eHealth for all? Towards usable and effective ehealth services in different health care settings

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Direct Access to Diagnostic Testing and Advice Service: a Qualitative Study with Potential Users into Facilitators and Barriers for the Use of Digital a Self-Management Service

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Abstract

Background: Health care lags in digital transformation, while technology can contribute to individuals' well-being. The COVID-19 pandemic has accelerated the uptake of technology in health care and increased the willingness of individuals to perform self-management using technology. A web-based service, Directlab Online, provides consumers with direct online access to diagnostic test packages, which can support self-management of health digitally.

Objective: The aim is to identify the facilitators, barriers an needs of Directlab Online, a self-management service for online access to diagnostic testing.

Methods: A qualitative method was used from a potential users' perspective. The (future) needs, facilitators and barriers for the use of Directlab Online were evaluated. Semistructured focus group meetings were performed in 2022. Two focus groups were focused on sexual transmitted infection test packages and two were focused on prevention test packages. The data analysis was performed according to the principles of the Framework Method. The Consolidated Framework for Implementation Research was used to categorize the facilitators and barriers.

Results: In total 19 participants participated in the focus groups. They had a mean age of 34.32 (SD = 14.70). Important barriers were lacking information of privacy, too much and difficult information and a commercial look and feel. Important facilitators were the right amount of information, the right kind of tests and involving a health care professional. The needs for a service like Directlab Online were ensuring that the service was there for users' health and how they could maintain healthy.

Conclusion: According to the participants, facilitators and barriers were comprehension of the information, the goal of the website and the total look and feel. Although the service is developed in co-creation with health care professionals and users, the needs did not align. For users, the information needed not to be concise and understandable. In addition, users would like to have other kinds of tests available on the service. For future research, it would be beneficial to focus on co-creation between involved medical professionals and users to develop, improve and implement a service like Directlab Online.

Keywords: eHealth; usability; self-management; diagnostic test service; diagnostic; testing; test service; perspective; focus group; user need; user testing; implementation; qualitative; test result; lab test; lab result

Introduction

Society is changing, and the world is becoming increasingly digital [1]. Health care lags in digital transformation, while technology can contribute to individuals' well-being [1, 2]. The COVID-19 pandemic accelerated the development and use of technology in health care, also referred to as eHealth, with more online consultations and increased use of home monitoring [3, 4]. Also, the pandemic, among others, has increased the need and willingness of individuals to perform self-management [5-7]. In chronic disease patients, self-management strategies are often used to support patients in dealing with treatment and lifestyle changes [8]. In addition, self-management strategies can be used to support individuals with home diagnostic tests [9]. The concept of self-management aligns with the positive health definition: "health as the ability to adapt and self-manage in the face of social, physical, and emotional challenges" [10, 11].

eHealth can be used in the three stages of laboratory diagnostic testing. Triage and advice on diagnostic testing is the first stage, the second stage is the testing itself (at home or a facility), and the third stage is the communication of the test results to the user. A systematic review showed that online diagnostic testing services were positively evaluated and preferred over clinic-based testing [9]. However, most of the evaluated services only offered tests to detect sexually transmitted infections (STIs) [9].

eHealth services can support self-management, for example with online services that support behavior lifestyle changes (eg, LIVA healthcare) [12], and with websites where individuals can obtain health information (eg, Thuisarts.nl) [13]. In addition, there are multiple apps to support patients with chronic conditions like hypertension, diabetes or lower backpain [14-16].

In the Netherlands, a web-based service called Directlab Online offers individuals direct access to laboratory diagnostic tests independent of a health care provider [17]. It is a so-called direct-to-consumer platform. Directlab Online gives individuals direct online access to diagnostic testing based on a triage that aligns with medical guidelines. Unlike the services identified in the systematic review [9], Directlab Online offers a variety of diagnostic tests, for example, diagnostic tests for STIs, COVID-19, vitamins, and testing for health questions concerning fatigue and the prevention of heart disease. The results and the information on the website can give individuals insight into their health, which could support and motivate them to adopt healthier behaviors [12]. In addition, it supports users to be better informed about their health without the interference of a health care professional, which can lead to more efficient and accessible care [18]. Packages to test the health of individuals fit with the patient-centered care approach, which can lead to a better quality of care [19]. Patient-centered care aims to empower patients to take charge of their health and actively participate in their health care [20]. Another term used is person-centered care, which is similar, only not disease-related, and fits better with the positive health definition [21].

To maximize the potential and impact of Directlab Online, it is important that the service is of high quality and user-friendly. For that reason, it is essential to know what barriers and facilitators there are for individuals to use the service. For example, known factors in dermatology that could influence the uptake of a digital service are, among others, financial aspects and accessibility for a digital service [22]. In another research, facilitators and barriers for digital services for older adults in primary care are researched. Non-familiarities with online environments appeared to be a barrier and efficiency is seen as an important facilitator for the use of a digital service in primary care [23]. In the earlier mentioned review about STI testing complicated language and insecurity about data handling, were also discovered for ordering online an STI test [9]. To our knowledge, no research has been performed into facilitators, barriers, and needs of a direct-to-consumer platform that offers direct access to multiple diagnostic tests and (online) results. Identifying the needs, facilitators and barriers will help determine what is necessary to optimize the use and improve the implementation of those services. This can give insight into the potential future directions for developing such services.

Objectives

The current study aims to identify the facilitators and barriers to using a service like Directlab Online and identify the needs regarding direct online access to diagnostic testing. To do so, focus groups were held. Half of the focus groups focused on STI testing and the other half on prevention test packages. STI tests and prevention test packages are the most ordered test packages on Directlab Online. The focus is on potential users, thus those who have not used Directlab Online before, because we are interested in people's first impression of the service.

