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Equity in Digital Health: The case of Norway

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Abstract

Norway’s culture is rooted in egalitarian values and its harsh climate and remote districts have forced it to invest heavily in digital health tools. This was recently increased because of the COVID-19 pandemic, which has unintentionally led to inequity in digital health especially among the disadvantaged groups. The aim of this study is to gain a deeper understanding into the factors that impact equity in digital health in Norway by focusing on challenges the disadvantaged face while using digital health tools. Evincing from the Digital Health Equity Framework (DHEF) and relying on a qualitative exploratory case study approach, semi-structured interviews were conducted and the respondents (N-8) were representative of disadvantaged groups in Norway. They were chosen following the quadruple helix model to represent citizens, academia, public authorities and industry experts in ICT. The findings indicate that majority of respondents have challenges to access digital resources because of financial constraints, access digital resources, knowledge on their use, financial restraints, underlying beliefs and causal values. Hence, there is a need to invest more in these factors to achieve digital health equity in Norway.

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Abbreviations

AI	Artificial Intelligence
COVID-19	Corona Virus
D & M	DeLone and McLean
DDOH	Digital Determinants of Health
DHEF	Digital Health Equity Framework
DSS	Decision Support Systems
FDA	Food and Drug Administration
ICTs	Information and Communication Technologies
SDH	Social Determinants of Health
UTAUT2	Unified Theory of Acceptance and Use of Technology
WB	World Bank
WHO	World Health Organization

1 Equity in Digital Health: The case of Norway

Health remains the most essential part of human life. Health as defined by the World Health Organization (WHO) 1946 constitution is "…a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity" (WHO 1946), remains the most important part of human life. It is ensured through comprehensive healthcare values founded on primary health care (PHC) and other factors beyond the healthcare system. These entail the provision of healthcare by promoting, preventing, treating and rehabilitating those affected. The importance of healthcare is further highlighted by the WHO (1986) Ottawa Charter, which places the responsibility to promote it on the entire society. In addition, the 1993 World Bank (WB), World Development Report, underscores the importance of investing in healthcare of households as a contributory factor to economic growth. By improving the health status of households, states address issues of poverty and inequities in their economies (WB, 1993). Notwithstanding the importance attached to healthcare over the last decades, variances in healthcare access, understanding and outcomes remain ubiquitous among households and communities (Lawrence 2022) regarding the demand for research.

1.1.1 Context

Norway's population is about 5.3 million people with the country having an elongated shape covering a surface area of about 400,000 sq.km (Alami et al. 2017) accompanied by the harsh climate and remote districts. This has forced Norway to invest in information and communication technologies (ICTs) in its healthcare system to enable equitable and continuous access to healthcare (Zaboni and Wootton 2016). This is complemented by the Norwegian Public Health Act' that aims to improve equity in health by addressing the social gradient in health (Lundberg and Lind 2021). According to the Institute of Health Equity (2021), the social gradient is a term used to explain the phenomena in which persons with lower socioeconomic status and are less advantaged have worse health (and shorter lives) than those with higher status and are more advantaged (Institute of Health Equity 2021). According to Smith et al. (2015), even though Norway did not explicitly adopt a health policy until 2007, it had been doing the 'right thing' by having increased wealth and social policies like generous parental leave, generous out-of-work benefits, free childcare and free education for its citizens (Smith et al. 2015). Although these practices entrench the egalitarian nature of its policies and laws, it raises questions that inspired this research. These include; Why digital health inequality when the country is considered to be doing the ‘right thing’ especially due to the increased wealth and being a welfare state which would directly imply a reduction in health inequalities. It continues to puzzle policymakers and observers why inequalities in mortality have been rising ever since the 1960s which has become to be known as a public health dilemma (Smith et al. 2015). Research by Clarsen et al. (2021) identified large differences in the life expectancy in Norwegian municipalities and in socioeconomic profiles within specific counties. The authors go on to mention that the persistence of social inequalities in mortality in the Nordic welfare states has been characterized as a paradox, the same puzzle that Smith et al. (2015) mentioned. Although this topic has received enormous political attention in Norway, it has not been studied in depth. Norway like many other countries in the World continues to face inequities in telemedicine services across its regions and society. Hence, the aim of this study is to explore and understand the factors that lead to digital health inequity by applying the case of Norway, one of the first countries to adopt digital health in the World.

1.1.2 The Problem

Digital health tools are software applications developed for the purpose of improving healthcare services and access to these services, but it can also harm health equity if digitally enabled ecosystems move forward without proactive engagement, planning, and implementation (Lyles et al. 2021; Marwaha et al. 2022). According to WHO (2019), there is a shortage of research on the level of equity in digital health and the unintentional exacerbation of inequity in the use of digital health tools specifically during the COVID-19 pandemic. This is intensified by divergences in socioeconomic profiles. Furthermore, Clarsen et al. (2022) stated that there are large differences, which are evident in the socioeconomic profiles within specific counties for instance, lower occupational status was associated with increased health problems, with a prevalence ratio of 2•0 for perceived poor health between men with the highest and lowest status (Clarsen et al. 2022).

The increase in digital health services as a result of COVID-19 has led vulnerable groups in Norway to continue to experience digital exclusion. Accordingly, this has become a societal problem that conflicts with the egalitarian nature of Norwegian society. This is aggravated by the inequality in factors that constitute the environment in which persons live, work and conduct most of their life activities. The imbalance in health access continues to widen in Norway despite efforts to ascertain and address unequal social determinants of health (SDOH) that interact with digital determinants of health (DDOH). Although knowledge of the problem now referred to as the puzzle exists, with the gap receiving much political attention there is no deeper investigation asking 'why'? Therefore, this research intends to fill this gap by identifying and understanding the cause of elements that lead to digital health inequities in Norway.

The research will provide insights into how health inequity in routine medical care can be reduced through addressing factors that different sector representatives especially in marginalized groups face while using digital health solutions. Since digital health exclusion has become a societal issue undermining Norway's egalitarian ideals, it will also help in drafting policies to promote cohesion to minimize societal tensions. More specifically, the purpose of this research is to provide intervention points for strategic public policies that will foster health equity through the creation of digital health tools.

1.1.2.1 Research Questions

This section presents the research questions I am proposing to guide my research. The main research question is "What key factors impact equity in digital health in Norway?" The sub-questions below will aid in answering the main research question: -

a) What are the factors that affect equitable access to digital health in Norway?

b) What is the difference in the use of digital health solutions between advantaged and disadvantaged groups? This will focus on the different perceptions of sector representatives in marginalized groups with reference to the quadruple helix model.

c) What are the immediate and long-term impacts of digital health applications on equity in healthcare?

Each research question will be followed by recommendations.

1.1.3 Significance of the Study

1) The study will help to shape policy on the contentious issue of multiculturalism

especially on how to promote digital health equity among the advantaged and disadvantaged groups in Norway.

2) It contributes to understanding the impact of digital health solutions on equity by evaluating the short and long-term effects of digital health on equity, both pre and post-pandemic.
3) This study adopts a broad framework as a foundation for digital health equity policy for policymakers when developing and planning future digital health tools.

1.1.4 The structure of the work.

Chapter One: This chapter discusses the introduction to the study by providing the research background, the problem, the main research question and the study objectives and chapter outline.

Chapter Two: It presents the theoretical background of the study by reviewing the extant literature on the topic. The chapter reviews the main theories used in understanding digital health inequity. It reviews the empirical literature and details the health infrastructural arrangement of Norway and lastly the conceptual map.

Chapter Three: Discusses the methodology of the study. This section explains the methods applied especially the case study method that follows a qualitative approach.

Chapter Four: Part 1. Presents the document analysis and discusses the findings. It highlights the major findings of the study explaining the significant study results in relation to the literature. Part 2. Presents the analysis of the interview questions, findings and summarizes the important research study conclusions.

Chapter Five: Provides the conclusion as well as the theoretical and practical contributions of the study with its implication for future research.

2 Theoretical background

2.1 Introduction

This section presents the theoretical background on the topic of digital health equity. The section discusses the literature on frameworks applied to measure equity in health especially digital health equity and its interactions with socio-economic determinants of health that are believed to be the cause of digital health inequity in Norway. The section is divided into four main sections. The first section presents the main terms, followed by the theoretical background, then the empirical literature on the subject the fourth section presents the case of Norway and discusses the socio-economic determinants of health and lastly conceptual framework and the conclusion.

2.2 Definition of main terms

Digital health has been defined by the US Food and Drug Administration (FDA) as, the use of information and communication technologies (ICTS) in medicine and other health professions to manage illness, and health risks and promote wellness (FDA 2020). This brings about a convergence between the digital, physical, and biological environment in healthcare. Digital health encompasses electronic health records, computerized provider order entry, remote care, and telehealth together with the use of artificial intelligence, personalized medicine, connected care, and smart health (Jandoo 2020).

Digital health has immense benefits both for patients, doctors, and providers, these benefits include financial benefits for the providers of the digital solutions, patients save money that would have been spent on aspects like travel costs to the health professional. Digital health has also been reported to increase efficiency in healthcare, improved access to personal health information and patient information, making medicine and care more personalized by capturing continuous data on individuals and populations that complement the data on individuals (Perakslis and Ginsburg 2020).

Although digital health has had substantial benefits, there is the other side to the coin, which is the shortcomings of digital health. These include the fact that digital health has exacerbated inequities in health, its access, provision and care, especially during the COVID-19 pandemic when healthcare providers predominantly switched to virtual care (Shadmi et al. 2020). Another shortcoming of digital health is the aspect of trust that patients have whilst sharing their personal data with these health systems, but this research will focus on the topic of inequities in digital health.

Equity in health is the absence of systematic disparities in health or, in the major social determinants in health between groups with different levels of underlying social advantages and disadvantages (Braveman and Gruskin 2003). These disparities are for example in the level of wealth, level of power, level of prestige, race, gender, location, level of education, and time (Marcin, 2021). The current COVID-19 pandemic has highlighted the inequities that are currently present in digital health (Marcin, 2021). Before the pandemic, there was a solution to walk into the health centre and get medical assistance but with the pandemic restrictions, there was a massive immediate shift to digital solutions. Research done by Dr. Marcin has shown that there are geographical barriers, access to internet barriers, education level, language barriers, and race in the use of digital health (Marcin 2021).

2.2.1 Health Inequities

Health inequalities (disparities) delineated as ‘differences in the burden of disease, injury, violence, or opportunities to achieve optimal health experienced by socially disadvantaged populations,’ tend to be influenced by race or ethnicity, geographic location, sex, socio-economic status and other social factors (CDC 2008). In some cases, these health differences are a result of disparities in individual attributes like biology, physiology, social and structural factors that ensue in social disadvantages on persons or the populace. These disparities lead to political, economic, and health inequities defined as ‘systematic differences in the health of groups and communities occupying unequal positions in society that are avoidable and unjust’ (WHO 2022). These are also influenced by other conditions in which people are brought up, work, and are inexplicably distributed resulting into a situation of inequity, which undesirably affects health and healthcare.

Despondently, WHO (2021) states that half of the population in the World does not receive and even have access to the health services they need. `Critical to this fright, there is a rise in practices, policies, and laws that promote health equity, which is aimed at reducing and eliminating disproportions in health’ (WHO 2021). Hence, health equity is affected by the uneven distribution of social determinants of health (SDH) leading to social injustice and health inequity among people. Identifying the factors that lead to health inequity helps to pinpoint what to target to bring health equity and equality. Solutions to these challenges have been sought through digital health and the design of digital health tools, which is “the field of knowledge and practice associated with the development and use of digital technologies to improve health” (Gwatkin 2000). These are seen as solutions to health inequities because they strengthen connectivity and improve accessibility. Broadly, they involve the application of “wearable devices, mobile health apps, artificial intelligence, internet, machine learning, blockchain, and other tools that enable storage as well as analysis of data” (Lawrence 2022).

The need for digital health has been underscored by Corona Virus (COVID-19) health crisis. COVID-19 compelled healthcare providers to limit their physical contact with patients to reduce spreading the virus by resorting to telehealth and remote patient monitoring (Crawford and Serhal 2020; Lewis 2021). This global shift to the use of digital solutions and services has not only been in healthcare but sectors such as travel, education and employment sectors. Each sector has its own corresponding positive and negative impacts due to the digital transformation. Likewise, there has been a substantial impact on patients and healthcare professions in the digital transformation of health services (Azzopardi Muscat and Sørensen 2019). According to Carolina et al. (2014) digital technologies have provided almost full interconnectivity among all humans and they should be used to meet key challenges to ensure that health is created and that it spreads to reach every person on earth.

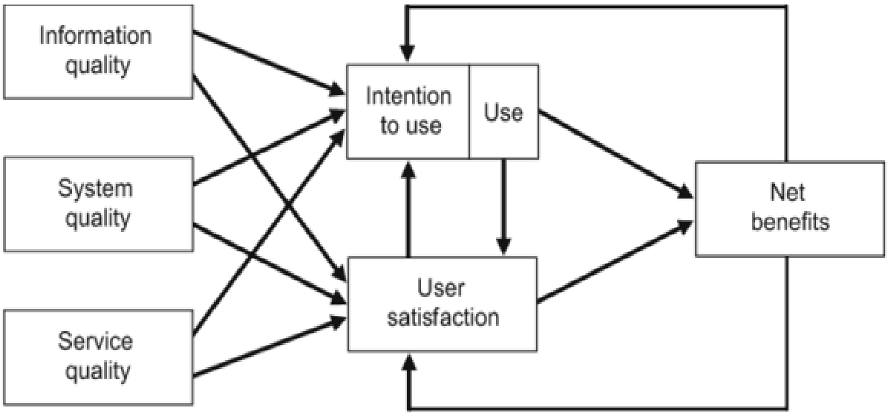
While digital health innovations have been seen to improve health results, patient safety and experiences, they may have unintentional results for socially side-lined groups leading to inequity in digital health (Barros et al. 2018). This has created a digital divide between those who have access to the technologies and those without. Despite the existence of some studies that focus on frameworks to measure digital health access (Dover and Belon 2019; Karri and Yarra 2020), there is a paucity of studies that look at the relationship between equity in digital health, health equity and Digital Determinants of Health (DDOH) across different socio-economic and socio-cultural contexts. As a consequence, the study applies the case study of Norway, which is founded on egalitarian values of social equality, equal rights for all people and the belief in equal distribution of wealth, equal access to opportunities, generosity and universally provided welfare arrangements (Smith et al. 2015) to examine these inequities.

2.3 The Theoretical Background

Various theoretical models have been advanced to capture the social determinants of digital health (Dover and Belon, 2019; Crawford and Serhal, 2020; Kaihlanen et al, 2022). The dominant frameworks that are applied to capture the impacts of factors on digital equity are the information System success model, the DeLone and McLean (D & M) model, the Unified Theory of Acceptance and Use of Technology (UTAUT2) plus the Digital Health Equity Frameworks (DHEF).

D & M model consists of six IS success variable constructs which are, system quality (ease of use, integration and learning, system flexibility, response time and system reliability), service quality (desirable characteristics including empathy, and communication), information quality (information, understandability, accuracy, added value, data security, completeness and usability of information), intention to use, user satisfaction, Net benefits which are both individual impact, and organizational impact (Ojo 2017), (Van Cauter 2016). The model assumes an interdependency between the success factors, that is, the existence of a system, service and information quality affect the use of intention to use and user satisfaction which does or does not yield individual or organizational benefits (Van Cauter 2016). This further affects the continual use of a system, which highlights the iteration that is the success of an information system (Ojo 2017). Use may affect positively or negatively user satisfaction, the opposite can also occur (Van Cauter 2016). Next, both use and user satisfaction are direct antecedents of individual impact, while finally, the impact on individual performance should have some organizational impact (Ojo 2017), (Van Cauter 2016).

The figure below illustrates the D & M information system Success Model

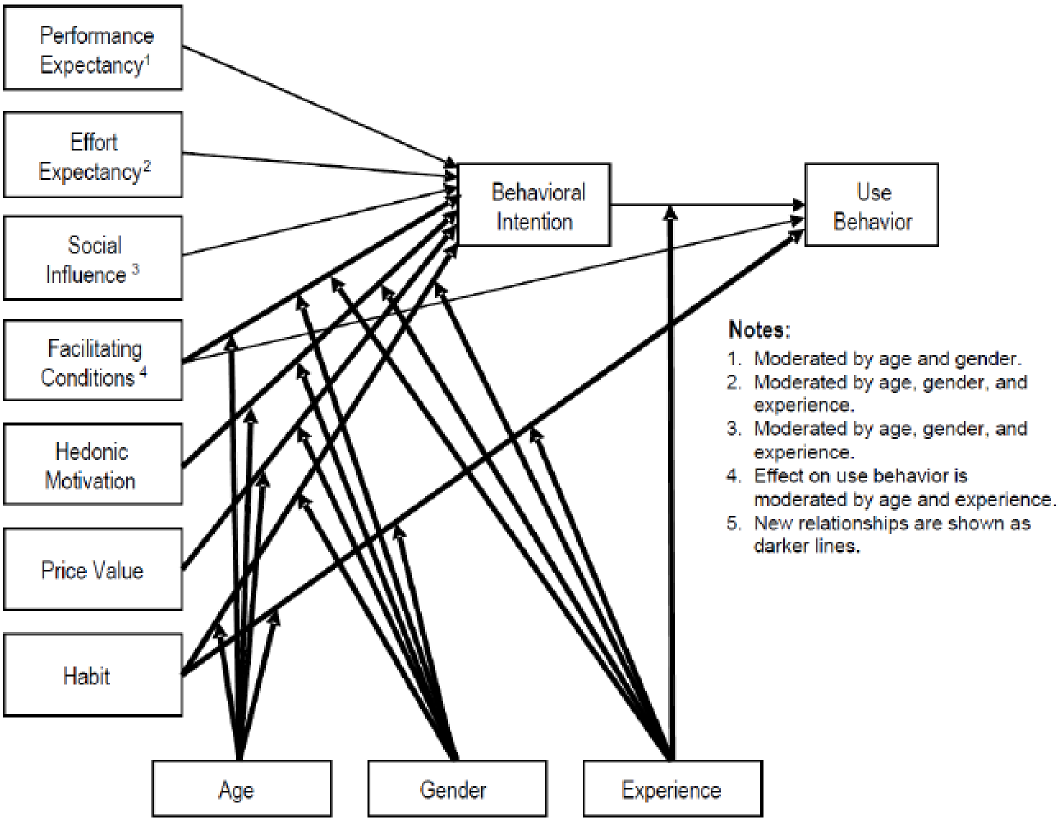


(DeLone and Mclean 2003)

Fig. 1 The D & M Model

UTAUT2 is used to investigate the acceptance of a technology (Nordhoff et al. 2020). UTAUT2 assumes that an individual's behaviour intention is influenced by the performance and effort expectancy, social influence, facilitating conditions, hedonic motivation, price value and one's habit (Nordhoff et al. 2020). Furthermore, UTAUT2 puts into consideration the factors of one's age, gender and voluntariness to use a technology (Chang, 2012).

The figure below illustrates UTAUT2.



(Tamilmani et al. 2021).

Fig. 2 UTAUT2

However, these frameworks manifest a number of short comings hence their limited predicative powers when applied on their own. According to Guy and McCandless (2012), the idea of social equity is rooted in each person's incontrovertible rights to health care. This is in sharp contrast to the belief one person is perhaps better than another that led to a theory of social equity. This was aimed at putting into consideration all the social and economic factors that impact on people in society (Guy and McCandless 2012).

It is in the context of achieving broad social equity, that Svara and Brunet (2005) suggested an operational delineation that entails "The fair, just and equitable management of all institutions serving the public directly or by contract, and the fair, just and equitable distribution of public services, and implementation of public policy, and the commitment to promote fairness, justice, and equity in the formation of public policy" (Svara and Brunet 2005).

Hence, digital health is sociotechnical because it also includes the technical domains of digital health that is; Artificial Intelligence (AI), Decision Support Systems (DSS), and machine learning. To jointly include all aspects of this socio-technical system with human focus, participation and research, digital health becomes sociotechnical. The socio-technical theory at the core has the idea that the design and act of any organizational system can only be understood and improved if both ‘social’ and ‘technical’ aspects are brought together and treated jointly and interdependently as parts of a multifaceted system (Hendrick 2009).

