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Digital health platforms for the elderly? Key adoption and usage barriers and ways to address them

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ABSTRACT

Digital healthcare platforms (DHPs) represent a relatively new phenomenon that could provide a valuable complement to physical primary care – for example, by reducing costs, improving access to healthcare, and allowing patient monitoring. However, such platforms are mainly used today by the younger generations, which creates a "digital divide" between the younger and the elderly. This article aims to identify: i) the perceived key barriers that inhibit adoption and usage of DHPs by the elderly, and ii) what DHP providers can do to facilitate increased adoption and usage by the elderly. The article draws on qualitative interviews with elderly and complementary process data from a major Swedish DHP. We find that the elderly perceives two key barriers to initial adoption of DHPs: i) negative attitudes and technology anxiety and ii) one key barrier affecting both adoption and usage – lack of trust. The analysis also identifies multiple development suggestions for DHP improvement to better accommodate the needs of the elderly, including suggestions for application development and tailored education activities. We provide an integrated framework outlining the key barriers perceived and ways to address them. In so doing, we contribute to the literature on mHealth and to the literature on platforms in healthcare.

1. Introduction

Digital technologies and the new business models enabled by them have rapidly changed the ways in which healthcare can be provided and received (Balta et al., 2021; Lai and Wang, 2015; Oderanti et al., 2021; Vukovic et al., 2018). For example, primary care services are increasingly provided through digital health platform firms (DHPs) (Hermes et al., 2020). A DHP allows interaction between patients and healthcare professionals by deploying digital technologies (Ardolino et al., 2020). DHPs offer a combination of video meetings, chat, and asynchronous communication services. They represent a relatively new phenomenon at both the technological level and the business level. From a technological perspective, DHPs can be understood as providing a curated mix of mHealth services accessible through a single interface. These services are increasingly provided by platform firms, sometimes referred to as "net doctors" or "online doctors" because they build their business model around DHP services.

In theory, DHPs and other forms of digital healthcare have many potential upsides. For example, DHPs can help reduce inefficiencies, improve access, reduce cost, increase quality, and allow for more personalized medicine (FDA, 2021). Deploying digital technologies could also provide greater flexibility for doctors and nurses (Ahern et al., 2006). The market for digital healthcare is estimated at around $25 billion globally, with expected continuous growth (Duggal et al., 2018). The COVID-19 pandemic with multiple national lockdowns has further accelerated the demand for well-functioning digital healthcare because it allows patients and doctors to meet without physical interaction (Zhang et al., 2022). Recent research has shown that performance expectations on such digital healthcare is high (Baudier et al., 2021).

However, the growth of DHPs has also received criticism in public debates globally. In Sweden, where the current study is situated, a salient line of criticism suggests that firms basing their business model on DHPs cater mainly to younger (and largely healthy) primary care users. The elderly does not use DPHs to the same extent (Dagens

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Samhälle, 2020). This may not be surprising as the elderly's rate of adoption and usage of digital health tends to be low in comparison to the population average (Wildenbos et al., 2017). Yet, this pattern is problematic because, in comparison with younger generations, the elderly tend to have a greater need for regular health consultations (Liu et al., 2019). In theory, elderly generations can benefit from using DHPs – for example, by enabling independent living and increased flexibility (Nikou et al., 2020). However, many elderly people have learned to interact with technology in a different time, which has created "digital segregation" (Ahern et al., 2006; Talukder et al., 2020), resulting in below-average adoption and use rates (Vasunilashorn et al., 2012).

Regarding DHPs in particular, reports show that the elderly are under-represented in DHP usage (Wemnell, 2020). As an example, individuals over 60 years represent 25 % of the population in Sweden, but only 4 % had used DHPs in 2018 (Dunér et al., 2020). This under-representation risks the marginalization of the elderly in the further development and use of DHPs and their services. Furthermore, it can mean a non-realized potential to deploy digital technology to reduce financial burdens and resource pressures on traditional healthcare systems if accessible to all generations (Fox and Connolly, 2018). The under-representation of elderly patients in DHP adoption and use is also significant from a DHP provider perspective because elderly care consumers constitute an increasingly important component of the future digital health market, given that the number of people worldwide above the age of 60 will triple between 2010 and 2050, from 760 million to 2 billion (Garatachea and Lucia, 2013).

Against this background, this article aims to shed light on the barriers that the elderly perceives in relation to DHP adoption and usage, and how they foresee that those barriers could be reduced. More specifically, the purpose of this article is twofold: i) to identify the key barrier types that inhibit adoption and usage of DHPs by the elderly and ii) to empirically investigate how DHP providers can facilitate increased adoption and usage by the elderly. We define the elderly as individuals above the age of 65 (Orimo et al., 2006).

By exploring these questions, we add to the literature on mHealth and DHPs, which, apart from emphasizing the potential of e-Health and DHPs (Biswas et al., 2014; Hoque and Sorwar, 2017; Lolich et al., 2019; Xue et al., 2012; Åkesson et al., 2007), provides little insight into why the elderly use or refrain from using DHPs. There is a substantial body of literature on digital technologies in healthcare, published under labels such as digital health, mHealth, eHealth, telehealth, and telemedicine (Kruse et al., 2017; Xue et al., 2012; Fox and Connolly, 2018; Knitza et al., 2020). However, these prior studies (e.g., Fox and Connolly, 2018; Bujnowska-Fedak and Pirogowicz, 2014; Kim et al., 2019) have not been conducted on DHPs. Secondly, previous literature (e.g., Heart and Kalderon, 2013; Nikou et al., 2020) seem to use the terms of adoption and usage interchangeably. However, adoption refers to the binary choice of selecting a technology for use or not (Sharma and Mishra, 2014), while usage refers to the post-adoption stage where an individual or organization utilizes the technology (Nadal et al., 2019a,b). In the current article, we aim to take these nuances into account by investigating the respective barriers to adoption and usage. Finally, some of the previous literature (Nikou et al., 2020; Knitza et al., 2020; Yusif et al., 2016; Ali et al., 2021) has focused on addressing barriers, drivers, and problems with digital health but does not explicitly study how DHPs can accommodate the needs of the elderly.

Drawing on interviews with elderly users and non-users of DHPs, combined with quantitative data on how the elderly use one of the major DHPs in Sweden, we propose a framework outlining the key barriers to adoption and use of DHPs, and ways to mitigate them. This framework contributes not only to the literature on mHealth and DHPs but also to the literature on platforms in general/beyond healthcare, where studies typically aim to predict usage by exploring usage intentions (e.g., Benson et al., 2019; Kuo, 2020), without distinguishing between adoption and use, and typically focusing on young individuals (studies including individuals aged 65+ are virtually non-existent). Finally, at a more practical level, and by unpacking the elderly's attitudes to DHP development needs, we contribute to more realistic expectations on the role of DHPs for the elderly. Hopefully, this will increase the opportunities to adjust the ongoing development to the needs of elderly users.

2. Theoretical background

2.1. What is a digital health platform?

Digital platforms have received much attention in recent years (Thomas et al., 2014); they have changed the way people interact, search for information, and utilize services (Evans and Gawer, 2016). Such platforms can be disruptive (de Reuver and Ondrus, 2017). For example, Hermes et al. (2020) describe how the traditional healthcare sector is being challenged as newcomers leverage platform-based business models. A digital platform is multi-sided; it mediates and facilitates interaction between different groups of users – for example, patients and physicians (Boudreau and Hagiu, 2009). In theory, the value for one group increases as the number of participants from the other group increases (Eisenmann et al., 2006). The platform provides the infrastructure that enables transaction and interaction between the two user groups (Ardolino et al., 2020) for which mobiles and tablets are considered catalysts (Dendere et al., 2019; Evans and Schmalensee, 2016). In this article, we draw on Boudreau and Hagiu (2009) and Ardolino et al. (2020) to define a digital health platform (DHP) as one that seeks to *"facilitate the interaction between patients and physicians via the use of digital technologies, e.g., video calls and chat"*.