Methods

The service: Directlab Online

Directlab Online is a Dutch web-based service available for everyone, where diagnostic tests can be ordered online [17]. The service was developed by a multi-disciplinary innovation team of a diagnostic company (Saltro, part of Unilabs) and was launched in 2016 [24, 25]. The process is presented in Figure 1. First, individuals go through an online triage, based on medical guidelines, to determine whether diagnostic tests are relevant and, if yes, which one. Second, individuals can order and buy associated tests. Depending on the ordered diagnostic tests, a self-sampling kit is sent to the individual's home address or an appointment is made at a blood collection center or a laboratory for a blood sample. Once the laboratory receives the collected specimen, high-quality analyses are conducted. The results of the tests are communicated through an online secure patient portal. Deviating results are also communicated to the patient's general

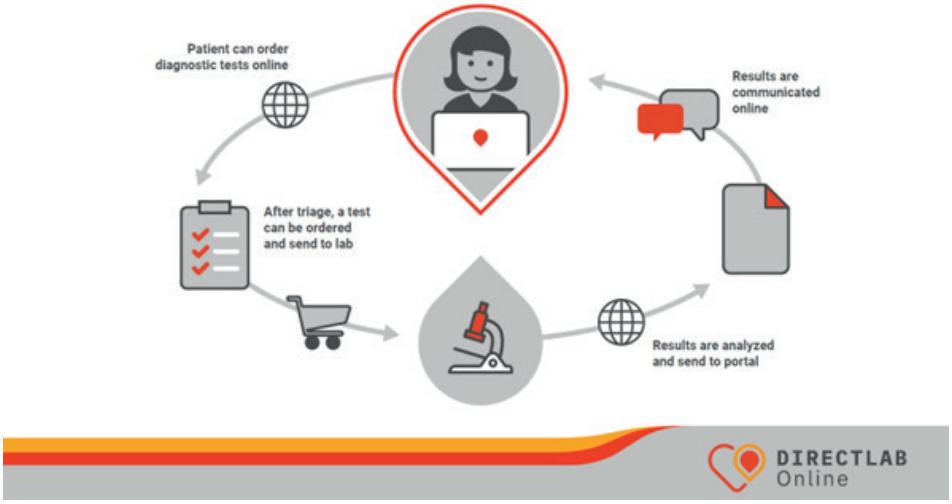

Figure 1. Stages of Directlab Online.

practitioner; however, only if the patient has authorized this. The triage is based on medical guidelines, and the diagnostic test packages were developed in co-creation with and tested by general practitioners and laboratory specialists referred to as medical doctors. Diagnostic test packages consist of different parameters for diagnostic testing. For example, a test package for cholesterol measures the following parameters: low-density lipoproteins, high-density lipoproteins, triglycerides, and total cholesterol. Appendix 1 provides a complete overview of the test packages that could be ordered on Directlab Online during the focus groups. Table 1 provides an overview of the prevention and STI test packages that were part of the discussions with the focus groups.

Study design and participants

Focus group meetings were performed with potential users of the service. As the Directlab Online service offers a wide variety of test packages, we focused on two specific categories (ie, prevention and STI test packages). These test packages were ordered most frequently. Half of the focus groups thus focused on STI test packages, and the other half focused on the prevention test packages. The general inclusion criteria for the focus groups were: speaking Dutch and not having used Directlab Online before. In addition, there were specific inclusion criteria to ensure that the socio-demographic characteristics of the participants in the focus groups were in line with the characteristics of the target population of the test packages. Namely, a specific inclusion criterion for the focus group about STI testing was that participants were between 18 and 30 years old. The specific inclusion criterion for the focus groups about prevention test packages was that the participants were between 18 and 65 years old. It is important to note that there were no specific health or disease requirements to participate.

Table 1. Test packages that are available on Directlab Online.

Category	Parameters
Prevention tests	
Health check-up	Check total cholesterol[a], low density lipoproteins (LDL)[a], high density lipoproteins (HDL)[a], triglycerides[a], Hba1C[a], albumin/creatinine ratio[b].
Health check-up at home*	Measuring parameters via self-sampling of blood: total cholesterol[c], LDL[c], HDL[c], triglycerides[c], Hba1C[c], albumin/creatinine ratio[b]
Cholesterol	Check total cholesterol[a], LDL[a], HDL[a], triglycerides[a]
Cholesterol at home*	Measuring parameters via self-sampling of blood: Total cholesterol[c], LDL[c], HDL[c], triglycerides[c]
Anemia	Check hemoglobin[a], mean corpuscular volume[a], ferritin[a] and C-reactive protein[a]
Diabetes	Check glucose[a] and Hba1C[a]
Healthy bones*	Check calcium[a] and vitamin D[a]
Healthy kidneys*	Check creatinine[a], glomerular filtration rate[a], albumin/creatinine ratio[b]
Thyroid check	Check thyroid function via thyroid stimulating hormone[a] and freeT4[a]
Sexual transmitted infection tests	
Chlamydia	Check for chlamydia[d] (eg oral, anal, vaginal, urine sample)
Gonorrhea	Check for gonorrhea[d] (eg, oral, anal, vaginal, urine sample)
Human Immunodeficiency Virus (HIV)	Check for HIV[a]
Syphilis	Check for syphilis[a]
Hepatitis B	Check for Hepatitis B[a]

[a]Blood sample needed for diagnostics, [b]Urine sample needed for diagnostics, [c]blood sample by self-sampling needed for diagnostics, [d]Oral, anal, vaginal or urine sample needed for diagnostic tests
*those tests are not available any more on Directlab Online after the service update

The study was declared to not fall within the scope of the Dutch Medical Research Involving Human Subjects Act by the Medical Ethics Committee (MEC) of the Leiden University Medical Center (N21.101). Focus group meetings were held until data saturation was reached.

