

Do patients behave as expected on a healthcare market in transition? Consequences of expanding patient choice and introducing telemedicine in primary healthcare



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**DO PATIENTS BEHAVE AS EXPECTED ON A
HEALTHCARE MARKET IN TRANSITION?
CONSEQUENCES OF EXPANDING PATIENT CHOICE AND
INTRODUCING TELEMEDICINE IN PRIMARY
HEALTHCARE**

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Do patients behave as expected on a healthcare market
in transition? Consequences of expanding patient
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To my dear family

POPULAR SCIENCE SUMMARY OF THE THESIS

Political and legal reforms during the last decades have transitioned Swedish primary healthcare into a quasi-market with free choice as the guiding principle. These reforms have had a major impact on the organization of primary healthcare and the allocation of resources, with both intended increases in access to physical visits and later also an unforeseen expansion of telemedicine visits. The reforms have been surrounded by controversy and their effects on quality, continuity, equity, and overall healthcare consumption remain uncertain.

In this thesis, I have aimed to shed light on the consequences of expanding patient choice and introducing telemedicine into primary healthcare. My main interest was the effect on patient behavior in response to these changes, and the impact this had on four central themes in healthcare: quality, continuity, equity, and demand. To investigate the aim, I departed from four assumptions about patient behavior related to these themes. These assumptions originate from different actors in the healthcare system, from policymakers to healthcare providers and citizens, as well as from economic theories about patient behavior such as rational choice and moral hazard.

The assumptions I investigated were:

- Quality assumption: Patients are sensitive to quality in their choice of primary healthcare provider.
- Continuity assumption: Lack of informational continuity leads to worse health outcomes.
- Equity assumption: Online physician consultations are used to a greater extent by individuals with lower healthcare needs.
- Demand assumption: Use of online physician consultations increases the overall consumption of primary healthcare.

The behaviors investigated were choice of provider, filled prescriptions, and use of online and face-to-face consultations in primary healthcare. Although patient behavior has been the main focus of the thesis, this behavior is also to a great extent influenced by the healthcare providers and the organization of the healthcare system.

The first assumption that I explored in the thesis relates to quality and originates from economic theories about rational choice. The assumption is that patients are sensitive to quality in their choice of primary healthcare provider, and that patient choice will therefore improve quality. The assumption was expressed in the Government Bill that proposed a patient choice system in primary healthcare. In the thesis, I found that quality did seem to have a small impact on choice, but that other aspects – such as the care needs of the individuals registered with a primary healthcare provider – seemed to be much more important.

The second assumption relates to continuity. The assumption is that lack of informational continuity leads to worse health outcomes. More fragmentation in healthcare, which could be associated with the patient choice reform, is a potential threat to continuity. In Region Stockholm, the indicator “recorded diagnosis” is used as a follow-up indicator in primary healthcare to measure the information transfer between different healthcare providers. However, its effects have not been thoroughly investigated. In the thesis, I found that if a patient

had a recorded diagnosis in primary healthcare, then he or she was more likely to fill a prescription of recommended pharmacotherapies. These findings indicated that a lack of informational continuity did seem to affect patients' health negatively and that "recorded diagnosis" has potential as a follow-up indicator.

The third assumption relates to equity. The assumption is that online physician consultations are used to a greater extent by individuals with lower healthcare needs – and will therefore increase healthcare disparities. This assumption has been prevalent in the public debate about telemedicine and has also been expressed by policymakers and healthcare professionals. The results of the studies in this thesis confirmed that telemedicine was used to a much greater extent by young, highly educated individuals with high income who were born in Sweden. The findings suggested a risk that online consultations could lead to a transfer of resources from individuals with more complex healthcare needs to those with less complex conditions, which are more suitable for online consultations.

The fourth assumption relates to demand for healthcare and originates from the public debate about online consultations as well as economic theories about moral hazard. The assumption is that online consultations create new demand and increase the overall number of visits to primary healthcare. In the thesis, I observed that users of online physician consultations increased their healthcare consumption more than matched controls. The findings indicated that use of online consultations led to more visits – for the individual and the healthcare system. This does not necessarily equate to increased spending but is likely to transfer healthcare resources from older to younger individuals.

My main messages to policymakers as a result of the work with this thesis are:

- The market mechanism of free choice seems to have little effect on quality in primary healthcare. The mechanism might be enforced by better information to patients but quality should be ensured through other measures.
- Informational continuity in healthcare across providers seems beneficial and should be encouraged.
- Measures to promote access to the groups in the population with a particularly low level of telemedicine consumption should be considered in order to ensure that all groups have access to the health services that best suits their needs. However, alternatives to digital channels need to keep being available.
- Lastly, the research highlights the need to continue investigating the costs and benefits of telemedicine, so that its use can be encouraged when it is most cost-efficient and limited when it is not. The methods applied in this thesis can be a useful tool to monitor this developing area.