A provider of DHPs performs both a technology-related role and a business-related role (Kim and Altmann, 2020) That is to say, it designs the architecture of its platform, and determines the means to attract end users and service providers. While DHPs have been heralded as holding great potential to complement and even replace traditional healthcare service channels, only limited research has been devoted to the fact that the elderly is under-represented in DHP usage. This is problematic from an academic perspective because it means there is an underdeveloped understanding of the operation of DHPs in relation to a major consumer group in healthcare. This gap applies also to the literature on platforms in general, where studies explore user intentions and behaviours (Zhao et al., 2019; Jordan, 2019), but largely exclude elderly (individuals 65+).

The lack of research focusing on the elderly's perception of DHPs is problematic on a more practical level because it may lead to unrealistic expectations of DHPs and a diminished potential to use DHPs to address the needs of the elderly. Furthermore, most countries have implemented directives or regulations mandating the provision of healthcare in an "equal" manner, based on needs. For example, from a legal perspective in Sweden, providers of digital healthcare must comply with the law of accessibility (Law, 2018:1937). This means that all individuals regardless of background, disability, and age should have the same opportunity to access care-related services through DHPs. This points to the importance of better understanding the reasons for the elderly refraining from adopting and using the services and how to address such perceived obstacles. With the aim of unpacking these questions, we outline our definitions of adoption and usage below.

2.2. Digital platform adoption versus usage

Many studies on attitudes to technology centres on adoption or conflates the terms adoption and usage. Established views of "technology acceptance" centre on an individual's intentions to adopt a certain technology (Davis, 1993; Dünnebeil et al., 2012). Here, adoption is understood as binary, either 0 or 1 – in other words, a DHP is either adopted or not; an application is downloaded or not. Focusing on adoption, these studies say little about post-adoption usage. We argue that it is important to highlight the different barriers to adoption versus usage, given that previous studies on technology in general show that

the elderly who pass the adoption stage are often hesitant to keep using the technology (Kim et al., 2019). Indeed, usage does not always follow adoption (Liao et al., 2009).

For the purpose of our study, we define adoption as the stage of up-front selection of a technology for use by an individual or organization (Sharma and Mishra, 2014). We define usage as the stage after adoption where an individual or organization utilizes the technology (Nadal et al., 2019a,b). This usage stage is sometimes referred to as post-adoption and involves many different usage trajectories, such as continued use, partial and discontinued use, and temporarily halted but resumed use (Ng, 2020). In other words, an individual who once used a DHP may not continue to do so, and an individual who has stopped using the services may start to use them again (Nadal et al., 2019a,b; Son and Han, 2011; Ye and Potter, 2011; Zhou, 2011; Parthasarathy and Bhattacherjee, 1998; Burns and Wholey, 1993; Greve, 2011). Drawing on these general definitions, we aim to explore the barriers that the elderly perceive in relation to DHP adoption and usage respectively, and how those barriers could be mitigated. In this endeavour, we build on previous research on technology adoption (primarily the UTAUT2 model) and the perceived barriers to adoption and usage, which we will account for below. It should be noted that this literature focuses largely on adoption or does not distinguish adoption from usage.

2.3. Unified theory of acceptance and use of technology (UTAUT)

A theoretical starting point for studying adoption and use of DHPs by the elderly is the so-called unified theory of acceptance and use of technology (UTAUT), which delineates multiple concepts and dimension of interests. UTAUT combines the technology acceptance model (Venkatesh and Davis, 2000) with the theory of planned behavior (Ajzen, 1985; Venkatesh et al., 2012). In brief, UTAUT assumes that an individual behavior intention to use technology is influenced by *expectation of performance* (the degree to which technology is perceived useful), *expectation of effort* (the degree to which technology is perceived to be simple to use), *social influence* (the extent to which significant others affect an individual to adopt or use a system) and *facilitating conditions* (the degree to which an individual believes they have access to the resources to be able to use a technology) (Venkatesh et al., 2003). Our starting point is the extended model (UTAUT2), which has been applied in recent studies of health care (Baudier et al., 2021; Ben Arfi et al., 2021). The UTAUT2 mentions *hedonic motivation* (the degree to which the new technology is considered enjoyable), *price value* (the monetary costs of the new technology in comparison to perceived benefits), and *habit* (the routines and time set aside to use the new technology) (Venkatesh et al., 2012). UTAUT2 also assumes that the use of technology is affected by variables such as age, gender, and experience. However, UTAUT2 has also been criticized (Chandrasekhar et al., 2013; Choi, 2016), e.g. for being too narrowly focused on individuals' relationship with a specific technology, thus omitting fundamental and wider concerns and conditions that may affect an individuals' attitudes and choices regarding specific technologies. To guide our empirical research, we therefore combine the UTAUT2 with prior literature regarding adoption and use of digital health.

2.4. Complementing UTAUT: Barriers for platform adoption and usage among elderly

There can indeed be specific factors beyond those in UTAUT that influences whether the elderly will adopt and subsequently use digital healthcare (Yusif et al., 2016). Studies outlining potential barriers to technology adoption or use are therefore relevant to consider in this study.

2.4.1. Technological anxiety

The elderly tend to be more uneasy in relation to new technologies in comparison with younger generations (Flick et al., 2020; Steele et al., 2009). This may be due to hearing and visual impairment, or lack of prior experience. Therefore, the elderly sometimes need help from family members to fully comprehend new technology (Cimperman et al., 2013). The elderly's potential anxiety over technology can therefore be considered a potential barrier to DHP adoption and usage (Flick et al., 2020; Steele et al., 2009). This can be understood as a particular dimension of facilitating conditions – the elderly may not have the resources (in terms of physical capabilities) needed to be able to fully use the technology.

2.4.2. Integrity and data security

Fox and Connolly (2018) propose that the elderly have a desire for data privacy in digital health. Technology adoption and future usage can therefore be affected by how trustworthy the DHP is perceived to be (Körber et al., 2018; Schaefer et al., 2016). It is also the case that the elderly has a greater risk perception of new technologies, which may reduce their willingness to use them (Clifton et al., 2012). For example, Shareef et al. (2021) and Lai and Wang (2015) show how distrust in data security is one of the most significant factors as to why elderly choose not to adopt healthcare technologies. In a similar vein, Anwar et al. (2015) illustrate how data security causes financial loss and damage to company reputation.

2.4.3. Negative attitudes to digital health

The elderly may be more conservative when it comes to technology, which results in a lower degree of digital health adoption (Cimperman et al., 2016; Yusif et al., 2016). In addition, if potential users have limited interest in using digital tools, such as computers or telephones, it will hurt the adoption and use of digital platforms (Selwyn et al., 2003). The service that the elderly show most the interest in is obtaining basic rather than complex recommendations from a doctor via phone or computer (Bujnowska-Fedak and Pirogowicz, 2014). This could imply that the elderly has a negative attitude to DHPs addressing medical problems beyond the most basic ones.

2.4.4. Financial constraints

Financial aspects may pose yet another barrier to the elderly adopting and using DHPs (Cimperman et al., 2013; Steele et al., 2009). To use digital care, the elderly have to pay for the service and the associated equipment – for example, a computer or a phone (Bujnowska-Fedak and Pirogowicz, 2014). Although the financial situation of elderly varies greatly, these studies point at the fact that economic conditions and inequalities can play a role in how elderly adopt and use new digital services.

