

# Usability Evaluation of an Online Patient Portal in Sweden from Users' Perspectives

Completed Research Paper

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## Abstract

*This study aimed to explore users' perspectives on the usability of an online patient portal (i.e., 1177 Vårdguiden) in Sweden. By following the ISO 9241-11 framework, the usability of 1177 Vårdguiden was evaluated by the three usability dimensions (i.e., effectiveness, efficiency and satisfaction) with nine users in Sweden. The users were asked to complete the given tasks, surveys, and take part in final interviews to reflect their perceptions to the online patient portal. Users were asked to think aloud as they carried out tasks. The effectiveness of the portal was just below average. However, task level satisfaction and system level satisfaction were just above average. Participants were not able to use the portal proficiently due to technical usability problems and unawareness about e-health services and relevant terminologies in some cases. Learnability of the features of the online patient portal resulted fairly high and so were the interests of the users in its features.*

**Keywords:** Online patient portal, usability evaluation, effectiveness, efficiency, satisfaction

## Introduction

With the growing influence of IT in the medical field, there is a focus to utilize information systems to promote patient-centered health care (Myreteg 2015). US National Library of Medicines defines a patient portal as a website for your personal health care. It is an online tool that helps you to keep track of your health care provider visits, test results, billing, prescriptions, and so on. This portal is able to give patients access to personal health related information regardless of time and location. The patient portal plays an important role in facilitating patient engagement and encouraging patients to take control of their own health, as well as improving patient-provider communication (Prey et al. 2013) (Kruse et al. 2015). Health Vault and Google Health are examples of commercial patient portals. Apart from large public interest in e-health related portals, only a few countries, including Sweden (i.e., 1177 Vårdguiden) and Denmark (i.e., sundhed.dk), have developed official national patient portals.

Some major features provided by the patients' portals are as follows: scheduling appointments, sending messages, checking personal health records, paying invoices. Previous research on the effectiveness of patient portals in US (e.g., (O'Leary et al. 2016; Winstanley et al. 2017; Woollen et al. 2016)) reported positive patient experience, including increased patient satisfaction (Winstanley et al. 2017), increased patient engagement (O'Leary et al. 2016), increased ownership of patients' own health conditions

(Woollen et al. 2016). Although online patient portals can offer personal health information to patients and some patients are positive about using patient portals, the usability of online patient portals has been reported as a major obstacle of the wide adoption of online patient portals (Hattink et al. 2016) (Greysen et al. 2014).

The key behind reaping online patient portals benefits lies into the adoption of online patient portals by the patients. Scandurra et al. (2015) indicated that many care professionals were concerned about negative effects deriving from patients reading their own health record information without support from clinicians. Alongside other factors that impacted the adoption of online patient portals by the patients, usability concerns and influences were presented as one of the frequently highlighted barriers to the adoption and use of online patient portals (Liu et al. 2011). Furthermore, Wang and Dolezel (2016) also indicated usability as a critical factor in the adoption of personal health records by the users.

According to ISO 9241-210, usability is defined as “the extent to which a product (e.g., a website or web portal) can be used by specified users to achieve specified goals with effectiveness, efficiency and satisfaction in a specified context of use”. And it defines user experience as “a person’s perceptions and responses that result from the use or anticipated use of a product, system or service”.

Lack of usability considerations in the design process can bring up human errors and user dissatisfaction, and dissatisfied patients simply abandon a poorly designed system (Jaspers 2009) (Zhang et al. 2003). Moreover, if a patient misunderstands a medical prescription and takes an overdose, a life could be lost (Belden et al. 2009). Given the criticality and importance of usability in online patient portals, developers need to ensure that the developed online patient portals always meet industry standards concerning usability. However, usability of online patient portals and how patient interact with online patient portals received little attention (Segall et al. 2011). Yen et al. (2018) carried out a usability evaluation of a commercial inpatient portal in US. Participants in the study frequently made operational mistakes with most in navigation and assuming non-existent functionalities. It was intuitive, forgiving of mistakes and allow users to perform necessary tasks quickly, efficiently and with minimum mental effort (Belden et al. 2009). Gu and Day (2013) found that consumers got maximum benefits if personal health records were easy to access and use in the system. In addition, the needs of online patient portals needed to be addressed in the development process of online patient portals in a better manner. Consequently, the developed portals were more likely to have a good usability.

The objective of this research was to further explore the usability of the online patient portal in Sweden. While there existed research on the users’ experience with online patient portals in the literature (e.g. (O’Leary et al. 2016)), this study aimed to address the research gap on the users’ performance on online patient portals in Sweden. To address this, we conducted a usability evaluation of an online patient portal to understand how users interact with the online patient portal in Sweden. More specially, we evaluated the usability of the online patient portal 1177 Vårdguiden in Sweden by the three usability dimensions (i.e., effectiveness, efficiency and satisfaction) proposed by ISO 9241-11.

The rest of the paper is structured as follows. In section 2, we describe the methodology used to collect users’ perspectives on the online patient portal in Sweden. The results are presented in Section 3. In Section 4, we discuss the findings of this study. We conclude the paper in Section 5.