Procedure and data collection

The recruitment period started on the 25th of October 2021 and lasted until the 20th of February 2022. Participants were recruited via different online channels (eg, LinkedIn and Facebook). Individuals were invited to contact the researcher (KS) via email when interested. Then the researcher sent them more information. In addition, questions were asked about their birth year and if they could understand Dutch. A few date options for online meetings were sent if the individual met the inclusion criteria. When individuals could participate, they received an email with the date and time, a link

to the Zoom platform where the meeting would take place (online), and a link to an online informed consent form which they were asked to sign before participation. All participants had the right to withdraw at any moment. The focus group meetings took place between the 10th of January and the 2nd of March 2022, with researchers MH and KS present [26]. KS led the focus groups, and MH managed the time and assisted with technical issues. The focus group meetings were semistructured, following a pre-defined topic list with open-ended questions to leave space for discussion (see Appendix 2). First, general questions were asked about using eHealth to see how familiar participants were with eHealth. Second, participants had ten minutes to look at the website of Directlab Online and navigate through the website on computer or phone; no further instructions were given. When the time was up, questions were asked about the website in general (eg, the first impression, whether they needed help when using it, and if they found the website attractive). While navigating the website, they had the option to write down notes or vocalize their impressions, expressing their observations, preferences and feelings about the site [27]. Third, participants were instructed to go through Directlab Online, do some triages, and look at their test advice. Namely, we allowed participants to navigate through the process as normal users would. Therefore they needed to read information, could do a triage with medical questions about their symptoms and they could receive a test advice. After that, questions were asked about the triage service, facilitators and barriers to using Directlab Online, and their needs for such a service. At the end of the focus groups, they received an online gift card of €25,-.

Data analysis

All focus groups were audio recorded for the subsequent analyses and were transcribed (intelligent) verbatim. When the transcripts were completed, the audio records were deleted. Two reviewers, MH and KS, conducted the qualitative data analysis according to the principles of the Framework Method [28]. The Framework Method is a systematic and flexible approach commonly used for the thematic analysis of health research semistructured interview data [29]. The method combines deductive and inductive techniques, which fit with the aim of the research to identify specific issues regarding the use of Directlab Online and leaves space to identify needs and opportunities that have not been formulated a-priori. First, open coding was performed independently by the two reviewers KS and MH. The interview data were coded using the software Atlas.ti 22. Second, the codes were compared between the two reviewers, and deductive coding was performed. Third, codes were grouped into categories, resulting in the analytical framework. Fourth, final themes were achieved via discussion and consensus between researchers KS and MH. Fifth, for identifying the facilitators and barriers, the Consolidated Framework for Implementation Research (CFIR) was used [30]. The framework is widely used for the content analysis of qualitative data about factors influencing implementation success [30]. The framework is also comprehensive and

makes it able to systematically study a wide array of facilitators and barriers [31]. In addition, using this framework made it possible to compare findings and transfer findings to other implementation studies [32]. The CFIR is a theory-driven model and comprises five domains: (1) the innovation domain, (2) the outer setting domain, (3) the inner setting domain, (4) the individuals' domain, and (5) the implementation process [30, 33]. Identified facilitators and barriers were placed within the CFIR domains.

Results

Participant characteristics

Data saturation was reached after four focus groups with 19 participants. The characteristics of the participants are shown in Table 2. The age ranged from 20 to 61, with a mean of 34.32 (SD=14.70). The number of males and females was almost equal (9 and 10). The focus groups lasted around 90 minutes per group.

Age differed over the two different focus groups, as fitted with the target population of the diagnostic test packages. Overall, the experiences and choices of the focus groups regarding the website were the same. In most cases, the focus group results were therefore discussed together. When the result(s) differed between the two groups, this was specified. Different themes around usability, facilitators, barriers, and needs emerged from the data and are elaborated on below.

Facilitators and barriers for the uptake of innovation

The identified barriers and facilitators were categorized into the domains of the CFIR, specifically into the following three domains: innovation domain, outer setting domain and individuals domain. The other two domains of the CFIR framework (ie, inner setting and implementation process) did not align with the facilitators and barriers mentioned by the participants and were therefore not discussed. Table 3 gives insight into the most essential and changeable facilitators and barriers identified. Therefore, it is not an exhaustive list of all potential barriers and facilitators that influenced the service uptake. It is important to realize that certain factors can be considered as a facilitator and barrier. For example, financial costs are frequently mentioned as a factor affecting the willingness to use digital health services [33]. When there are high user costs, it is a barrier; however, low costs can be considered a facilitator. Below the table, the identified facilitators and barriers are explained in more detail and explained per domain.

Facilitators and barriers in the innovation domain

A) Innovation source

Participants mentioned different factors that were related to the innovation source of the innovation domain. Those factors mainly influenced the credibility and trustworthiness in a positive (facilitator) or negative (barrier) way. First of all, the website's com-

Table 2. Characteristics of the participants.

Participant	Gender	Age	Focus group[a]
1	Female	27	1
2	Female	25	1
3	Male	24	1
4	Male	30	1
5	Female	20	1
6	Female	25	2
7	Female	46	2
8	Female	59	2
9	Male	24	2
10	Male	20	2
11	Female	25	3
12	Male	25	3
13	Female	30	3
14	Male	24	3
15	Male	39	4
16	Female	58	4
17	Female	59	4
18	Male	30	4
19	Male	62	4

[a]Groups 1 and 3 focused on STI packages, and groups 2 and 4 focused on prevention packages

mercial look and feel were the most frequently mentioned barriers that influenced its reliability. Participants mentioned, for example, that the option to buy a gift card for a diagnostic test package was not fitting for a website that is designed for your health. In addition, they mentioned the high prices for diagnostic test packages and the website's general look and feel. The following was said about this:

The website said: buy this. But I want to know why this test? (p4)

I found it a very commercial website; this lowers my enthusiasm. (p8)

Participants did not notice that health care professionals were involved in the service and partly developed the service.

Second, the availability of reviews was frequently mentioned as a facilitator for reliability and credibility but, in some cases, as a barrier. Good reviews could be experienced as a facilitator, and bad reviews as a barrier to experiencing the website as reliable and trustworthy. The following was said about this:

Yes, ... I found it important if I go to a new website to sell or buy something to see that others used the site and what they bought. (p13)

Table 3. Facilitators and barriers derived from the focus groups embedded in the conceptual framework for implementation research (CFIR).