ABSTRACT

Background: Political governance and technological development have transitioned the Swedish primary healthcare market from a centrally planned, community-oriented model with limited choice for patients to a quasi-market with extensive patient choice. Starting in 2007, reforms promoting patient choice in primary healthcare were gradually introduced in multiple regions in Sweden, and in 2010, all regions across the country were legally required to enable patient choice. Provision of telemedicine – in this thesis defined as healthcare consultations via video calls or text messaging where the patient and the healthcare personnel are spatially separated – emerged in primary healthcare when patient choice was further expanded in 2015. From this point, choice was no longer limited to a certain geographical region, but could extend to primary healthcare providers throughout the country.

Aim: The aim of this thesis was to shed light on the consequences of expanding patient choice and introducing telemedicine in primary healthcare by empirically investigating patient behaviors in response to these changes.

Methods: To approach the aim, I departed from four assumptions about patient behavior which related to four central themes in healthcare: quality, continuity, equity, and demand. The assumptions I investigated were:

- Quality assumption: Patients are sensitive to quality in their choice of primary healthcare provider.
- Continuity assumption: Lack of informational continuity leads to worse health outcomes.
- Equity assumption: Telemedicine consultations are used to a greater extent by individuals with lower healthcare needs.
- Demand assumption: Use of telemedicine consultations increases the overall consumption of primary healthcare.

In all studies of the thesis, comprehensive total population registries were used to investigate patient behaviors. In the quality study, Study I, we investigated whether quality influenced choice of primary healthcare provider by exploring the trade-off between distance to chosen primary healthcare provider and subjective and objective quality measures. We investigated choice of provider in 2017 and included all residents of Region Stockholm who had been in contact with primary healthcare at least once in 2016 or 2017 in the study population (n=1.4 million). The trade-off was studied using a conditional logit analysis.

In the continuity study, Study II, logistic regression was applied to investigate if patients who had had their inpatient diagnosis recorded in primary healthcare as well – a measure of informational continuity – filled prescriptions of recommended pharmacotherapies to a greater extent than patients whose diagnosis was not recorded. The study population consisted of 19,072 individuals with an inpatient diagnosis of stroke, transient ischaemic attack, or acute coronary syndrome during the period 2010–2013.

In the equity study, Study III, we explored the characteristics of users of telemedicine consultations by investigating the socioeconomic, demographic, and contextual determinants for having made at least one telemedicine consultation in 2018. For comparison, face-to-face

physician consultations in primary healthcare were included in the study, as well as digital-physical physician consultations, i.e., telemedicine consultations offered by traditional primary healthcare providers also offering face-to-face visits, and telephone consultations by nurses. All residents of Region Stockholm who were registered with a primary healthcare provider (n=2.0 million) were included in the study population.

In the demand study, Study IV, we investigated healthcare consumption following a telemedicine consultation and a face-to-face consultation, respectively. The study population included all individuals who had ≥ 1 physician consultation (telemedicine or face-to-face) during the first half of 2018. Telemedicine users were matched 1:2 to users of face-to-face visits on diagnosis and demographic and socioeconomic variables. Their healthcare consumption, in terms of physician consultations, was compared in an interrupted time series analysis.

Findings: The findings of the thesis lent some support to the four assumptions about patient behavior on the primary healthcare market in transition. In the quality study, the findings suggested that quality had a small impact on choice of provider. However, other aspects – such as the care needs of the individuals registered with a primary healthcare provider – seemed much more important. In the continuity study, the findings revealed a clear positive association between recorded diagnosis and use of recommended pharmacotherapies, indicating that informational continuity is beneficial for patient health. Regarding the equity and demand studies, the findings showed that the use of telemedicine was not equally distributed in the population and that telemedicine users increased their healthcare consumption after a physician consultation more than the matched control group consisting of users of only face-to-face consultations.

Conclusions: The findings suggest that the market mechanism “choice” is not sufficient to ensure quality in primary healthcare. The mechanism might be enforced by better information to patients, but quality should be ensured through other measures. Informational continuity seems beneficial for patients and should be encouraged. The measure “recorded diagnosis” does seem to have a valid role as a follow-up indicator in primary healthcare and the level of diagnosis recording could most likely be improved. Regarding telemedicine, it is important to ensure that the fast technological development does not create a digital divide in healthcare. It will grow increasingly important to ensure that those who need an alternative to a digital channel – whether it is for seeing a physician or booking an appointment – are not deprived of this. In addition, measures to promote access to the groups in the population with a particularly low level of telemedicine consumption should be considered in order to ensure that all groups have access to the health services that best suits their needs. Telemedicine and digital innovations have a lot of potential but are also associated with a risk of overuse. The research highlights the need to promptly investigate the costs and benefits of telemedicine, so that its use can be encouraged when it is most cost-efficient and limited when it is not. The methods applied in this thesis may be useful to monitor the development of the area.

Key words: healthcare reform, primary healthcare, quality, choice, quasi-market, telemedicine, e-health

LIST OF SCIENTIFIC PAPERS

This thesis is based on the following papers, which are referred to in the text by Roman numerals.