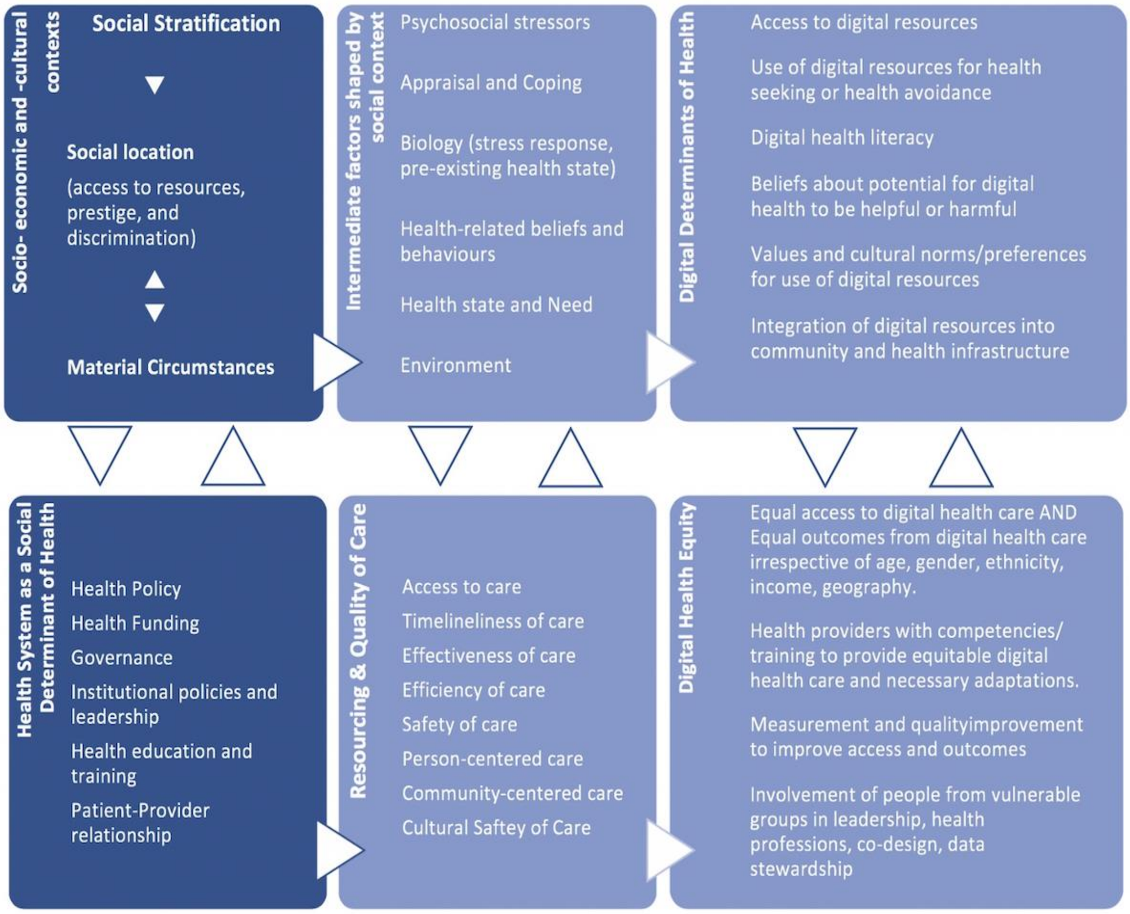
2.3.1 Digital Health Equity Framework (DHEF)

The DHEF and the health equity measurement framework by Dover and Belon (2019), incorporates a number of social, cultural, and economic factors that impact health and well-being as well as the interactions among these factors to measure health equity (Crawford and Sehral 2020; Dover and Belon 2019). It was refined by Crawford and Sehral (2020), for academics to broadly capture the impacts of social aspects on health by measuring digital health equity factors (Crawford and Sehral 2020). In a nutshell, this framework ascertains the digital determinants of health and their links to digital health equity.

The paper by Dover and Belon (2019), reviews and addresses previous frameworks such as the Social Determinants of Health and the Health Equity Measurement Framework and comes to a conclusion that these frameworks are superficial and do not address equity in digital health (Dover and Belon 2019). The research by Dover and Belon (2019) presents health equity factors that Crawford and Sehral (2020) then link and conceptualize to form the Digital Health Equity Framework (DHEF).

Crawford and Sehral (2020) provide a broad view of digital determinants of health that entail “access to digital resources, application of resources to seek health, digital health literacy benefits from digital healthcare, values and cultural preferences in application of digital resources together with their integration into the community”. This broad of determinants of digital health complement the health equity sector through an ecological approach that entails a multitude of social, cultural, and economic factors, which influence health and well-being as well as the interactions among these factors.

Below is an image of the DHEF



(Crawford and Sehral 2020)

Fig. 3 DHEF

Thus, approaching digital health technologies from an ecological perspective provides the best way how to capture the impact of social determinants of health on digital technology by individuals. This model justifies the application of different factors such as social, cultural, and economic in extending technology to people (Crawford and Sehral 2020). Contextually, social stratification refers to the hierarchical allocation and unequal distribution of power, prestige, and resources (Dover and Belon 2019). Whereas the digital determinants of health interact with intermediary health factors which, from the framework, are psychological stressors, predicting health conditions and the environment (Crawford and Sehral,202 0). This along with other factors such as personal health beliefs and mental state and needs.

Crawford and Sehral (2020) assert that access to digital health resources and digital health literacy to some extent interacts with the psychosocial stress a person experiences. For example, if one falls ill during this pandemic and has just lost a job or is stressed with school and is experiencing depression due to this occurrence, they may be reluctant to seek medical help for fear of costs or simply because it takes a lot of effort to find the right online source for help or it is too much effort as there is no walk-in service. On the factor of race inequity in digital health, some digital tools are created to predominantly focus on the population that is the social norm, thus leaving out underrepresented groups (Lawrence 2022). This representation can be in skin colour or language available on these tools.

Hence, given the drawbacks of all the other frameworks, this study will adopt a broad ecological model that captures all factors that impact digital health equity including minorities and other socially disadvantaged groups. This model captures all ecological factors, more than the D & M model, which only tries to provide an understanding of information system's success by identifying, describing, and explaining the relationships among six of the most critical dimensions of success along which information systems are commonly evaluated (DeLone and Mclean 2003). Furthermore, the DHEF considers the multitude of social, cultural, and economic factors that impact health and well-being as well as the interactions among these factors to measure health equity. Additionally, this will help in identifying which factors to address to achieve digital health equity.

2.4 Empirical Literature

2.4.1 Social Determinants of Health

According to WHO (2008), social determinants of health are the conditions in which persons are born, grow up, live, stay, work are employed and age, as well as the systems established to handle illness. A social determinant of health point of view offers a framework that helps to understand health disparities as embedded in and molded by social differences. Social determinants of health, in terms of digital accessibility, are understood as social factors, which determine a person's health by considering conditions that influence their abilities to digital access. This is contrary to the basic needs, which consider education and work opportunities as necessary drivers of health that are accessed through ICTs making digital access to be progressively associated with social determinants of health.

Evans (2020) avers that social factors as determinants of health play a fundamental role in understanding ways how consequences of health may be fashioned by digital accessibility levels. Broadly, a social factors health viewpoint strives to explore how health disparities within as well as among nations, are not ‘natural’ however a result of social elements (Marmot et al. 2008). The imbalances in the distribution of accessibility to vital resources influence individual conditions of living directly, especially in access to basic needs for example education, shelter, or medical care, which ultimately shape experiences of morbidity as well as mortality resulting from these situations (Marmot et al. 2008).

In terms of digital accessibility, Lawrence (2022) states that social factors as determinants of health influence conditions which subsequently affect an individual’s level of digital accessibility. Conversely, accessibility to basic needs and services, education and work opportunities, plus political and social engagement are fundamental drivers of health and mortality, which are progressively accessed through ICTs, digital accessibility itself must be regarded as a social factor of health. In addition, the social determinants of health approach help in understanding ways in which social structures impact on health outcomes as opposed to limiting investigations to personally-based risk elements.

Since access to digital health services is affected by health inequalities resulting from social determinants of health, the study runs the risk of asserting that a study on health inequalities runs the danger of commissioning approaches to the management of race, class as well as sex and gender, which distill the impacts of social and relational beliefs, structuring practices that lead into features of distinct and self-contained persons (Romero-Rivera et al. 2022; Kaihlanen et al. 2022). According to Williams (2003) by integrating a structure oriented approach to understand the causes of health inequalities we are entrenching the socioeconomic, demographic health differences constructed through power relations instead of persons’ characteristics. Yet, resources just assist people to avoid risks of sickness by understanding, power, status, and more interpersonal possessions like social connectedness.

2.4.2 The Digital Divide

Health inequalities and inequities brought about through increased innovations in digital health technology have led to unintended consequences expanding health inequalities and inequities among socially marginalized groups. According to Lawrence (2022) it has led to a digital divide, a term that refers to gaps between individuals, communities, or larger populations of people that do or do not have access to critical technologies, including health technology'. This happens because of uneven accessibility to various resources and in certain situations through ICTs and digital accessibility, which impacts health results. Such resources might be known as the instruments that connect digital access to health results.

According to van Dijk (2005), digital accessibility takes place through four successive phases and types of access. These are motivational and accessing digital knowledge progressively by shifting from the first two phases. Motivation takes place once material access has been attained, which is followed by access to skills as well as usage. While there are different theoretical views for understanding digital divide, van Dijk's sequential model is mainly used for understanding the various points at which digital access levels can be either limited or advanced by their resource accessibility. By integrating the application of digital ICTs to reap disconnected rewards for users into the digital accessibility concept, we understand ways in which health consequences may be molded by individuals' digital accessibility levels. Motivational access is the first stage and the kind of access that might be understood as the inspiration on the side of the potential user to utilize digital ICTs (van Dijk 2005).

According to Lawrence (2022) most people do not have the motivation either since they think digital ICTs are inappropriate for their living conditions. Some are doubtful with anxiety around or suspicion about digital ICTs (Crawford and Serhal 2020). When the individual overcomes the obstacles to motivational accessibility, then their access will be shaped by the second phase and the kind of access. Material plus physical access is broadly understood as the ability to access a computer connected to the internet. On the other hand, the transmission of smartphones plus other types of technology like tablets has extended this kind of access.

The third category and accessibility stage is skills access and this refers to the various types of skills necessary for applying digital ICTs. This leads to the final stage of digital access, which is dealing with the real application of digital ICTs. Utilization access might be assumed in terms of the frequency as well as duration of usage, the types of undertakings done and content accessed through digital ICTs (van Deursen and van Dijk 2014). This inequality in application behaviours is significant because not all digital ICT undertakings offer users with similar benefits. According to Zillien and Hargittai (2009) the first-three stages of digital access and types are important preconditions to utilize access despite remaining inadequate.

2.4.3 How do Social Determinants of Health Impact Digital Access?

A number of authors (Lawrence 2022; Sinha and Schryer-Roy 2018; Evans 2022) identify education, income, race and ethnicity to be linked with health results in terms of inequalities in digital accessibility. Education Digital accessibility might impact health consequences as digital ICTs turn out to be increasingly significant for accessing educational prospects. Research has shown that education is a substantial predictor of health through a range of health consequences (Kaihlanen et al. 2022; Rivera-Romero et al. 2022; Lawrence 2022; Schnittker 2004). Specifically, higher education is characterized by lower morbidity rates and low chronic illnesses (Cutler and Lleras-Muney 2006). Similarly, health consequences might be impacted by digital accessibility levels with regard to the connection between accessibility to digital ICTs, learning opportunities, and academic attainment. This is evidenced through the digital ICTs formation of the curricula at different education levels.

People with digital skills might be successful in achieving higher education levels and in this case, digital skills accessibility might have an influence on educational achievement. According to Paino and Renzulli, (2013) digital access is characterized by higher academic attainment but, formal digital learning skills training and informal education supported via digital ICTs have been fundamental to curriculum of official education knowledge environments. In this case, a person’s level of skills accessibility might depend on the level of formal education attained. Research has shown that persons with higher education levels have better levels of digital skills (Zillien and Hargittai 2009). In fact, the divide in digital ICTs accessibility and Internet connectivity by educational achievement is most evident.

Digital accessibility might impact health via revenue pathway both in terms of the person’s capability to get and retain a job, as well as the employment type or occupation qualifications. People with low digital accessibility experience considerable obstacles while looking for employment both in terms of the job category they qualify for and how accessibility to job opportunities has been digitized through online job schedules as well as applications. Accessibility to ICTs might also perform a significant role in structuring incomes for employed individuals. Some studies indicate that those who use the internet gain meaningfully more in income than those who do not use it (DiMaggio and Bonikowski 2008). This might be due to the fact that higher digital skills levels enable workers to have better access to labour market information. Similarly, they are probably better and are more effective in what they are doing. Furthermore, health inequalities structured by economic disparities might be influenced by digital access since the level of access is seen to differ by income levels.

Equally, income levels affect accessibility to digital ICTs through diverse factors like income, which might influence motivational access to equipment and connectivity. The quality of the available equipment and the dependability of the connection may have an impact on how individuals come up with the decision to access digital ICTs. The connection between income and material or physical access is rather open with regard to the extent to which individuals might afford ICTs equipment as well as internet connectivity. Conversely, income levels might also have an effect on digital ICT skills access. For instance, kids who grow up in homes with computers and Internet are better off when it comes to skills access since research has demonstrated that most of digital literacy is gained informally from home since it is entrenched in the individual’s life. Contrary to formal training, some authors have argued that, digital learning skills are attained in informal environments (Meyers, Erickson, and Small 2013). Hence, usage accessibility becomes a vital consideration for the strategies through which digital access might be shaped by income levels.

According to Williams and Mohammed (2013) racial and ethnic health inequalities persevere in terms of higher mortality rates amongst racially marginalized groups and lead to greater severity and disease progression. Research has recorded the ways in which these injustices in morbidity and mortality are a consequence of social relegation of racial and ethnic minorities plus other disadvantaged populations (Weinstein et al. 2017; Ford et al. 2017). Racial and ethnic health inequalities are an outcome of racism affecting health in various ways. Williams and Mohammed (2013) highpoint three main pathways via which empirical evidence show racism to be affecting health. This is evidenced in the recent COVID-19 pandemic, which was more predominant against minorities in some countries.

Moreover, minorities experience higher occurrences of underlying medical circumstances that have been seen to intensify the risk of severe responses to COVID-19 comprising of hospitalization and death because of the virus (Centers for Disease Control and Prevention 2021). Furthermore, digital access impacts race as well as ethnic health differences because of uneven distribution of resources and uses existing through digital ICTs. Since the resources and applications existing through digital ICTs are created by and for a dominant culture, individuals falling under marginalized ethnic or racial groups might find the information unwanted, inappropriate, or unreachable.

Additionally, employment status, profession, and job fulfillment all impact accessibility to necessary health supporting materials with regard to remunerations, psychosocial assets such as a sense of control, and social connectedness (Marmot 2015). Employment status and profession may also perform a role in defining a family location in societal hierarchies regarding their access to control, their prestige and status. This does not mean that the links between employment status and profession together with health are minor. Nonetheless, employment status and profession may both be harmful and helpful to health through provision of financial resources to the workers (Landsbergis et al. 2014; Lawrence 2022).

Although the literature that has been reviewed above establishes a connection between social determinants of health and digital health, there is a paucity of literature on (in)equity in digital health including, unintentional exacerbation of inequities in the use of digital health, especially during the pandemic in populations that do not access digital devices. In addition, there is a need for a framework that can appropriately measure these inequities so that evidence-based developments are integrated in the usual medical care solutions (Jandoo 2020).

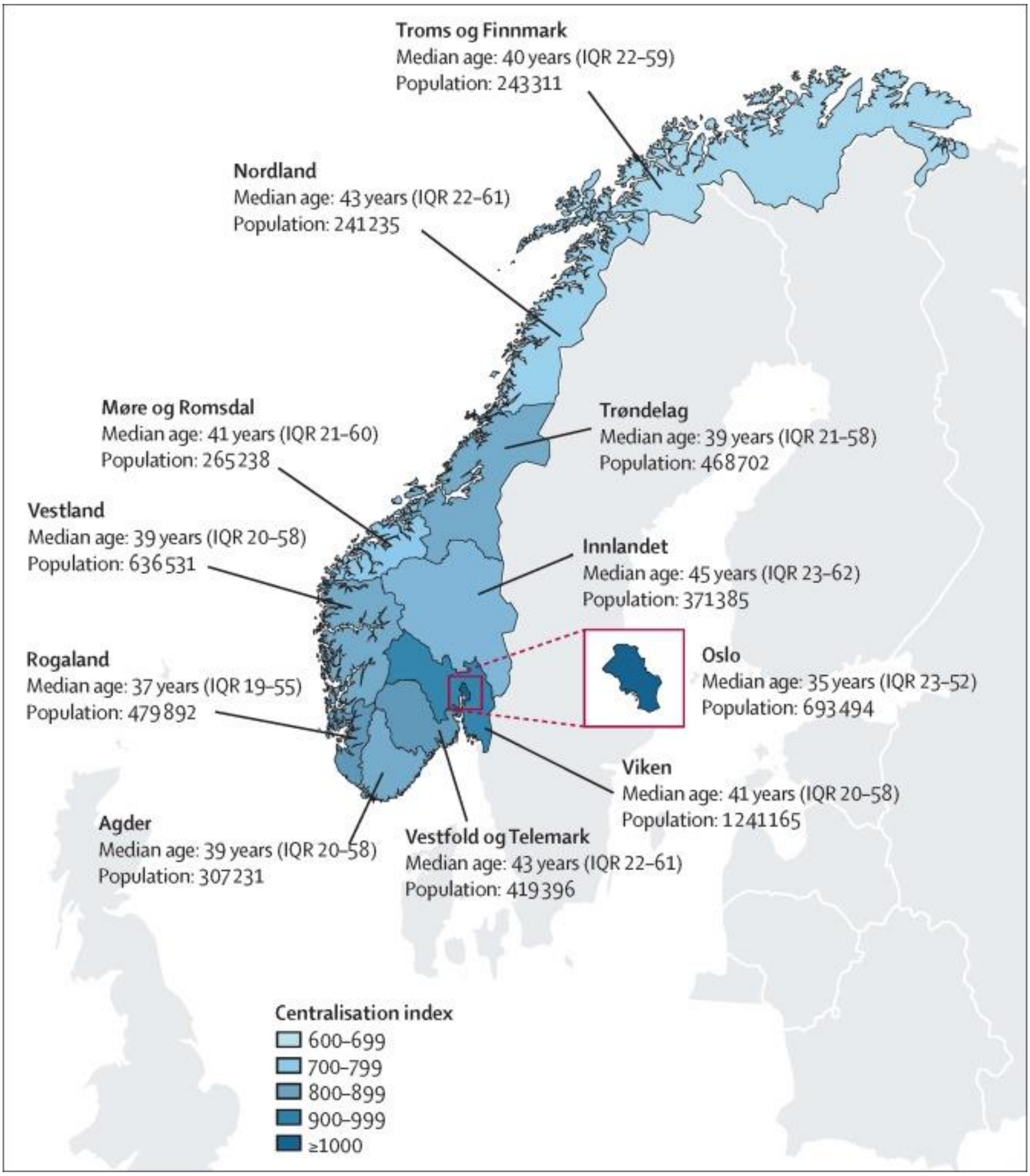
There is a need for research that focuses on how individuals are able to access digital resources, which has not been the focus of the previous studies. Although the studies above have looked at how the use of digital health technology can lead to unintended consequences such as digital health inequity, they do not provide and in-depth analysis of how this inequity can be measured and equity established. Digital health users are still affected by lack of resources, negative cultural underpinnings, weak and at times broken health infrastructure in society that undermines health equity. Hence, there is a need for a framework that captures all these factors holistically to provide equitable digital health to consumers.

Besides, the WHO "Global Strategy for Digital Health 2020-2025", underscores equity in digital health, there is a scarcity of in-depth and extensive literature on frameworks that capture all the factors which negatively impact digital health equity. Thus, one of the novel roles of this research is to adopt the DHEF framework by Crawford and Sehral (2020), because it captures all the aforementioned factors to achieve digital health equity. In addition, the periodic, both long-term and short-term, impacts of digital technology solutions are not well known which requires attention if issues of digital health inequality are to be resolved.

2.4.4 Why the Case of Norway?

Norway provides a good example of a country that is rooted in egalitarian values of social equality, equal rights for all people and the belief in equal distribution of wealth, equal access to opportunities, generosity, and universally provided welfare arrangements (Smith et al. 2015). It has 'The Norwegian Public Health Act (2)' to improve equity in health by addressing the social gradient in health (Lundberg and Lind 2021). According to the Institute of health equity (2021), the social gradient is a term that is used to explain the phenomena in which persons with lower socioeconomic status and are less advantaged have worse health (and shorter lives) than those with higher status and are more advantaged (Institute of Health Equity 2021).

Additionally, Smith et al. (2015) aver that Norway has been doing the 'right thing' by having increased wealth and social policies like generous parental leave, generous out-of-work benefits, free childcare and free education (Smith et al. 2015). Although the nation tried to reduce health inequalities, the reverse is instead the reality. Inequalities in mortality have been rising ever since the 1960s making it a public health puzzle (Smith et al. 2015). According to Clarsen et al. (2021), the Norwegian population manifests divergences in life expectancy and socioeconomic profiles within specific counties. The persistence of social inequalities in mortality in the Nordic welfare states, which has implications for the main research question of this study is best described as a paradox (Clarsen et al. 2022, Smith et al. 2015). As aforementioned, despite the vaunted political debate on this topic in Norway, it had not been deeply researched. It is because of providing enough variables for the research question of this study that Norway is chosen as a case. The figure below illustrates the map of Norway with the 11 counties.