In summary, previous studies suggest a set of conditions, some of which do not concern the specific technology in focus but pointing instead to wider prerequisites that can contribute to elderly individuals' positive and negative attitudes to new technology. Although these studies do not distinguish between adoption and use, and do not capture the entire set of potential contextual dimensions that could influence an individuals' attitudes and choices regarding technology, the identified themes provide important inroads for our exploration of the barriers perceived by the elderly in relation to their adoption and use of DHPs.

2.5. Potential solutions in previous literature

Previous literature has only scratched the surface of potential solutions to overcome barriers to digital health adoption and usage (Ali et al., 2021; Knitza et al., 2020). However, while prior studies offer little guidance on how DPH providers can facilitate adoption and usage, the literature provides a set of general insights that are relevant to our study. Firstly, studies indicate that privacy and ethical issues regarding data are important (Lupton, 2014). The system must be designed so that it is easy to operate in a way that can generate trust (Shareef et al., 2021). In this context, the design of online and offline components of a service requires careful attention. “Adequate” face-to-face interaction affects whether

consumers consider information reliable or not (Chong, 2013). It therefore seems relevant to further examine whether non-face-to-face communication affects trust in digital health and how the different communication channels – video calls or chats – are perceived by the elderly. Furthermore, studies indicate that the elderly tend to trust different web-based health services depending on the reputation and name recognition of service providers (Choi, 2020). This suggests that not only the quality of online services per se but also the brand and the trust in the organizational actor providing DHPs need careful consideration.

Research further suggests that, for technologies that are in the early stages of the life cycle (something that applies to DHPs), there is a need to overcome negative attitudes and demonstrate superior benefits compared to traditional methods (Heart and Kalderon, 2013; Steele et al., 2009; Bujnowska-Fedak and Pirogowicz, 2014). For example, showcasing technology and offering training, which can relieve anxiety, are recommended (Steele et al., 2009). Here, studies argue that certain designs are needed that are more adapted to the conditions of individuals with impairments – for example, those suffering from hearing and visual impairment (Steele et al., 2009).

Whilst the studies summarized above provide relevant insights, they are not conducted in a DHP context nor on the elderly. What exactly DPH providers can, therefore, do to overcome barriers to adoption and usage among this user group remains an open question. The following section describes our methods for probing this issue.

3. Methods

3.1. Research approach and case selection

A case study was selected as a research approach, which is suitable when there is a large variety of factors and relationships included in the study (Becker, 1970; Bergström and Ekman, 2021; Yin, 1994). The study draws mainly on qualitative data, but it contains some quantitative data to validate and triangulate the qualitative findings. We followed an abductive research approach because it allows for multiple iterations between theory and empirical data (Dubois and Gadde, 2002; 2014). The study was conducted in association with a DHP provider in Sweden who develops DHP technology and uses it in its DHP-based business model for primary care (hereafter referred to as Alpha). It had annual revenues of 186 MSEK in 2019, making it one of the larger DHP players in the Swedish market for digital primary care. The company provides healthcare services both online and, more recently, through physical health centres. Because the study focused on the healthcare sector, ethical approval was sought and subsequently provided by Swedish Ethical Review Authority [Etikprövningsmyndigheten] (DNR 2021-01383).

3.2. Data collection

We started by collecting and analyzing process data from Alpha – namely, behavioural and background data from primary care patients aged 65 or older. The variables included in the quantitative data were *age of patient*, *gender,*[1] *number of errands*, *their healthcare errand (guide)*, *city of residence*, *customer satisfaction*, *device used*, *number of messages from healthcare professional*, *number of messages from patient*, *average time for patient to answer,* and *number of times patient checked the errand.* These variables provided valuable complementary information to the qualitative data (see below). The data set ranged from 4904 to 13,317 unique observations per variable and were collected through usage data from 2019 to 2020. All data were anonymized in consideration of GDPR. A more thorough description of each variable is presented in Table 1.

The second round of data collection was conducted by interviewing the elderly. We used semi-structured interviews following a predefined interview guide (Appendix A). In total, 22 interviews were held and, due to the COVID-19 pandemic, the interviews were conducted by using phone or video. Consent was sought prior to each interview, and the research purpose, design and interview questions were explained in detail to each respondent. We used a judgment sample technique and based respondent selection on three primary criteria. First, we took into account the importance of not considering the elderly as a homogenous group and the likelihood that there could be significant variation in experiencing digital products and services (Ghorayeb et al., 2020; Kutluay et al., 2003). Therefore, we interviewed candidates who had previous experience of DHPs as well as those who had not. We interviewed eight non-users with no prior experience of DHPs and four non-users with development experience of digital health. These four individuals had, in their working life, been engaged in developing services for the elderly but were currently not using these services themselves. Finally, we interviewed ten current users of DHPs who were experienced with DHP services. The idea was that a combination could provide more diverse insights into why the elderly were non-users, and what led some users to adopt and use. Second, we opted for a spread of ages for the interviewees, ranging from 65 to 80. Lastly, we took gender into consideration and aimed for a balanced distribution between men and women. Despite this goal, we had 16 female respondents and 6 male respondents. Thus, female respondents were highly over-represented in our study. Table 2 gives an overview of the interviews.

3.3. Data analysis

The quantitative data set included multiple string variables–for example, gender, city of residence, and device. Firstly, gender was transcribed to 1 and 2, corresponding to female and male. City of residence was coded into representative municipality size according to Jordbruksverket's directions; *big city district*, *city district*, *countryside*, and *sparsely populated countryside* (Jordbruksverket, 2021). Lastly, the variable device contained over 59 permutations of app-ios, app-android, mobile-or-tablet, and desktop. It was therefore coded into: mobile, i.e., app-ios, app-android, mobile-or tablet; desktop, i.e., computer; mobile-

Table 1
Variable description.

Variable name	N	Description
Age of patient	13,317	Age ranges from 65 to 99
Gender	13,317	Female or male
Number of errands	13,317	How many individual errands the patient has had during 2019 and 2020
Guide	13,317	The health errand the patient sought medical attention for, e.g., fever or rash
City of residence	13,317	Name of the city and county
Customer satisfaction	4904[a]	Customer satisfaction, range from 1 to 5
Device used	13,317	The device used for interaction. App-ios, app-android, mobile or tablet, desktop or a combination of those.
Number of messages from physician	13,155[b]	How many messages the physician has sent
Number of messages from patient	13,155[c]	How many messages the patient has sent
Average time for patient to answer	7546[d]	How long it took for patient to answer (in seconds)
Number of times patient has checked errand	13,136	Number of times patient has logged in and checked the errand on the platform

[a] Number of N varies since customer satisfaction is not a mandatory question.
[b] Number of messages from physician may be caused by the fact that the errand cannot be correctly diagnosed or treated online and is therefore closed.
[c] Number of messages from patient may also be caused by the same facts as in b.
[d] Average time for patient to answer is caused by patient not sending message.

[1] Defined as a binary variable. Although this binary categorization can be criticized and alternatives exist (Thornton et al. 2019), we could not affect the pre-existing variables.

Table 2
Sample.

	Previous experience	Age	Gender	Length of interview
1	n	67	m	16 min
2	y	69	f	18 min
3	n	80	f	11 min
4	e	70	m	33 min
5	n	68	m	17 min
6	n	68	f	29 min
7	n	75	f	10 min
8	y	65	m	13 min
9	y	65	m	24 min
10	n	69	f	16 min
11	e	65	f	18 min
12	n	74	f	25 min
13	y	66	m	17 min
14	y	65	f	24 min
15	y	71	f	17 min
16	e	70	f	22 min
17	y	75	f	20 min
18	e	73	f	18 min
19	y	67	f	19 min
20	y	67	f	38 min
21	n	75	f	21 min
22	y	75	f	34 min

The previous experience column indicates if they have previously used DHPs with yes (y) or no (n). Individuals with (e) are those who have not previously used but have been participating in the development of similar services and, therefore, possess relevant knowledge of the topic.

desktop, i.e., one from mobile then computer; desktop mobile, i.e., first computer then one from mobile and mobile-desktop mobile. All coding can be found in Table 3.