- I. **Dahlgren, C.**, Dackehag, M., Wändell, P., & Rehnberg, C. (2021). Simply the best? The impact of quality on choice of primary healthcare provider in Sweden. *Health Policy*, 125(11), 1448-1454.
- II. **Dahlgren, C.**, Geary, L., Hasselström, J., Rehnberg, C., Schenck-Gustafsson, K., Wändell, P., & von Euler, M. (2017). Recording a diagnosis of stroke, transient ischaemic attack or myocardial infarction in primary healthcare and the association with dispensation of secondary preventive medication: a registry-based prospective cohort study. *BMJ Open*, 7(9), e015723.
- III. **Dahlgren, C.**, Dackehag, M., Wändell, P., & Rehnberg, C. (2021). Determinants for use of direct-to-consumer telemedicine consultations in primary healthcare—a registry based total population study from Stockholm, Sweden. *BMC Family Practice*, 22(1), 1-10.
- IV. **Dahlgren, C.**, Spånberg, E., Sveréus, S., Dackehag, M., Wändell, P., & Rehnberg, C. Short- and intermediate-term impact of DTC telemedicine consultations on subsequent healthcare consumption. *Manuscript submitted*.

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LIST OF ABBREVIATIONS

CI	Confidence Interval
COPD	Chronic Obstructive Pulmonary Disease
DTC	Direct To Consumer
LISA	Longitudinal Integration Database for Health Insurance and Labor Market Studies
NPE	National Patient Survey
NPR	National Patient Registry
RTB	Total Population Register
TIA	Transient Ischaemic Attack
VAL	Region Stockholm Healthcare Database

1 PREFACE

My first job after my studies in economics was as a healthcare data analyst in Region Västra Götaland. It was a great job. It got me acquainted with the fantastic healthcare database VEGA (which may have inspired me to name my first-born daughter VERA) and it allowed me to combine my interest in healthcare with my love of numbers. During that time, the patient choice reform was high on the agenda, and everyone was talking about primary healthcare. My senior colleagues told me that this was “*the most extensive change to healthcare*” that they had experienced in their entire careers. Those early experiences sparked an interest in primary healthcare, and in the mechanisms and assumptions underlying political decision-making, which laid the foundation for the work with this thesis. This interest was further fueled by another, more recent, extensive change to primary healthcare: the emergence of online physicians. While the patient choice reform was an intentional, politically driven development, the increase of telemedicine was unintentionally enabled by the expansion of patient choice. However, these two developments have the common denominator that they are both associated with diverging opinions about their benefits and risks. My hope in taking on the task of writing this thesis has been to bring some clarity regarding these benefits and risks and hopefully contribute to the continuing development of the healthcare sector

2 INTRODUCTION

Political governance and technological development have transitioned the Swedish primary healthcare market from a centrally planned, community-oriented model with limited choice for patients to a quasi-market with extensive patient choice. Starting in 2007, reforms promoting patient choice in primary healthcare were gradually introduced in multiple regions in Sweden, and in 2010, all regions across the country were legally required to enable patient choice (1). The patient choice reform was ideologically driven, underpinned by steps towards increased choice taken already in the 1990s, and enabled by the change in political direction in 2006. The reform relied on the assumption that patients' choices are guided by the quality of primary healthcare providers. This assumption is supported by economic theories about rational choice but is contradicted by the level of uncertainty which is inherent in healthcare, and which was the reason that market mechanisms were avoided in the first place.

Provision of telemedicine – in this thesis defined as healthcare consultations via video calls or text messaging, where the patient and the healthcare personnel are spatially separated – emerged in primary healthcare when patient choice was further expanded in 2015. From this point, choice was no longer limited to a certain geographical region, but could encompass primary healthcare providers throughout the country. The freedom to choose a provider from anywhere in the country enabled telemedicine providers to reach patients all over Sweden – and receive public funding – which increased the consumption of telemedicine rapidly (2). Similar healthcare services have emerged in other countries as well and the introduction of telemedicine has been surrounded by controversy in Sweden and abroad. Proponents have emphasized the advantages in terms of convenience and access, while critics have expressed concerns regarding equity, overutilization, fragmentation of care, quality, and safety (3).

This thesis takes its starting point in the expansion of patient choice and introduction of telemedicine and investigates patient behaviors on this primary healthcare market in transition. Increased marketization is not unique to the Swedish healthcare system, nor to the healthcare sector. More emphasis on consumer choice is a common trend in the public sector in many countries, including the Nordic countries and the UK. In addition, digitalization in healthcare is a megatrend undergoing fast development, especially following the COVID-19 pandemic. This thesis addresses aspects of increased choice, including expansion of telemedicine, which are highly relevant from a policy perspective. It also addresses areas in which research evidence to date is scarce or inconclusive. The studies can have implications for future policymaking regarding approaches to assess and increase quality in primary healthcare and regarding the role of telemedicine consultations in the future healthcare system.