(Clarsen et al. 2022)

Fig. 4 Map of Norway and the 11 counties, including the median ages and population numbers in 2019

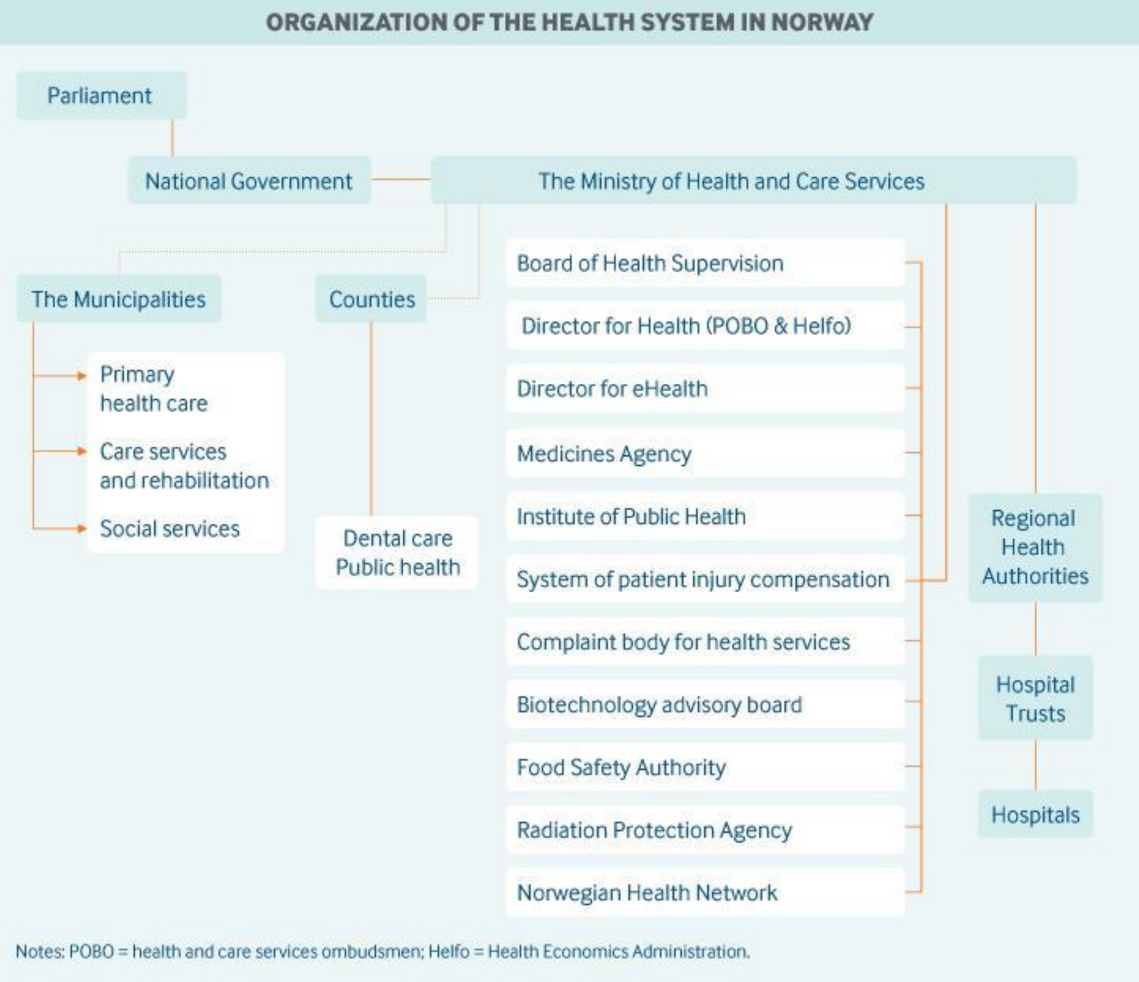
2.4.5 Norway's National Healthcare System

Healthcare in Norway is a constitutional right, therefore, every member of the Norwegian National Insurance Scheme (NIS), or “Folketrygd” has the right to access medical services (Kasper et al. 2022; Tikkanen et al. 2020). The idea is to provide equitable services across all phases of life, regardless of socioeconomic status, ethnicity, or area of residence (Kasper et al. 2022). Public sources account for over 85% of total health expenditure, mostly comprising of financing from the central and local governments and from NIS (around 12% of total health expenditure) (Debesay et al. 2019).

Norway's healthcare system is financed by public taxpayers as hospitals are owned by the State and ensure medical services to its entire population. This system is extended to even those who live in remote areas of the country that may be geographically inaccessible (Elford 1997). In addition, Norways' healthcare system is semi-decentralized with the Ministry of Health and Care services responsible for the development and implementation of national health policy. The Ministry is also tasked with drafting regulations and allocation of resources however; its policy is implemented by the Norwegian Directorate of health. A subordinate of the Norwegian Directorate of Health is the e-Health Directorate that is responsible for establishing e-Health standards in the country. The e-health Directorate was established on the 1st of January 2016. This Directorate makes sure that the policy is implemented in its five regional administrative regions (Central also known as Trøndelag, Western, Northern and Southern, and Eastern Norway). These are state administrative centers responsible for health services in the regions (Romoren, Tarjessen and Landmark 2011).

Furthermore, in support of the aforementioned paragraph, the national government provides equal access to healthcare, hospital and specialty care while, the municipalities are responsible for providing primary, preventive, nursing and long-term care (Lundberg and Lind 2021; Tikkanen et al. 2020). The Directorate of eHealth is and has been responsible for steering and coordinating eHealth through close collaboration within Norway's various levels of health care. These are the regional health authorities, local authorities, technical organizations and care providers (Lundberg and Lind 2021). In cooperation with counties, municipalities also decide on public health initiatives or campaigns to promote healthy lifestyles and reduce social health disparities. This promotes bottom-up decision-making and implementation of health initiatives, the health system in Norway is therefore, a semi-decentralised structure (Kasper et al. 2022; Tikkanen et al. 2020). Under the National government, there are four Regional Health Authorities (RHAs) that have the overall responsibility of implementing national health policy through planning, organizing, managing, and coordinating activities in their region (Lundberg and Lind 2021; Tikkanen et al. 2020).

The figure below illustrates the Organisation of the Health system in Norway.



Notes: POBO = health and care services ombudsmen; Helfo = Health Economics Administration.

(Tikkanen et al. 2020).

Fig. 5 Organisation of the Health System in Norway

In accordance with the Public Health Act (2) mentioned in the introduction, the health act's main policy measures are delegating responsibility for identifying and targeting underserved groups to the municipalities (Lundberg and Lind 2021). Furthermore, the responsibility of implementing health in all policies approach lies on the municipalities (Lundberg and Lind 2021). In the plans made by the government, they highlight a person-centred approach and the citizen as a resource which consequently empowers people and encourages self-management through digital solutions (Lundberg and Lind 2021).

2.4.6 Digital Health in Norway

In recent years, the digitalization of health services has been a key priority for Norway's Ministry of Health and Care Services (Lundberg and Lind 2021). Therefore, the Directorate of eHealth was established in 2016 to promote a long-term strategy for eHealth with a detailed roadmap for primary health care (Lundberg and Lind 2021). This strategy focuses on three main objectives for developing information and communication technologies in the health and care sector which are:-

1. Health professionals should have easy and secure access to patient and user information (Lundberg and Lind 2021).

2. Citizens should have access to simple and secure digital services (Lundberg and Lind 2021).

3. Data should be available for quality improvement, health monitoring, management and research (Lundberg and Lind 2021).

The urgent COVID-19 pandemic response has resulted in the acceleration and rapid deployment of digital technology across care levels.

2.4.6.1 Helsenorge / department of e-Health

The department of eHealth in Norway also known as Helsenorge has the overall responsibility for the digitalisation of the healthcare sector (The Department of eHealth, 2016). The area of responsibility for the department of eHealth is broad, covering from establishing and providing good digital health services to health professionals and the public to following up on the long-term strategy of "one patient-one record" and creation of the platform, helsenorge.no (Ryvarden 2018; The Department of eHealth 2016).

The areas of work for the department of ehealth are; Governance of the Directorate for eHealth, Governance of Norwegian Health Net (secure infrastructure), National health registries, Information security, privacy and HealthCERT, ICT standards, coding and terminology, Digital services on the national health portal www.helsenorge.no, Digital dialogue between citizens and healthcare professionals, Electronic patient's records and Summary care records, Patient travel – automatic reimbursements of journeys to and from publicly approved healthcare appointments, Telecare and Mobile health technology (mHealth), chat service for mental health “Mental helse”, E-prescription(The Department of eHealth 2016).

With Helsenorge.no, citizens are able to book doctor’s appointments and digital consultations and see which health care personnel have accessed their patient information through helsenorge.no. (Lundberg and Lind 2021). The health portal Helsenorge.no, a strategic instrument resulting from the eHealth strategy, enables people to log in and access a range of options concerning their health and health care services, this includes scheduling an appointment with the general practitioner — in person or as a video consultation – sending an electronic message to the general practitioner, renewing a prescription for medicines and accessing patient health records. In the past few years, the portal has included a list of digital self-management tools. It includes apps, videos, and eLearning courses to help cope with somatic and mental symptoms and problems (Lundberg and Lind 2021).

2.4.7 Health and Migrants in Norway

Regarding undocumented immigrants, health access is limited to emergency acute care (Debesay et al. 2019). This exception covers free care for prenatal care, forced admission for psychiatric treatment, treatment for contagious diseases, and vaccinations. The rest of the health services and care for undocumented immigrants are out of pocket (Debesay et al. 2019).

As a consequence of globalisation, the Norwegian population has become multicultural and these migrants go to Norway for a plethora of reasons including political reasons, tourism, socio-economic reasons or for studies and stay in Norway either for the long term or short term (Debesay et al. 2019). According to “Migration and health in an increasingly diverse Europe”, when immigrants first arrive in Europe, they are considerably healthier than the non-immigrant population. They manifest a ‘healthy migrant effect’ but, data shows that as time progresses of these immigrants being in foreign countries, they are more susceptible to factors in line with the social and economic inequalities and inequities. These factors have been shown to play a large role in the declining health profile of populations, both in Norway and internationally (Debesay et al. 2019).

These immigrants are more susceptible to communicable diseases due to poor living conditions. They also face occupational health hazards since they may have to work in dangerous conditions like mines, and construction sites. They have to work despite being sick and in poor mental health conditions. These have been recorded in asylum seekers, refugees, immigrants and undocumented migrants. They are also exposed to more violence than in their home countries of origin and, experience stress during migration and after this stress continues even after their arrival in the host countries, which exacerbates mental health issues as well (Debesay et al. 2019; Rechel et al. 2013). In Norway, a larger proportion of migrants report mental health problems compared to the entire population, but few visit psychologists or psychiatrists (Debesay et al. 2019).

Diabetes is another health condition reported among migrants since unhealthy food may be cheaper and more accessible (Rechel et al. 2013). Other health conditions reported among migrants include maternal and child health problems due to negligence of health personnel or lack of awareness, obesity and insufficient physical activity (Rechel et al. 2013). Language barriers are one of the biggest issues subverting both the availability of health services for migrants and the quality of the services received (Rechel et al. 2013). Other barriers to immigrants receiving healthcare include the immigrants' unfamiliarity with rights and entitlements, the overall structure of the health system, gaps in health literacy, social exclusion, and direct and indirect discrimination or racism (Rechel et al. 2013). These features may undermine migrants’ consumption of health care services (Debesay et al. 2019).

Debesay et al. (2019), conclude their paper by stating that although there is universal coverage for all inhabitants in Norway, there is reason to believe that differences in consumption exist despite equal needs although there is a lack of sufficient research to illustrate and understand migrants’ consumption and access to health services, which would help in when designing health and social services (Debesay et al. 2019).

2.4.8 Norwegian policy to reduce health inequity

Although Norway has policies to reduce health inequality and inequity in place, my research will investigate if these policies have achieved their objectives. If to date they have failed what led to their failure especially given the efforts that were put in place after realising the problem of health inequity. In 2007, a comprehensive strategy was introduced by the 'Red/Green' government to reduce social inequalities in health, this was due to an influential paper that was written by Mackenbach et al.(1997). It elucidated the fact that Nordic countries have substantial health inequalities in comparison with other Western European countries (Smith et al. 2015).

This comprehensive strategy to reduce social inequalities in health was also fuelled by the 2011 Rio-declaration on Social Determinants of Health (SDH) which Norwegian authorities signed and agreed to adopt in efforts to tackle health inequities (Arntzen et al. 2019). The Rio-declaration states: "Health inequities arise from the societal conditions in which people are born, grow, live, work and age, referred to as social determinants of health. These include early years' experiences, education, economic status, employment and decent work, housing and environment, and effective systems of preventing and treating ill health." (Arntzen et al. 2019).

According to Van der Wel (2016), this strategy was considered to be ambitious especially in Europe since it was proposing action on the SDH, such as income structure, employment opportunities and affordable child-care, the strategy was able to approach the entire social gradient rather than just the socially disadvantaged (Van der Wel 2016). There were three key characteristics of the Norwegian strategy and these were:-

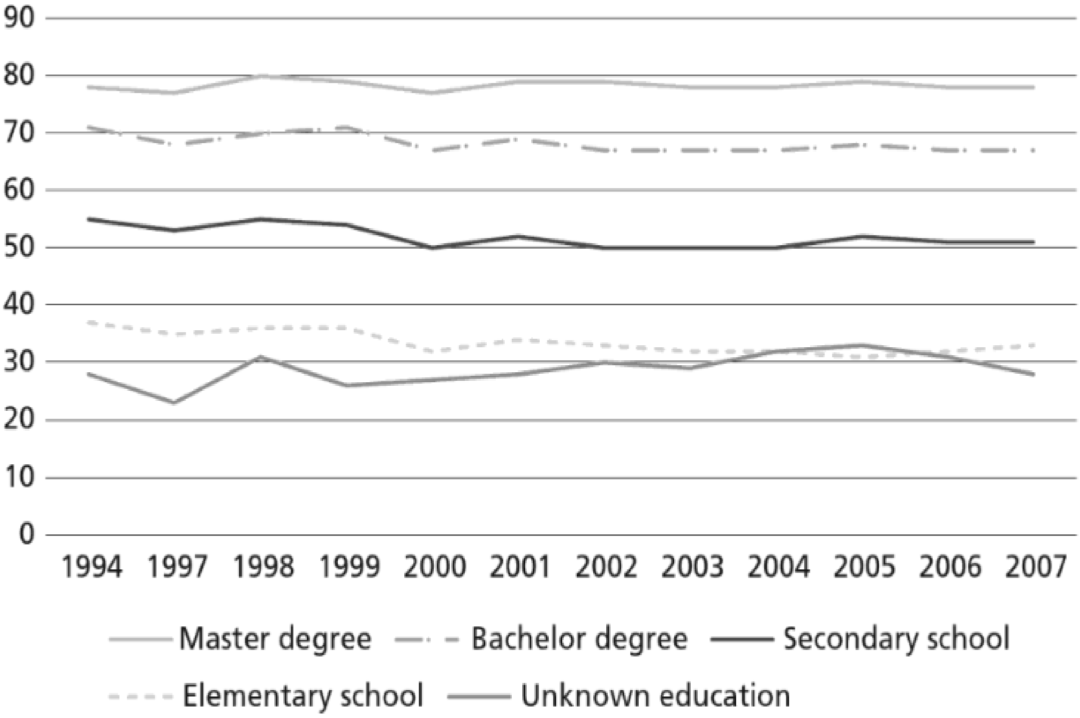
1. a holistic, broad cross-sectoral approach, which covered all ministries in the sense that all governmental ministries had a topic of concern and fostered political will as well. The selected domains of actions to reduce health inequalities were: childhood/adolescence and education, work and working conditions, income, health services, and health behaviour, as well as social inclusion (Arntzen et al. 2019; Van der Wel 2016).

2. an explicit focus on the gradient instead of the disadvantaged groups (Fosse et al. 2018; Van der Wel 2016). The social gradient in health, which according to the institute of health equity,

   > "is a term used to describe the phenomenon whereby people who are less advantaged in terms of socioeconomic position have worse health (and shorter lives) than those who are more advantaged" (Institute of health equity 2021).

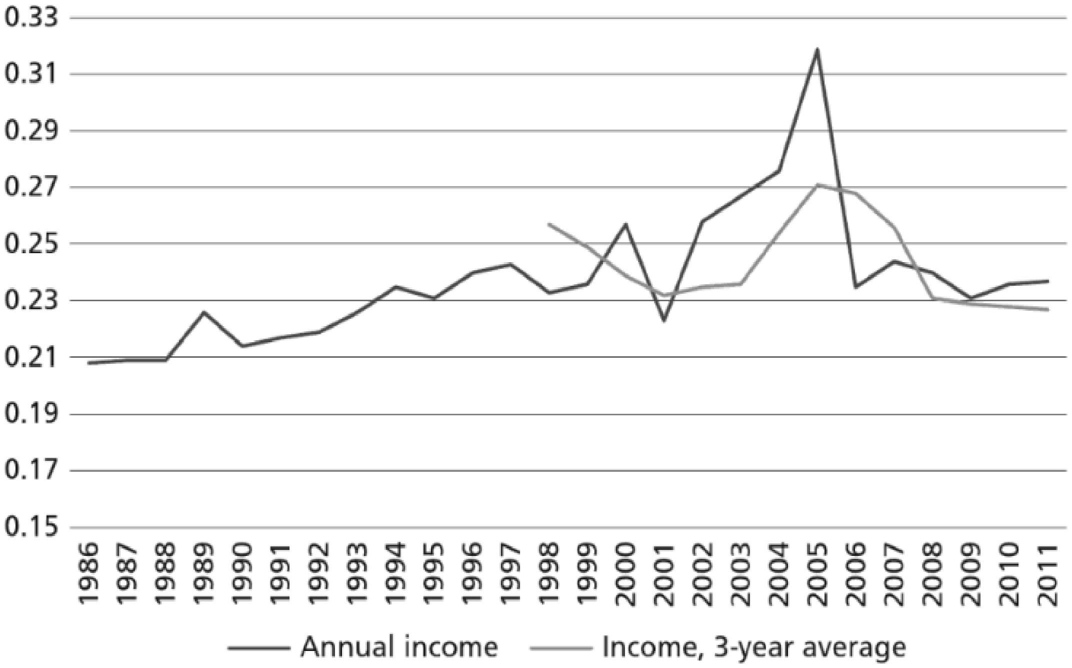
Before 2002, the problem of health inequality was reduced to a problem of marginalisation and poverty, therefore seen as a dichotomy and not as a social gradient in health, in other words as a social phenomenon and not something individual (Arntzen et al. 2019; Van der Wel 2016). In light of the above, the focus is on the social gradient in the health equality policy. The aim was to reduce stigmatisation that is associated with disadvantaged persons receiving specialised services. According to Van der Wel (2016), the approach of universality is less stigmatising, more effective in preventing people from ending up in high-risk positions and capable of protecting disadvantaged groups (Arntzen et al. 2019; Van der Wel 2016). Figures 7 and 8 below illustrate the ‘gradient’ between 1994 to 2007. Figure 7 illustrates pupils who complete secondary education within five years by parental education, this illustrates that the level of parents’ education influences pupils’ completion of secondary education and directly affects their socioeconomic status (Van der Wel 2016). Figure 8 illustrates the income inequality after taxes measured by the Gini coefficient against household equivalent income (Van der Wel 2016). These two figures show the basis that was used for the explicit focus of the strategy to reduce health inequality (Smith et al. 2015).

3. the principle of ‘proportional universalism’, i.e. population-covering policies in combination with more targeted measures (Van der Wel 2016).



(Van der Wel 2016)

Fig. 6 The proportion of pupils who completes secondary education within five years by parental educational level



(Van der Wel 2016)

Fig. 7 Income inequality after taxes measured by the Gini-coefficient.

To expound on the figure above, the household equivalent income (EU scale) excluding student households. The spike in the trend is most likely due to some temporary changes in taxation.

According to Fosse et al. (2018) in a research paper titled “Addressing the social determinants of health at the local level: Opportunities and challenges”, their results found that municipalities had an unclear understanding on the concept of social inequities or how to create policies and strategies that would focus on the social gradient (Fosse et al. 2018). Therefore, with this lack of understanding the policies created focused on the disadvantaged and not the social gradient as it was intended (Fosse et al. 2018).

In light of the above-mentioned national strategy to reduce health inequalities that focused on social determinants of health also known as the “national 2013-2017 strategy Equality and Equity in Health Care – Good Health for All”. According to Tikkanen et al. (2020), the emphasis in health has now shifted to individual health-related behaviours (Tikkanen et al. 2020). These individual health-related behaviours usher in the use of e-health tools. The question then is, in this effort to move to individual health-related behaviour by the use of e-health and away from SDH, is there a risk of inequity in this shift?

2.5 Life Expectancy

There is a correlation between education levels and longevity in Norway. Steingrímsdóttir et al. (2012), has stated that education frequently comes up as a major determinant of longevity (Steingrímsdóttir et al. 2012). Data that was collected from the last three decades of the twentieth century show that those with higher educational attainment have enjoyed a more rapid increase in life expectancy (Steingrímsdóttir et al. 2012). This research will therefore, investigate how life expectancy like education is a social determinant or an intervening factor of digital health equality in Norway.

2.6 The Conceptual Framework

Deriving from the Delone and Mclean (D & M) model, Unified Theory of Acceptance and Use of Tech (UTAUT2). The Digital Equity Framework (DHEF), the empirical literature and the Norway case while extending the DHEF model by incorporating social determinants of health, the conceptual framework of the study is summarized in the table below.