## **Methodology**

This study was based on summative approach of evaluation. Summative evaluation may be carried out to validate and refine the product after its completion (Belden et al. 2009). According to Petrie and Bevan (2009), summative usability testing may be based on the principles of ISO 9241-11 and it can measure a variety of usability components such as effectiveness, efficiency and satisfaction. Following this approach, both qualitative and quantitative methods were applied in this study.

### *Conceptual Framework*

The ISO 9241-11 standard defines usability as the combination and convergence of effectiveness, efficiency and satisfaction (Sauro 2011). This definition is one of the most popular and the most widely used definitions of usability (Sauro 2011). The framework of the ISO 9142-11 model prompts for its

use in usability evaluation and suggest that usability is an abstract construct which can be measured within the three stated dimensions.

Effectiveness and efficiency are performance dimensions easy related to business objectives (Bevan 2009), as they measure whether someone can use a product (a web portal in this case) and how long users take to complete tasks (Bevan 2009). For example, finding a nearby emergency clinic online accurately and successfully is equally critical as finding it in a shortest possible time in an emergency situation. User satisfaction is the perception dimension to describe how user felt about the used system. In this study, a usability evaluation was employed. The following key performance metrics and instruments (see Table 1) were used to collect data.

**Table 1.** Used key performance metrics and instruments

ISO 9241-11 Usability Dimensions		ISO/IEC 9126-4 Performance Metrics	Other instruments Selected
<b>Effectiveness</b>	The accuracy and completeness with which users achieve specified goals	<ul style="list-style-type: none"> <li>▪ Task completion rate</li> </ul>	
<b>Efficiency</b>	The resources expended in relation to the accuracy and completeness with which users achieve goals.	<ul style="list-style-type: none"> <li>▪ Time to complete task</li> </ul>	
<b>Satisfaction</b>	Freedom from discomfort, and positive attitudes towards the use of the product.		<ul style="list-style-type: none"> <li>▪ <b>SEQ:</b> Single Easy Question (Sauro and Dumas 2009)</li> <li>▪ <b>SUS:</b> System Usability Scale (Brooke 1996)</li> </ul>

### Method

The usability evaluation is one of human or user centered design (HCD) techniques in which users are given a task or set of tasks to perform using the product being evaluated. HCD philosophy is a product or system design philosophy that seeks to obtain optimal functioning of human-machine system. It increases human capabilities, overcomes human limitations, and cultivates user acceptance and satisfaction (Endsley 2016).

In this usability evaluation, HCD principles were applied by using HCD methods (e.g., think aloud protocol, surveys and interview). In think aloud experiments, participants verbalized their thoughts while performing a task. As a result, it can provide detailed insight into the usability problems and their underlying causes (Jaspers 2009). Moreover, two Likert scale survey instruments (i.e., single easy question (SEQ) and system usability scale (SUS)) were selected to study satisfaction dimension. Sauro and Dumas (2009) proposed that SEQ was suitable for measuring post-task perceived ease-of-use of an interface and it was appropriate to use with small sample sizes typically used in usability testing, even below 10 participants. And that SEQ has the potential to provide diagnostic information in usability test other than being additional measure of user satisfaction. SUS served to measure users' impression of the overall ease of use of the system being tested (Brooke 1996). SUS has a history of its reliability for more than thirty years. Tullis and Stetson (2004) indicated that it was possible to get reliable results with SUS with a sample of 8-12 users. Sauro and Dumas (2009) calculated strong correlation ( $r > 0.6$ ) between post-task ratings and post-test ratings of SEQ and SUS, knowing one can predict about 36% of the other. At the end of every session, each user took part in semi-structured interview based on three

short open-ended questions. This type of interview could provide an opportunity for users to reflect upon their experience with the tasks (in this case) and raise new issues which are important in their opinions (Wilson 2013). Since using different methods were of help to facilitate a deeper understanding of the problem, methodological triangulation was adopted for this research (Denzin 2017).

This study preferred to use user testing over heuristic evaluation technique for the following reason. Heuristic evaluation was considered suitable during early design and development stages of a website (Tan et al. 2009). Tan et al. (2009) also suggested that user testing was typically suitable for the evaluation of developed websites. The scope of this study was to study users' perspectives on the online patient portal which was already operational. Therefore, user testing was a natural choice.

#### *The online patient portal in Sweden*

A national online patient portal, '1177.se' is available for anyone seeking healthcare or health-related information in Sweden. The patient portal named 1177 was originally launched in 1998. Since November 2013 it was renamed to 1177 Vårdguiden. 1177 Vårdguiden is currently first common portal for all the regions and counties in Sweden. It gives patients a hand at managing their own health care and offers them the facility of self-care through multiple e-health services, such as facts and advices (Fakta och råd), find care (Hitta vård), e-Services (e-tjänster). Through e-Services (e-tjänster), it is possible to book cancel and reschedule online appointments with a nurse or a doctor, prescription refill, view medical reports results and previous medical history, and so on.