3 A PRIMARY HEALTHCARE MARKET IN TRANSITION

Healthcare markets are characterized by several imperfections, which to a great extent originate from the uncertainty inherent to the nature of health and healthcare and the imperfect information exchange between different actors in the market (4-6). Due to the special features of the healthcare market, free markets in healthcare are rare. Almost all healthcare systems in the world have some level of government intervention and the Swedish healthcare system is no exception.

As a substitute for market mechanisms, the Swedish healthcare system has historically relied on planning and coordination (7) and has been organized with an extensive public sector responsibility for both provision and financing of healthcare services. The growth of the public sector started already in the 1930s, but the most rapid expansion occurred in the 1960s and 1970s (8). The 1970 Seven Crowns reform was part of a series of political decisions after 1945 that transformed the Swedish healthcare system from a rather fragmented system in terms of organization and financing to one where public regional care providers (county councils) gained control over provision and financing of healthcare (9). As a part of the reform, county councils took over responsibility for outpatient care, having already taken over responsibility for provincial general practitioners and mental health services in the 1960s (10). In addition, the Seven Crowns reform introduced a uniform co-payment for patients and fixed salary employment for physicians and abolished fee-for-service in outpatient care (11).

3.1 EXPANDING PATIENT CHOICE

Although an extensive public sector responsibility for provision and financing of healthcare might eliminate some of the issues related to uncertainty and information asymmetry in healthcare, there are also problems associated with it. Examples include weak incentives for productivity and limited responsiveness to consumer preferences. The Study of Power and Democracy, which was a special commission of inquiry established by the Swedish Government that began in 1985 and ended in 1990, intensified the debate about whether the public sector and its working methods met the requirements of the time regarding service orientation, efficiency, and participation (12).

Since the beginning of the 1990s, extensive deregulation and privatization have taken place in the Swedish healthcare system (13). The increased interest in finding new ways of organizing healthcare could be attributed to a large financial deficit and negative economic growth, combined with a change in the political orientation (7). Some of these deregulations were efforts to increase patients' freedom of choice regarding healthcare provider. Historically, patient choice has been limited in Swedish primary healthcare. The organization of the sector was previously focused around public healthcare providers responsible for the care of residents in a defined geographical catchment area (1). Consequently, patients were restricted to using the primary healthcare center nearest to their place of residence (14). In 1994, a short-lived general practitioner reform was implemented through the Family Doctor Act and the Act on Freedom to Establish Private Practice, which stipulated that individuals should have the right

to choose primary healthcare provider and that providers in primary healthcare should have the opportunity to establish themselves. However, these acts were removed by the new political majority in 1995, before they were fully implemented (10).

Another step towards increased choice was a recommendation from the Federation of County Councils in 1989, which stated that patients should be given the opportunity to choose among healthcare providers throughout the country. Although the recommendation had little effect, it paved the way for the patient choice reform that was implemented nationally through legislation in 2010 (15).

The patient choice reform consisted of three parts: free choice for patients, free establishment for providers, and uniform payment to providers based on the choices of individuals (1). The reform began in some regions in 2007 (in Region Stockholm in 2008) and was made mandatory nationally following a change in the Health and Medical Services Act in January 2010. Arguments for increased choice in Swedish healthcare emphasized that choice would send a signal to poorly performing healthcare providers and improve the efficiency in the system, and that it was an effective way to empower patients (16). The patient choice reform also had the objective to make it easier for private healthcare providers to enter and operate in the system (17). The reform also meant that the former structure of primary healthcare providers being responsible for the provision of primary healthcare for a geographically defined area was formally abandoned (10).

The patient choice reform paved the way for telemedicine providers to enter the Swedish healthcare system. The increase in telemedicine consultations was the result of technological innovation but was also unintentionally enabled by the Patient Act (18), which expanded patient choice to include all publicly financed outpatient care in the entire country. The combination of expanded patient choice and the already established agreement between regions regarding conditions and reimbursement for healthcare provision across regions enabled telemedicine providers, that were subcontractors in one region, to reach patients nationally.

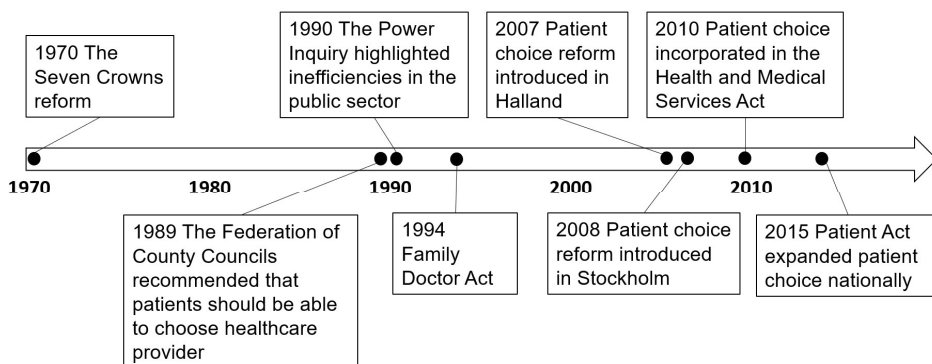


Figure 1. Steps towards increased choice.