Domain of CFIR	Domain description	Results
Innovation domain		
A.Innovation Source	The group that developed and/or visibly sponsored the use of the innovation is reputable, credible, and/or trustable.	The general practitioner group that developed and/or visibly sponsored the service was reputable, credible, and trustable, which resulted in a reliable service Information about privacy and presenting good reviews improved reliability and credibility Commercial look and feel influenced the credibility. Also stock pictures influenced this
C.Innovation relative advantage	The innovation is better than other available innovations or current practices.	The service was easy to use, which made the service accessible It was easy to use the service without going to the general practitioner
F.Innovation complexity	The innovation is complicated, which may be reflected by its scope and/or the nature and number of connections and steps.	Too many testing possibilities and too much information made the website less user-friendly The search bar and filters on the website increased the user friendliness of the website Using a lot of medical words made the service difficult to comprehend
Outer setting domain		
D. Partnerships and connections	The Inner Setting is networked with external entities, including referral networks, academic affiliations, and professional organization networks.	The service was linked with academic institutions and other medical professionals, which increased the reliability of the service for users
G.1. Societal pressure	Mass media campaigns, advocacy groups, or social movements or protests drive the implementation and/or delivery of the innovation.	Media campaigns, reviews and blogs could helped stimulate participants to use the service
Individuals domain: subdomain patient characteristics		
B. Capability	The individual(s) has interpersonal competence, knowledge, and skills to fulfill Role (different characteristics of individuals)	If participants had experience with a similar service, they felt more confident in using the service. Otherwise, feelings of anxiety or tension could have influenced their competence, knowledge, and skills

Third, seven participants mentioned the facilitator's "privacy". For the participants, it was important to know where the data was stored and for how long. This information was, however, difficult to find on the website. The following was said about this:

And then it is the question of how long data is stored and how that is important to know. (p8)

I want to know, what happens to the data and how long is it stored? (p16)

Participant 7 pointed out that a clear and transparent privacy statement could be a unique selling point of the service.

Lastly, the most mentioned barrier in the innovation source was the presence of stock pictures on Directlab Online. Participant 3 said:

... those stock pictures on the website; they gave an image of unreliability.

As a facilitator, participants mentioned that real people in pictures or even famous people that used the tests could positively influence the reliability and use of the service. Also, they mentioned that a short video with education and instructions about diagnostic test packages could improve the triage's clarity and the diagnostic packages' content.

C) Innovation relative advantage

Participants mentioned several factors why they would use this innovative service. Those factors were mostly related to accessibility of the service compared to other services or to normal practice. For example, the easiness of ordering a test online without going to the general practitioner was a relative advantage of the service. A participant mentioned:

Yes, I would rather order online because going to the general practitioner… it takes time. (p7)

Also another participant mentioned the benefit of ordering a test online without going to the general practitioner:

Hmm yes, I thought of a few things when I first saw the website.. of the vitamin tests, STI tests, and COVID tests... I thought yes, you do not want to go to the general practitioner for that. Especially for STI testing, the threshold is high. In this way, you still test and see if you are healthy. (p1)

However, the relative advantage was negatively influenced by the high costs of the tests. One participant stated:

The costs will stop people from buying anything. (p17)

F) Innovation complexity

Several facilitators and barriers that influenced the complexity of the service were mentioned by the participants. First of all, the amount of test packages and parameters available were confusing. It became clear from the focus groups that offering the 'right' number of diagnostic tests was important; participants were not enthusiastic about a test package with many separate parameters. Participants mentioned that they were optimistic about the possibility of ordering STI testing, COVID-19 testing, and some prevention tests. However, participants mentioned that after the triage, they received advice to test a lot of different test packages. Recommending many diagnostic test packages to the participants was a barrier because they were confused about which test package was important for them. Also the high amount of information provision about those testpackages was experienced as difficult by around half of the participants. Participant 13 mentioned:

When I open the website, a lot of information is present. Too many tests are available. Of course, this website wants to sell tests, but... I do not know. I found the home page too complicated, too unclear.

Second, the language used on the website was a factor that influenced the use of the service. The language on the homepage was experienced as straightforward and was therefore a facilitator. However, when completing the triage and choosing the diagnostic package, the information was more challenging to understand. Namely, medical and incomprehensible terms were used. Participant 8 mentioned:

I think you have a very broad target group of people who would like to use this, and I think it is written for the somewhat well-educated, reasonably well-informed citizen, shall we say. … Offer more comfort to people by using less difficult vocabulary.

Third, participants mentioned elements of the website itself, which influenced the user-friendliness. Participants were happy with the filters in the search bar to look for a particular test, the search function and the website's colours. Participant 14 mentioned:

Personally, I found the website easy to use, and what I experienced as very positive were the filters….

However, about a third of the participants found the website unclear (among others, due to too much text) and complicated (eg, where to find what they were looking for), and they found the homepage too busy.

Facilitators and barriers in the outer setting domain

D) Partnerships and connections

The service was linked to academic institutions, which increased its reliability. Mentioning partners would increase the uptake according to the participants: Participant 13 mentioned*:*

Yes, mentioning partners would be nice.. And famous names always attract attention.

G.1) Societal pressure

Participants mentioned that reviews and blogs could help in increase the use of the service and its reliability. Participant 5 mentioned:

You want to read reviews and experiences of others.

Facilitators and barriers in the individuals domain

B) Capability

The individual's skills and knowledge regarding services like Directlab Online influenced their willingness to use the service and their perception of potentially using it. The younger participants (20-30 years old) mentioned that they had experience with this kind of website, which reassured them to use this service. However, some older participants (39 years and older) had less experience with digital services in general and mentioned some anxiety and tension when they needed to order a test. Some of them would prefer to go to the general practitioner for diagnostic tests. However, all age groups mentioned the benefit of ordering STI tests online without going to the general practitioner.

Future needs

Different needs were identified regarding the services like Directlab Online. First, the service's purpose must be more explicit for the participants. For them, it was unclear that the service could help them self-manage their health. Participant 19 indicated:

And this is what I miss on the website; what is in it for me and my health as a patient or consumer?