NORWAY	
Concept	**Sub-Concepts**
Access to digital technology	Citizenship
Training/ Education	Ethnicity
Application of Digital Tools	Life Expectancy
Causal Values	Cultural Values
Underlying beliefs	Digital infrastructure

Tab. 1 Concept Map

The concepts identified in the concept map above will guide this study to ascertain the impact of social determinants of health on digital equity in Norway. These concepts will also guide the interpretation of the results of the study.

2.7 Conclusion

This section has reviewed the theoretical frameworks applied to understand the social impact of health on digital health as well as the empirical literature and the case study of Norway. The section has carefully examined the relevance of DHEF model that enlightens our understanding of how social determinants of health influence digital health equity among the Norwegian population. In addition, the section has reviewed the extant empirical literature on the subject throwing more light on our understanding of the benefits of how social determinants of digital health influence health equity and how they interact with digital health technology. Lastly, the section has identified the conceptual framework of the study, which will act as a guide for the research especially the methodology in the next section.

3 Methodology

3.1 Introduction

Deriving from the conceptual framework in the previous section, this section discusses the methodological approach followed in the study. Qualitative research methodology is deemed most relevant for this study. This is because the study focuses on exploring the factors that impact digital health equity in Norway. The qualitative research methodology employs semi-structured interviews, which provide rich descriptions through open-ended questions enabling a chance for the respondent to reply in their own words making the responses valid as well as a better understanding of the social setting. It also provides qualitative validity, which benefits qualitative research projects by allowing findings to depend on the researcher's, the respondent, or the reader's perspective. Descriptions provided by semi-structured interviews enable results to be with detailed explanations about the context and the theme, which results into richer and more realistic findings (Bryman 2016 p. 392; Creswell 2009 pp. 176-178). Subsequently, this section presents the processes and techniques employed to answer the research question by fulfilling the stated objectives. Hence, the chapter discusses the philosophical foundations, approach, choices taken together with tools used for data collection and analysis. To fulfil this endeavour, the section discusses the validity and reliability of different instruments through various sub-headings. The section concludes with the ethical considerations and the researcher's self-reflection of the study.

3.2 Philosophical Foundations

Research is buttressed by diverse theoretical standpoints that shape the researchers' approach to generate knowledge within a specific setting. Saunders, Lewis and Thornhill (2009) state that a methodological philosophy deals with an investigation of ideas germane to the subject being investigated. This includes a justification of the proposal and rationale of the inquiry in contrast to other choices. This is arranged in such manner because the goal of the research is to avoid preference of a single research philosophy against another.

Most times, every research philosophy plays a certain role and is appropriate to a type of research than the other but conditional on the research questions in the study (Bryman and Bell 2007). The dominant philosophical research traditions are positivism and interpretivism. Positivism is derived from natural sciences while interpretivism relies on observing and recognizing the world from what is seen. Positivism focuses on theories to enable the researcher to make predictions basing on the observed social phenomenon (Collis and Hussey 2009).

This philosophical tradition is concerned with observing data and normally typified by surveys and experimental approaches (Jupp 2006). Researchers following an interpretivist tradition interact with the topic being studied and as a consequence positivists criticize them to lack objectivity. They accuse them of relying on feelings, perceptions, influence from external environments and relying on subjective views (Jancowicz 2005). In sharp contrast, positivists pride themselves of rational inferences and objectivity of their results since they can be reproduced by other researchers if they apply similar methods.

Hence, since the main research question investigated here is ‘How do diverse sector representatives perceive the key factors that impact equity in digital health in Norway?’ this research will follow an interpretivist philosophical tradition and rely on interviews conducted with different stakeholders, experts in the digital industry, public authorities, representatives from academia, digital health users, citizens especially disadvantaged groups.

This selection of diverse stakeholders is intended to gather their opinions on experiences how they perceive digital health. The interview guiding tools were created based the digital health equity framework (DHEF) (Crawford and Sehral 2020) that broadly captures the social determinants of health that impact on digital health equity. These factors are ‘individual access to digital resources, application of these resources to obtain health, possession of digital knowledge, beliefs about the potential harm or assistance by digital healthcare, cultural influences that impact the use of digital resources and integration of digital resources into the health infrastructure (Crawford and Serhal 2020). Semi-structured interviews permit the interviewer to maintain an open mind on the outlines of the required knowledge allowing concepts plus theories to arise out of the information (Bryman 2016). This enables the researcher to explore the factors that impact on digital health equity in Norway. The Semi-structured interviews use a set of enquiries and provides the interviewer freedom to perform follow-up questions (Magnusson and Marecek 2015, p. 62).

3.2.1 Alternative approaches

Customarily, the choice of the method adopted for a specific research is a result of research questions posed in the research. This suggests that the choice of the method employed by the researcher to be dependent on the type of data, its collection and the manner it is analysed (Johannesen, Tufte and Christoffersen 2010). Consistently, the choice for the approach is between qualitative and quantitative methods (Bryman 2012). The two approaches present different qualities and are dominantly differentiated by structure.

The quantitative method is more organized and uses quantifiable data to examine and validate propositions. In a qualitative approach, a few respondents are interviewed and the contact tends to be much longer than with a quantitative approach. For a quantitative approach, it normally studies a larger population in a short period of time and draws wider conclusions. While it does not rely on previous theory, it is employed to set up new hypotheses, as a foundation for theory building.

Conversely, the qualitative research approach is more appropriate when dealing with observable data close to the subject being researched. This enables the qualitative study approach to explain the world and its social structure directly through respondents in their natural settings (Ringdal 2013) and also facilitates the exploration of diverse experiences and perspectives. To fulfil this, the interview environment is expected to be transparent, so as to enable the informant to talk about their experiences freely. Contrariwise, the quantitative approach enables the researcher to study the population from a distance (Ringdal 2013), which enables the researcher to describe differences and outcomes in the population. Thus, this thesis utilizes a qualitative approach aiming to answer the research question ‘How do diverse sector representatives perceive the key factors that impact equity in digital health in Norway?’ based on interviews.

3.3 Research Design

This section mentions the research plan I used to conduct my research and why? The research needed to complete the objectives of this study is divided into three phases with respective study objectives. The description and composition of each phase are as follows:

Phase I – the research starts with the literature review. The literature review fixed the basis of the study, as it informed the researcher on what has been known about the study area and how past research studied the subject in a serious manner (Bryman, 2016, p. 8). The main objective is to identify applicable theories, acquire knowledge about existing literature and gain a deep understanding of equity in health, the social determinants of health in Norway and the corresponding strategies and policies in line with health equity in Norway.

Key instruments to achieve first the phase objectives are various theories through which the theoretical framework can be defined, use-cases to identify common key areas of investigation, papers, policies, and governmental decrees to grasp the state of the art, which relied on key words. This phase helped to develop the tools that will facilitate the exploration of the main research question and the sub-research questions.

Phase II – the second phase is the empirical data gathering to collect information for answering the research questions. This phase had the aim to ensure the data collection tools, in this case the interview guide is developed and piloted. As a part of Phase II, 8 interviews were conducted.

Phase III – the third phase focuses on the analysis of the interview data. The analysis is presented in the findings section of the paper with a focus on common and contrasting themes among the interviews conducted with diverse sector representatives.

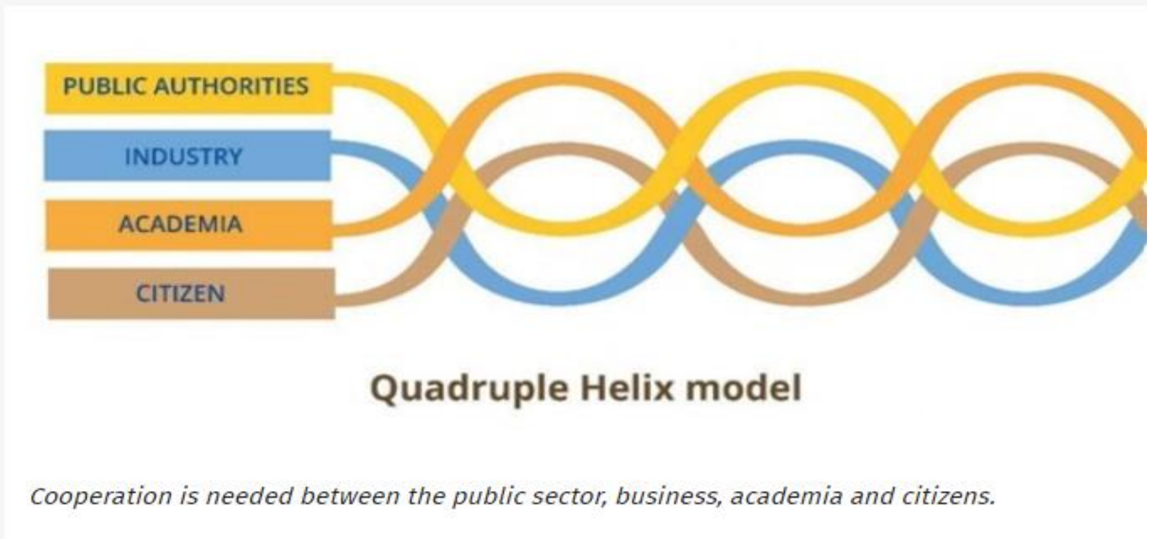
3.3.1 The Case Study Method

The research design was attempted to address the main research question of the study. Relying on Digital Health Equity Framework (DHEF), a case study research methodology is deemed appropriate to explore factors that impact on digital health in Norway. Although the methodology chosen is a case study, it follows an exploratory qualitative approach to provide an in-depth explanation of the factors that impact digital health equity. The case study methodology was chosen because it provides a larger picture of the factors that influence digital health equity in Norway.

Norway as a case was selected for two significant reasons: first, it is a very good laboratory to explore factors that impact digital health equity given Norway’s egalitarian culture. Secondly, Norway provides variables of interest for the research question that outstrip the number of data points such as persistent inequity in its healthcare system (Yin 1994). Its choice is based on its capacity to complement the qualitative approach. Conversely, the qualitative research approach helped the researcher to target specific sections of respondents whose selection is contingent on the research question (Bryman 2012).

Using purposive sampling, the respondents were selected with aim of obtaining diverse insights of experiences of their digital health inequity, including the factors that impact digital health. Since the researcher was on the ground, a snowball sampling method was adopted while meeting the respondents. As noted in Bryman (2016, p. 202), utilizing the snowball method implies linking with respondents that are all pertinent for the study objective. Although the respondents involved public authorities, industry experts, academia and citizens, the sample was representative of the disadvantaged groups especially people of colour, low income earners, older adults 65 years and above, unemployed and migrants. This diverse choice of respondents was intended to gain a clear understanding of health inequity, factors that impact on digital health equity in relation to the most disadvantaged groups.

The selection of the respondents was done following the quadruple helix model (Lundberg 2022) to represent respondents, each from the public sector, business, academia and citizens (society) immigrants, elderly, ICT experts. The quadruple helix model emphasises on co-creation between academia, business, public sector and citizens which yields better results in problem solving of complex societal challenges, the Quadruple helix is illustrated in the figure below (Lundberg 2022). Interviews using a prepared questionnaire were conducted with the selected respondents. In total, 8 personal meetings for interviews representing respondents from the 4 sectors were conducted.



(Lundberg 2022)

Fig. 8 Quadruple Helix - Cooperation is needed between the public sector, business, academia and citizens

3.3.2 Interviews and Interview Guide

Interviews are directly the major common research method used in qualitative approach Bryman (2012). Saunders et al. (2009), remark that interviews may be designed in various ways and three major types of interviews exist, which are structured interviews, semi-structured and in-depth interviews. When carrying out a structured interview, it implies that the interviewer/researcher has control on the whole interview irrespective of any open conversation, which is opposite to in-depth interviews. This form of interview provides an opportunity to the respondent to speak about the specific subject freely. Whereas, the semi-structured interview is a more structured and organized kind of interview (Saunders, et al. 2009).

The semi-structured type of interview is associated with the process in which an interviewer has an interview guide, consisting of a list of particular topics as well as questions to focus on. When conducting a semi-structured interview, the respondent exercises the freedom of generating their own responses. Semi-structured interviews further provide the interviewer an advantage to follow-up questions spontaneously (Bryman 2012).

The interview guide assisted the researcher to keep track of the concerns which were significant to approach the relevance as well as study questions of the thesis. A simple interview guide was designed and utilized as a basis for various interviews. However, the interview guide was sometimes reviewed so as to respond to the needs of different participants. When conducting interviews, predetermined questions supported the various follow-up questions, which emerged when interviewing.

As Ryen (2004) proposes, all the interview responses were recorded based on the respondent's consent, this was done to ensure that the subsequent data considered in the paper was right and direct information. All of the interview responses were transcribed, and this is also in agreement with Ryen (2004) who noted that, transcription of the interview responses facilitates the understanding of the data and helps the analysis process. In addition, to fulfil the ethical considerations in the research approach, the researcher needs to inform all the participants directly engaged in the study on how their responses will be applied and managed.

Each participant was told about the purpose of the study and that participating in the research exercise was voluntary. The respondent can interfere in the interview with queries and later they had a chance on changing their replies if they wish. During the interview process, the researcher made sure that there was transparency throughout the process by seeking their consent which was emphasized before each interview. Following a purposive sampling technique and snowballing whereby some respondents were referred by those already chosen, eight individual semi-structured interviews, with each taking approximately 30 to 45 minutes were carried out in July 2022, in Ås and Oslo. These two locations were used because Ås is a student city in the countryside of Norway with student immigrants and senior citizens that usually prefer to live their retirement out in the countryside. Oslo was chosen because the largest number of immigrants in Norway live in Oslo. The language used in the interviews was English.

3.3.2.1 Designing the Interviews

The interviews were designed to be easy so that they could easily be understood by the target population to be able to respond. This was aimed at increasing the opportunity of getting reliable answers by avoiding confusion and reducing risk (Trost 2007). According to Holme and Solvang (1997) explanation, if the study questionnaire is too incomprehensive, the interviewers might risk getting few responses from the participants.

The interviews begun with an introductory consent form, which describes the purpose of the questionnaire and the reason why respondents are invited-in an attractive manner to take part in the interview. In the survey questionnaire, both structured and semi-structured questions were used and asked. The survey questionnaire was structured into six sections; access to digital technology, use of digital tools, digital health training, financial resources, questions on income or economy, questions on life expectancy, on digital access, education, causal values and underlying beliefs. The choice of the elements was dependent on the purpose of the study and the theoretical framework.

3.4 Data analysis

Analysis of data followed inductive and deductive content analysis (Elo and Kyngas 2008). A combination of these approaches enabled identification of themes to gain a deeper understanding of subject. This was done by first writing down different reactions, reflections and other things noticed in the process. These were things deemed to be necessary for the analysis. According to Bell and Bryman (2011) the best way to approach qualitative information is through thematic arrangement of key words; equity, social equity, digital health, which were practical in the empirical data. Following this, data was divided into sections, grouped in categories and then brought together under various common themes. Following themes in the research findings, the data was analysed via cross perspective assessment.

The semi-structured individual interviews were transcribed through attending to the recordings many times. After transcription, I read through various interviews many times to obtain a summary of the data. While carrying out qualitative data analysis, the use of thematic analysis facilitates identification, examination and interpretation of themes or meaning patterns (Clarke and Braun 2017 p. 297). Themes were documented based on the research questions, which were generated and altered as new insights emerge.

The notes were finally made into more actual themes that were selected as applicable, which were shared with different researches. This was done to differentiate the similarities and differences among participants' responses. A cross-case examination may be appropriate when a researcher needs to have a better presentation of differences and similarities between various institutions or participants (Bell and Bryman 2011).

3.4.1 Validity and Reliability

Bryman (2012) asserts that validity within the domain of qualitative research is to examine and ascertain that the research has achieved what was promised. In this research, semi-structured and structured interviews were carried out following an interview guide. This facilitates and strengthens the validity of the research. In addition, a specific outline detailing all the steps followed in this research has been presented for the examiner. Hence, the concept of validity, which is to gauge the credibility of the study and see how easy its results can be replicated when it relies on a similar methodology (Bryman 2012) has been met. As a consequence, this study relied on a well explained methodology that can facilitate replication of its results if applied elsewhere.

While one aspect of reliability is portability, the data gathered in this research can be transferred, read and understood. This has been met in this study by describing the work through a detailed process that can be followed. Another element of reliability that has been met by this study is dependability. This is intended in seeing if findings are reliable by being consistent with data over time. Guba and Lincolns' (1989) dependability is similar to reliability, from quantitative research methods. While assessing dependability, it eliminates changes that happen due to the methodological choices over time by the assessor. The review of this entire work has been met through this methodology, which proves that this work is of a dependable quality (Bryman 2012).

Another criteria of validity data has to meet is transferability, which relates to the comparison of data with other settings. It is comparable to external validity or being generalizable like in quantitate research. However, Guba and Lincoln (1989 p. 241) scrutinise applicability in different settings as being substituted by an empirical process to check the extent of similarity in sending as well as receiving contexts.

While conformability relates to assessing that your research has a level of neutrality as well as the findings not designed according to the researcher's bias, inspiration or interest. Conformability aims at ensuring that data and results of the research are founded in contexts and persons not from the researcher perspective (Guba and Lincoln 1989). Although, in the qualitative research process, the data gatherer cares about the superiority and suitability of the data gathering process. For the data to be valid and consistent, it must meet conformability criteria for it to be neutral. This can be achieved by promoting consistency of the data if it is from original sources Guba and Lincoln (1989 p. 243).

Lastly, this work is reliable because it follows a subjective social research approach that the topic was chosen because it was important for the researcher.

3.4.2 Ethical Considerations

Ethics and safeguarding the respondent's confidentiality in qualitative research is important, and was assessed at each stage of the study research process. This would be performed each time before going out to a potential respondent. During the course of the research, it was ensured that ethical issues pertinent to the research were taken into consideration. This required notification of respondents and explaining to them about the research and why they were taking part. This statement involved explaining the aim and purpose of the research or interview together with reasons why the data was being collected. This was done before they gave their responses to the questions.

Getting accessibility to informants, involved acquiring vital knowledge on ways in which ethical principles impact on the research process, plus the ethical problems that might appear. These were realized when getting accessibility to ICT experts and respondents representing public authorities. While the questionnaire was administered through personal meetings, the choice of the participants relied on the quadruple helix model (Lundberg 2022) to make sure that all the stakeholders were represented in the study.

The principle about whether there is harm to respondents, was considered and engaged researchers working on issues associated with privacy as well as informed consent, and assessed the ethics plus the protection of the respondent's privacy at each stage of data collection. The recordings were treated with confidentiality and after interviewing, the recordings were stored into an encrypted storage device and then deleted from the portable device. The recordings were later transcribed and individual data de-identified. The audio recordings interview data and transcriptions were allocated a pseudonym.

All respondents could pull out from the interview at any particular time even during the course of the interview. While interviewing, it was ensured that terminologies plus the themes offered to the respondents in the process of interviewing was the similar throughout the discussions. However, probing enquiries was a means of ensuring that the research methodology was consistent during the research process. Preparing the memos was also beneficial in reviewing the study findings and its validity.

Data comparison and preparation memos about codes plus their definitions is beneficial in ensuring that there is not a drift in the code definitions, or a change in the meaning (Creswell 2009 p. 176). It was ensured that the code meanings were similar when coding the transcript, and I had to write memos during coding. By applying a thematic analysis alongside putting down notes in the tables enabled utilization of similar codes in order to ensure that there was dependability in the application of codes.

3.4.3 Researcher's Self Reflection

The application of the qualitative research method poses some challenges to the researcher because of its subjective nature. My major objective was to meet the phenomena with different, "naïve" eyes as well as setting individual experiences and biases aside. I tried to avoid bias or personal influences by making sure that my ideas, background by asking add on questions that were aligned with the study purpose and design. To gain deeper insights on factors influencing digital equity, perceptions of the respondents were very important. However, I as the researcher had to consider individual prejudices and maintain a distance to the topic while carrying out the interviews and data analysis without any bias.

To maintain neutrality during the interview, I continuously jotted down notes of my comments and those of the participants. This was to make sure that these could not be misinterpreted in any way or at any one point my views would dominate. After the interview, I kept editing my subjective comments and those of the respondents. During the data analysis, I kept asking myself questions like what I knew about digital health equity in comparison to what the participants had answered. This was intended to keep my position neutral so that I could easily identify my views and thoughts from those of the respondents. This process continued during the transcription of the interviews.

Hence, I maintained an independent position during the research process and this was individually recognized while putting into consideration the biases that could have arisen during the research process because of the subjective nature of the qualitative research methodology. However, the likely impacts during the discussions as well as in the analysis course may not totally be dismissed. Furthermore, as certain interviews covered obviously less than one hour it was more likely that the results could be influenced by my views which I tried to avoid.

4 Results and Discussion

4.1 Introduction

This chapter aims to answer the main research question of the research as a consequence, it is divided into two major sections. The first section analyses the demographic data of the participants and Norway. This is done to fulfil the research questions b and c in the introduction. The second main section attempts to answer the main question of the research and as a consequence, is divided into components. The initial component presents the results gathered through interviews with the 8 respondents. These are then thematically analysed to gain a deeper understanding of the perceptions of the respondents and factors that impact on digital health equity. Different themes are identified in order to increase the researcher's understanding of social determinants of health that impact digital health equity. This section with its corresponding components is followed by the discussion comparing our findings with previous studies to clearly identify the contributions of this research and prove its validity.