3.2 THE FORMATION OF THE QUASI-MARKET

The patient choice reform led to major changes in the organization of primary healthcare and the allocation of resources. These changes had implications for the actors and objectives in primary care (19) and represented a considerable marketization in some dimensions. The introduction of market mechanisms in Swedish primary healthcare created what is sometimes referred to as a quasi-market. Quasi-markets have some of the characteristics of the central planning model and some of the characteristics of the competitive market. The Qs in Figure 2 illustrates the features of the primary healthcare market in Sweden after the implementation of the patient choice reform.

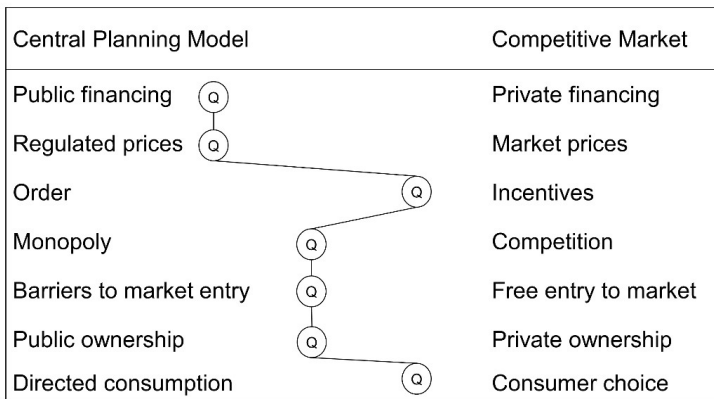


Figure 2. Six dimensions of the central planning model versus the competitive market and the position of the quasi-market in these dimensions (Q). Figure adapted from Figure 1 in Rehnberg, 1995 (7).

The primary healthcare market after the introduction of patient choice – the quasi-market – is characterized by *public financing* and *regulated prices*, just like in the planning model. The fact that prices are regulated suggests that the competition between providers will be based on factors other than price, such as quality or accessibility (20).

The quasi-market positions somewhere in between the planning model and the purely competitive market model regarding the dimensions *competition/monopoly*, *entry to the market* and *private/public ownership*. In the primary healthcare market after the reform, the barriers to entry are low and there is competition between providers over patients (21). However, there is still some regulation and private and public providers share the market.

The two dimensions in which the quasi-market is most similar to the competitive market are *directed consumption/consumer choice* and *order/incentives*. As described in the previous section, the market has shifted from a low level of choice in primary healthcare to freedom of choice between all the providers in the entire country, including telemedicine providers. The dimension direct order/incentives is influenced by the reimbursement to primary healthcare providers. Following the patient choice reform, the reimbursement model changed. Although,

there are regional variations in the design of the reimbursement models, a common denominator is that the money follows the patients. Consequently, primary healthcare providers are guided in their provision of healthcare by economic incentives rather than by direct orders.

The Qs in Figure 2 provide a general description of the Swedish primary healthcare market post the patient choice reform. However, the positions of the Qs vary with the local conditions in different regions in Sweden. The Swedish healthcare system is decentralized, with regional variations in the organization of healthcare and – perhaps more importantly – substantial variations in the conditions for providing healthcare. Although the regulations regarding choice and establishment for new providers are the same in all regions, the levels of competition and choice differ across the country. In Region Stockholm, the number of primary healthcare providers increased substantially following the patient choice reform, which increased the levels of choice and competition on the primary healthcare market. Other regions have other levels of choice and competition due to aspects such as shortage of physicians or lower population density, decreasing the possibilities of establishing new primary healthcare centers.

3.3 INTRODUCING TELEMEDICINE

During the last few decades, there has been major digitalization in many sectors of society, including healthcare. Telemedicine is one example of digitalization in healthcare that has increased substantially in recent years, especially in primary healthcare. The term telemedicine comes from the Greek word *tele* and the Latin word *medicus* and means “healing at a distance” (22). The area of telemedicine is developing rapidly, and the terminology used in the literature varies. The World Health Organization (23) has adopted the following broad definition:

“The delivery of health care services, where distance is a critical factor, by all health care professionals using information and communication technologies for the exchange of valid information for diagnosis, treatment and prevention of disease and injuries, research and evaluation, and for the continuing education of health care providers, all in the interests of advancing the health of individuals and their communities.”

In this thesis, I use a more narrow definition and define telemedicine consultations as *consultations between a healthcare personnel and a patient that are physically separated using video call or electronic chat*. In the thesis, I mainly focus on national telemedicine providers that target patients directly without connection to the patients’ primary healthcare center. These consultations are referred to as *direct-to-consumer (DTC) telemedicine consultations*. In some analyses, I compare these consultations to telemedicine consultations provided within Region Stockholm by primary healthcare centers also offering face-to-face consultations. These consultations are referred to as *digi-physical telemedicine consultations*.