Second, there was a need to understand what the advantages were of ordering diagnostic tests online (eg, more accessible compared to going to the general practitioner for tests). Participants wanted this information to be more evident on the website.

Third, participants also explained that they would like to have more information about how they could remain healthy or what they could do to become healthier after getting their test results back. It could help, according to the participants, to let them know more specifically that general practitioners make the diagnostic test packages designed for the service. All participants saw the benefit of ordering STI diagnostic test packages online and receiving them at home. The current offer of diagnostic test packages does not meet the wishes of all participants. There was a need for additional tests, such as tests for food allergies, testosterone, fertility or urinary infections. A participant mentioned:

I want a urine tract infection test; those are relatively cheap, I think…(p1)

Discussion

Principal findings

The current qualitative study aimed to evaluate the facilitators and barriers of an online direct access to diagnostic test service from the perspective of potential users. In addition, the study tried to identify the needs, to use such services. The study showed that a tailored amount of information could benefit the service. Participants needs to use a service like Directlab Online were to be ensured that the website was there for their health. It was important that the participants saw the benefit of a diagnostic test package. Identified barriers and facilitators were categorized using the Consolidated Framework into Implementation Research. The study showed that privacy, too much information and a commercial look and feel were important barriers. Facilitators were the right amount of information on the service and involving a health care professional in the service. In addition, the study showed that a tailored amount of information could benefit the use of the service. In short, we noticed that a lot of facilitators and barriers were influencing the reliability or accessibility of the service. For example, the commercial look and feel and lack of privacy information contributed to a less reliable service for the potential users and ordering a test online without a health care professional was influencing the accessibility.

Directlab Online is a service for users to support them in self-managing their health. An important quality-enhancing element for Directlab Online was that medical doctors had been actively involved in developing the service. Medical doctors have significantly influenced the content and information shown on the website. The focus groups with potential users, however, identified needs and wishes that did not completely align with the ideas of the general practitioner. To illustrate, medical doctors wanted other types of diagnostic test packages online than the participants wanted to use. Furthermore, the general practitioners wanted detailed information on the website, whereas this information overload was not always working well for the participants.

A study about an online results portal also discussed the complex balance between the medical necessities and participants' needs for the right amount of understandable information [34]. Presenting information requires a balance between too much medical information and the information users need to understand test packages and results. A potential way to solve overwhelming participants with information is to not present all the information directly in one view to the participant but by offering clickable links or short videos [34].

The current study used the CFIR to identify and categorize the facilitators and barriers. In another study, researchers performed an inventory to determine which obstacles must be overcome and how to optimize eHealth in primary care using this framework [33]. They found similar results to our study; costs and privacy issues were identified as important barriers. In addition, in line with other studies, the following facilitators were identified as "experience with eHealth" and "easiness to use" [33, 35]. In comparison with other studies utilizing the CFIR to classify facilitators and barriers, similar factors were predominantly identified. A notable factor highlighted in a study involving cancer patients utilizing a digital self-monitoring system was the necessity to elucidate the service's added value, alongside concerns regarding privacy issues. [36]. However, other factors were also mentioned, such as the connection with health care professionals, which were not identified in our study. The target population (cancer patients) could be an important explanation for this difference. The comparison with other literature revealed that irrespective of the type of digital service or the user population, the facilitators and barriers remained quite consistent. The current study's inventory could help determine what obstacles need to be overcome and how we might optimize an application like Directlab Online.

Depending on the participants, mainly influenced by age, some would use an online website to organize their health. In contrast, other participants, mainly older participants, were more at ease with going to the general practitioner and organizing their health directly via the general practitioner [37]. The older participants would rather go to the general practitioner in this research, which could lead to the cautious conclusion that online direct access to diagnostic services is not attractive for everyone [37]. In addition, this study showed that the use of a service like Directlab Online is not only age-related but also the user's health-related problem and the type of test package was important. Participants' needs were to feel the relevance of ordering a diagnostic test package online instead of going to the general practitioner. The relevance was clear for the STI test packages but unclear for other diagnostic test packages. The study results showed that it remains important to involve all end-users in the service to ensure that the service supports the needs of the target population [38]. Directlab Online was developed with general practitioners and elements that they found important were integrated in the service. Whilst this current study gave insight in the facilitators and barriers of potential users and it appeared that those things were not the same. It is important for a reliable and proper service, that both perspectives of

all stakeholders should be included in (further)development of such services. Finally, the facilitators and barriers to using a service like Directlab Online that were found could be used to optimize the service and comparable services.

Strengths and limitations

There is a lot of direct access to diagnostic testing services available, mainly when it entails STI diagnostic test packages. However, not many of them have a scientific basis or are developed by medical professionals. This is the first study that looked into the facilitators and barriers of a service that provides more diagnostic test packages than only STI tests and which is developed in co-creation with medical doctors. Another strength of the study was that the CFIR framework was used to analyze the facilitators and barriers mentioned in the focus groups. Embedding the facilitators and barriers in this framework made the comparison with other research easier. In addition, the domains identified by the CFIR framework can help to find the right implementation strategy [33, 39].

The current study focused on potential users because we were interested in their first impression of the service. The rationale was that - in the real world - such a service could be visited by many new users [40]. Previous experiences have not biased the impression of potential users. However, this could also be a limitation because participants who did use Directlab Online before could have another opinion about the service. This made the results less generalizable. Another limitation is that the mean age of participants was relatively low, making it more difficult to generalize the results to the general Dutch population. However, all participants, independent of age, mentioned the benefit of ordering STI tests online. The service showed benefits for participants who are ashamed to visit a general practitioner for a diagnostic package; and for participants who wish to order tests in an accessible, non-binding way.

Future research

Directlab Online is a service developed for a wide range of users. However, the current study showed that it is important to include end-users to ensure that the service fits the population's needs. Co-creation with end-users and medical professionals could be a solution to solve disbalances in wishes and needs between them and to improve an eHealth application [38]. For future research, organizing co-creation sessions and analyzing their results could be beneficial to improve the service. Finally, in future research, information about the influence of the diagnostic test's result on the user's lifestyle could be analyzed. Namely, this could possibly result in a preventive role for a service like Directlab Online to improve the health of a population.