4.2 Section 1

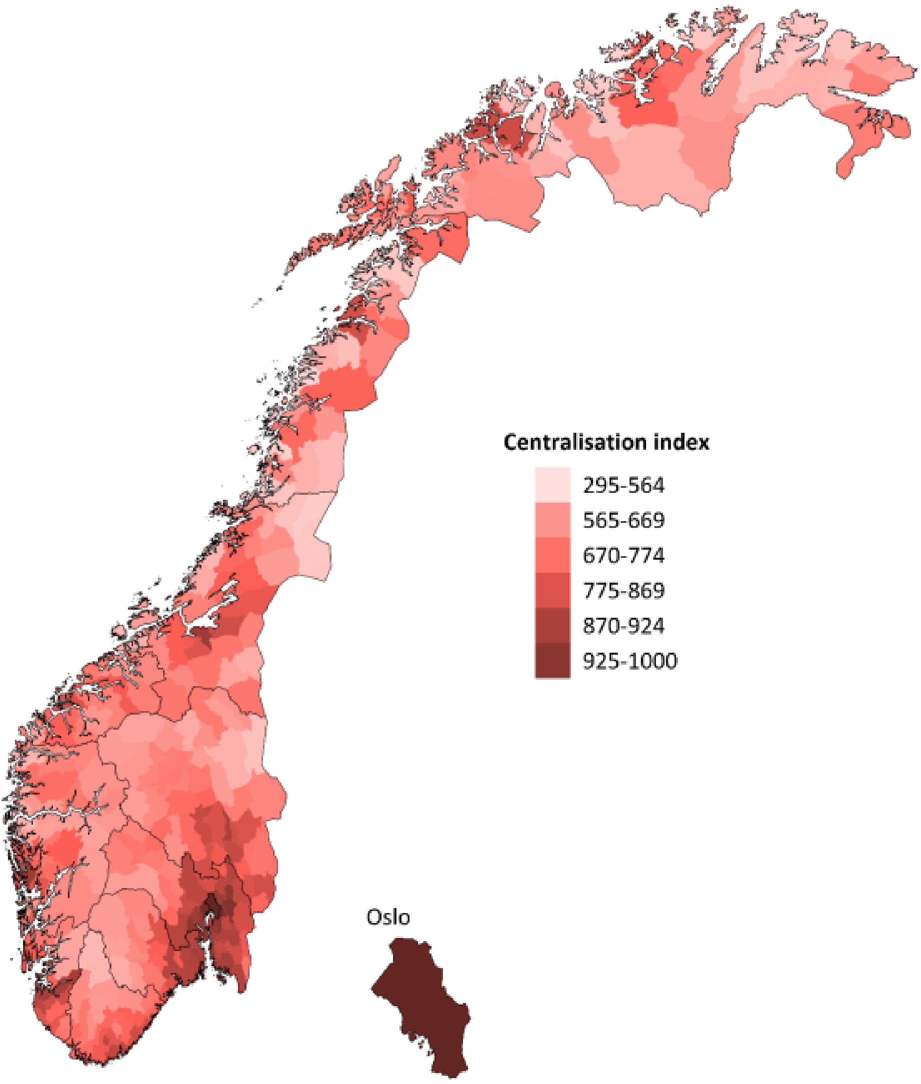
This section presents the demographic data of the respondents and Norway to answer the research sub-questions B and C. To address the issue of the disadvantaged groups, the research discusses the issue of equity in digital health in relation to the dis -advantaged groups as explained in accordance to equity. In this section, the DHEF is used as a reference point and guide. The topic of the elderly is followed by another disadvantaged group the immigrants. The same procedure is used for referencing the DHEF as far as digitalisation and equity are concerned in Norway.

4.2.1 Disadvantaged groups in digital health services

The disadvantaged groups refer to people who may have trouble accessing and making use of digital tools to a number of factors including health, economic, cultural or social factors. According to Kaihlanen et al. (2022), the key disadvantaged groups include the elderly, immigrants, the unemployed, and mental health service users, to mention but a few (Kaihlanen et al. 2022). These people may have been disadvantaged in accessing digital tools because of increased digitalisation such that they cannot afford digital tools because of the costs involved. This disproportionality happens because social stratification in society which is at times a consequence of socio-economic status.

4.2.1.1 Social stratification, access to resources,

The issue of Geography is not an influencing factor in accessing health services Norway’s density of doctors is among the highest in Europe, with 4·7 practising physicians per 1000 inhabitants (Clarsen et al. 2022). Despite the scattered population as shown in the Figure below, Norway performs well in organising and delivering health care to its population, compared with other high-income countries (Clarsen et al. 2022).



(Clarsen et al. 2022)

Fig. 9 Map of Norway showing the 11 counties (black borders) and 356 municipalities (shaded areas).

In the figure above, the background shade of each municipality reflects its degree of population centralisation, based on an index of all municipalities from the least centralised (Utsira -295) to the most centralised in Norway (Oslo - 1000)

Therefore, although residents are sparsely populated as shown in the figure above, the distribution of health workers across Norway might have been important in preventing geographical differences in health (Clarsen et al. 2022). Therefore, under the DHEF, the issue of Geographical location is not an influencing factor that would have led to digital health inequity. The country has enough doctors who provide treatment to its population.

4.2.2 Elderly

The second group of less advantaged people that are disproportionately affected by digital health are the elderly. These are in vulnerable positions in society and this makes them to be affected by use and access to digital health tools as solutions to accessing health care. The elderly in Norway face a number of challenges, their challenges, range from various impairments to lack of knowledge to use or access digital tools for healthcare. This takes place despite having affected by the elderly followed by initiatives for these persons. The DHEF is referenced to illustrate how the elderly fit into this framework and if according to the framework the requirements are met for equitable digital health.

In the context of this research, the estimated population in Norway was 5.4 million in 2020, and according to Capar (2020), the population of the elderly in Norway in the same year was 940,000 - that is, persons over the age of 65 (Capar 2020; Trading Economics, 2020). These numbers illustrate that the elderly constitute 17.4% of the total population in Norway. It is further projected by the Senior researcher, Astri Syse, the head of Statistics Norway, that in just 10 years from today, there will be more elderly people than children (Ellingsen 2020).

The elderly, who are persons from the age of 65 and above face the challenge of ageism, this ageism, unfortunately, makes senior citizens learning curve for digital tools even steeper and further increases the digital divide (Salkowitz 2008). Because the elderly have the shortest history of the use of digital technology in comparison to the other generations that are currently alive, they more often than not, easily get frustrated and decide not to use digital tools altogether (Dimaggio et al. 2004; Ijsselsteijn et al. 2007).

Furthermore, according to research by the "*nasjonalt senter for e-helseforskning*" [Norwegian center for ehealth research], titled "*Målrettede grep for å inkludere flere, sosialt og digitalt*" [Doing social and digital inclusion] an ageing population and the rapid development of digital citizen services mean that vulnerable people fall outside the digital community, therefore it is imperative that senior citizens are included in order to combat issues of loneliness and having the skillset to use digital tools (Lundberg 2022). This has also been highlighted in the study by Tomczyk et al. (2020), who has stated that the elderly have a fear of being laughed at by younger persons while they learn to use new technologies (Tomczyk et al. 2020).

For the context of this study, the elderly have various impairments, which range from visual impairments, essential tremors, Alzheimer's, Parkinson's and dementia that affect the elderly’s use of digital devices. Particularly in the case of Parkinson’s, Alzheimer’s and Dementia, in 2018, over 10 million Europeans had these diseases (Alzheimer's Association 2018). The corresponding symptoms for these diseases are:-

Difficulty managing complex tasks and trouble with problem-solving or reasoning affect critical thinking skills, planning, and organization (Alzheimer's Association 2018). This symptom affects the elderly’s use of digital tools since these said tools are usually complex with a number of intricate flows (Tomczyk et al. 2020).

Struggles with visual or spatial abilities, which means a decline in coordinating motor functions (Alzheimer's Association 2018). The symptom of the decline in motor functions affects the elderly’s handling of a digital device, either by holding it in hand, tapping on a touch screen or typing on a physical keyboard because of essential tremors.

Difficulty with verbal expression (Alzheimer's Association 2018). This verbal expression affects the elderly’s abilities to use voice recognition technologies (Tomczyk et al. 2020).

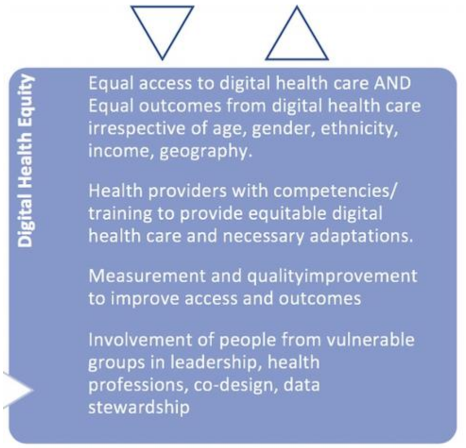
In the case of visual impairments, one out of three elderly experiences sight loss and over 90% of visually impaired persons are people over the age of 65 (Hadi and Abrahams 2015). This makes it challenging to use digital technologies due to factors relating to low contrast, poor spacing or lack of or poor voice navigation of these technologies (Papadopoulos and Goudiras 2005), (Tomczyk et al. 2020).

Unfortunately, the category of the elderly is often not considered in the testing for the ease of use of digital tools, this further hinders and makes them marginalized persons in the use of digital tools. (Tomczyk et al. 2020). But, the “*nasjonalt senter for e-helseforskning*” [Norwegian centre for ehealth] research has projects in place in order to skill senior citizens for inclusion in this digital transformation age. For instance, the centre has the “Collaboration with the pensioners’ association” ‘*Samarbeid med Pensjonistforbundet’*, where they recruited older residents to a national technology ambassador corps (Lundberg 2022). The goal of this collaboration is to recruit over 400 technology ambassadors from each of the 428 municipalities in Norway (Statistisk sentralbyrå statistics Norway 2022; Lundberg 2022). In a direct quote made by Elin Thygesen, the professor in e-health at the University of Agder,

"the ambassadors receive…information and training on welfare technology and get to test VR technology. Then they will share this knowledge with others in their municipalities. Inclusion and participation are at the centre of this project"

(Lundberg 2022).

In relation to the DHEF, a key factor to ensure digital health equity is the involvement of people from vulnerable groups in leadership, health professions, co-design, and data stewardship (Crawford and Sehral 2020). Therefore, the "Collaboration with the pensioners' association" '*Samarbeid med Pensjonistforbundet*' initiative by the Norwegian Centre for e-health research fulfils the aforementioned factor for Digital Health Equity.



Equal access to digital health care AND Equal outcomes from digital health care irrespective of age, gender, ethnicity, income, geography.

Health providers with competencies/ training to provide equitable digital health care and necessary adaptations.

Measurement and qualityimprovement to improve access and outcomes

Involvement of people from vulnerable groups in leadership, health professions, co-design, data stewardship

(Crawford and Sehral 2020).

Fig. 10 The Digital Determinants of health extracted from the DHEF

Evincing from the figure above, a number of factors influence Digital Health Equity, in as far as participation of the elderly are concerned. In addition, the involvement of people from vulnerable groups in leadership, health professionals, co-design and data stewardship is seen as a means to achieve digital health equity.

As Lundberg (2022) asserts, the most important thing is to address challenges which create burdens for the elderly to apply digital tools to access healthcare. She underscores that the elderly should be assisted to apply digital technologies in their homes and in all the activities they undertake. By using digital technology in their homes, the burden will be reduced while increasing responsibility to use technologies in homes of old residents. Instead, there is need to explore ideas and strategies like “digital home help” which can assist them when there are problems with the use of digital technology platforms (Lundberg 2022).

Complementing ideas of Lundberg, the Norwegian center for e-health research developed a “quadruple helix model” (Figure 8) that focuses on integration of different stakeholders incorporating academia, business, public sector and volunteers, the participation across sectors is seen as essential in solving complex societal challenges, the integration of end-users from the start to finish of a project and awareness and contribution of vulnerable people must be considered (Lundberg 2022). This is the same model that influenced the selection of the respondents.

Although the elderly are considered a vulnerable group, in Norway because of the efforts by the “*nasjonalt senter for e-helseforskning*” [Norwegian centre for ehealth], there are initiatives to skill and equip the elderly in this digital age so that they are able to apply digital tools in their daily lives.

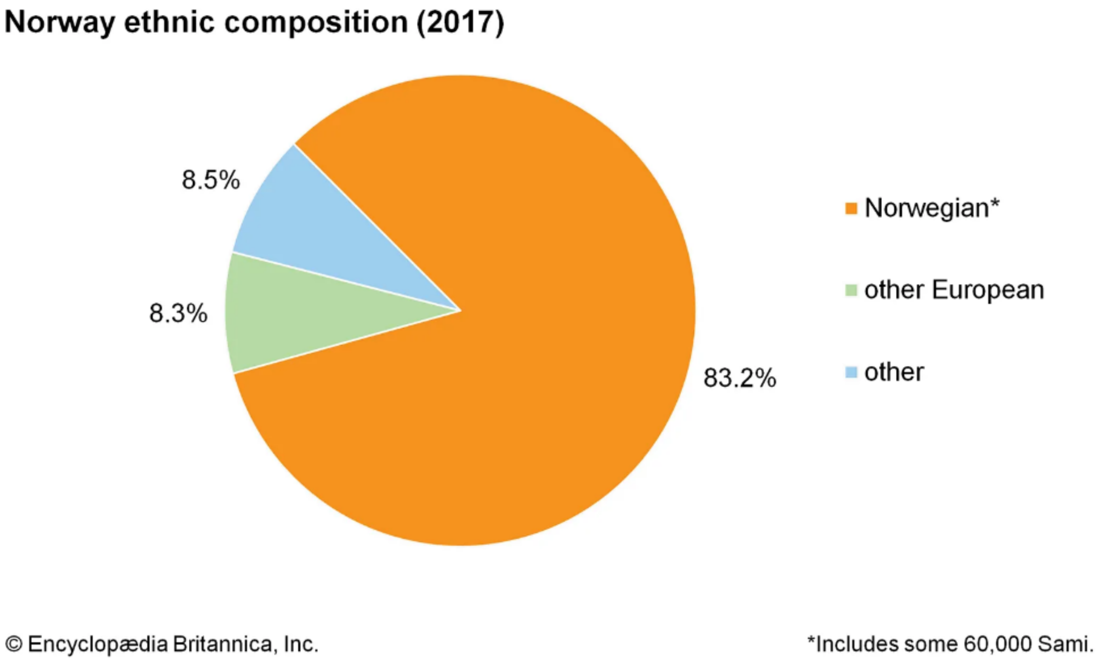
4.2.3 Immigrants

Another group of people that are disproportionally affected by use of digital tools and platforms are the immigrants as vulnerable persons in digital health equity. An immigrant is a person living in another country other than his or her country of birth. This can be for reasons of studies, employment and as a refugee, to mention but a few. Persons that are in Europe but hold citizenship that is not European are referred to as “persons/citizens from other countries”, “non-EEA” or “third country citizens”. This clarification is for the purpose of the section below that refers to these terms interchangeably.

As aforementioned in the literature review, the DHEF created by Crawford and Sehral (2020) highlights the importance of approaching digital health technologies from an ecological perspective. To recap, an ecological perspective means the ways that the use of technology by an individual extends out into (and is shaped by) their social, cultural, and economic position in the world (Crawford and Sehral 2020). In this section, I will demystify the DHEF model presented in the literature review along with relevant immigrant examples for these factors to expound on the inhibitors to the use of digital tools in Norway. This section of the paper will be looking at immigrants' experiences through the lens of the recommended ecological perspective of the DHEF (Crawford and Sehral 2020). This comparison with the use of the DHEF will aid in answering the research question "What is the difference in the use of digital health solutions between advantaged and disadvantaged groups? This question will explore the differences (inequities) the groups face in their use of digital health tools."

As the researcher and an immigrant, I have an experience of using digital tools in Norway. As aforementioned, Norway is an egalitarian society and represents equity and equality. As aforementioned in this research, the estimated 2020 population in Norway was 5.4 million, in 2022, there are reported to be over 819,356 immigrants in Norway (Statistics Norway 2022), (Trading Economics 2020). This illustrates that immigrants constitute 15.1% of the total population in Norway.

The piechart image below is a visual aid to illustrate the percentage of ethnic diversity in Norway as of 2017.



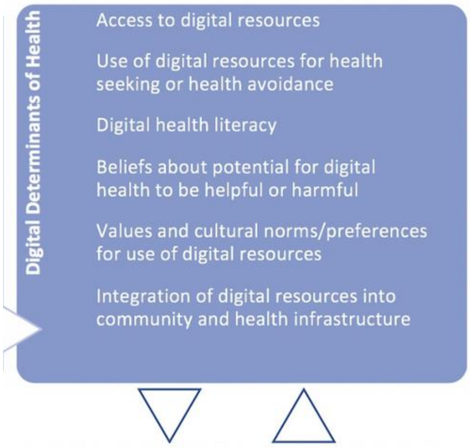
(Encyclopedia Britannica 2017)

Fig. 11 Norway ethnic composition

Norway is an egalitarian society that focuses on an equality with the percentage of immigrants at over 15%.

In reference to the DHEF, among the digital determinants of health is access to digital resources (Crawford and Sehral 2020). In Norway the D number or an ID number is acquired only if you are a citizen or resident of the Nation. Otherwise as an undocumented immigrant, or unregistered person, one does not have an identification number which, as aforementioned is the number that enables one to access the e-services including e-health. Immigrants are able to access health care or public services only after they acquire a national identification number which is received only after 3-6months and before that time the person is "locked out" from accessing the e-services. Therefore, in the period before immigrants receive national insurance and the residency status which comes with an identification number and smart ID. So, for that period of time, one is "locked out" of the digital solutions provided. Therefore, it is challenging for patients to receive medical documents with results after medical consultations.

In Norway, one has to wait the same period of time but to add insult to injury the ID or D number is used with Bank ID. Therefore, a Norwegian Bank account is needed, to acquire a Bank ID. Getting a Norwegian Bank account is a bureaucratic process that takes a minimum of 6weeks. This means a longer waiting time without access to interactive e-services like helsenorge.no. An alternative to access these e-services is to acquire a commodfies private e-ID, this costs 1180 NOK for 3 years. Some immigrants may not be in the most suitable financial position to acquire a Commfides e-ID, therefore they remain locked out of the e-service. Therefore, in relation to the DHEF, the factor of having an ID number or ID affects one having access to digital services. The image below is the Digital Determinants of health extracted from the DHEF (Crawford and Sehral 2020).

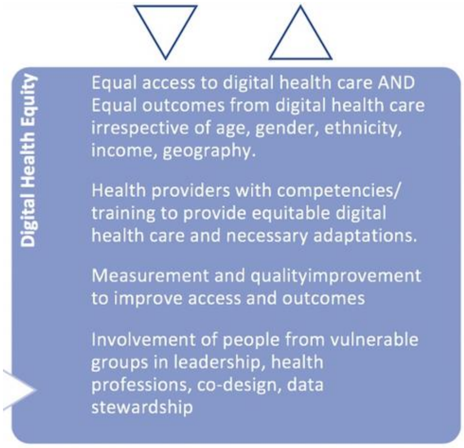


(Crawford and Sehral 2020).

Fig. 12 The Digital Determinants of health extracted from the DHEF, specifically access to digital resources

In relation to the aforementioned factor of having Identification, I would like to mention the section of the DHEF that mentions equal access, to digital health as illustrated in Figure 13 below.

In Norway, residents including immigrants are entitled not to pay medical fees if their usage of public health services in a year go above 2,961 NOK (Norsk Helsenett 2019). Therefore, if one's medical bill goes beyond that aforementioned amount then the immigrant is subject to free healthcare, but it is vital to mention that this exemption is only valid if one acquires an exemption card, this card is acquired by logging into the health platform Helsenorge.no. To emphasise, an undocumented person or an immigrant cannot log in to the Helsenorge.no portal without a BankID therefore they cannot claim this exception card without external assistance. Furthermore, not all immigrants are well equipped with such information of benefits and may therefore shy away from receiving medical help. Furthermore, in case of an emergency, immigrants may be reluctant to seek medical help for fear of costs since to some immigrants the cost of 2,961 NOK may still be too high to incur. This factor is related to the factor of "using of digital resources for health-seeking or health avoidance" under the digital determinants of health as shown in Figure 12 above. Furthermore, it can be argued that Norway confirms more to the factors that positively influence Digital Health Equity



Equal access to digital health care AND Equal outcomes from digital health care irrespective of age, gender, ethnicity, income, geography.

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Measurement and qualityimprovement to improve access and outcomes

Involvement of people from vulnerable groups in leadership, health professions, co-design, data stewardship

(Crawford and Sehral 2020).

Fig. 13 Factors that influence Digital Health Equity

To delve further into the health barriers immigrants face in endeavouring to access medical attention in Norway, unregistered immigrants in need of medical care are limited to only emergency care services. For ease in accessing health services, one needs to register with a “house doctor” one cannot have a personal registered house/ home doctor without an ID or D number. Therefore, when an immigrant needs to access medical care and attention they are left at the mercy of their nearest health provider to agree to see them because they are not officially registered with that, or any health provider for that matter.