The analysis included univariate techniques and descriptive statistics – for example, investigating frequencies and mean values among the different variables.

For the *qualitative analysis*, we deployed thematic analysis as described by Braun and Clarke (2006) and coded the data using four steps. Step 1 was *familiarizing with the data.* Here, interview transcripts were read through by two of the authors to create a shared understanding. We then made remarks about preliminary insights and highlighted potential codes and sub-themes. We then moved to Step 2, generating initial codes and sub-themes. This meant reading through the transcribed interviews carefully. Firstly, we brainstormed codes and sub-themes based on respondents' terms and language. Subsequently, we looked deeper into each interview with the specific code in mind to identify quotations from the respondents. All quotations were then translated from Swedish to English and then added to a spreadsheet used for the thematic analysis. The analysis was iterative; we moved back and forth between theory-driven and data-driven approaches. In other words, we tried to look at data inductively but then switched to a more theory-based approach and back again. In particular, insights from the literature in terms of dimensions identified in UTAUT and additional aspects influencing adoption and usage were consulted on a continuous basis. This step allowed us to eliminate redundant sub-themes and codes that did not have a connection to our research questions. In Step 3, we *identified and reviewed themes.* Firstly, we identified themes by reviewing the codes from step 2. Then, we identified similarities and differences among codes in order to generate themes. The themes, sub-themes, and codes were then extensively discussed and eventually reviewed to ensure that the themes were relevant to the research questions. In this process, all the codes and associated quotations were reviewed in detail with the purpose of excluding those that had no distinct connection to the themes identified. Again, two of the authors did the analysis jointly to avoid misinterpretations. Finally, in Step 4, we defined and named codes and themes. Here, all the themes, sub-themes, and codes were further examined to ensure a complete representation of the respondents' answers. Each theme was carefully examined to ensure that sub-themes and codes were assigned to the correct theme.

Table 3
Coding of variables.

Variable	Name	Content	Code
Gender	Female		1
	Male		2
Municipality	Big city district		1
	City district		2
	Countryside		3
	Sparsely populated countryside		4
Device	Mobile	App-ios, app-android, mobile-or-tablet	1
	Desktop	Computer	2
	Mobile-desktop	First one from mobile, then computer	3
	Desktop-mobile	First computer, then one from mobile	4
	Mobile-desktop-mobile	First computer, then one from mobile	5

4. Results and analysis

This chapter outlines the results from the qualitative/thematic analysis, and Table 4 describes the data structure. The quantitative results will primarily act as a validator for some of our qualitative findings. The analysis is supported by some power quotations from the interviews, while representative quotations are provided in Appendix B. The first sub-chapter aims to answer the first research question, and the second sub-chapter the second one.

4.1. Barriers to DHP adoption and usage by the elderly

This chapter is divided into four sub-sections, which aim to distinguish barriers to adoption, to usage, or to both. In doing so, we highlight differences between elderly users (users) and non-users (non-users)– namely, those who have adopted DHPs and those who have not.

4.1.1. Attitudes towards DHP's

It is worth noting that, overall, users of DHPs maintained a positive attitude to the adoption and usage of DHPs (9 out of 10). This generally positive attitude among users is also highlighted in the quantitative analysis of customer satisfaction among users ($M = 4.22$, $SD = 1.067$), indicating that users overall are satisfied with the DHP. Users' positive attitudes often centred on how "fast" and "accessible" digital healthcare was in comparison to physical healthcare – for example, queues can be avoided. Many respondents also held the opinion that DHPs are suitable for recurring errands that require frequent and continuous care. One previous user stated:

> "Digital health provides faster help for easier problems, or recurring errands. Getting a prescription renewal is amazing [...] and there is always a risk going into a healthcare centre and be in the waiting room with sick people"- R9 (y)

In contrast to users, non-users often exhibited a more negative attitude to DHPs. Non-users' negative attitude to DHPs reflected a general scepticism related to the possibility of using digital rather than physical healthcare. For the elderly, it would be an "uncomfortable" way of seeking care, which we refer to as a **disbelief in the potential of digital care.** A majority of respondents who were non-users held a negative attitude to DHPs. This seemed related to the relative satisfaction with existing (offline) care among non-users. Their current physical arrangements were not causing sufficient trouble to go down the digital route.

Table 4
Thematic analysis.

Codes	Subthemes	Themes
Barriers to adoption		
• Scepticism towards DHPs • Feel that digital healthcare can't replace physical • Uncomfortable way of consuming healthcare • The need isn't strong enough to use digital healthcare	Disbelief in the potential of digital care	**Attitudes to technology**
• Resistance to using DHPs due to privatization • Knows about the debate but does not care • Regions and counties have to pay	Political concerns	
• Belief that DHPs only take on the easiest cases • No interest in learning digital devices • Hard to use DHPs without digital experience	Disinterest in digitalization	
• Not confident in using digital products • Concern their own knowledge isn't enough • Need experience of digital devices to enable adoption of DHPs	Low digital maturity	**Technological anxiety**
• Hard to understand DHPs without basic technology knowledge • Fear of pressing the wrong button • Scared of causing problems • Find it difficult to navigate through questionnaires before contact with physicians	Fear of making mistakes	
• Mixed feelings regarding data security • Overall, there is a feeling of trust, but there are minor concerns regarding usage of data and viruses	Data security risks	**Trust**
• More anonymous to use digital healthcare • Minimizing risk of running into someone • Not reliable enough	Personal integrity worries	
• Feels as if the ability to feel and test is lost and will affect precision of diagnosis	Inaccuracy of diagnosis	
Development suggestions		
• Need to create awareness that DHPs exist • Present benefits of using DHPs • Clearly communicate what errands can be treated online safely (and what cannot)	Depoliticizing and boundary making marketing	**Facilitating increased adoption**
• Decouple from political debate – to defuse the explosivity • Monitor need for education about digital tools, e.g., phones and iPads • Education on practical usage of these products	General education for potential users	
• Belief that education and knowledge of overall digital knowledge is key for adoption and usage of DHP • Learning by actual training		

Table 4 (*continued*)

Codes	Subthemes	Themes
• Variable willingness to pay among elderly • Uncertainty about costs (fees) tied to different online services (chat, video, advice, etc.)	Designing clear price models targeting different preferences among the elderly	**Facilitating increased usage**
• Make the apps easier to use and intuitive for users with different cognitive and physical impairments • Provide step-by-step instructions • Include elderly test panels for future developments	Technological interface design improvement	
• Specific services for specific medical conditions • Introduce a fixed point of contact in the healthcare system as it eases the communication • Provide option to communicate with the same physician for different health problems	Service design improvements – fixed point of contact	
• Offer one contact over time for users with chronic conditions • Digital healthcare cannot fully replace physical • Need for both physical and digital healthcare	Exploiting the omnichannel approach (mixing online and offline channels)	
• Use online for follow-ups *after* physical treatment • Online offers for questions that need quick answers and for individuals in need of time saving		

> "I find it hard to see any benefits with it [...] for my part, the regular works" – R6 (n)

Thus, a negative attitude to DHPs in terms of a disbelief in the potential of digital healthcare can explain the currently modest adoption rates among the elderly, which aligns with the position of Yusif et al. (2016). However, this finding indicates that such attitudes constitute an adoption barrier rather than a usage barrier. Non-users as well as users spontaneously and frequently referred to how the intense public debate in Sweden brought **political concerns** about DHPs to the surface, which made the respondents less keen on adopting (non-users) as well as continuing to use (users) DHPs. Most respondents were concerned that the current setup with private DHP providers could "drain" resources from the public system of physical healthcare. As one respondent pointed out:

> "I think, if I am to be a little political about the counties or the region, that their opposition to this makes many people back off when I think about it. And then they do not feel really safe using this... for the region, it's a lot about economic issues, not if it's good or bad."- R11 (n)

The political concern about the consequences of DHPs as a new digital service on the surrounding healthcare system – specifically, the impact on the distribution of public resources as a barrier to adoption and use – has not previously been mentioned in the literature about digital healthcare among the elderly. The theme is raised in interviews with both previous users and non-users, with five previous users and six non-users pointing this out. Thus, the heated political debate over

healthcare resources seems a concern among the elderly both pre- and post-adoption stage.