Conclusions

According to participants, information provision, comprehension, and the total look and feel of the website were the most important elements that influenced the use and uptake of a direct-to-consumer website for diagnostic test packages. Barriers, like the commercial look and feel and lack of privacy information, negatively influenced reliability and accessibility. The study showed that it is important to include relevant stakeholders in creating an eHealth intervention because there was a disbalance between users' needs and what involved general practitioners consider necessary. Future research could take a quantitative approach to further identify the needs regarding test packages and to identify the demographics of users and the influence of test results on the behavior of users. Directlab Online offers opportunities for more online self-management of health.

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Conflicts of Interest

During the research, KS and ETK were employees at Unilabs.

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Abbreviations

CFIR = Consolidated Framework for Implementation Research
STI = Sexually Transmitted Infection

References

1. Chui M, Roberts R, Yee L. McKinsey Technology Trends Outlook 2022. 2022.
2. Evan Rawstron, Baulderstone M. Plugging healthcare workers into the digital future. 2022.
3. Clipper B. The Influence of the COVID-19 Pandemic on Technology: Adoption in Health Care. Nurse Leader. 2020 2020/10/01/;18(5):500-3. doi: https://doi.org/10.1016/j.mnl.2020.06.008.
4. Keuper J, Batenburg R, Verheij R, van Tuyl L. Use of E-Health in Dutch General Practice during the COVID-19 Pandemic. Int J Environ Res Public Health [Internet]. 2021 2021/11//; 18(23). Available from: https://europepmc.org/articles/PMC8656482?pdf=render.
5. Menting J, Schelven Fv, Boeije H. Gevolgen van de coronapandemie voor gezondheid, behandeling en zelfmanagement van mensen met een chronische ziekte. Utrecht: Nivel. 2020.
6. Flinterman L, Groenewegen P, Verheij R. Zorglandschap en zorggebruik in een veranderende eerste lijn. 2018.
7. Gauthier-Beaupré A, Battistini BJ, Kuziemsky C, Jutai JW. Policymaker perspectives on self-management of disease and disabilities using information and communication technologies. Health Research Policy and Systems. 2023;21(1):1-13.
8. McGowan P, editor. Self-management: a background paper. New perspectives: international conference on patient self-management; 2005.
9. Versluis A, Schnoor K, Chavannes NH, Talboom-Kamp EPWA. Direct Access for Patients to Diagnostic Testing and Results Using eHealth: Systematic Review on eHealth and Diagnostics. J Med Internet Res. 2022 2022/1/12;24(1):e29303. doi: 10.2196/29303.
10. Huber M, Knottnerus JA, Green L, Horst Hvd, Jadad AR, Kromhout D, et al. How should we define health? BMJ. 2011;343:d4163. doi: 10.1136/bmj.d4163.
11. Huber M, van Vliet M, Boer I. Heroverweeg uw opvatting van het begrip'gezondheid'. Nederlands tijdschrift voor geneeskunde. 2016;160:A7720.
12. Komkova A, Brandt CJ, Hansen Pedersen D, Emneus M, Sortsø C. Electronic Health Lifestyle Coaching Among Diabetes Patients in a Real-Life Municipality Setting: Observational Study. JMIR Diabetes. 2019 2019/03/12;4(1):e12140. doi: 10.2196/12140.
13. Spoelman WA, Bonten TN, de Waal MW, Drenthen T, Smeele IJ, Nielen MM, et al. Effect of an evidence-based website on healthcare usage: An interrupted time-series study. BMJ open. 2016;6(11):e013166.
14. Machado GC, Pinheiro MB, Lee H, Ahmed OH, Hendrick P, Williams C, et al. Smartphone apps for the self-management of low back pain: a systematic review. Best Practice & Research Clinical Rheumatology. 2016;30(6):1098-109.
15. El-Gayar O, Timsina P, Nawar N, Eid W. Mobile applications for diabetes self-management: status and potential. Journal of diabetes science and technology. 2013;7(1):247-62.
16. Alessa T, Hawley MS, Hock ES, de Witte L. Smartphone apps to support self-management of hypertension: review and content analysis. JMIR mHealth and uHealth. 2019;7(5):e13645.
17. Directlab Online. 2022; Available from: https://directlabonline.nl/.
18. Holman H, Lorig K. Patient self-management: a key to effectiveness and efficiency in care of chronic disease. Public health. 2004;119(3):239-43.
19. Bergeson SC, Dean JD. A systems approach to patient-centered care. Journal of American Medical Association. 2006;296(23):2848-51. doi: 10.1001/jama.296.23.2848.
20. Reynolds A. Patient-centered care. Radiologic technology. 2009;81(2):133-47.
21. Starfield B. Is patient-centered care the same as person-focused care? Perm J. 2011 Spring;15(2):63-9. PMID: 21841928. doi: 10.7812/tpp/10-148.
22. Ariens LF, Schussler-Raymakers FM, Frima C, Flinterman A, Hamminga E, Arents BW, et al. Barriers and facilitators to eHealth use in daily practice: perspectives of patients and professionals in dermatology. Journal of medical Internet research. 2017;19(9):e300.
23. Vergouw JW, Smits-Pelser H, Kars MC, van Houwelingen T, van Os-Medendorp H, Kort H, et al. Needs, barriers and facilitators of older adults towards eHealth in general practice: A qualitative study. Primary health care research & development. 2020;21:e54.
24. Saltro. Saltro. Available from: https://saltro.nl/.