#### *Participants of this study*

The participants of the study were recruited at one of the universities in Sweden by using snow ball sampling. Snowball sampling was often used to find and recruit hidden populations, that was, groups not easily accessible to researchers (Heckathorn 2002). University students were chosen as the subjects for this study for the following reasons. Firstly, university students often had more IT experience than older adults and should therefore be indicative of what future users of e-health portals might be like. Secondly, young generation might be more likely to use new technologies and would be a major group of e-health portal users in the future.

Nine participants agreed to participate in the usability evaluation of the 1177 Vårdguiden portal. All the participants were third year undergraduate students. Five out of nine students were majoring in Economics, one was majoring in civil engineering, and three were majoring in nursing. Overall there were three female students and six male students. Macefield (2009) presented that for most studies related to problem discovery a group size of 3 to 20 users was valid and 5 to 10 participants was a sensible baseline range. Therefore, a user group of nine participants in study was deemed to be in a sensible baseline range. All the participants were fluent in Swedish and competent English language speakers. Since 1177 Vårdguiden web portal was in Swedish language and the user testing was designed to be moderated in English language, so the aspect of bilingual proficiency was an important consideration.

#### *Research ethics*

For ethical purposes, each participant was briefed beforehand about the following aspects: (a) they would logon to 1177 Vårdguiden portal using their actual health care accounts using Swedish personal number, (b) start and end task times while performing task would be noted on the prescribed form given in (see appendix A) by the evaluation moderator from the screen, (c) no health record of participants in this study would be noted and presented in the analysis or otherwise during and after the course of this study.

#### *Data Collection*

Single user test was employed for each participant. Each user was asked to complete ten performance tasks given on the predesigned form given in Appendix A. Users were briefed to perform tasks in an appropriate normal time in a similar fashion they used other services and that they would speak loud "task begin", "task completed" or otherwise "I quit". And start and end of the task times were noted accordingly. The average user testing session time (excluding task briefing time) remained at 22 minutes with an exception of 41 minutes taken by user 1. Also, users were asked to complete each task as

accurate as possible. Although every task was sufficiently briefed before starting it, they could ask task clarification at any time during task completion activity. Each session was carried out on a similar computer machine. Home page of 1177 Vårdguiden was made available to users before each test session.

Data concerning following the performance metrics was noted down in front of participants during the session using a pen and paper: task time (i.e., start and end task time), task completion rate (i.e., task completed=1, not completed=0), giving up was also considered not completed. Immediately after a task completion, each participant filled out SEQ survey (see Appendix B). And at the end of each session, each participant was required to fill out SUS survey (see Appendix C).

Finally, the participants were asked to answer the following three questions in semi structured interviews about the usability problems they faced: 1) whether they would use 1177 Vårdguiden in the future, 2) factors that would prevent them from using it, and 3). additional functionalities that they would like to view? All the data was recorded with the help of a pen and paper on prescribed forms.

#### Data Analysis

Data analysis was performed by both qualitative and quantitative techniques (see Table 2). The selection of techniques was made on two aspects, research objective and type of data. Since task completion (task effectiveness) is fundamental metric of usability, beginning with the analysis of task effectiveness, means and percentage were applied to proportionally explore and represent the task effectiveness.

To further enhance the intuitiveness of the data, comparisons of the patterns were made through tabulation. For efficiency and user satisfaction data, fundamental data summarizing techniques like measure of central tendency and measure of dispersions were used.

**Table 2.** Data Analysis Methods and Tools

Dimensions	Data Type	Methods	Tools
Effectiveness	<ul style="list-style-type: none"> <li>▪ Task Performance Evaluated Data</li> </ul>	<ul style="list-style-type: none"> <li>▪ Means</li> <li>▪ Percentage</li> <li>▪ Tabulation</li> <li>▪ Frequency</li> <li>▪ Range</li> </ul>	<ul style="list-style-type: none"> <li>▪ MS-Excel</li> <li>▪ SPSS</li> <li>▪ Pen and Paper</li> </ul>
Efficiency			
Satisfaction	<ul style="list-style-type: none"> <li>▪ Task Level (SEQ) Likert Scale 7</li> </ul>	<ul style="list-style-type: none"> <li>▪ Average</li> <li>▪ Percentage</li> <li>▪ Frequency</li> </ul>	<ul style="list-style-type: none"> <li>▪ MS-Excel</li> </ul>
	<ul style="list-style-type: none"> <li>▪ System Level (SUS) Likert Scale 5</li> </ul>	<ul style="list-style-type: none"> <li>▪ Average</li> <li>▪ Tabulation</li> </ul>	<ul style="list-style-type: none"> <li>▪ MS-Excel</li> <li>▪ SUS calculator Package</li> </ul>

According to the ISO 9241-11, efficiency is defined as “the resources expended in relation to the accuracy and completeness with which users achieve goals”. Relative efficiency was calculated via “ratio of the time taken by the users who successfully completed the task(s) in relation to the total time taken by all the users”.

Qualitative data collected in the interviews, screen observations and think aloud verbalizations was analyzed through summative content analysis (Hsieh and Shannon 2005). Finally, the results were compared with the results of task completion rate (effectiveness), task level satisfaction (SEQ results) and System level satisfaction (SUS results) proposed by (Sauro 2011) as the benchmark.