Statistics usher in the factor of race and inequity in digital health. Some digital health applications created predominately focus on the population that is the “social norm”, leaving out persons that are not the norm. In this case “social norm” refers to persons of Caucasian descent with whiter skin tones. This creates an imbalance in persons of colour in receiving or making use of digital health tools that are centred around skin conditions. For instance, a popular skin health tool, Dermtest that is used in Europe that detects early skin melanoma falls prey to this inequity. Unfortunately, the studies of skin in this health tool have predominantly been done on persons with whiter skin which leaves persons of colour at a disadvantage in using the digital tool DermTest. Upon conducting an inquiry with the CEO of DermTest, he clarified that the in fact only detected early melanoma in white skin and not darker skin tones, since more data is available for the whiter skin tones.

4.2.4 Loneliness of the Elderly and Migrants

This section merges the topic of the elderly, immigrants and the issue of loneliness that affects both groups. According to the Norwegian centre for e-health research, there are a number of initiatives for the elderly, these initiatives are to ensure that the elderly receive the skill set they need for this digital age and combat issues to do with loneliness that digital tools can potentially solve.

Despite the centre acknowledging that vulnerable peoples' needs have to be addressed, the centre mostly acknowledges senior citizens as vulnerable (Berntsen 2021; Lundberg 2021). This assumption is made because all the initiatives and scope of research done by the research centre focus on vulnerable people such as senior citizens, and people with chronic conditions like diabetes but not immigrants. What's interesting to note though, is that on the issue of loneliness, the Norwegian research centre for e-health acknowledges that immigrants are affected by loneliness, although, just the study and solution being done so far are for and on senior citizens in Arendal (Berntsen 2021). Although both senior citizens and immigrants are threatened by loneliness and other Health issues the University of Agder has only developed the aforementioned solution for the elderly in Arendal (Berntsen 2021; Lundberg 2021). The concern that arises in the aspect of loneliness among disadvantaged groups is 'What about the latter, what initiatives or thoughts does the centre for e-health research in Norway have for immigrants?' The latter in this case being immigrants.

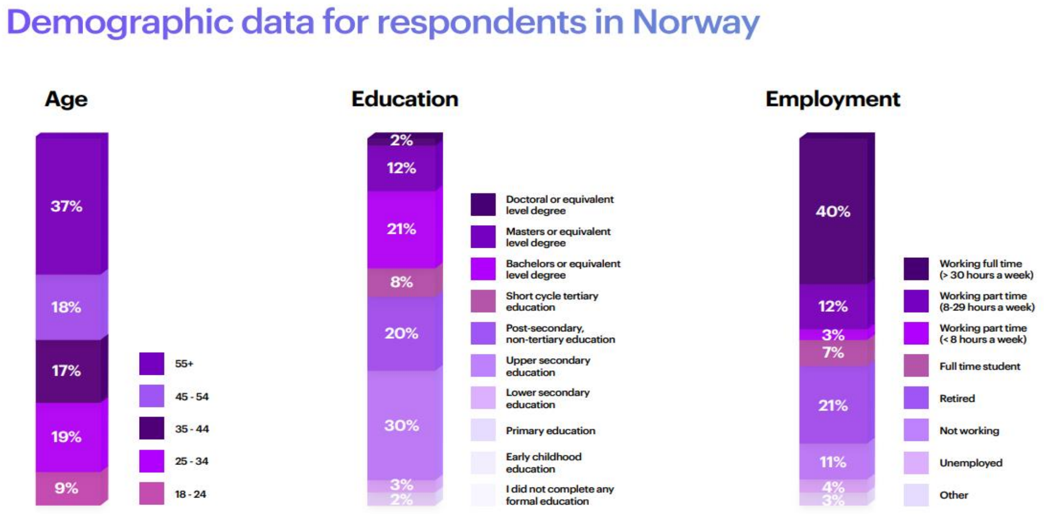
4.2.5 Acceptance

This section of my research will focus on the factor of acceptance in the use of digital health tools in Norway. The specific research question this section will be aiding to answer is "What is the attitude of users to digital health interventions? This research question will use the technology acceptance model UTAUT2 and the Delone and Mclean model to understand the quality, intention and inhibitors to use."

First, I will look at the survey conducted by Accenture in 2021 titled "Digital adoption in healthcare: Reaction or revolution?" (Accenture 2021). The 2021 Accenture Health and Life Sciences Experience Survey commissioned almost 11,823 people from the United States, Italy, United Kingdom, Norway, Australia, Finland, Singapore, Japan and Spain in order to get data about their attitudes towards the healthcare system (Accenture 2021).

This survey revealed how the healthcare experience is changing in terms of access, equity, service experience, digital technology adoption and trust (Accenture 2021).

The survey included people from the aforementioned countries, with 648 of the respondents coming from Norway (Accenture 2021). Forty per cent of the total sample represents patients with current conditions in the following therapeutic areas: Oncology, Cardiovascular, Respiratory, Immunology, Gastroenterology and Neurology. It is important to note that of the demographics recorded in this survey, the aspect of ethnicity, and immigration status were not recorded but age, employment and level of education were recorded as shown in figure 14 below.



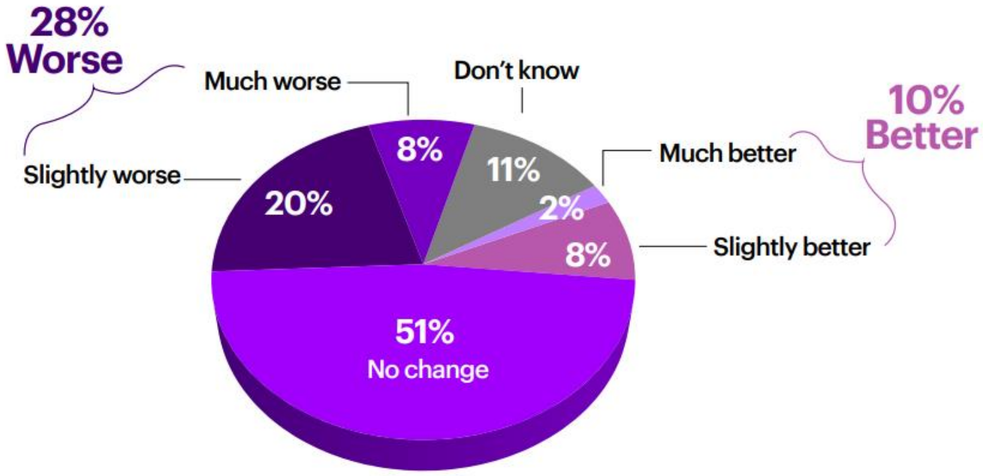
(Accenture 2021).

Fig. 14 Demographic data for respondents

The demographic data for the respondent's ages in this research was 37% of the respondents were 55+ years, 18% were between the age of 45-54, 17% were between 35-44 years old, 19% were between the age of 25-34 and 9% were between the age of 18-24 (Accenture 2021). The employment demographics were as follows, 40% of the respondents which was the majority were working full-time, full-time being 30+ hours of work a week, followed by 12% of the respondents that were working part-time (8-29 hours a week), 3% worked less than 8 hours a week and 7% of respondents were full-time students with 21% of the respondents retired, 11% not working, 4% unemployed and 3% falling under the categorisation of other (Accenture 2021). The education demographics was the majority of the respondents completed primary education with 30%, followed by

21% of the respondents that achieved a bachelor's or equivalent level degree, then 20% of the respondents that completed lower secondary education, the least number of the respondents were on the opposite ends of the spectrum with 2% either with a doctoral degree or equivalent or did not complete any formal education (Accenture 2021).

According to the survey results, the responses illustrated that Norwegian healthcare handled the pandemic well compared to other countries, and often provided critical care at difficult times, this was because of the existent and hastily setup Helsenorge platform and the readiness of the healthcare providers and patients to use these tools (Accenture 2021). The question the respondents were asked was "Overall, has your access to healthcare been better or worse since the onset of the COVID-19 pandemic, or has there been no change?" From the results below, 51% of the respondents saw no change, and 20% responded that the healthcare provided was slightly worse.



(Accenture 2021).

Fig. 15 Respondents access to healthcare before the COVID-19 pandemic.

The figure above illustrates the proportion of respondents when they were asked "Overall, has your access to healthcare been better or worse since the onset of the COVID-19 pandemic, or has there been no change?" (Accenture 2021)

Even though telehealth solutions were available in Norway before the pandemic, the uptake of e-consultations among general practitioners was slow (Berntsen 2021). In an interview for the Norwegian centre for e-health, Lene Lindberg expounds on this by saying,

> “…In January 2020, about one-third of all GPs offered e-consultations (text, video and telephone), but this comprised only 3.1 per cent of all consultations. Soon after the first lockdown, e-consultations experienced a boost, enabled by factors such as technology readiness, competence among health workers and financial incentives. Within the next months, almost all doctors had started to use e-consultations…”

(Berntsen 2021).

According to primary data collected by Accenture (2021), the use of the aforementioned virtual consultations more than doubled during the pandemic which confirmed the demand for convenient and fast care. This, therefore, illustrates that although the digital tools were ready, the spark needed to ignite and hasten the actual use of these tools was the COVID-19 pandemic.

The pandemic furthermore accelerated the implementation, use and entire shift in the use of digital tools to receive and use health services (Accenture 2021). In addition, during the pandemic, the health portal Helsenorge.no was developed rapidly which enabled data-sharing across health units (Berntsen 2021).

The Norwegian Centre for E-health Research 2021 produced a status report for the World Health Organization (WHO) on the use of digital tools in Norwegian primary health care during the Covid-19 pandemic and in an interview by Lene Lindberg (the Senior Adviser, Norwegian Centre for E-health Research) about the report, Lindberg mentioned that although these tools were used, it is imperative to understand how these digital resources for health like video consultations, self-monitoring, sharing of health data and much more, could and can contribute to better health services (Berntsen 2021).

4.3 Section 2

4.3.1 The Findings

The research identified that social determinants of health whose disproportionate distribution leads to digital health inequity were the major elements that impact digital access to especially the disadvantaged groups. The findings indicate that the representative sample gathered following the quadruple helix model to obtain a deeper and clear understanding health equity and what are the social determinants of health that disproportionately affect disadvantaged groups like minorities, low incomes earners, immigrants and senior citizens.

Keeping focused on the research question of this research which is, exploring the factors that affect digital health in Norway. The research focused on obstacles and facilitators of digital health equity, initially the thematic analysis identified nine themes, which were narrowed down to six these were access to digital technology, financial resources, applying digital tools for health, digital health training, underlying beliefs on digital health and causal values in digital use. To obtain an overview of the data that was gathered through personal semi-structured interviews, notes were transcribed on the interview questionnaire of each respondent. It involved going back and checking the information that was gathered from the interviews, which helped to shape the themes and make them more focused.

4.3.1.1 Identifying Barriers to Digital Health Equity

Broadly, the findings of interviews indicate that inequitable access to digital technology was tied to disadvantaged groups. This includes the socio-economic status of respondents with ethnicity and race. Access to technology is seen as one of the most important factors that impact on digital health equity with disproportionate distributions leading digital health inequality. About 90% of the participants mentioned that their use of digital health tools was affect by low knowledge in the use of digital tools (Helsenorge) and understanding how to use it.

Furthermore, the respondents made it clear that the use of the digital health tools - Helsenorge was hampered by knowledge in the use of the devices needed for to access digital health services. They mentioned there is no proper training and support by the authorities in application of digital tool - Helsenorge to access health services. Their concern was that accessing health services through the digital tool - Helsenorge was not considerably supported by any forms of training to provide the necessary knowledge on how to use it.

About 80% of the respondents stated that the use of the digital tool - Helsenorge to access health services required high levels of digital skills than those that are ordinarily needed to use a smart phone. Most of the participants remarked that they are hampered by poor computer skills despite possessing some digital devices.

4.3.1.2 Access to Digital Technology

For some of the participants who indicated that they were experiencing income constraints, they remarked that they cannot even afford digital tools like a phone, computer and internet connectivity affordability was somewhat cumbersome which has a considerable impact to their access of digital health services. 20% of the respondents were above 65 years of age and felt that the use of the digital tool - Helsenorge hindered them from accessing health services freely because they required higher digital skills which they do not possess. They also stated that they lack the digital tools necessary to access digital health such as computers, smartphones which they also mentioned are delicate to keep.

"We are of a different generation, these computers are delicate to maintain and they require a lot of skills, we need more guidance and training in using some of the digital tools so that we can take advantage of digital health services but, some of us have demanding schedules, and conditions relating to aging such that there is no time or space for such training".

10% of the respondents responded that they did not even have time to learn new digital skills just for the sake of accessing digital health services. It was just a burden on them by changing the system they were accustomed to accessing health services. The system they were accustomed to is either a walk in service or calling the health provider to acquire an appointment promptly. They remarked that even if they had time to, COVID-19 had made the whole situation hard as they needed to maintain minimum physical contact. This has made it complicated for participants to attend training and skilling in the use of the digital tool - Helsenorge to access digital health services.

Participants especially from disadvantaged groups, mainly immigrants explained that they could not easily access digital resources (Helsenorge) because digital resources (Helsenorge) require one to have official documents to access the service -Helsenorge. For one to be able to access official resources in Norway, they must have a Bank ID, to acquire this Bank ID one needs official documents for citizenship or legal stay in Norway. This requires one to have D number or an ID, which is only acquired by a citizen or resident and not easily available for immigrants in Norway until they have legalized their stay. One of the respondents described that as immigrants in Norway they faced language challenges to use of digital health services especially Helsenorge. Even obtaining an interpreter is a very complicated and expensive exercise because one cannot risk exposing their vital personal data to someone else and in some cases risk exposing themselves as undocumented immigrants.

4.3.1.3 Financial Resources

Some participants who described themselves as low income and unemployed indicated that they were unable to obtain the necessary digital tools (smart phone, computer or mobile internet) for digital health because of the strain in finances. Even some who may possess some of those digital tools their functioning is still hindered by financial strain such that they cannot maintain the costs involved. The interviews indicated that income has a negative impact on digital health equity because some of the respondents indicated that they are at times unable to access digital health services. One of the respondents indicated that digital equipment most times develops problems and needed routine repairs which could not be afforded because of low finances.

One of the respondents remarked that: "*My computer broke down before COVID-19 and since then I have not been able to replace it because of lacking financial resources. It has become very hard to find work where I could have earned some money to repair or change it, this has made it difficult to access digital health services".*

Furthermore, respondents who described themselves as being unemployed indicated that digital health was impractical because most of the times one would only use Helsenorge when in a settled situation than when they are insecure and unstable. The stated that at time the connections are unstable depending on the particular location.

4.3.1.4 Privacy concerns

Regarding application of the digital tool - Helsenorge for health seeking, the participants indicated that they were at times hampered by financial resources. As indicated in the conceptual framework and in the aforementioned factor, financial resources are a major factor that impact on digital health equity because the most disadvantaged groups in society cannot afford some of the digital tools that are needed. Participants also, mentioned that issues of privacy curtailed their willingness to use digital tools to seek medical help. The use of digital tools was seen as exposing them and their medical information to everyone that could access their medical information digitally. Seeking medical help, acquiring appointments or mental history data through the digital tool Helsenorge was seen as an invasion of privacy because majority of the respondents indicated that they were afraid of revealing their medical data on what they consider to be an open network. The respondents expressed this concern by mentioning that they do not know who is at the other end receiving their data or who has viewed their personal data without their consent.

"I do not need to expose my private information to everyone, even people I have never met, I feel that medical information is private and should be between the patient and the doctor, although during COVID-19, I used the digital resources to seek medical help, I still don't feel comfortable about it".

Majority of respondents indicated that they preferred the traditional face- to-face meetings of seeking for medical help instead of using digital devices. Digital means of seeking for medical help were broadly seen as exposing their medical data to even all those who are not concerned. Almost 70% of the participants indicated that it was an intrusion in their private lives to compel them to seek health services through the national digital health network. However, some of the participants credited the use of digital health resources for being convenient and avoiding unnecessary movements to make appointments in person directly with doctors to view their medical results and history. Participants indicated that person to person with doctors was much better as they were able to communicate to the person who understood their medical problems. This also, helped to curtail challenges of communication as some people from disadvantaged groups cannot communicate effectively through digital platforms.

4.3.1.5 Digital Health Training

While choosing themes, digital health training was chosen because it was seen as a means of acquiring, processing and comprehending health information from digital data that can be applied in making relevant health choices. As aforementioned, digital training was a concern for the respondents. Participants indicated that the use of the digital health tool – Helsenorge and digital health infrastructure was hampered by lack of knowledge on how to apply digital data to make right health choices. Training on how to apply digital data would benefit them to apply digital knowledge in health decisions. Participants indicated that this could be applied through learning the required skills on how to apply the digital data to health issues.

"I feel it is just a bother to use digital tools to access health care because I have little knowledge or training in the use of these computers and electronic devices. Instead, I prefer visiting the doctor on a personal basis because I don't see how he will examine me through a phone when he needs to listen to what is in my stomach or my pulse rate?"

Training was mentioned by participants as one of the major barriers limiting their use and acceptance and is linked to a sub-theme of digital health literacy. Participants mentioned that one of the barriers to application of digital tools was insufficient knowledge on how to apply them. Knowing how to obtain knowledge from digital data would help them to see what was missing or wrong and ask what might have gone wrong to improve their understanding.

4.3.1.6 Underlying beliefs on Digital Health

80% of the participants raised an issue of eavesdropping on digital health data that is communicated through digital health platforms. Participants could not trust the use of digital platforms like when they are directly dealing with doctors. Most participants said that it was hard for them to discuss personal matters online without seeing the person they are communicating to especially when there are some other people listening to your story, this is in particular using the Helsenorge's Mental Helse's chat service sidetmedord.no. Participants also raised issues of making serious mistakes in the information that might lead to loss of their lives as that mistake may not be detected immediately. The issue of making wrong inputs and getting wrong answers through digital platforms dominated the theme of beliefs on digital health. Respondents of over 65 years and above stressed that it is very possible to make a mistake via digital platforms, which might cost your life because the doctors may prescribe a wrong drug based on wrong information. As a consequence, underlying beliefs by participants is a barrier to use of digital health platforms because of their perceived beliefs.

4.3.1.7 Causal Values in Digital use

90% of the participants indicated that they favour local face-to-face discussions with doctors instead of accessing services through digital platforms. They further indicated that digital platforms do not offer services similar to human beings like doctors and nurses insinuating that better treatment is through human interaction. Some of the respondents who happened to represent immigrant groups and affected by language barriers indicating that they can explain their sicknesses better through personal gestures, facial expressions, plus touches.

They indicated that expression of emotions are important in treatment and these cannot be provided by digital health platforms in particular Mental Helse's chat service sidetmedord.no. Hence, utilizing non-verbal communication would be undermined by digital health services which are inefficient compared to personal treatments by physicians. Furthermore, the interaction with the health care expert was regarded as less personalized in the digital health services than the face-to-face services. Some participants responded that offering services remotely requires a lot of time longer than a face to face service, which alluded to the fact that they preferred physical services. Some older adults in the population sample indicated that accessing services through phone calls would lead to mistakes and they were worse than personal to persona services because they keep the person waiting on the line.

Most of the participants responded that they preferred their conditions checked systematically by the doctors instead of using the digital tool Helsenorge to diagnose their conditions through the use of their medical history. To reiterate the earlier factors that arose, most of the participants indicated that their skills in the use of digital platforms especially on smart phones and computers was very poor and they disliked them. Disconsolately, digital health services were seen not to be having any added benefit to the service users' than person to person services.

4.4 The Discussion

This study has examined the factors that influence digital health equity especially among the disadvantaged persons who utilize digital health services (Helsenorge). This has led to an imbalance in use of digital tools that has been amplified by the COVID-19 pandemic. These disparities are a consequence of digital health innovations intended to improve health results, patient safety and experiences that have led to unintentional results for socially side-lined groups leading to inequity in digital health (Barros et al. 2018). This has created a digital divide between those who have access to the technologies and those without.

This study has offered valuable information by providing pertinent data why some individuals are impacted disproportionately leading to health disparities in terms of accessing digital tools (Beaunoyer, Dupere and Guitton 2020). The findings of this study are corroborated with findings of other studies that disadvantaged groups face problems with several social determinants of health that are determinants of digital health. The most noticeable barriers to utilization of digital health facilities entail various challenges associated with accessibility to digital assets.

Overwhelmingly, the findings of the study irrespective of the age or group participants' responses indicated that their abilities were inadequate to access the digital health services. They did not have skills or enough training to use digital health platforms. Most of these respondents were either immigrants, senior citizens, the unemployed or the low income earners (Jeffrey et al. 2019). In sharp contrast to the previous studies (Selsky 2013; Jeffrey et al. 2019), this study indicates that persons who might have good digital expertise may be able to use digital tools but not able to access the digital health tool Helsenorge. This was mainly because of lack of training and knowledge on how to use digital tools, lack of access (without a bank ID) poor usability and little understanding of the digital health vocabulary that would lead them into mistakes. This finding is in support of the findings of other studies, which indicate that challenging vocabulary in the digital health services is a barrier to access and acceptance of digital health services (Acharya 2016; Jeffrey et al. 2019; Yoon and Huang 2005).