25. Unilabs. Unilabs. 2022 [cited 2022 28-11]; Available from: https://unilabs.com/.
26. Willemsen RF, Aardoom JJ, Chavannes NH, Versluis A. Online synchronous focus group interviews: Practical considerations. Qualitative Research.0(0):14687941221110161. doi: 10.1177/14687941221110161.
27. Bonten TN, Rauwerdink A, Wyatt JC, Kasteleyn MJ, Witkamp L, Riper H, et al. Online Guide for Electronic Health Evaluation Approaches: Systematic Scoping Review and Concept Mapping Study. J Med Internet Res. 2020 2020/8/12;22(8):e17774. doi: 10.2196/17774.
28. Spencer L, Ritchie J, Lewis J, Dillon L. Quality in qualitative evaluation: a framework for assessing research evidence. 2004.
29. Gale NK, Heath G, Cameron E, Rashid S, Redwood S. Using the framework method for the analysis of qualitative data in multi-disciplinary health research. BMC medical research methodology. 2013;13(1):1-8.
30. Breimaier HE, Heckemann B, Halfens RJG, Lohrmann C. The Consolidated Framework for Implementation Research (CFIR): a useful theoretical framework for guiding and evaluating a guideline implementation process in a hospital-based nursing practice. BMC Nursing. 2015 2015/08/12;14(1):43. doi: 10.1186/s12912-015-0088-4.
31. Safaeinili N, Brown-Johnson C, Shaw JG, Mahoney M, Winget M. CFIR simplified: Pragmatic application of and adaptations to the Consolidated Framework for Implementation Research (CFIR) for evaluation of a patient-centered care transformation within a learning health system. Learning health systems. 2020;4(1):e10201.
32. Ross J, Stevenson F, Lau R, Murray E. Factors that influence the implementation of e-health: a systematic review of systematic reviews (an update). Implementation Science. 2016;11(1):146.
33. Versluis A, van Luenen S, Meijer E, Honkoop PJ, Pinnock H, Mohr DC, et al. SERIES: eHealth in primary care. Part 4: Addressing the challenges of implementation. European Journal of General Practice. 2020 2020/12/16;26(1):140-5. doi: 10.1080/13814788.2020.1826431.
34. Talboom-Kamp E, Tossaint-Schoenmakers R, Goedhart A, Versluis A, Kasteleyn M. Patients' Attitudes Toward an Online Patient Portal for Communicating Laboratory Test Results: Real-World Study Using the eHealth Impact Questionnaire. JMIR Form Res. 2020 2020/3/4;4(3):e17060. doi: 10.2196/17060.
35. Cajita MI, Hodgson NA, Lam KW, Yoo S, Han HR. Facilitators of and Barriers to mHealth Adoption in Older Adults With Heart Failure. Comput Inform Nurs. 2018 Aug;36(8):376-82. PMID: 29742549. doi: 10.1097/cin.0000000000000442.
36. Verweij L, Smit Y, Blijlevens NM, Hermens RP. A comprehensive eHealth implementation guide constructed on a qualitative case study on barriers and facilitators of the digital care platform CMyLife. BMC Health Services Research. 2022;22(1):751.
37. Wilson J, Heinsch M, Betts D, Booth D, Kay-Lambkin F. Barriers and facilitators to the use of e-health by older adults: a scoping review. BMC Public Health. 2021 2021/08/17;21(1):1556. doi: 10.1186/s12889-021-11623-w.
38. Kasteleyn MJ, Versluis A, van Peet P, Kirk UB, van Dalfsen J, Meijer E, et al. SERIES: eHealth in primary care. Part 5: A critical appraisal of five widely used eHealth applications for primary care – opportunities and challenges. European Journal of General Practice. 2021 2021/01/01;27(1):248-56. doi: 10.1080/13814788.2021.1962845.
39. Powell BJ, Waltz TJ, Chinman MJ, Damschroder LJ, Smith JL, Matthieu MM, et al. A refined compilation of implementation strategies: results from the Expert Recommendations for Implementing Change (ERIC) project. Implementation Science. 2015 2015/02/12;10(1):21. doi: 10.1186/s13012-015-0209-1.
40. Grindrod KA, Li M, Gates A. Evaluating User Perceptions of Mobile Medication Management Applications With Older Adults: A Usability Study. JMIR Mhealth Uhealth. 2014 2014/03/14;2(1):e11. doi: 10.2196/mhealth.3048.

Appendix 1

Overview of test packages on Directlab Online

Table 1. The other test packages on the website Complete of Directlab Online.

Category	Parameters
Vitamin tests	
Vitamins check	Gain insight in blood levels of vitamins B6, B11, B12, and D
Vitamins plus check	Gain insight in blood levels of vitamins B6, B11, B12, D, ferritin and hemoglobin
Vegetarian	Gain insight in blood levels of vitamins B12, D, hemoglobin, mean corpuscular volume, and ferritin.
Vegan	Gain insight in blood levels of vitamins B12, D, hemoglobin, mean corpuscular volume and ferritin.
Vitamin D	Gain insight in vitamin D blood level
Vitamin B12	Gain insight in vitamin B12 blood level
Test for common complaints	
Fatigue	Check for causes of fatigue in blood levels: glucose, thyroid stimulating hormone, C-reactive protein, freeT4, hemoglobin, mean corpuscular volume, ferritin, B11, B12 and glomerular filtration rate
Hair loss	Check for causes of hair loss in blood levels: hemoglobin, mean corpuscular volume, ferritin, thyroid stimulating hormone)
Burn out*	Check for causes of burn out in blood levels: glucose (non-fasting), HbA1c, C-reactive protein, thyroid stimulating hormone, freeT4, hemoglobin, mean corpuscular volume, ferritin, Vitamin B11 and B12
Why do I not lose weight?*	Check for thyroid stimulating hormone and glucose (non-fasting)
Drugs test	
Amphetamine/XTC	Check if there are traces in urine of Amphetamine/XTC
Benzodiazepines	Check if there are traces in urine of Benzodiazepines
Cocaine	Check if there are traces in urine of Cocaine
Cannabis	Check if there are traces in urine of Cannabis
Opiates	Check if there are traces in urine of Opiates
Total drugs tests	Check if there are traces in urine of benzodiazepines, amphetamine/XTC, cannabis, cocaine, Gamma Hydroxy Butyrate and opiates.
COVID-19 tests	
Antibody test	To check if a consumer has antibodies against COVID-19 in their blood
Post-COVID test	If a consumer has still complaints after a COVID-19 infection he/she can check if something is wrong. Gain insight in blood levels: glucose (non-fasting), total cholesterol, low density lipoproteins, high density lipoproteins, triglycerides, C-reactive protein, thyroid stimulating hormone, freeT4, hemoglobin, mean corpuscular volume, ferritin and vitamins B11, B12 and D
Vitamins test	Gain insight in blood levels of vitamins B6, B11, B12, and D after COVID-19 infection

*those tests are not available any more on Directlab Online after the service update

Table 2. The test packages focused on in the focus groups.