By and large, respondents stressed that they as individuals and as a group – namely, "the elderly" – often **lack interest in digitalization** generally, which further impedes the adoption and usage of DHPs. This may partly support the position of Cimperman et al. (2016) who described the elderly as more conservative in terms of new technology. However, previous users have often indicated a significant interest in digital technologies. Hence, lack of interest in digitalization seems to impede adoption rather than post-adoption usage.

4.1.2. Technological anxiety

On the whole, both users and non-users perceive that the elderly often lag behind in **digital maturity (**that is to say, actual and hands-on experience of using digital technology) compared to younger generations, who often experience digital products from a very early age. It is often based on internal mistrust and lack of confidence as well as knowledge on how to use technology. Some respondents indicated that many elderlies find it difficult to navigate through the lengthy questionnaires before even establishing contact with a physician. In the words of one respondent:

> "Sometimes there can be a lot of questions before getting in contact with a physician and starting the chat."– R2 (y)

Furthermore, respondents confirmed that what we define as elderly (65+) is by no means a homogenous group. For example, many respondents explained that the "older elderly" often have lower digital maturity and therefore higher technological anxiety, which curbs adoption of DHPs. This is also confirmed in our quantitative analysis, which shows that the majority of users are considered "younger elderly" (M = 71, SD = 5.1) – namely, between the age of 65 and 74 (cumulative percent of 78.1). As a comparison, according to population data from SCB (2019), the age distribution among the elderly in Sweden is 53.28 % for those between 65 and 74, 33.97 % for those aged 75 to 84, and 12.75 % for those aged 85 and over. In comparison, our data set from Alpha contained 78.1 % of people in the 65 to 74 age group, 19.9 % of people in the 75 to 84 group and 1.6 % of people in 85 and over age group. So, of the elderly that have used DHPs, the relatively younger elderly is more common than the population average (see the fine graded distribution in Fig. 1). This deepens the findings of Ali et al. (2021) who show that only a minor proportion of the elderly, around 9 %, use digital health services. One respondent stated:

> "Many people do not have the same digital habits as me. Those around 80, only a few can do this because they can't handle new technology"- R4 (e)

Many elderly expressed a **fear of making mistakes** – for example, "pressing the wrong button" and causing problems – and they identified this anxiety as a barrier to their (and other elderly people's) adoption of DHPs. This is in line with Morris and Venkatesh (2000) who suggested that the elderly might become demotivated and disinclined to use digital technology because of concerns about doing something wrong or causing technology breakdown. The following quotations were representative of many others:

> "I am afraid of technical problems, or that I will make a mistake." – R1 (n)

> "First, you must dare to press the buttons and then you need to understand what to do so that you are not causing any problem." – R12 (n)

However, other respondents acknowledged the likely scenario of a generation shift of the elderly becoming more digitally mature, since more of the younger elderly (aged 65 to 74) will enter the category over time. This may occur from becoming more accustomed to digital tools throughout their working life. One respondent pointed out that:

> "There is a large group that will not approach this, but that group, for natural reasons, is getting smaller and smaller." -R12 (n)

Hence, our findings indicate that technological anxiety is primarily an adoption barrier, although it may also affect the elderly at the post-adoption stage. However, technological anxiety in the usage phase is not as prominent among previous users as it is among non-users.

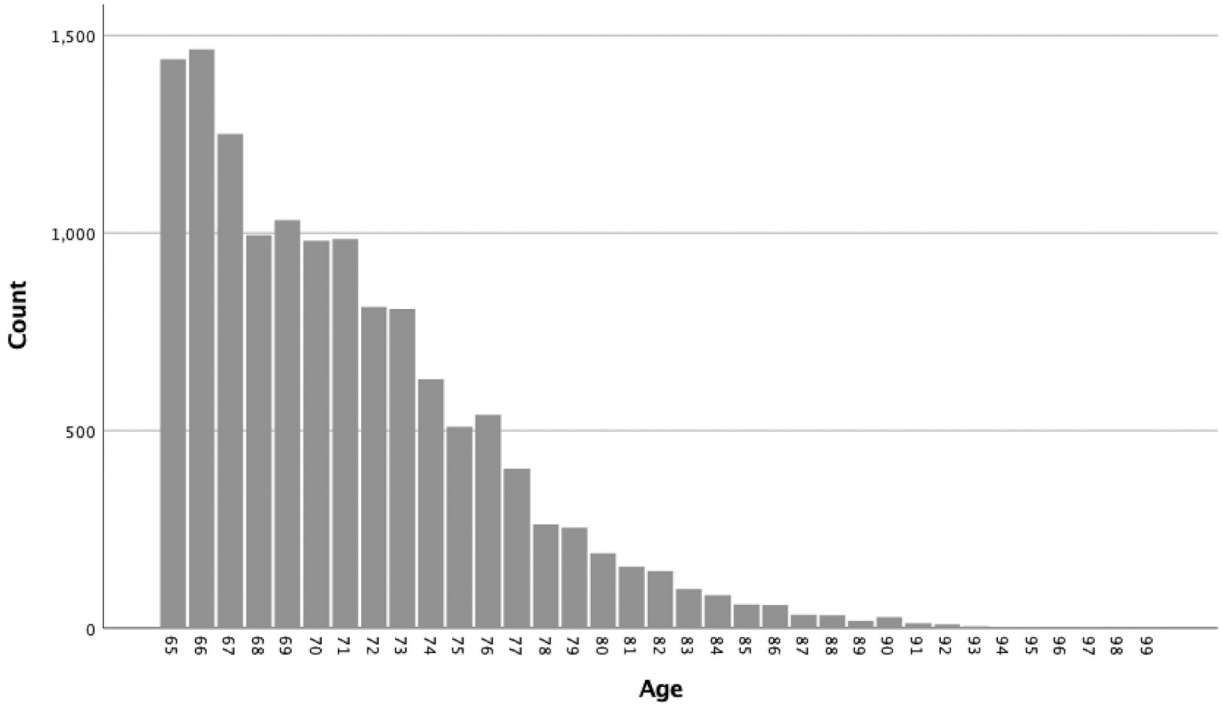


Fig. 1. Age distribution in the data set from Alpha.