## Results

Among nine users who participated in this study, seven had used 1177 Vårdguiden at least once. They specifically mentioned that they had browsed facts and advices (Fakta och råd) feature of the portal

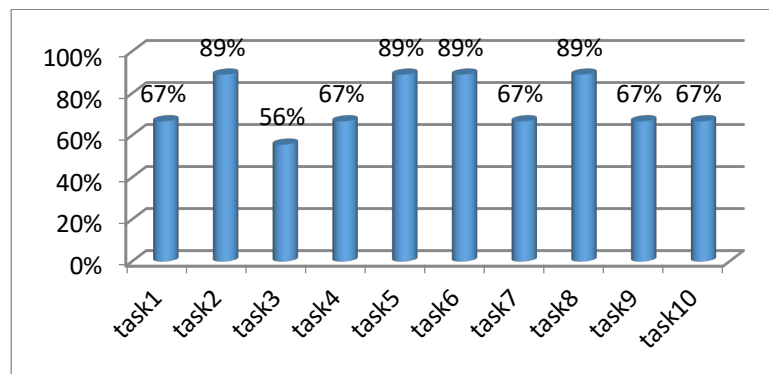
once or twice, and two had never used this site. Therefore, all the users were using task 2, 4 and 10 on 1177 Vårdguiden for the first time during user testing sessions (see Table 3).

**Table 3.** Ten Performance tasks

Task1	Search information on “behandling vid pollenallergi”.
Task2	Make an appointment with a doctor in your Vårdcentral.
Task3	Find nearest clinics (i.e., Vårdcentral) which are open on weekends.
Task4	View your last medical test (e.g., Blood, Urine etc.) results
Task5	Reschedule appointment time with the doctor.
Task6	View your last doctor’s name who diagnosed you.
Task7	Set SMS Reminder Alert for previously scheduled appointment with your doctor.
Task8	Cancel a doctor appointment and delete SMS alert for appointment.
Task9	Add new mottagningar (e.g., Varbergagatan medical center) to your health care account.
Task10	Book online appointment with (e.g., Varbergagatan medical center) and create SMS alert.

### Effectiveness

Figure 1 indicates proportions of successful task completions. On average, 89% of the users that was eight out of nine users completed the tasks 2, 5, 6 and 8. And 67% of the users successfully completed tasks 1, 4, 7, 9 and 10. According to figure 1, only six out of nine users were able to complete task 3. Overall task completion rate in ten tasks was 74%.

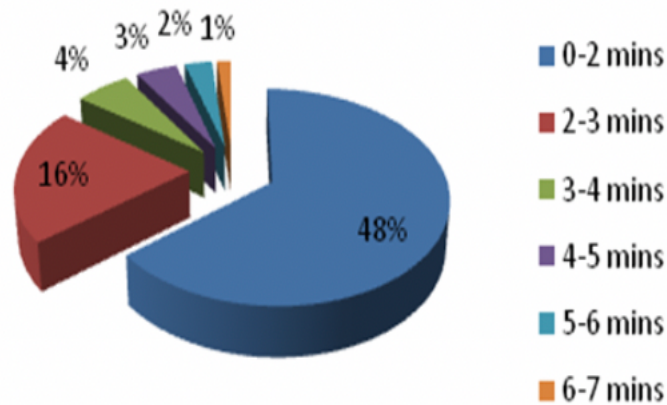


**Figure 1.** Proportions of successful task completions

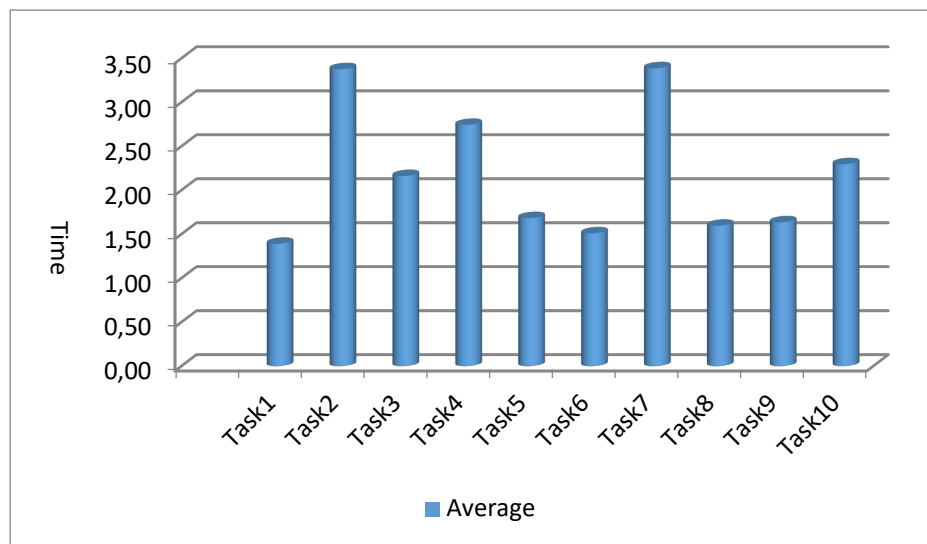
### Efficiency

Figure 2 shows succeeded task completion times in groups. Majority of the users were able to complete the tasks between 0 to 3 minutes. Average time to successfully complete the tasks remained 2.14 minutes.