Furthermore, this study has shown that deficient digital skills were frequently connected to other issues such as access to digital technology and access to services. Despite other studies support for the development of mechanisms to promote digital access (Reiners et al. 2019; Sakaguchi-Tang 2019), there is still inadequate support. Some societal members like immigrants are hampered from accessing health care through digital tools because they lack a Bank ID, as aforementioned. The Bank ID is acquired only if you hold a bank account in Norway, to get a bank account, one needs a D number or an ID number which is acquired only if you are a citizen or resident of the Nation with alot of underlying red tape. Therefore, a Norwegian Bank account is needed, to acquire a Bank ID. Getting a Norwegian Bank account is a bureaucratic process that takes a minimum of 6weeks, this process can take up to 7 months. This means a longer waiting time without access to interactive e-services like helsenorge.no. An alternative to access these e-services is to acquire a Commodfides private e-ID, this costs 1180 NOK for 3 years. Some immigrants may not be in the most suitable and conducive financial position to acquire a Commfides e-ID and remain locked out of the e-service.

Then as an undocumented immigrant, or unregistered person, one does not have an identification number or D number. It is this number that enables one to get a Bank ID that enables one to access the e-services including e-health. In Norway, one has to wait to receive the ID which is used with the Bank ID digital system.

Therefore, in relation to the DHEF, the factor of having an ID number or ID affects one having access to digital services. Thus, digital health equity in Norway is impacted by economic, cultural and social conditions that hinge on race and inequity in digital health. Some digital health applications created predominately focus on the population that is the "social norm", leaving out persons that are not the norm. In this case "social norm" refers to natural citizens of Norway.

Furthermore, the findings of this study are corroborated by other studies (Berry et al. 2016; Liberati et al. 2021) that respondents mainly faced that communication-associated weaknesses that prevented their use of digital resources for seeking health care services. Communication weakness in this case refer to language barrier, the tool Helsenorge is primarily in Norwegian. Because of this language barrier, the digital health service has not yet been considered to be capable of meeting multifaceted service requirements. This leads to digitalization challenges particularly among those who are most vulnerable that would require patient-expert person to person contacts. The findings of this study further complement these arguments by showing that interaction challenges in the digital services impact on different service users with diverging challenges. Khan and Hoque (2016) also observed that the application of digital health resources may cause insecurity and lead to privacy problems.

Nevertheless, the findings of the study further indicate that the utilization of digital services needs more digital resources that ensure confidentiality whenever the service is utilized. This study has indicated that privacy plus confidentiality concerns might be particularly evident for the persons who are incapable of using the digital health service – Helsenorge. Hence, the study stresses that face-to-face-health services are usually appreciated and preferred than the digital services. Like in previous studies (Helspar et al. 2017; Hepomeni et al. 2021), some respondents admitted that they have a low enthusiasm towards digital healthcare solutions because of issues of privacy.

Therefore, it appears that awareness of digital services as well as their potential to support health plus well-being may not yet appear to reach everybody. Furthermore, there is still need to improve digital health services through strategies like increasing physical accessibility, digital expertise and social support together with improvement of infrastructures that can reduce digital health inequities. These would help to promote the utilization of technology and digital services while removing barriers that prevent the most marginalized from accessing health services through digital platforms (Nguyen, Hargittai and Marler 2021).

4.4.1 Validity and Reliability of the Findings

This section tries to answer the question whether the findings of the study exploring the factors that impact digital equity in Norway are dependable? To prove that the findings of the study were credible different techniques are applied to prove credibility. These entail prolonged engagement, persistent observation, peer debriefing, negative case analysis and progressive subjectivity. The researcher in this study applied the prolonged engagement technique through involving in semi-structured interviews. The researcher was present and had a direct encounter with respondents instead of using a telephones or email to interview the participants. This made the answers given in the responses more credible because better insights on the factors that impact digital health equity of the respondents were directly gained. This made the answers more credible as the researcher was able to ask extra questions through face-to-face interviews. Personal encounter with participants was an opportunity to create trust that ensued into answering the interview questions truthfully. Thus, it is believed that the findings of this research are credible.

This mode of acquiring findings enabled the researcher to gain a deeper understanding into the impediments that lead to digital health inequity among disadvantaged groups. These impediments were identified to be a consequence of poor access to digital technology, financial ability, application of digital tools to seek health, lack of knowledge to use digital health platforms as well as underlying beliefs and preferences, which is also a result of the socio-economic status of respondents with ethnicity and race. This provided the researcher with deeper insights on what causes digital inequity in Norway.

Applying the peer debriefing technique, the results of the study were seen to be credible up to at least 80%. This is because after compiling the research results, the researcher asked 6 of the respondents if they believed that what presented in the semi-structured interviews covered what they considered to be the real factors impacting digital equity among people in Norway especially the disadvantaged groups. The 6 respondents that were debriefed confirmed that those factors given as answers to interviews questions were indeed representative of the barriers that led to digital health inequity. Furthermore, the findings of the study are transferable to other countries with similar contexts like Norway that experience disproportionate access to the digital health tool Helsenorgeespecially after the inception of COVID-19.

4.5 Conclusion

This chapter has presented the findings of the study in two different sections. The first section has presented the demographic data and the issue of digital health in Norway. The second section presents the findings from the semi-structured interviews. The findings indicate that despite efforts by the authorities in Norway to provide digital health equity, not all those among its society have been able to benefit from its digital health equity policy.

Overwhelmingly, the findings of this study indicate that digital health equity is impacted by factors that emanate from failure of individuals to access digital resources, knowledge on their use, financial restraints, underlying beliefs and causal values. Furthermore, the findings of this study indicate that disadvantaged groups are the most affected by this digital health imbalance as they cannot access digital health services on Helsenorgebecause of the aforementioned factors. That is why most of the respondents are in favour of face-to-face means of seeking health care instead of using digital platforms.

5 Conclusion and Future Research

5.1 Introduction

This last section of the thesis ties the whole argument together by presenting the key results on how the objectives of the study were achieved through answering the main research question. As a consequence, it presents the chapter summary and the findings in relation to the objectives of the research questions. This looks at the theoretical contributions of the study and its practical contributions. Based on this, some study limitations are presented. This chapter ends in a wider perspective including the author's future research proposals.

5.2 Purpose and Research Question

The foundational research question guiding this thesis was to gain deeper insights into what leads to digital health inequity in Norway, a country that has an egalitarian culture. The purpose was to acquire better knowledge of the digital health equity "What key factors impact equity in digital health in Norway?" To implement this purpose, the thesis entails the subsequent research questions:

a) What are the factors that affect equitable access to digital health in Norway?

b) What is the difference in the use of digital health solutions between advantaged and disadvantaged groups?

c) What are the immediate and long-term impacts of digital health applications on equity in healthcare?

The findings of the study overwhelmingly indicate that the foundational research question was answered. The factors which influence equity in digital health in Norway are the causal values in digital health use, underlying beliefs on digital health, digital health training, access to financial resources and access to digital health technology. These factors impact on equity in digital health in Norway because they are unevenly distributed among the Norwegian society especially disadvantaged groups.

The subsequent research questions were answered through the literature review and section 1, of chapter four. They indicate that there is a difference in the use of digital health tools between the advantaged and disadvantaged groups as well as short and long-term impacts of digital health applications.

5.3 Summary Conclusions

Chapter One: Presented the main research question of the study and shaped the argument of the research that there has been inequity in digital health in Norway especially with the inception of COVID-19.

Chapter Two: The discussion in this section presents the different theoretical frameworks and it indicates that the framework which captures the factors that impact digital health is the DHEF from which the conceptual framework is derived.

Chapter Three: Discusses the methodology of the study. This section explains the methods applied and it justifies the methodology as an exploratory qualitative case study methodology. The qualitative research methodology relying on semi-structured interviews is deemed most relevant for this study. The qualitative research methodology employs semi-structured interviews, which provide rich descriptions through open-ended questions enabling a chance for the respondent to reply in their own words making the responses valid as well as a better understanding of the social setting.

Chapter Four: Part 1. Presents an analysis of demographics of Norway to answer the subsequent research questions. Part 2. Presents the analysis of the interview questions, findings and summarizes the important research study conclusions. The findings indicate that despite efforts by the authorities in Norway to provide digital health equity, not all those among its society have been able to benefit from its digital health equity policy.

Overwhelmingly, the findings of this study indicate that digital health equity is impacted by factors that emanate from failure of individuals to access digital resources, knowledge on their use, financial restraints, underlying beliefs and causal values. Furthermore, the findings of this study indicate that disadvantaged groups are the most affected by this digital health imbalance as they cannot access digital health services because of these factors. That is why most of the respondents are in favour of face-to-face means of seeking health care instead of using digital platforms.

Moreover, the findings of this study have reinforced the notion that equity in digital health is associated with other social inequities. Thus, putting the situation in order will require a multisector and multi-level approach that promotes collaboration and coordination on inequity issues that affect society.

5.4 Theoretical contributions

This research has contributed to an area that needs enormous research because of the ongoing COVID-19 pandemic. The pandemic has led to an increase in research on digital applications, which had limited research before. By reviewing the different frameworks so far applied in the area of digital health equity, the research has adopted a broad model that is seen as the best to capture social determinants of health that have an influence on the digital health equity. This mixture of theories allows for a synthetic framework relying mainly on the DHEF (Crawford and Sehral, 2020) framework to capture what is causing digital health inequity. The findings of this thesis have indicated that application of a broad model to study the factors that impact equity in digital health is helpful to policy makers in targeting aspects that are seen to be the causes of digital health inequity. Similarly, the application of a qualitative exploratory case study of Norway connected the research objective giving a deeper understanding of digital health inequity.

5.5 Practical contributions

The study has given an overview of the causes of what impacts digital health equity from various stakeholders who are facing challenges in using digital health platforms. This will assist planners to see where problems are and address them accordingly. Digital health has become a hot topic recently because of the COVID-19 pandemic, insights from this study will help planners on how they can deal with issues of providing healthcare to COVID-19 patients.

This study helps to explain different factors that affect the use of digital technologies, and whether the factors that affect the digital health tools acceptance are due to the intention and attitude of use. This will facilitate and guide policy makers to design strategies that equitably promote digital health and tools in Norway.

Furthermore, this study explores digital health which will consequently help to shape policy on the contentious issues of multiculturalism especially on how to promote digital health equity among the advantaged and disadvantaged groups in Norway. It contributes to understanding the impact of digital health solutions on equity, there is a need to evaluate the short and long-term effects of digital health on equity, both pre and post-pandemic. This is because the pandemic is still ongoing, and to acquire post pandemic effects on equity would require a longitudinal study to be conducted to effectively explore and discover these effects.

The research focused on digital equity which has implications on the manner of how policies are designed taking into consideration that society has diverse individuals who need to be catered for when adopting the use of digital applications for healthcare. Nonetheless, the findings of this current study and other literature indicate that equity challenges faced by the disadvantaged in society is at times associated with governments decisions that has the ability to influence issues of inequity in digital health.

5.6 Study Limitations

The study focused on few years (2 years) from the time the COVID-19 pandemic started to the present day, such findings arrived at from a short period may be inconclusive. A long-term study would have enabled us to ascertain the manner on how inequity in health and digital health developed in Norway. Therefore, to reiterate, a longitudinal study should be conducted to effectively explore and discover the post COVID-19 effects on digital health equity.

In addition, the timeframe influenced the choice of the methodology that was applied. The study relied on the case study method following a qualitative approach. Although this provides a detailed analysis, it does not cover a large population in a short time period. An extended period for the research would have allowed for the use of eclectic approaches that can facilitate the researcher to obtain a more information on what impacts digital health equity.

5.7 Recommendations for future research

Everything is in constant flux and with constant changes, future research should examine if the contributions of Digital health outweigh those of face-to-face consultations. Future research should be broader and look at all the nations of the world, and in Norway, not only the disadvantaged should be the focus of the research but other groups of persons in Norway.

In future, this study should be expanded by using an eclectic methodological approach. This will allow the researcher to explore a combination of methods to make a more in-nuanced study of factors that impact equity in digital health. An eclectic approach combining multiple methods facilitates the researcher to expand the research to a wide audience capturing more factors that impact equity in digital health.

This should also include exploration of the perceptions of teenagers and very young adults on digital health equity. Preparing the future to embrace digital health tools requires dealing with the youth of today so that they get accustomed to the applications. To prepare society to adopt the use of digital health tools, they should replicate this study in different contexts and comparatively examine the differences in levels of digital adoption and ask the question of “why”. Why Norway despite its’ egalitarian culture and heavy investment in digital resources continued to experience digital inequity? Replication of the research in other contexts will help to provide more insights on the issues of inequity. This will also contribute to the body of knowledge in as far as barriers to digital technology that affect people in Norway. Future studies should be expanded to cover large population samples so that perceptions on the uses of digital technology in society are changed, that is how it will help to reduce barriers that are in play at present.

References

Abrassart, C., Bengio, Y., Chicoisne, G., Marcellis-Warin, N., Dilhac, M., Gambs, S., & Gautrais, V. 2018. *2018 REPORT MONTRÉAL DECLARATION FOR A RESPONSIBLE DEVELOPMENT OF ARTIFICIAL INTELLIGENCE*. Montréal Declaration Responsible AI. (https://monoskop.org/images/b/b2/Report_Montreal_Declaration_for_a_Responsible_Development_of_Artificial_Intelligence_2018.pdf).

Accenture. 2021. *Digital adoption in healthcare: Reaction or revolution?* (https://www.accenture.com/_acnmedia/PDF-175/Accenture-Digital-Adoption-Healthcare-Norway.pdf#zoom=40).

Ahmed, T., Rizvi, S. J. R., Rasheed, S., Iqbal, M., Bhuiya, A., Standing, H., Bloom, G., and Waldman, L. 2020. "Digital Health and Inequalities in Access to Health Services in Bangladesh: Mixed Methods Study," *JMIR MHealth and UHealth* (8:7), p. e16473. (https://doi.org/10.2196/16473).

Alzheimer's Association. 2018. "2018 Alzheimer's Disease Facts and Figures," *Alzheimer's & Dementia* (14:3), pp. 367–429. (https://doi.org/10.1016/j.jalz.2018.02.001).

Arcaya, M. C., Arcaya, A. L., and Subramanian, S. V. 2015. "Inequalities in Health: Definitions, Concepts, and Theories," *Global Health Action* (8:1), pp. 1–12. (https://doi.org/10.3402/gha.v8.27106).

Arntzen, A., Bøe, T., Dahl, E., Drange, N., Eikemo, T. A., Elstad, J. I., Fosse, E., Krokstad, S., Syse, A., Sletten, M. A., and Strand, B. H. 2019. "29 Recommendations to Combat Social Inequalities in Health. The Norwegian Council on Social Inequalities in Health," *Scandinavian Journal of Public Health* (47:6), pp. 598–605. (https://doi.org/10.1177/1403494819851364).

Azzopardi-Muscat, N., and Sørensen, K. 2019. "Towards an Equitable Digital Public Health Era: Promoting Equity through a Health Literacy Perspective," *European Journal of Public Health* (29:Supplement_3), pp. 13–17. (https://doi.org/10.1093/eurpub/ckz166).

Barros, P., Bourek, A., Brouwer, W., Lehtonen, L., Barry, M., Murauskiene, L., Ricciardi, W., Siciliani, L., and Wild, C. 2018. “ASSESSING the IMPACT of DIGITAL TRANSFORMATION of HEALTH SERVICES Expert Panel on Effective Ways of Investing in Health (EXPH).” (https://ec.europa.eu/health/sites/default/files/expert_panel/docs/022_digitaltransformation_en.pdf).

Beaunoyer E, Dupere S, Guitton MJ. 2020. COVID-19 and digital inequalities: reciprocal impacts and mitigation strategies. Comput Hum Behav. 2020;111:106424.

Berntsen, H. 2021. *WHO report highlights innovation in Norwegian primary health care*. Norwegian Centre for E-Health Research. (https://ehealthresearch.no/en/news/2021/who-report-highlights-innovation-in-norwegian-primary-health-care).

Braveman, P., and Gruskin, S. 2003. “Defining Equity in Health,” *Journal of Epidemiology & Community Health* (57:4), pp. 254–258. (https://doi.org/10.1136/jech.57.4.254).

Bryman, A. 2016. *Social Research Methods* (5 ed.). United Kingdom: Oxford University Press.

Bryman, A. 2012. *Social research methods.* (4rd edition) Oxford University press, Oxford.

Business-jadu. (n.d.). *Socio-technical systems theory*. Business.leeds.ac.uk. Retrieved November 22, 2021, from (https://business.leeds.ac.uk/research-stc/doc/socio-technical-systems-theory#:~:text=Socio%2Dtechnical%20theory%20has%20at).

Capar, R.-I. 2019. *Norway’s population is aging rapidly and fertility is at a historic low, study shows*. Norway Today. (https://norwaytoday.info/news/norways-population-is-aging-rapidly-and-fertility-is-at-a-historic-low-study-shows/#:~:text=An%20aging%20population&text=Today%2C%20940%2C000%20Norwegians%20are%20over).

Carolina, J.-M., Maria, Raisa, D., & R., J., Alejandro. 2014. Information and communication technology (ICT) and eHealth policy in Latin America and the Caribbean: a review of national policies and assessment of socioeconomic context. *Rev Panam Salud Publica;35(5-6),Mayo-Jun. 2014*. (https://iris.paho.org/handle/10665.2/8110).

Carter, N., Bryant-Lukosius, D., DiCenso, A., Blythe, J., and Neville, A. J. 2014. "The Use of Triangulation in Qualitative Research," *Oncology Nursing Forum* (41:5), United States, pp. 545–547. (https://doi.org/10.1188/14.ONF.545-547).

CDC. 2018. *Implementing Clinical Decision Support Systems*. Centers for Disease Control and Prevention. (https://www.cdc.gov/dhdsp/pubs/guides/best-practices/clinical-decision-support.html).

Chang, A. 2012. "UTAUT and UTAUT 2: A Review and Agenda for Future Research," *The Winners* (13:2), p. 10. (https://doi.org/10.21512/tw.v13i2.656).

Clarsen, B., Nylenna, M., Klitkou, S. T., Vollset, S. E., Baravelli, C. M., Bølling, A. K., Aasvang, G. M., Sulo, G., Naghavi, M., Pasovic, M., Asaduzzaman, M., Bjørge, T., Eggen, A. E., Eikemo, T. A., Ellingsen, C. L., Haaland, Ø. A., Hailu, A., Hassan, S., Hay, S. I., and Juliusson, P. B. 2022. "Changes in Life Expectancy and Disease Burden in Norway, 1990–2019: An Analysis of the Global Burden of Disease Study 2019," *The Lancet Public Health* (7:7), pp. e593–e605. (https://doi.org/10.1016/s2468-2667(22)00092-5).

Crawford, A., and Serhal, E. 2020. "Digital Health Equity and COVID-19: The Innovation Curve Cannot Reinforce the Social Gradient of Health," *Journal of Medical Internet Research* (22:6), p. e19361. (https://doi.org/10.2196/19361).

Creswell, J. W. 2009. *Research design : qualitative, quantitative, and mixed methods approaches* (3rd ed. ed.). Los Angeles: SAGE.

Debesay, J., Arora, S., & Bergland, A. 2019. 4. Migrants' Consumption of Healthcare Services in Norway: Inclusionary and Exclusionary Structures and Practices. *Inclusive Consumption: Immigrants'Access to and Use of Public and Private Goods and Services*. (https://doi.org/10.18261/9788215031699-2019-04).

DeLone, and Mclean. 2003. “The DeLone and McLean Model of Information Systems Success: A Ten-Year Update,” *Information Systems Research, Journal of Management Information Systems* (19:4), pp. 9–30. (http://eli.johogo.com/Class/p7.pdf).

Dimaggio, P., Hargittai, E., Celeste, C., & Shafer, S. 2004. *From Unequal Access to Differentiated Use: A Literature Review and Agenda for Research on Digital Inequality**. (https://digitalinclusion.typepad.com/digital_inclusion/documentos/revdimaggio.pdf).

Dover, D. C., and Belon, A. P. 2019. “The Health Equity Measurement Framework: A Comprehensive Model to Measure Social Inequities in Health,” *International Journal for Equity in Health* (18:1). (https://doi.org/10.1186/s12939-019-0935-0).

EC Europa. 2021. *Governance of migrant integration in Estonia | European Website on Integration*. Ec.europa.eu. (https://ec.europa.eu/migrant-integration/country-governance/governance-migrant-integration-estonia_en).

Ellingsen, A. 2020. *Norway’s population aging rapidly*. Norway Today. (https://norwaytoday.info/everyday/norways-population-aging-rapidly/).

Encyclopedia Britannica. 2017. Norway ethnic composition 2017. In *Britannica*. (https://www.britannica.com/place/Norway/Climate#ref37914).

eurostat. 2022. *Non-EU citizens make up 5.3% of the EU population*. Ec.europa.eu. (https://ec.europa.eu/eurostat/web/products-eurostat-news/-/ddn-20220330-2).

FDA. 2019. What is Digital Health? *FDA*. (https://www.fda.gov/medical-devices/digital-health-center-excellence/what-digital-health).