4.1.3. Trust

Lack of trust in **data security** of DHPs was communicated as a barrier among a few elderly (4 out of 8 non-users) who perceived that physical healthcare is the "safer" option regarding data handling. Their particular concern was whether their data would be shared with other third-party actors. Low trust in data security is, according to Shareef et al. (2021), the most significant factor explaining low adoption among the elderly. Yet, a majority of the respondents (13 out of 22) trust that their data and information will not be shared with other actors. 13 out of 14 previous users, who were respondents with digital health development experience, trust the data security on DHPs:

> "Technology has improved, and I trust the safety of bank-ID. It's constantly improving and it's important to feel safe using an app." – R9 (y)

> "And I can believe that this is what scares many people, that they are afraid of being deceived of scams and things like that." – R13 (y)

Other respondents point out that **personal integrity worries** in terms of the perceived inability of the DHP to prevent third parties from identifying one's identity as a DHP user makes them hesitant users of DHPs. However, other respondents felt the integrity of their data was more secure by using DHPs, seeing it as more "anonymous" than physical healthcare. The distance and less personal information provided through a screen was perceived as a protective shield. One respondent stated:

> "I must say that digitally it is more anonymous. Firstly, it's so hard getting into a healthcare centre, you need to book an appointment and so on. And you might meet someone you don't want to see." - R8 (y)

Lacking trust in terms of the perceived risk of receiving an **inaccurate diagnosis** and treatment was emphasized by some elderly, who feared that receiving a diagnosis digitally was not reliable enough – that the ability of the physician to feel and test is an important factor in making a correct diagnosis. This was particularly salient in relation to more severe diagnoses.

Trust in diagnostic precision is an interesting finding because it has not been widely discussed in the previous literature. Thus, the elderly not trusting DHPs to provide them with the help that they require can be seen as a key barrier that DHP providers will need to overcome. Here, the data revealed that the means of communication also affects the trust in DHPs. Some who were anxious about inaccurate diagnosis stemming from *chat* found that *video calls* were the most preferable option among our respondents. This was because elderly patients value seeing the physician and being able to show visible symptoms. One respondent who perceived the risk of inaccurate diagnosis said:

> "It would be good to see people, I mean through video, even if it's just for a prescription renewal. I would appreciate video around the clock." – R8 (y)

Chong (2013) gave early support to this view by arguing that face-to-face interaction affects the degree of trust when receiving information. On the other hand, others found video riskier, placing greater value on *chat as means of communication* because it gave time to properly think what to write and ask, making the interchange a less stressful experience. As noted by a respondent who was mindful of the risk of inaccurate diagnosis:

> "For my own personal part, I like chat, because then you have time to think what to write." – R22 (y)

This adds to the prior literature and poses a challenge to Chong's (2013) study, which did not consider the chat option. Yet, it is worth noting that many respondents did not perceive inaccurate diagnosis as a significant risk, at least not for "easy and non-complicated conditions". In the words of two respondents:

> "I trust that there is no difference in safety."- R10 (n)

Furthermore, some respondents believed that a correct diagnosis and treatment can be performed by DHPs. But, if it cannot be performed digitally, they trust that they will be referred to someone who can, or to the physical care centres.

> "And if they are unsure, then I believe that you will be referred to an emergency hospital or health centre and such."– R13 (y)

4.1.4. Summary

Our findings indicate that there are multiple barriers and dimensions that may inhibit the elderly from adopting and using DHPs. We acknowledge that not all barriers apply to both adoption and usage. Firstly, our results indicate that **attitudes to DHPs** constitute an adoption barrier rather than a usage barrier. Although political concerns may mean boundary conditions for usage as well, previous users are more inclined to take cognizance of the debate than view it as a reason to stop using DHP services. Technological anxiety is similarly a barrier that primarily affects adoption. Technological anxiety is still prominent among users' post-adoption stage, although it cannot directly be considered a barrier because elderly work with it and around it rather than abandon the DHP altogether. Lastly, distrust is both an adoption and usage barrier according to our respondents. However, distrust among previous users concerning digital diagnosis only applies to smaller conditions and is dependent on the means of communication.

4.2. How DHP providers can facilitate increased adoption and usage

This sub-chapter aims to answer the second research question – namely, informants' opinions on how DHPs can better facilitate the elderly and adjust to fit their needs and, thus, promote increased adoption and usage. This section is therefore organized around the last theme from the thematic analysis: *development suggestions*. The first three sub-themes focus on adoption while the last four sub-themes centre on usage. Marketing incentives apply to both.

4.2.1. Facilitating increased adoption

4.2.1.1. Depoliticizing and boundary making marketing. Many respondents stated that the most elderly do not know that DHPs exist. Therefore, simple marketing activities aimed at creating awareness among the elderly can be an important factor in increasing adoption rates. Here, the anxiety over the political matters mentioned above (including intensely debated issues such as: "Will private DHPs drain the resources of public healthcare system?") needs to be actively addressed because it seems to have made many elderly hesitant to use the services. DHPs should be decoupled from the political questions by stressing that similar technology was used by public care providers without being "tied" to any specific political ideology. We refer to this as *depoliticizing marketing*.

As noted in 4.1.1., there was a difference in attitudes between users and non-users, where the latter often maintained a more negative attitude to the potential of DHPs, and they were uncertain about what conditions the DHPs were actually targeting. This highlights the importance of DHP providers being able to demonstrate the benefits of adopting and using DHPs for certain conditions. This is in line with the research of Bujnowska-Fedak and Pirogowicz (2014) who asserted that awareness of the benefits of a service must be created in the elderly before they will consider adopting them. Our data also indicated the relevance of clearly communicating the precise conditions where DHPs

will not to be used for diagnosis and treatment. We refer to this as *boundary making marketing*. By emphasizing the boundaries delimiting the scope of the DHP, trust can be built.

4.2.1.2. General education for potential users. Furthermore, some users mentioned that they had thought – before trying DHP services – that using DHPs would be harder than it was in reality. Many argued in favour of marketing activities that emphasized the simplicity of usage, starting with a few basic functions. Many informants emphasized the need to provide testing opportunities, educational online services, and personal guidance for such initiatives – in other words, step-by-step instructions that help guide elderly patients throughout the process. The suggestion of allowing the elderly to navigate through the platform by watching others and learning by doing may help increase adoption.

4.2.1.3. Designing clear price models targeting different preferences among the elderly. Since there was a perceived uncertainty about price among informants and, indeed, variability in the willingness to pay among the elderly, a solution may reside in offering tiered pricing models to accommodate differing preferences. Again, clear communication regarding what is to be paid for and why was suggested as a means to reduce the uncertainty.

That said, the vast majority stated that they would be willing to pay similar amounts for digital healthcare in the same way that they do for traditional physical healthcare, although they appreciate that online services are currently not charged. Therefore, although our sample was small, there seems to be a willingness on the part of the elderly to pay for the use of DHPs. This contradicts Bujnowska-Fedak and Pirogowicz (2014) who assert that the elderly are often less willing to pay for digital healthcare.

> "If I receive the same quality, I don't mind paying the same as for a physical visit." – R2 (y)

There was uncertainty regarding how much – if anything – should be paid for chats, video meetings, and asynchronous messaging, seemingly making the elderly even less disposed to use the services. By making these things clearer, anxiety could be reduced. Varying pricing models (regarding the out-of-pocket fee) could accommodate different preferences. It was suggested there could be a trade-off between, on the one hand, high fees, immediate access, and longer video meetings and, on the other, lower cost and slower access. Yet, providing these opportunities will always have a political dimension because healthcare services are publicly financed, for the most part.