According to Figure 3, users successfully completed the task 1 with highest efficiency, within 2 minutes as compared to task 4, 7, 9 and 10. However, users spent on average highest time on task 7, 2 and 4 in order.



**Figure 2.** Succeeded task completion times in groups

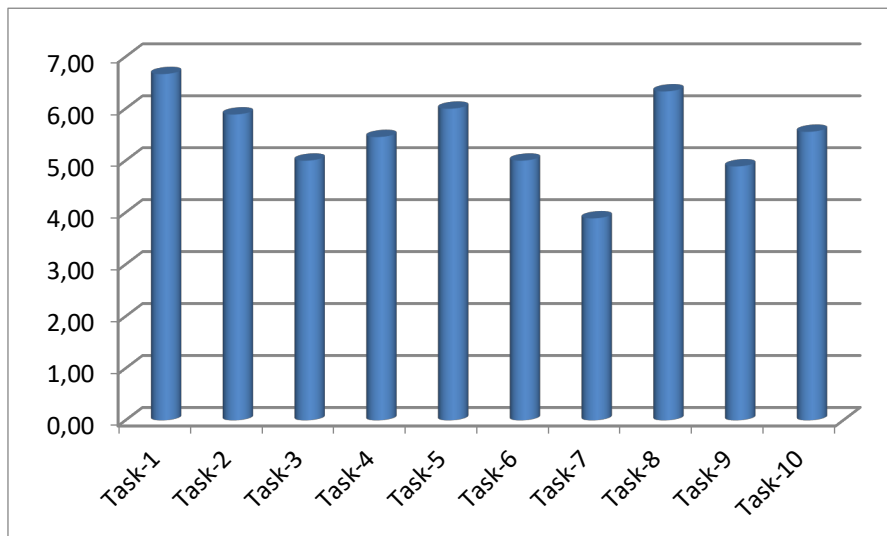


**Figure 3.** Average of total time spent on tasks

### *Satisfaction*

Surveys results for perceived ease of use of tasks was 5.3 out of 7.0 on average, and overall user satisfaction of system usability score was 71.1 out of 100.

According to figure 4, users felt highly satisfied in browsing relatively simple information searching tasks in task 1 with an average score of 6.67 out of 7.0. Users also looked somewhat satisfied in new sets of online services (e-tjänster) (e.g., task 5: rebooking appointment time with the doctor, and task 8: cancel doctor appointment and delete SMS alert for appointment) which none of them had used before. Users however demonstrated significantly low satisfaction level in task 7 (i.e., setting SMS alert for previously scheduled appointment).



**Figure 4.** Satisfaction level by task (7-point scale) scale display

#### *Chronbach's alpha results*

Chronbach's alpha for SUS score remained at 0.73, which was interpreted as good. It describes internal reliability (i.e., how likely it was that respondents answered questions in a similar way). Also, both mode and average results of SUS indicated that the system was not unnecessarily complex. In responses to Q3 and Q4 of SUS, on average, users agreed that the system was easy to use and majority of them responded that there was no need for a technical support to use the system. In general, users' feedback in SUS survey was high on positive questions as compared to very low satisfaction on negative questions.

#### *Learnability*

The learnability score calculated from SUS feedback was 81.9, which also indicated that users experienced the features of 1177 Vårdguiden with fairly good learnability. This is in line with the suggestion from Lewis and Sauro (2009). Learnability is an important aspect of usability, but there is little agreement on its definition (Grossman et al. 2017). Most of the definitions were somewhat similar to definition from (Nielsen 1994) which defined learnability as a novice user's experience of the initial part of the learning curve, stressing that a highly learnable system might be "allowing users to reach a reasonable level of proficiency".

#### *Interview*

Seven out of nine users took part in the interviews. The average interview time was approximately 7 minutes. Feedbacks collected from the interviews identified a number of positive items of 1177 Vårdguiden portal as perceived by the users. Users particularly mentioned their likeness in Facts and advices service of 1177 Vårdguiden. They also expressed their interests in having online appointment (i.e., booking, rebooking and rescheduling), and having access to their medical record through e-services in 1177 Vårdguiden. In response to Q2, prominent remarks were on the difficulty to follow the information of setting SMS alert service (task 7). For instance, user 2 mentioned that "setting SMS is a complex procedure, it is very important it should be made very simple to follow" and browsing speed issues (smoothness they mentioned) of the portal. In response to Q3, user 9 said that "I recommend this service to others" and that "it is trust worthy it is a state-owned portal not a private service". Finally, the interviewees indicated that the site was an effective and efficient way to approach care providers and to deal with day to day health issues. Majority of the interviewees thought they would recommend this site to others.



## Discussion

Effectiveness and satisfaction results identified in this study were assessed and compared against findings proposed by (Sauro 2011) (see Table 4).

