57f4-f4c1-4e15-be67-0a3caf5414ed#
HealthVault
Ekle
yasser almadani
almadani
Kan basıncı
liste çizelge kaynaklar
EKLE
YAZDIR
DIŞARI AKTAR
İÇERİ AKTAR
SİL
FİLTRELE: Tümü
paylaşımı göster
Giriş sayfası
Temel profil
Sağlık görünümü
Ölçümler
Adet
Boy
Egzersiz
Kan basıncı 2
Kan şekeri
Kilo
Kolesterol
Pik akım
Vücut bileşimi
Vücut ölçüleri
Yiyecek ve içecek
Sağlık öyküsü
Belgeler
Uygulamalar ve cihazlar
Tarih
Sistolik
Diyastolik
Nabız
Düzensiz Kalp Atışı
Notlar
21.12.2015 02:09:00
160 mmHg
110 mmHg
95 BPM
20.12.2015 20:00:00
150 mmHg
100 mmHg
85 BPM
© 2015 Microsoft
Yardım
Geri bildirim
Gizlilik ve Tanımlama Bilgileri
Yasal
Kullanım Kuralları
Geliştiriciler

APPENDIX K

CURRICULUM VITAE

PERSONAL INFORMATION

Surname, Name: YASSER Almadani

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Phone: +90534 727 68 26 / +9647711300393

Marital Status: Married

E-mail: yasser_madani@yahoo.com
yasseralmadany@gmail.com

EDUCATION

Degree	Institution	Year of Graduation	City
M.Sc.	Çankaya University, Mathematics and Computer Science	2016	Ankara / TURKEY
B.Sc.	Al-Yamruk University Collage	2001	Baghdad / IRAQ
High School	Al-Markazia Preparatory School	1994	Baghdad / IRAQ

WORK EXPERIENCE

Place	Experience	Year
Diyala	Head of Computer maintenance unit of Diyala University presidency	2004-2006
Diyala	Head of the Internet unit of Diyala University presidency	2006-2009
Diyala	Head of Continuing Education unit, Faculty of Engineering, University of Diyala	2009-2011
Diyala	Head of Computer Maintenance unit in Faculty of Engineering, University of Diyala	2011-2013

LANGUAGES

Native Arabic, Advanced English, Beginner Turkish

HOBBIES

Reading Stories, Stamps Collecting, Shopping, Watching Movies, Sports, Travel.