4.2.2. How DHP providers can facilitate increased usage

4.2.2.1. Technological interface design improvements. Many elderly who had tried the services found them difficult to use. Respondents stated that DHP providers needed to engage in innovation and design a platform that is more intuitive and easier to use by the elderly with lower digital maturity. Informants explained that they often found it difficult to navigate multiple steps – for example, filling out symptoms in questionnaires – before getting in contact with a physician. This might result in high drop-out rates before first use is completed. Furthermore, buttons and icons can sometimes be hard to understand, or too small, causing the elderly with visual impairment to quit the service prematurely. Informants suggested that having a test panel of elderly could help provide more suitable solutions and design choices. One respondent stated:

> "If you're developing a healthcare app, you need to have a test panel that can make it easy and intuitive. It should be clear where to press [...] it shouldn't be anything hard or small, it should be bigger things for the elderly [...] it should be idiot proof." – R4 (e)

4.2.2.2. Service design improvement – fixed point of contact. When being asked about improvement measures, some respondents argued that having a fixed point of contact in healthcare is one of the most important factors. The anxiety some of them experienced with DHP services concerned meeting new and unfamiliar faces and who they might be facing next in a DHP encounter. By providing a fixed point of contact through a DHP, the more elderly may be willing to seek medical care on a repeated basis and increase their usage rates. One respondent stated:

> "If someone has a serious condition and uses a digital service, it is of course important to have follow ups with the same doctor."– R9 (y)

4.2.2.3. Exploiting the omnichannel approach. While the respondents had used only online DHP services, most of them found the idea of a mix of online and offline services through an omnichannel approach had considerable appeal. The elderly view DHPs as a viable way to arrange follow-up appointments after physical healthcare, indicating that there are considerable upsides to a "mixed care system" of physical and digital healthcare, where each service can be geared to what it does best. Since there is a continuing belief that digital healthcare cannot fully replace physical healthcare, generating confidence that conditions that cannot be diagnosed or treated online can be handled by the same provider using offline channels could increase loyalty to DHPs. (*Note: In Sweden, the DHPs were establishing physical care centres at the time of the study, but the respondents had only used online channels).*

5. Discussion

The popular and academic debate is evidence of grand hopes tied to the potential of digital platforms to disrupt industries (Van Alstyne et al., 2016; Zhu and Iansiti, 2012; Cenamor and Frishammar, 2021). In the healthcare context, DHPs are still relatively new and have not yet disrupted markets fully. Yet, their potential to increase the effectiveness of healthcare has been acknowledged globally (Balta et al., 2021). However, while health is a universal human right (UN, 2000; European Social Charter, 1961/65), access to healthcare is unequally distributed not only among countries but also among user groups within countries. While expectations about the role of DHPs in healthcare and beyond are extensive, the elderly are under-represented in DHP usage which is indeed problematic. Yet, empirical insights into the attitudes of elderly users to DHPs and why they have tended to refrain from adopting and using DHPs remain virtually non-existent to date (Peek et al., 2014). This neglect of elderly's perceptions also applies to the literature on platforms in general/beyond healthcare, where studies on attitudes to and the use of various kinds of platform – for instance, social media platforms (Benson et al., 2019), sharing economy platforms (Lu et al., 2021), and mobile payment service platforms (Kuo, 2020) – focus exclusively on users below the age of 65. Our work moves research a step forward, providing a broad overview of the barriers to DHPs perceived by the elderly and outlining their views on how those barriers could be surmounted.

More specifically, we provide a framework identifying and categorizing barriers that cause low adoption, low usage, or both. We also shed light on how DHP providers can improve their platforms and service offerings to fit the requirements of elderly generations. Our results are summarized in Fig. 2.

As illustrated in Fig. 2, our analysis suggests that a set of barriers to adoption and use by the elderly can lead to non-adoption or lapsed usage by the elderly. We also propose a set of factors and activities that can mitigate the barriers and counteract their negative influence. Our results are important as the number of elderly grows and as healthcare costs and queues increase (Marešová et al., 2015; Garatachea and Lucia, 2013). Our research also matters in the context of the Covid-19 pandemic, which has underscored the need for digital healthcare (Baudier et al., 2021) when physical interaction is restricted. The results are also of

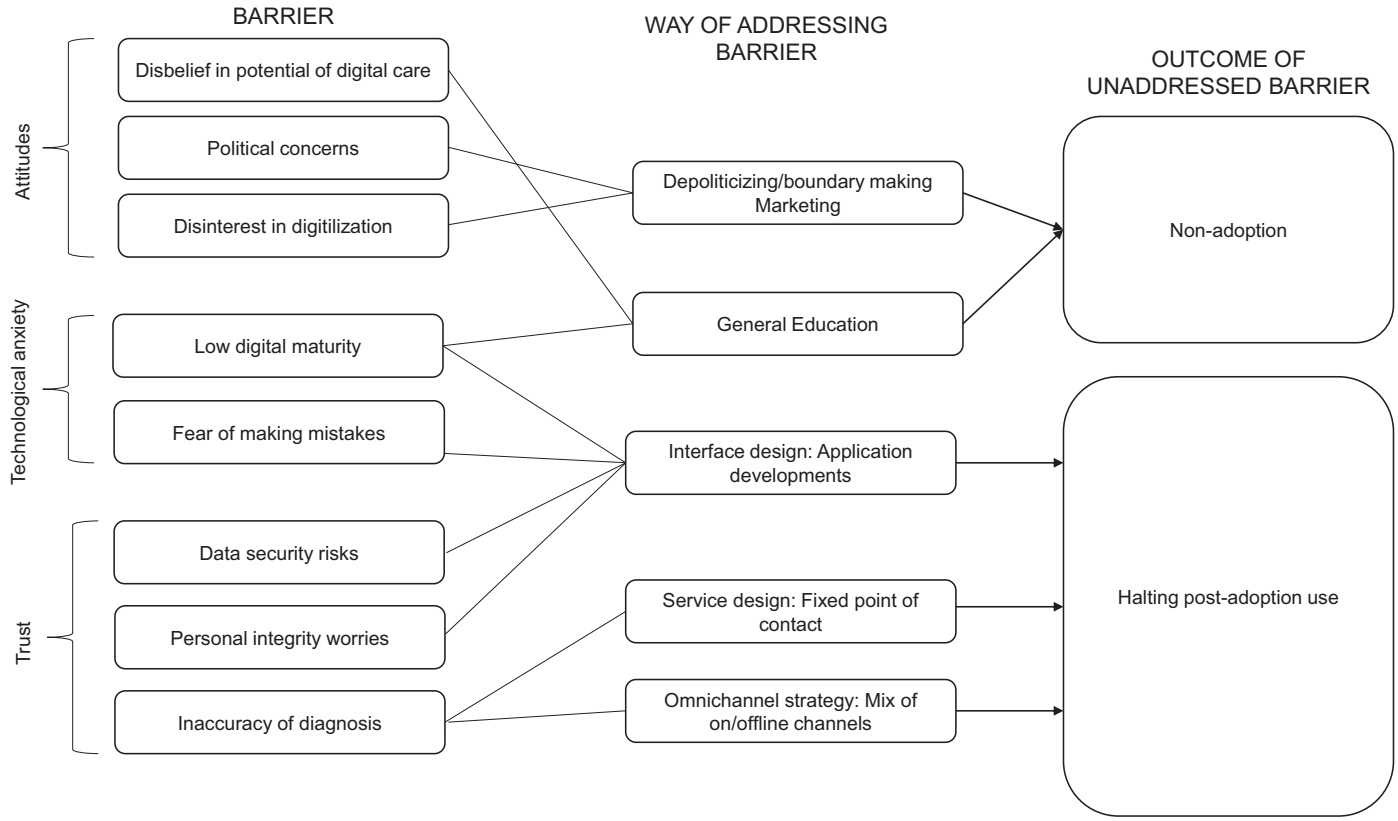


Fig. 2. Key barriers and ways of addressing them.

consequence to DHP developers – both private and public – and other actors in the healthcare ecosystem as healthcare provision becomes increasingly digitalized. Exploring the barriers to adoption among the elderly as an under-represented group in DHPs is important, given that access to digital health services will be an increasingly important channel for them to access public healthcare. If the elderly is intentionally or inadvertently excluded from such platforms, then a threat is posed to core values of equal access to public care and delivering care based on need, as stated in many national directives and regulations underpinning healthcare systems in Sweden and elsewhere.