**Table 4.** Results comparison

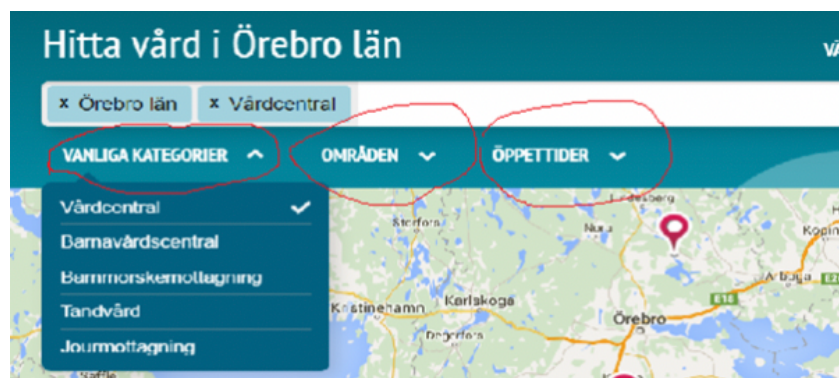
	Benchmark value	Results in this study
<b>Effectiveness</b>	78%	74%
<b>Task level satisfaction (SEQ average)</b>	4.8	5.3
<b>System level satisfaction (SUS score)</b>	68	71.1

Although task completion rate is the fundamental usability metric, its results alone do not represent the clear picture of usability or user experience. Sauro (2011) also associated task completion with the user perception and context. In this study task completion rate remained relatively below average, but the users' feedback on perceived ease of use of the tasks was relatively above average. Similarly, system level satisfaction appears relatively above average (See Table 4).

The following discussion critically reflected on the results and present users' perspective on the usability of 1177 Vårdguiden portal.

### User Interface

Mostly users faced difficulty in performing task 3 and task 7. Mostly users failed to complete task 3 (see Figure 1). The problem was popped up in three drop down menus (see Figure 5).



**Figure 5.** The screen shot for task 3 (drop-down menus)

User didn't perceive the process to combine hidden choices under each different drop-down menu intuitive. They often selected a choice from any one or two dropped down menus to look for results. Users thought it could be more user friendly to see options given in three menus all at once.

In task 7, SMS alert setting feature was found unnecessarily lengthy and complex. For example, user 2 mentioned twice about the incompleteness of the information. User 2 verbalized "Bad information". And later in answer to Q2 in the interview, user 2 expressed economic significance of task 7. User 2 said that "I would like to change SMS alert setting feature because if any patient forgets appointment time and date and cannot reach on time the patient is supposed to pay".

### Learnability

Users' perception on the features of the online portal showed high learnability. To have a better understanding on this, we further analyzed the results of users' performances on task 4, task 6, task 7

and task 8. In order to get the task to be completed, task 4 and task 6 had some common screens. And task 7 also shared some similar screens with task 8. The effectiveness, efficiency and perceived ease-of-use for task 6 were increased by 33%, 45% and 50% over task4 respectively. Similarly, the efficiency, effectiveness and perceived ease-of-use for task 8 were increased by 54%, 33% and 63% over task 7 respectively. These improvements observed in terms of usability dimensions in task 6 and task 8 over task 4 and task 7 respectively indicated positive learnability of 1177 Vårdguiden.

*Understanding of medical terms*

Most users indicated that they did not know or understand the key terms to complete task 4 and task 6. But during performing task 4, users saw screens by hit and trial later used in task 6. Thus, relative score (in usability dimensions) in task 6 remained at high. But users’ perceived ease of use of task 6 was lower than the perceived ease of use task 4. Further studies on this are needed to clarify this. It did not however undermine that poor knowledge of medical term impact on user perception. It was mainly supported in screen observations and in think aloud feedback notes.

**Conclusion**

The study was set out to explore the extent of usability of the online patient portal in Sweden from users’ perspective by using HCD methods. Usability testing, interview, and surveys were used in this regard. Overall, results showed usability of the portal was quite good. Users were moderately satisfied with its usability and ease of use. However, features of the portal show high learnability. Analysis of the collected data also found some problems in the, e.g., design of a process to register for SMS service, menu used to search nearby Vårdcentral (i.e., clinics). We also found that lack of understanding in medical terms impacted the perception of users which further resulted into poor usability of the Portal (in terms of efficiency and effectiveness). We suggest these terminologies should be made easy to understand for a public portal like this. This is in line with the suggestion from Liu et al. (2011). These results can be useful for the developer to develop more user friendly and effective personal health record systems. The findings also highlighted the importance of studying and including users’ needs and requirements in the early stages of the design of health portals. Timely promotion of online health portals may reduce the errors of misunderstanding of medical terms in their uses and citizens will start getting good outcomes (Gu and Day 2013) of this huge investment. The results may also contribute and encourage scholarly efforts to investigate the usability of state-owned portals. User particularly expressed their trust in the services of 1177 Vårdguiden considering it was a state-owned online health service.

We were also aware of some limitations of this study. Firstly, a convenience sampling method was utilized. A random sampling would be better to make the results more generalizable. Secondly, the sample size of this study was quite small. Thirdly, since health portals like 1177 Vårdguiden were developed for general public, we recommend in future more comprehensive study with a large number of users including different groups of society (e.g., old adults).