The expansion of telemedicine consultations in Swedish primary healthcare started in 2016 and can be explained by several factors:

- The expanded patient choice through the Patient Act enabled DTC telemedicine providers to reach the patient population in the entire country *and* receive public funding.
- The availability of face-to-face physician consultations in primary healthcare did not meet the population's expectations (24). The number of primary healthcare physicians per capita is lower in Sweden than in many other countries (25). Consequently, limited accessibility and long waiting times have been perceived as major issues in Swedish healthcare in general, including in primary healthcare (10).
- There is a high level of digital competence in the Swedish population. Sweden ranked fifth among OECD countries regarding the percentage of the population using the internet to search for health information (26). In addition, according to a goal set by the Swedish government, Sweden will be best in the world at using the opportunities offered by digitalization and eHealth by 2025 (27).
- DTC telemedicine providers raised awareness of their new healthcare service through national marketing campaigns. Attracting patients through broad advertising campaigns had not previously been common in Swedish healthcare (28).

During the first years after the introduction of telemedicine in Swedish primary healthcare, DTC telemedicine providers mainly operated in parallel to traditional primary healthcare. Even though the telemedicine consultations were financed through tax-based public funding, the consultations were (in most cases) made without the involvement of a patient's healthcare center or region. Formally speaking, these remote consultations took place outside the patient's home region and therefore followed other principles for reimbursement than visits at a traditional primary healthcare center. However, since 2016, other types of telemedicine consultations have emerged in response to the development of nation-wide DTC telemedicine providers and several regions have developed services similar to those offered by the DTC telemedicine providers. In addition, steps have been taken towards greater integration of digital and face-to-face healthcare, not least as a consequence of the COVID-19 pandemic (29).

4 RESEARCH AIM AND RESEARCH QUESTIONS

The transition of primary healthcare into a quasi-market can be expected to influence patient behavior in several ways. The aim of this thesis was to shed light on the consequences of expanding patient choice and introducing telemedicine into primary healthcare by empirically investigating patient behaviors in response to these changes, and their impact on four central themes in healthcare: quality, continuity, equity, and demand. To approach the aim, I departed from four assumptions about patient behavior which were investigated through four research questions:

Research question I: Are citizens willing to make a trade-off between distance to chosen provider and quality of care?

The first research question related to the assumption that people are sensitive to quality in their choice of primary healthcare provider. In order to investigate the assumption, citizens' willingness to trade distance to their chosen primary healthcare provider against quality of care, was explored using objective and subjective quality indicators.

Research question II: Is recording of a diagnosis in primary healthcare associated with filled prescriptions of recommended pharmacotherapies?

The second research question investigated the assumption that lack of communication between silos in the healthcare system can lead to worse health outcomes. To investigate lack of communication, we constructed an indicator for informational continuity. The indicator measured if an inpatient diagnosis was also recorded in primary healthcare. As a proxy for health outcomes within the study population, we studied filled prescriptions of recommended pharmacotherapies associated with decreased risk of future cardiovascular events.

Research question III: What characterizes users of direct-to-consumer telemedicine consultations in primary healthcare?

The third research question addressed the assumption that telemedicine consultations are used to a greater extent by individuals with lower healthcare needs. To explore the assumption, we investigated the characteristics of users of telemedicine and compared them with users of face-to-face consultations.

Research question IV: What is the impact of use of direct-to-consumer telemedicine on subsequent healthcare consumption?

The last research question investigated the assumption that use of telemedicine consultations can increase overall primary healthcare consumption. This was studied by comparing healthcare consumption following a telemedicine and a face-to-face consultation, respectively.

5 EXPECTATIONS ON PATIENT BEHAVIOR ON A PRIMARY HEALTHCARE MARKET IN TRANSITION

In this chapter, I present some of the empirical evidence and theoretical underpinnings of the four assumptions about patient behavior on a primary healthcare market in transition that were addressed in the thesis through the research questions. The assumptions reflect some of the hopes and concerns that have been vocalized in the transition of the primary healthcare market and relate to important themes in healthcare such as quality, continuity, equity, and demand.

All the patient behavior that I have studied in investigating these assumptions were related to healthcare consumption in some form. More specifically, I explored choice of primary healthcare provider, filled prescriptions, and use of telemedicine and face-to-face consultations in primary healthcare. Even though the behaviors analyzed are all patient behaviors, the determinants of those behaviors originate from both the demand side – the individuals themselves – and the supply side – the healthcare providers or the healthcare system. A choice of provider can only be made if there is a primary healthcare center to choose, a prescription can only be filled if it is prescribed, and telemedicine consultations and face-to-face consultations can only be consumed if they are offered. Some of the factors that affect healthcare consumption are presented in Figure 3.

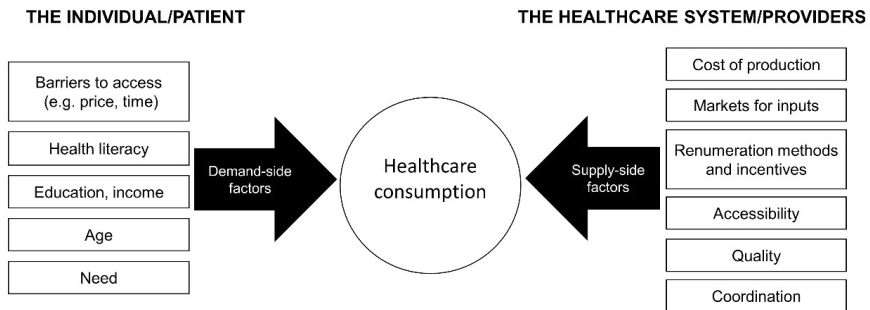


Figure 3. Demand-side and supply-side factors influencing healthcare consumption.