5.1. Theoretical contributions

This study contributes to prior research in three main ways. First and foremost, and to the best of our knowledge, research on primary care through DHPs for the elderly is non-existent in the literatures on mHealth, digital platforms or technology adoption. One recent study has shed light on digital business models for centrally mediated platforms in the form of ridesharing services (Schiavone et al., 2021). Prior research on mHealth has only included single elements from eHealth, mHealth, and telehealth (Kruse et al., 2017; Lolich et al., 2019; Xue et al., 2012; Fox and Connolly, 2018; Knitza et al., 2020). It has not explored how users perceive DHPs, which are understood as bundled and curated sets of mHealth services that are provided by DHP providers who build their business model around the DHP technology. Furthermore, as noted above, the literature on digital platforms has generally excluded the elderly in studies of platform attitudes and usage, and it has not theorized attitudes to DHPs as a specific form of platform. Since healthcare is undergoing a process of platformization in which various actors are pursuing platform-based business models in primary care, studying this sector will become more and more relevant in platform studies. In particular, it serves as a cautionary example of a highly regulated sector where platformization runs the risk of contributing to a digital divide between elderly and younger individuals (Flick et al., 2020).

Second, we challenge the previous literature by making a clearer distinction between perceived barriers to adoption on the one hand, and usage on the other. Here, prior studies seem to have used these terms interchangeably when exploring digital health among the elderly (e.g., Heart and Kalderon, 2013; Nikou et al., 2020; Fox and Connolly, 2018). We offer a deeper understanding of both adoption and usage. We contribute by distinguishing three main barrier types that can inhibit adoption and usage. Furthermore, our results indicate that the real centre of gravity regarding barriers lies *before* the adopting stage of DHPs – in other words, they prevent adoption from happening due to negative attitudes, technology anxiety, and lack of trust. After adoption, the remaining barriers are fewer and centre on the lack of trust. This gives a more detailed and nuanced picture of adoption and usage of digital platforms by the elderly. By contrast, prior research (e.g., Heart and Kalderon, 2013; Fox and Connolly, 2018) has only identified barriers for the elderly in terms of digital health broadly. Due to the interchangeable use of adoption and usage previously, research has lacked a clear account of what actually hinders the elderly i) from adopting and ii) from continuously using DHPs. We therefore propose a sharper distinction between adoption and usage barriers compared to prior studies (Bujnowska-Fedak and Pirogowicz, 2014; Steele et al., 2009; Cimperman et al., 2016; Heart and Kalderon, 2013).

Third, we provide novel implications on how DHP providers can overcome key barriers (as illustrated by the "moderators" in Fig. 2). These results add to the literature (e.g., Knitza et al., 2020; Ali et al., 2021; Yusif et al., 2016), which has primarily focused on identifying barriers rather than providing empirical insights into how these can be bridged. A few studies in non-platform and non-elderly settings have indicated the need to be mindful of combinations of online and offline services (Chong, 2013), and the need to overcome negative attitudes and demonstrate superiority (superior benefits compared to traditional methods) (Heart and Kalderon, 2013; Steele et al., 2009; Bujnowska-

Fedak and Pirogowicz, 2014). However, we provide a set of more specific and empirically substantiated suggestions. We have been able to identify development suggestions that allow DHP developers and other healthcare actors to facilitate both increased adoption and usage by the elderly. These suggestions involve a range of measures, from marketing and education about DHPs, investment in interface and online service design, to a well-considered omnichannel strategy.

5.2. Managerial implications

This study provides managerial implications for DHP developers to better fit platforms to the needs of the elderly over the age of 65. Our findings indicate that most of the barriers affecting the elderly occur at the pre-adoption stage, and only a few barriers exist post adoption. This provides clear managerial implications for DHP developers. Generally, it seems that working to facilitate adoption is what is needed to subsequently increase usage. In particular, DHP developers should adjust their platform and design it in a more intuitive manner, making it easy for the elderly to comprehend and use. What is clear and straightforward for younger generations may not readily apply to the elderly; therefore, general design principles and solutions based on the profile of elderly users should be applied (see e.g. Iancu and Iancu, 2020, p. 7).

What exact changes should be implemented is beyond the scope of our article, but test panels that include the elderly with different levels of previous experience and of different ages could be a crucial step in improving DHPs. These test panels can either include the elderly at the development stage or in subsequent phases for validation purposes, or both.

Better and tailored information campaigns for the elderly can be beneficial for increasing both adoption and usage. Given the skewness in age distribution among users, DHP owners need to create increased awareness among the elderly as a first step towards adoption. It is also vital to provide and illustrate the specific benefits that the elderly will obtain by using DHPs, and what services the DHP should provide. This may help surmount some of the negative attitudes to DHPs and help address the issue of trust. Needless to say, these implications apply to DHPs run by both private and public primary care providers. Finally, as the elderly in general prefer having a fixed point of contact, DHP providers should provide opportunities for users to contact the same physician for all interactions.

5.3. Limitations and future research

This study contains some limitations and recommendations for future research. Firstly, it is important to note that the results from this study rest on a limited sample. This limits the scope for generalizing our findings. Second, not all DHP providers are the same, and the results may not be directly transferable to other settings. Many digital platforms in health care are active in several different countries and elderly are underrepresented in digital care in most if not all countries. The relatively low digital literacy among the elderly compared to the entire population in general in Sweden (Internetstiftelsen, 2022) also applies to other countries (OECD, 2021; PEW research, 2021). Given that, it remains for future research to see if our findings prove stable outside the Swedish context. We therefore encourage future research to use multiple case studies and include multiple DHP providers from other settings and countries.

Third, an aspect that was particularly hard to determine throughout our research was whether it was age or digital maturity that caused the adoption and usage rate of DHPs by the elderly to be low. We therefore recommend that future research explores this area to determine the nature of the relationship between age and digital maturity. Finally, the literatures on digital platforms and the unified theory of acceptance and use of technology are far from the only literatures that can be deployed to study digital health care platforms. Neither the aspects influencing elderly's adoption and use patterns nor the potential ways of addressing them mentioned in this study are exhaustive. The reasons for why elderly choose (not) to or are (un)able to adopt and use DHPs or digital services more generally are complex and rooted in fundamental aspects beyond the specific technology in focus. Although we touch upon political and financial aspects, the role of and how to address wider conditions, such as the inequal social and economic conditions in which elderly often live are beyond the scope of this study. Future studies could depart from literature in sociology, political theory or critical gender studies and thereby highlight the historical, structural, and systemic power asymmetries that shape technology adoption and usage. Such analysis could be a valuable complement to the current study.

CRediT authorship contribution statement

Johan Frishammar: Conceptualization, Methodology, Formal analysis, Investigation, Writing – original draft, Writing – review & editing, Supervision, Project administration, Funding acquisition. **Anna Essén:** Conceptualization, Methodology, Formal analysis, Writing – original draft, Writing – review & editing, Funding acquisition. **Frida Bergström:** Conceptualization, Methodology, Formal analysis, Writing – original draft. **Tilda Ekman:** Conceptualization, Methodology, Formal analysis, Writing – original draft.

Data availability

The authors do not have permission to share data.

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Appendix A. Supplementary materials: Interview guide, and Tables with representative quotes

Supplementary data to this article can be found online at https://doi.org/10.1016/j.techfore.2023.122319.

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