Fosse, E., Helgesen, M. K., Hagen, S., and Torp, S. 2018. “Addressing the Social Determinants of Health at the Local Level: Opportunities and Challenges,” *Scandinavian Journal of Public Health* (46:20_suppl), pp. 47–52. (https://doi.org/10.1177/1403494817743896).

Global strategy on digital health 2020-2025. (n.d.). Retrieved October 16, 2021, from (https://www.who.int/docs/default-source/documents/gs4dhdaa2a9f352b0445bafbc79ca799dce4d.pdf#page19).

Goh, S. 2021. Say what you mean, mean what you say: inequality and inequity. *Www.bmj.com*. (https://www.bmj.com/content/356/bmj.j556/rr-8#:~:text=%22Inequity%20and%20inequality%3A%20these%20terms).

Guy, M. E., and McCandless, S. A. 2012. "Social Equity: Its Legacy, Its Promise," *Public Administration Review* (72:s1), pp. S5–S13. (https://doi.org/10.1111/j.1540-6210.2012.02635.x).

Hadi, F., & Abrahams, C. 2015. *Improving later life for people with sight loss*. (https://www.ageuk.org.uk/globalassets/age-uk/documents/reports-and-publications/reports-and-briefings/health--wellbeing/improving_later_life_for_people_with_sight_loss-full_report.pdf).

Heath, R. 2017. *Brussels is blind to diversity*. POLITICO. (https://www.politico.eu/article/brussels-blind-to-diversity-whiteout-european-parliament/).

Helsper EJ. 2012. A corresponding fields model for the links between social and digital exclusion. Communication Theory. 22(4):403–26.

Hendrick, H. W. 2009. "A Sociotechnical Systems Model of Organizational Complexity and Design and Its Relation to Employee Cognitive Complexity," *Proceedings of the Human Factors and Ergonomics Society Annual Meeting* (53:16), pp. 1028–1032. (https://doi.org/10.1177/154193120905301607).

Heponiemi T, Gluschkoff K, Leemann L, Manderbacka K, Aalto A, Hypponen H. 2021. Digital inequality in Finland: access, skills and attitudes as social impact mediators. New Media Soc. 14614448211023007.

Holme, I. M., & Solvang, B. K. 1997. *Forskningsmetodik: Om kvalitativa ochkvantitativa metoder.* (2:a uppl.). Poland: Studentlitteratur.

Ijsselsteijn, W., Nap, H. H., de Kort, Y., & Poels, K. 2007. Digital game design for elderly users. *Proceedings of the 2007 Conference on Future Play - Future Play '07*. (https://doi.org/10.1145/1328202.1328206).

Information, N. C. for B., Pike, U. S. N. L. of M. 8600 R., MD, B., & Usa, 20894. 2019.

Future research. In *www.ncbi.nlm.nih.gov*. World Health Organization. (https://www.ncbi.nlm.nih.gov/books/NBK541890/

Institute of health equity. 2021. *Social Gradient - Institute of Health Equity*. Institute of Health Equity. (https://www.instituteofhealthequity.org/in-the-news/articles-by-the-institute-team-/social-gradient#:~:text=Social%20Gradient%20%2D%20IHE&text=%22The%20social%20gradient%20in%20health).

Jandoo, T. 2019. WHO guidance for digital health: What it means for researchers. *DIGITAL HEALTH, 6,* 205520761989898. (https://doi.org/10.1177/2055207619898984).

Kaihlanen, A.-M., Virtanen, L., Buchert, U., Safarov, N., Valkonen, P., Hietapakka, L., Hörhammer, I., Kujala, S., Kouvonen, A., and Heponiemi, T. 2022. "Towards Digital Health Equity - a Qualitative Study of the Challenges Experienced by Vulnerable Groups in Using Digital Health Services in the COVID-19 Era," *BMC Health Services Research* (22:1). (https://doi.org/10.1186/s12913-022-07584-4).

Kasper, J., Stensdal, L.-A., Kienlin, S., Eiring, Ø., Neset, T., Andersen-Hollekim, T., & Fog Heen, A. 2022. New status report from Norway: Implementation of patient involvement in Norwegian health care. *Zeitschrift Für Evidenz, Fortbildung Und Qualität Im Gesundheitswesen* (*171),* 105–112. (https://doi.org/10.1016/j.zefq.2022.04.021

Khan S, Hoque. 2016. A. Digital health data: a comprehensive review of privacy and security risks and some recommendations. Comput Sci J Moldova. 71(2):273–92.

Lawrence, K. 2022. *Digital Health Equity* (S. L. Linwood, Ed.). PubMed; Exon Publications. (https://www.ncbi.nlm.nih.gov/books/NBK580635/

Lewis, J. 2021. *The COVID-19 Strain On Health Care Remains, As Administrators Look To Long-Term Impacts*. JD Supra. (https://www.jdsupra.com/legalnews/the-covid-19-strain-on-health-care-6775783/

Liberati E, Richards N, Parker J, Willars J, Scott D, Boydell N, et al. 2021. Remote care for mental health: qualitative study with service users, carers and staff during the COVID-19 pandemic. BMJ Open.11(4):e049210.

Lundberg, L. 2022. *Målrettede grep for å inkludere flere, sosialt og digitalt*. Nasjonalt Senter for E-Helseforskning. (https://ehealthresearch.no/nyheter/2022/malrettede-grep-for-a-inkludere-flere-sosialt-og-digitalt).

Lundberg, L., & Lind, K. 2021. *NORWAY USE OF EHEALTH TOOLS IN PRIMARY HEALTH CARE DURING THE COVID-19 PANDEMIC*. (https://ehealthresearch.no/files/documents/Rapporter/Andre/2021-09-WHO-eHealth-tools-in-primary-health-care-during-COVID.pdf).

Lyles, C. R., Wachter, R. M., and Sarkar, U. 2021. "Focusing on Digital Health Equity," *JAMA* (326:18), p. 1795. (https://doi.org/10.1001/jama.2021.18459).

Magnusson, E., & Marecek, J. 2015. *Doing Interview-based Qualitative Research: A*

Marwaha, J. S., Landman, A. B., Brat, G. A., Dunn, T., and Gordon, W. J. 2022. "Deploying Digital Health Tools within Large, Complex Health Systems: Key Considerations for Adoption and Implementation," *Npj Digital Medicine* (5:1), pp. 1–7. (https://doi.org/10.1038/s41746-022-00557-1).

MHealth Tallinn. 2019. *Everything you need to know about the Estonian eHealth reform*. Tallinn.mhealth.events. (https://tallinn.mhealth.events/en/article/vsyo-o-tsifrovoy-meditsinskoy-reforme-v-estonii-97210).

NCP. 2017. *National contact point*. Estonian Health Insurance Fund. (https://www.haigekassa.ee/en/kontaktpunkt/national-contact-point).

Nicky. 2018. *The Montreal Declaration for the Responsible Development of Artificial Intelligence Launched*. CABC. (https://www.canasean.com/the-montreal-declaration-for-the-responsible-development-of-artificial-intelligence-launched/).

Noble, H., and Heale, R. 2019. "Triangulation in Research, with Examples," *Evidence Based Nursing* (22:3), pp. 67–68. (https://doi.org/10.1136/ebnurs-2019-103145).

Nordhoff, S., Louw, T., Innamaa, S., Lehtonen, E., Beuster, A., Torrao, G., Bjorvatn, A., Kessel, T., Malin, F., Happee, R., and Merat, N. 2020. “Using the UTAUT2 Model to Explain Public Acceptance of Conditionally Automated (L3) Cars: A Questionnaire Study among 9,118 Car Drivers from Eight European Countries,” *Transportation Research Part F: Traffic Psychology and Behaviour* (74), pp. 280–297. (https://doi.org/10.1016/j.trf.2020.07.015).

Norsk Helsenett. 2019b. “Exemption Card for Public Health Services,” *Www.helsenorge.no,* January 1. ((https://www.helsenorge.no/en/payment-for-health-services/exemption-card-for-public-health-services/).

Nguyen MH, Hargittai E, Marler W. 2021. Digital inequality in communication during a time of physical distancing: the case of COVID-19. Comput Hum Behav. 120:106717.

Ojo, A. I. 2017. “Validation of the DeLone and McLean Information Systems Success Model,” *Healthcare Informatics Research* (23:1), p. 60. (https://doi.org/10.4258/hir.2017.23.1.60).

Papadopoulos, K. S., and Goudiras, D. B. 2005. “Accessibility Assistance for Visually-Impaired People in Digital Texts,” *British Journal of Visual Impairment* (23:2), pp. 75–83. (https://doi.org/10.1177/0264619605054779).

Paparini, S., Papoutsi, C., Murdoch, J., Green, J., Petticrew, M., Greenhalgh, T., and Shaw, S. E. 2021. “Evaluating Complex Interventions in Context: Systematic, Meta-Narrative Review of Case Study Approaches,” *BMC Medical Research Methodology* (21:1). (https://doi.org/10.1186/s12874-021-01418-3).

Perakslis, E., and Ginsburg, G. S. 2020. “Digital Health—the Need to Assess Benefits, Risks, and Value,” *JAMA* (325:2). (https://doi.org/10.1001/jama.2020.22919).

Rechel, B., Mladovsky, P., Ingleby, D., Mackenbach, J. P., and McKee, M. 2013. “Migration and Health in an Increasingly Diverse Europe,” *The Lancet* (381:9873), pp. 1235–1245. (https://doi.org/10.1016/s0140-6736(12)62086-8).

Reiners F, Sturm J, Bouw LJ, Wouters EJ. 2019. Sociodemographic factors influencing the use of eHealth in people with chronic diseases. Int J Environ Res Public Health.16(4):645.

Ryen, A. 2004. *Kvalitativ intervju - från vetenskapsteori till fältstudier*. Malmö: Liber.

Rønning, R., Enquist, B. & Fuglsang, L. (2014) *Framing Innovation in Public Service*

Sectors. Vol. 30. Routledge.\

Ryvarden, E. 2018. Helse-Norge bør samles rundt ett IT-system. *Tidsskrift for Den Norske Legeforening*. (https://doi.org/10.4045/tidsskr.18.0656).

Sakaguchi-Tang DK, Bosold AL, Choi YK, Turner AM. 2017. Patient portal use and experience among older adults: systematic review. JMIR Med Inform. 5(4):e38.

Salkowitz, R. 2008. *Generation blend : managing across the technology age gap*. John Wiley & Sons.

Saunders, M., Lewis, P. & Thornhill, A. 2009. *Research methods for business students.*

Fifth edition. Harlow: Pearson Education Limited.

Selsky C, Luta G, Noone A, Huerta EE, Mandelblatt JS. 2013. Internet access and online cancer information seeking among Latino immigrants from safety net clinics. J Health Commun. 18(1):58–70.

Shadmi, E., Chen, Y., Dourado, I., Faran-Perach, I., Furler, J., Hangoma, P., Hanvoravongchai, P., Obando, C., Petrosyan, V., Rao, K. D., Ruano, A. L., Shi, L., de Souza, L. E., Spitzer-Shohat, S., Sturgiss, E., Suphanchaimat, R., Uribe, M. V., and Willems, S. 2020. “Health Equity and COVID-19: Global Perspectives,” *International Journal for Equity in Health* (19:1). (https://doi.org/10.1186/s12939-020-01218-z).

Smith, K. E., Bambra, C., and Hill, S. E. 2015. “Health Inequalities: Critical Perspectives,” *Google Books,* Oxford University Press. (https://books.google.no/books?hl=en&lr=&id=UeLkCgAAQBAJ&oi=fnd&pg=PA33&dq=Dahl).

Starfield, B. 2011. "The Hidden Inequity in Health Care," *International Journal for Equity in Health* (10:1), p. 15. (https://doi.org/10.1186/1475-9276-10-15).

Statistics Norway. 2022. *Immigrants and Norwegian-born to immigrant parents*. SSB. (https://www.ssb.no/en/befolkning/innvandrere/statistikk/innvandrere-og-norskfodte-med-innvandrerforeldre).

Statistisk sentralbyrå statistics Norway. 2022. *Municipal accounts*. SSB. (https://www.ssb.no/en/offentlig-sektor/kostra/statistikk/kommuneregnskap).

Steingrímsdóttir, Ó. A., Næss, Ø., Moe, J. O., Grøholt, E.-K., Thelle, D. S., Strand, B. H., and Bævre, K. 2012. "Trends in Life Expectancy by Education in Norway 1961–2009," *European Journal of Epidemiology* (27:3), pp. 163–171. (https://doi.org/10.1007/s10654-012-9663-0).

Svara, J. H., and Brunet, J. R. 2005. "Social Equity Is a Pillar of Public Administration," *Journal of Public Affairs Education* (11:3), pp. 253–258. (https://doi.org/10.1080/15236803.2005.12001398).

Tamilmani, K., Rana, N. P., Wamba, S. F., and Dwivedi, R. 2021. "The Extended Unified Theory of Acceptance and Use of Technology (UTAUT2): A Systematic Literature Review and Theory Evaluation," *International Journal of Information Management* (57), p. 102269. (https://doi.org/10.1016/j.ijinfomgt.2020.102269).

The Department of eHealth. 2016, February 29. *The Department of eHealth*. Government.no. (https://www.regjeringen.no/en/dep/hod/organisation-and-management-of-the-ministry-of-health-and-care-services/Departments/the-department-of-ehealth/id2473079/).

The Economist Intelligence Unit. 2016, March 5. *Wayback Machine*. Web.archive.org. (https://web.archive.org/web/20160305143559/http://www.yabiladi.com/img/content/EIU-Democracy-Index-2015.pdf).

The United Nations High Commissioner for Human Rights. (n.d.). *The Right to Health*. (https://www.ohchr.org/Documents/Publications/Factsheet31.pdf).

Tikkanen, R., Osborn, R., Mossialos, E., Djordjevic, A., & Wharton, G. 2020. Norway |

Commonwealth Fund. In *www.commonwealthfund.org*. (https://www.commonwealthfund.org/international-health-policy-center/countries/norway).

Tomczyk, Ł., Mróz, A., Potyrała, K., and Wnęk-Gozdek, J. 2020. "Digital Inclusion from the Perspective of Teachers of Older Adults - Expectations, Experiences, Challenges and Supporting Measures," *Gerontology & Geriatrics Education*, pp. 1–16. (https://doi.org/10.1080/02701960.2020.1824913).

Trading Economics. 2020. *Norway Population | 1960-2019 Data | 2020-2022 Forecast | Historical | Chart | News*. Tradingeconomics.com. (https://tradingeconomics.com/norway/population

Trost, J. 2007. *Enkätboken.* Studentlitteratur, Sweden.

UNESCO. 2016. *Estonia 2016 report*. Diversity of Cultural Expressions. (https://en.unesco.org/creativity/governance/periodic-reports/2016/estonia#:~:text=Estonia%20with%20the%20population%20of).

United Nations. 2015. "Concepts of Inequality Development," *Development Strategy and Policy Analysis Unit & Development Policy and Analysis Division Department of Economic and Social Affairs*, pp. 1–1. (https://www.un.org/en/development/desa/policy/wess/wess_dev_issues/dsp_policy_01.pdf).

Van Cauter, L. 2016. *Government-to-government information system failure in Flanders: an in-depth study*.

Van der Wel, K. A. 2016. The norwegian policy to reduce health inequalities key cha. *Nordisk Välfärdsforskning*. (https://doi.org/10.18261/ISSN.2464-4161-2016-01-03).

Vitezić, V., and Perić, M. 2021. "Artificial Intelligence Acceptance in Services: Connecting with Generation Z," *The Service Industries Journal* (41:13), pp. 1–21. (https://doi.org/10.1080/02642069.2021.1974406).

WHO. (n.d.-a). *The Right to Health*.(https://www.ohchr.org/Documents/Publications/Factsheet31.pdf).

WHO. (n.d.-b). *Universal Health Coverage*. Www.who.int. (https://www.who.int/health-topics/universal-health-overage#:~:text=Universal%20health%20coverage%20means%20that).

World Health Organization. 2021. *Universal health coverage (UHC)*. Who.int; World Health Organization: WHO. (https://www.who.int/news-room/fact-sheets/detail/universal-health-coverage-(uhc)

Yin, R. 1994. *Case Study Research: Design and Methods*. Thousand Oaks, California,

USA, SAGE Publications.

Yoon J, Huang H. 2005. Trends in health information-seeking behaviour in the US foreign-born population based on the health information National Trends Survey, 2005-2014. Inform Res Int Electronic J. 2017;22(3):n3.

Zanaboni P, Wootton R. 2016. Adoption of routine telemedicine in Norwegian hospitals: progress over 5 years. BMC Health Serv Res. 16(1):496.

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Tab. 2 References for illustrations

Appendix

A Appendix 1

Letter of Consent Information letter:

Dear Sir/Madam,

The role of this survey is to obtain your opinion on social determinants of digital health in Norway. Despite Norway being one of the pioneers of digital health in Europe, it is still manifesting health disparities among its population. These iniquities have been brought about by digital health technology such as computers, phones, the internet, text message and video calling.

They are especially experienced among socially disadvantaged populations, race, ethnicity, geographic location, sex, socio-economic status and other social factors. The research is intended to find out which factors impact on health equity in Norway so that policy makers know which areas to target to achieve digital health equity. Your participation will be treated anonymously and the responses kept under lock and key to be only this research.

I appreciate your participation in this research.

For the participant I understand that by taking part in the study I will be interviewed and recorded.

For the participant: I understand that taking part in the study will include being interviewed and audio recorded.

I give my consent to allow the researcher to use my data for this research.

Place & Date Signature & Name in Block Letters

Thank you for your time.

Sincerely

Jackline Nakiganda

Interview guide

Informant's background

Gender

Age

Profession

Have you been out of employment in the last six months?

Years of practising the profession/experience

Topic: Descriptive information; Underlying Personal values/experiences

What is your experience with using digital platforms in particular using HelseNorge?

Do you at times use digital platforms like HelseNorge or tools to access health care services?

What do you consider to be the advantages of accessing those services through digital tools?

Similarly, what do you consider to be the demerits of using the tool HelseNorge for healthcare services?

Do you think accessing medical services through the digital tool HelseNorge is better than visiting a doctor in person?

How about negative aspects of vising a doctor instead of using the digital tool HelseNorge?

What do you consider to be the impediments of using digital tools that is to say HelseNorge?

What are your perceptions and attitudes towards digital health?

Topic: Role of Digital health services in the community?

Do you consider digital health services to be well established?

How have digital services disrupted or promoted your life since the inception of the COVID-19 pandemic?

Have you had any community training services by the community in the use of digital tools especially HelseNorge?

How are eHealth services promoted in your community?

Informed consent for master’s thesis research
Title of the master’s thesis: Equity in Digital Health: The case of Norway Name + contact details of supervisor, advisor and student researcher(s) Supervisors and advisors Joep Crompvoets - joep.crompvoets@kuleuven.be

Tayfun Kasapoglu – tayfun.kasapoglu@taltech.ee
Student researcher
Jackline Nakiganda – jacklinenakiganda@gmail.com
Aim and methodology of the master's thesis research: The aim of this study is to explore and understand the factors that lead to digital health inequity by applying the case of Norway, one of the first countries to adopt digital health in the World.
The methods applied in the research is the case study method that follows a qualitative approach.
Period/duration of the study: July 2022

- I have received sufficient information about the purpose of the research.
- I understand what is expected of me in the study.
- I am aware that I will participate in the following survey / interview(s) / experiment:
- I consent to the interview(s) being audio (video) recorded.
- I understand that my participation may involve risks or inconvenience:

- Taking part in the study may provide the following benefits to me or others:

- I understand that my participation in this study is voluntary. I am aware that I can discontinue my participation at any time. I will not have to provide a reason for this and I will not suffer any disadvantages.

  Alternative 1 (if the study is commissioned by a public authority or the results will be made public)
  Under the GDPR, the data collected during the study will be processed on grounds of public interest. This means that if I withdraw from the study, any previously collected data can still be lawfully processed and do not need to be deleted by KU Leuven.

  Alternative 2 (if the study is commissioned by an agency/company where the results will not be made public)
  I can also request at any time to have the processing of my data stopped and, where appropriate, to have the collected data deleted.

- (To be added if any of the following data will be processed: race (≠ nationality) or ethnicity, political opinions, religious or philosophical beliefs, or trade union membership; genetic data, biometric data for the unique identification of a person, health data, or data relating to a natural person's sexual behaviour or orientation).
  I understand that some of the data collected for the purposes of this study are classified as ‘sensitive personal data’ under the General Data Protection Regulation. I hereby expressly consent to the collection of these data for the purposes of this study.
- The findings may be used for research purposes and may be published. My name will not be published; anonymity and confidentiality is guaranteed at every stage of the research project. The complete dataset can be made available to the research community in the anonymised manner described.
- I understand that I will receive no/the following payment for participating in the research.
- I would like to be informed of the results of this research. The student researcher may contact me at the following e-mail address:

- I understand that I can contact .....
    - the student researcher (see above for contact details)
    - the supervisor or advisor (see above for contact details)

for any questions or to exercise my rights (access to or correction of data, ...) after participating in the study.

- For any complaints or other concerns about ethical issues relating to this study, I can contact KU Leuven’s Social and Societal Ethics Committee: smec@kuleuven.be.

I have read and understand the information above and have received answers to all my questions regarding this study. I agree to participate in the study.

Date

X

Jackline Nakiganda

Name and signature of the respondent/participant