There exists some opportunities for future research. Future research may explore the usability of online patient portals in other countries. In addition, the usability study with other user groups (e.g., old adults) may provide fresh insights for future research.

**APPENDICES**

*Appendix A: User Performance Evaluation Tasks Form*

Performance Measurement Tasks

Participant ID: \_\_\_\_\_

Task-1	Search Information on “Behandling vid pollenallergi”.	
Start Time: _____	End Time: _____	
Task completed?	Yes	No

Task-2	Make an appointment with a doctor in your Vårdcentral.
Start Time: _____ End Time: _____	
Task completed?    Yes    No	
Task-3	Find nearest clinics (Vårdcentral) which are open on weekends.
Start Time: _____ End Time: _____	
Task completed?    Yes    No	
Task-4	View your Last medical test (Blood, Urine etc.) Results
Start Time: _____ End Time: _____	
Task completed?    Yes    No	
Task-5	Reschedule appointment time with the doctor.
Start Time: _____ End Time: _____	
Task completed?    Yes    No	
Task-6	View your last doctor's name who diagnosed you.
Start Time: _____ End Time: _____	
Task completed?    Yes    No	
Task-7	Set SMS Reminder Alert for previously scheduled appointment with your doctor.
Start Time: _____ End Time: _____	
Task completed?    Yes    No	
Task-8	Cancel doctor appointment and Delete SMS alert for appointment.
Start Time: _____ End Time: _____	
Task completed?    Yes    No	
Task-9	Add New Mottagningar e.g. (Varbergagatan medical center) to your health care account.
Start Time: _____ End Time: _____	
Task completed?    Yes    No	
Task-10	Book online appointment with e.g. (Varbergagatan medical center) and create SMS alert.
Start Time: _____ End Time: _____	
Task completed?    Yes    No	

### Appendix B: SUS (System Usability Scale)

#### System Usability Scale

Participant ID: \_\_\_\_\_

	Strongly Disagree				Strongly Agree
	1	2	3	4	5
Q1. I think I would like to use 1177 site frequently.					
Q2. I found 1177 Web Portal unnecessarily complex.					
Q3. I thought the 1177 Web Portal was easy to use.					

Q4. I thought that I would need help from medical staff from clinics to be able to use 1177 Web Portal.					
Q5. I found various parts of 1177 Web Portal were well integrated.					
Q6. I thought there was too much inconsistency in 1177 Web Portal functions.					
Q7. I would imagine that most people would learn to use 1177 Web Portal very quickly.					
Q8. I found 1177 Web Portal very awkward to use.					
Q9. I felt very confident using 1177 Web Portal.					
Q10. I needed to learn a lot of things before I could get going to get with 1177 Web Portal.					

### Appendix C: Single Easy Question (SEQ)

Question:

Overall, how difficult or easy did you find this task?

**Very Difficult**      **Very Easy**  
**1**                      **2**                      **3**                      **4**                      **5**                      **6**                      **7**

## References

- Belden, J. L., Grayson, R., and Barnes, J. 2009. "Defining and Testing Emr Usability: Principles and Proposed Methods of Emr Usability Evaluation and Rating," Healthcare Information and Management Systems Society (HIMSS).
- Bevan, N. 2009. "International Standards for Usability Should Be More Widely Used," *Journal of Usability Studies* (4:3), pp. 106-113.
- Brooke, J. 1996. "Sus-a Quick and Dirty Usability Scale," *Usability evaluation in industry* (189:194), pp. 4-7.
- Denzin, N. K. 2017. *Sociological Methods: A Sourcebook*. Routledge.
- Endsley, M. R. 2016. *Designing for Situation Awareness: An Approach to User-Centered Design*. CRC press.
- Greysen, S. R., Khanna, R. R., Jacolbia, R., Lee, H. M., and Auerbach, A. D. 2014. "Tablet Computers for Hospitalized Patients: A Pilot Study to Improve Inpatient Engagement," *Journal of hospital medicine* (9:6), pp. 396-399.
- Grossman, S., Abraham, I., Golan-Gueta, G., Michalevsky, Y., Rinetzky, N., Sagiv, M., and Zohar, Y. 2017. "Online Detection of Effectively Callback Free Objects with Applications to Smart Contracts," *Proceedings of the ACM on Programming Languages* (2:POPL), p. 48.
- Gu, Y., and Day, K. 2013. "Propensity of People with Long-Term Conditions to Use Personal Health Records," *HIC*, pp. 46-51.
- Hattink, B., Drees, R.-M., Sikkes, S., Oostra, E., and Lemstra, A. W. 2016. "Evaluation of the Digital Alzheimer Center: Testing Usability and Usefulness of an Online Portal for Patients with Dementia and Their Carers," *JMIR research protocols* (5:3).
- Heckathorn, D. D. 2002. "Respondent-Driven Sampling Ii: Deriving Valid Population Estimates from Chain-Referral Samples of Hidden Populations," *Social problems* (49:1), pp. 11-34.
- Hsieh, H.-F., and Shannon, S. E. 2005. "Three Approaches to Qualitative Content Analysis," *Qualitative health research* (15:9), pp. 1277-1288.
- Jaspers, M. W. 2009. "A Comparison of Usability Methods for Testing Interactive Health Technologies: Methodological Aspects and Empirical Evidence," *International journal of medical informatics* (78:5), pp. 340-353.
- Kruse, C. S., Argueta, D. A., Lopez, L., and Nair, A. 2015. "Patient and Provider Attitudes toward the Use of Patient Portals for the Management of Chronic Disease: A Systematic Review," *Journal of medical Internet research* (17:2).