Category	Parameters
Prevention tests	
Health check-up	Check total cholesterol[a], low density lipoproteins (LDL) [a], high density lipoproteins (HDL)[a], triglycerides[a], Hba1C[a], albumin/creatinine ratio[b].
Health check-up at home*	Measuring parameters via self-sampling of blood: total cholesterol[c], LDL[c], HDL[c], triglycerides[c], Hba1C[c], albumin/ creatinine ratio[b]
Cholesterol	Check total cholesterol[a], LDL[a], HDL[a], triglycerides[a]
Cholesterol at home*	Measuring parameters via self-sampling of blood: Total cholesterol[c], LDL[c], HDL[c], triglycerides[c]
Anemia	Check hemoglobin[a], mean corpuscular volume[a], ferritin[a] and C-reactive protein[a]
Diabetes	Check glucose[a] and Hba1C[a]
Healthy bones*	Check calcium[a] and vitamin D[a]
Healthy kidneys*	Check creatinine[a], glomerular filtration rate[a], albumin/creatinine ratio[b]
Thyroid check	Check thyroid function via thyroid stimulating hormone[a] and freeT4[a]
Sexual transmitted infections tests	
Chlamydia	Check for chlamydia[d] (eg oral, anal, vaginal, urine sample)
Gonorrhea	Check for gonorrhea[d] (eg, oral, anal, vaginal, urine sample)
Human Immunodeficiency Virus (HIV)	Check for HIV[a]
Syphilis	Check for syphilis[a]
Hepatitis B	Check for Hepatitis B[a]

[a]Blood sample needed for diagnostics, [b]Urine sample needed for diagnostics, [c]blood sample by self-sampling needed for diagnostics, [d]Oral, anal, vaginal or urine sample needed for diagnostic tests
*those tests are not available any more on Directlab Online after the service update

Appendix 2

Semistructured interview guide

1. Introduction, explanation, informed consent
    a. Welcome. Introduction moderator and note taker
    b. Introduction subject
    c. Focus group rules
    d. Scheduling
    e. Consent Form
    f. Practical questions?

2. Proposal round
    a. Each participant briefly introduces himself.

3. Opening Questions
    a. Explanation about digital care in general, Explanation of 'Directlab Online'
    b. What were your experiences with digital health care before this study started?

Explanation of what we are going to do
Let the participants go through the website for about 10 minutes.

4. Overall website
    a. How did you find the Directlab website?
    b. What is your first reaction to the website?
    c. What expectations do you have now? / Is it clear what service is offered on the website?
        i. What do you think of the service?
    d. How did you experience the website?
        i. To what extent did you find the website easy to use?
        ii. Do you think you can handle the website quickly?
        iii. Were you able to easily find what you were looking for?
        iv. To what extent did you find the website attractive?
        v. Do you need help using the website?
        vi. Does the Directlab website form an unambiguous whole for you?

5. Elements of the website
    a. Did you find the general information provided on the website clear?
        i. Do you think information is missing?
        ii. Do you think other elements are missing on the website (e.g., Chatbot or similar)
    b. Have you seen the blogs on the website? If so, will you read or use it?
    c. Have you noticed that there are two different types of packages?
        i. Yes? Do you understand the difference between the two types of packages? Is a distinction between lifestyle and medical packages of added value for you?
        ii. No? Explanation about the two different packages and why it was decided to make this distinction: reliable] How do you view this?

Show the triage questions yourself, different per focus group

6. Triage plus test advice
    a. How did you experience the questions on the website that led to testing advice?
    b. To what extent did you understand these questions?
        i. Are there any words you had to look up?
    c. To what extent were the questions easy to answer?
    d. Did you understand why you had to answer these questions?

7. Facilitators, barriers, improvements: points and potential contributing and counteracting factors of the website and online testing method for the future
    a. In principle, this service is intended for everyone. What factors do you think may hinder/encourage the service?
        i. Which points do you see as barriers to using Directlab?
        ii. The service is currently paid for. Would you pay for it? [Disadvantage, if something is reimbursed, you have to provide more personal information]
        iii. Compensation, costs, personal characteristics?
        iv. What do you need to assess Directlab (even) more positively?
    b. Do you have ideas on how to improve Directlab?
        i. If so, what could these improvements look like?
    c. Does this way of ordering tests give you a sense of control?
    d. To what extent does Directlab feel to you as a reliable service? [probing – why is that]

e. If you were not using Directlab to request diagnostics, would you have gone to the GP?
    i. How do you feel about being able to request a diagnostic test without a counselor?
f. How do you experience privacy [complete online questionnaires, order tests, enter personal data, and pay]?
    i. How do you think Directlab handles this?

8. Needs: Request utility of online diagnostic test
    a. To what extent does this method of ordering online tests meet your needs?
    b. Would you use Directlab yourself in the future?
        i. What tests would you use Directlab for [tell more about other types of tests]
        ii. Would you like to see other types of tests that are not currently available?
        iii. Developments are underway about self-drawing blood for a test. How do you feel about this?
    c. Would you skip a doctor's appointment using Directlab?
    d. How do you feel about being able to request a diagnostic test without a counselor?

9. Closure
    a. Of all the things we discussed today, what did you find most important?
    b. To what extent would you recommend Directlab to others?
    c. Are there any points that we have not discussed?
    d. Do you have any additional comments/questions?
    e. End of the focus group. Would you like to be kept informed of the results of the research?