Factors influencing the demand for healthcare include barriers to access, health literacy, socioeconomic factors such as education and income, demographic factors such as age and need (30). Examples of barriers to access are price and time. According to standard economic models, the demand curve for most goods is downward sloping, indicating that with a decrease in price, there is an increase in the quantity demanded. This relationship between price and demand has been shown to be present also in healthcare (31-33). The same principle can be assumed to apply for time costs, although different groups in the population might value time differently (34). Differences in health literacy, education, income and age may lead to differences in demand for healthcare due to factors such as differences in health beliefs, unequal capabilities, differential knowledge, and unequal resources (35). These factors can also influence the need for healthcare. Need for healthcare is evidently a strong determinant for

demand for healthcare, but there are also examples of need that is not converted into demand, such as compulsory psychiatric care, and demand that does not correspond to need, for example demand for antibiotics for viral infections (36).

Factors influencing the supply of healthcare are for example markets for inputs, costs of production, and remuneration methods and incentives (30). The markets for inputs can influence the supply of healthcare for instance due to shortage of skilled labor. Cost of production and remuneration methods and incentives determine the level of production. The economic incentives that providers face depend on three factors: when the resources are distributed (prospectively or retrospectively), the level of variability in the reimbursement (fixed or variable), and the unit used for financing (for example item-of-service, visit, or patient) (37). The dominating reimbursement scheme in Swedish primary healthcare is capitation. In most regions, this scheme is complemented by fee-for-service (38). Capitation is a fixed and prospective reimbursement scheme where the unit of financing is the patient. In a capitation scheme, the providers know in advance the size of the payment that they will receive, which creates an incentive to limit costs (39). On the other hand, capitation might encourage undertreatment and referrals of time-consuming patients (40). Fee-for-service is a variable reimbursement scheme in which providers are paid retrospectively depending on their production, although prices are often set prospectively. Fee-for-service creates an incentive to maximize the volume of care produced, which makes the model a useful tool to stimulate production. However, fee-for-service can lead to problems with cost containment and overproduction of care (37).

Additional supply-side factors, that may not influence the level of production of healthcare consultations, but that may influence healthcare consumption in other forms – for example choice of provider and filled prescriptions – are quality of care, accessibility, and coordination between different healthcare providers.

Both demand-side and supply-side factors are highly relevant for the healthcare consumptions investigated in this thesis:

- For choice of primary healthcare provider, important demand-side factors are health literacy and barriers to access, such as distance to provider. Supply-side factors such as quality and accessibility are also likely to have a strong impact.
- For filled prescriptions of pharmacotherapies, the demand-side factor need is crucial, but filled prescriptions are also heavily dependent on supply-side factors such as prescription patterns and *knowledge* about the need which, in turn, can be influenced by the coordination and communication between a primary healthcare center and other healthcare providers.
- For consumption of face-to-face and telemedicine physician consultations in primary healthcare, demand-side factors such as need, health literacy, and barriers to access are important. On the supply side, cost of production, remuneration methods and incentives are crucial to the level of healthcare provision.

In the following sections, the four assumptions investigated in the thesis are addressed in greater detail.

5.1 QUALITY ASSUMPTION: PATIENTS ARE SENSITIVE TO QUALITY IN THEIR CHOICE OF PRIMARY HEALTHCARE PROVIDER

The first assumption investigated in the thesis is the assumption that patients are sensitive to quality in their choice of primary healthcare provider. The Government Bill that proposed a patient choice system in primary healthcare argued that this was the case and that increased choice therefore would lead to increased quality of healthcare services (17):

“By money following the patients, increased choice can also contribute to increased quality since large patient groups will list with the provider that provides the best quality care. This will create competition which will spur healthcare providers to improve quality and accessibility.”

(Government Bill 2008/09:74).

Elements of a quasi-market could theoretically promote quality of care. The underlying idea is that dissatisfied patients are expected to vote with their feet and “exit” providers with low quality, choosing other healthcare centers for future care. When the money follows patient choices, caregivers that offer better services will gain resources and market shares. In order for unpopular providers to stay in business, they need to improve their quality to attract new patients and retain listed ones (41). The possibility to withdraw from a dissatisfying relationship through the mechanism of exit was described by Hirschman (42) and contrasted to the mechanism of “voice”, which comprises the possibility to influence decisions and improve or repair a relationship through complaints or proposal for change (which can also be used in a choice system).