- Lewis, J. R., and Sauro, J. 2009. "The Factor Structure of the System Usability Scale," in *Human Centered Design*. Springer, pp. 94-103.
- Liu, L. S., Shih, P. C., and Hayes, G. R. 2011. "Barriers to the Adoption and Use of Personal Health Record Systems," *Proceedings of the 2011 iConference: ACM*, pp. 363-370.
- Macefield, R. 2009. "How to Specify the Participant Group Size for Usability Studies: A Practitioner's Guide," *Journal of Usability Studies* (5:1), pp. 34-45.
- Myreteg, G. 2015. "Cost-Benefit Evaluation of E-Health Services: Acceptance and Value Creation Are Interactive Forces," *Health Systems* (4:3), pp. 204-211.
- Nielsen, J. 1994. *Usability Engineering*. Elsevier.
- O'Leary, K. J., Sharma, R. K., Killarney, A., O'Hara, L. S., Lohman, M. E., Culver, E., Liebovitz, D. M., and Cameron, K. A. 2016. "Patients' and Healthcare Providers' Perceptions of a Mobile Portal Application for Hospitalized Patients," *BMC medical informatics and decision making* (16:1), p. 123.
- Petrie, H., and Bevan, N. 2009. "The Evaluation of Accessibility, Usability, and User Experience."
- Prey, J. E., Woollen, J., Wilcox, L., Sackeim, A. D., Hripcsak, G., Bakken, S., Restaino, S., Feiner, S., and Vawdrey, D. K. 2013. "Patient Engagement in the Inpatient Setting: A Systematic Review," *Journal of the American Medical Informatics Association* (21:4), pp. 742-750.
- Sauro, J. 2011. *A Practical Guide to the System Usability Scale: Background, Benchmarks & Best Practices*. Measuring Usability LLC Denver, CO.
- Sauro, J., and Dumas, J. S. 2009. "Comparison of Three One-Question, Post-Task Usability Questionnaires," *Proceedings of the SIGCHI conference on human factors in computing systems: ACM*, pp. 1599-1608.
- Scandurra, I., Jansson, A., Forsberg-Fransson, M.-L., and Ålander, T. 2015. "Is 'Patient's Online Access to Health Records' a Good Reform?—Opinions from Swedish Healthcare Professionals Differ," *Procedia Computer Science* (64), pp. 964-968.
- Segall, N., Saville, J. G., L'Engle, P., Carlson, B., Wright, M. C., Schulman, K., and Tcheng, J. E. 2011. "Usability Evaluation of a Personal Health Record," *AMIA Annual Symposium Proceedings: American Medical Informatics Association*, p. 1233.
- Tan, W.-s., Liu, D., and Bishu, R. 2009. "Web Evaluation: Heuristic Evaluation Vs. User Testing," *International Journal of Industrial Ergonomics* (39:4), pp. 621-627.
- Tullis, T. S., and Stetson, J. N. 2004. "A Comparison of Questionnaires for Assessing Website Usability," *Usability professional association conference*.
- Wang, T., and Dolezel, D. 2016. "Usability of Web-Based Personal Health Records: An Analysis of Consumers' Perspectives," *Perspectives in Health Information Management* (13:Spring).
- Wilson, C. 2013. *Interview Techniques for UX Practitioners: A User-Centered Design Method*. Newnes.
- Winstanley, E. L., Burtchin, M., Zhang, Y., Campbell, P., Pahl, J., Beck, S., and Bohenek, W. 2017. "Inpatient Experiences with Mychart Bedside," *Telemedicine and e-Health* (23:8), pp. 691-693.
- Woollen, J., Prey, J., Wilcox, L., Sackeim, A., Restaino, S., Raza, S. T., Bakken, S., Feiner, S., Hripcsak, G., and Vawdrey, D. 2016. "Patient Experiences Using an Inpatient Personal Health Record," *Applied clinical informatics* (7:2), p. 446.
- Yen, P.-Y., Walker, D. M., Smith, J. M. G., Zhou, M. P., Menser, T. L., and McAlearney, A. S. 2018. "Usability Evaluation of a Commercial Inpatient Portal," *International journal of medical informatics* (110), pp. 10-18.
- Zhang, J., Johnson, T. R., Patel, V. L., Paige, D. L., and Kubose, T. 2003. "Using Usability Heuristics to Evaluate Patient Safety of Medical Devices," *Journal of biomedical informatics* (36:1-2), pp. 23-30.