In order for the mechanism of exit to improve quality in practice, patients need to be able to make informed choices and have access to information about the quality of care offered by different providers (43). On the supply side, providers need to receive information about patients’ choices, analyze it, and respond to it (44). However, being able to make an informed choice is an inherent problem in healthcare because of the information asymmetry between patients and healthcare providers. It can be difficult to judge the quality of care, as it is not always clear if it is the treatment that leads to an improved or altered state of health (4).

The political expectation when patient choice was implemented was that the reform would drive quality (45) – but it is still uncertain to what extent patients are guided by quality when choosing a healthcare provider. A population survey study from three regions in Sweden indicated that only 3 percent of the respondents who had made a choice had used the internet to search for information about different providers. The results imply that quality is not an important factor in patients’ choice of provider (46). A scoping review of determinants of patients’ choice of healthcare provider, including Swedish studies, also found that few patients used comparative information when making their choice (47). On the other hand, quality information could be collected from more informal sources, such as Facebook groups or

neighbors' experiences. Empirical evidence from the US has suggested that quality seems to influence choice of hospital even before quality information is widely available (48).

In the last few years, there has been increased interest in developing and using quantitative statistical methods to study choices made by individuals. The purpose of such analyses is twofold: to gain a better understanding of how choices are made and to forecast future choice responses (49). There is an emerging literature on the relationship between quality of care and choice of healthcare provider. A common approach is to investigate the trade-off between distance to chosen practice and quality of care using various measures. Most studies have focused on choice of hospital in a US setting, and they have generally found a positive association between quality and patient choice of hospital (48, 50-55).



Figure 4. An approach to study choice in healthcare is to investigate the trade-off between distance to chosen practice and quality of care.

There is also some evidence from European settings concerning choice of hospital and quality. In a Dutch study, Varkevisser and co-authors (56) examined the relationship between publicly available quality ratings and choice of hospital for angioplasty. Their findings suggested that patients were more likely to choose a hospital with low readmission rates and good reputations. In an English study, various quality measures for hip replacements and their effects on hospital demand were explored. The quality measure "increase in health gain" was found to increase demand, while more traditional measures of hospital quality seemed less important in hospital choice (57).

Quality has also been shown to influence choice of provider in primary care. In a Norwegian study, the authors found that quality had a positive effect on demand. Excess mortality rate at the general practitioner level was used as an indicator of quality (58). Norwegian studies have also found that patient shortage was associated with more switching of care provider (59) and more dissatisfaction among patients (60), which indicates that the mechanism of exit is utilized in primary healthcare. A positive association between choice and quality has been found in the UK primary care setting. Santos and co-authors (61) found that patients were more likely to choose practices with higher clinical quality and that the results were robust across age, gender, and socioeconomic status.

5.2 CONTINUITY ASSUMPTION: LACK OF INFORMATIONAL CONTINUITY BETWEEN INPATIENT CARE AND PRIMARY HEALTHCARE WILL LEAD TO WORSE HEALTH OUTCOMES

The second assumption investigated in the thesis is the assumption that lack of informational continuity leads to worse health outcomes. With the introduction of the quasi-market and patient choice, patients were given the right to seek outpatient care from any healthcare center in any region. Simultaneously, healthcare has been becoming increasingly specialized and new forms of care and care providers have been established (62). The development that patients are seen by an increasing number of providers in a wide range of organizations and places might entail a risk of fragmentation of care and could potentially counteract continuity of care. Increased difficulties with coordination of care for those with large care needs have been raised as a potential adverse effect of the patient choice reform (63).

Continuity is defined by the World Health Organization in the following way:

“[T]he degree to which a series of discrete health care events is experienced by people as coherent and interconnected over time and consistent with their health needs and preferences.” (64)

The term continuity is multifaceted. In order to develop a common understanding of the concept continuity, Haggerty and co-authors identified three types of continuity: informational, management, and relational (65).

- Informational continuity—The use of information on past events and personal circumstances to make current care appropriate for each individual.
- Management continuity—A consistent and coherent approach to the management of a health condition that is responsive to a patient’s changing needs.
- Relational continuity—An ongoing therapeutic relationship between a patient and one or more providers. (65)

Continuity between patients and healthcare staff is considered to promote the quality and efficiency of care, and to be central to the experience for both patients and healthcare professionals (62). Under the Swedish Health and Medical Service Act (2017:30), healthcare must meet a patient’s need for continuity. However, the importance of continuity for a patient may depend on his or her healthcare need. Rognes and co-authors (66) categorize patients across two dimensions: if the provision of healthcare takes place within one silo of the healthcare system or across several silos and if the treatment is completed or continuous. This creates four patient categories: simple, complicated, chronic, and complex (Figure 5). For the first group, simple patients, access may be of higher relevance than continuity in their healthcare consumption. The second group, complicated patients, consumes healthcare across silos and benefit from good collaboration and communication between units and groups. The third group, patients with chronic diseases, benefits from prevention work as a complement to treatment, making continuity and monitoring of the chronic condition important factors. The fourth group, complex patients, benefits from individualized,

personalized solutions with a high level of continuity, teamwork, and network-oriented healthcare.

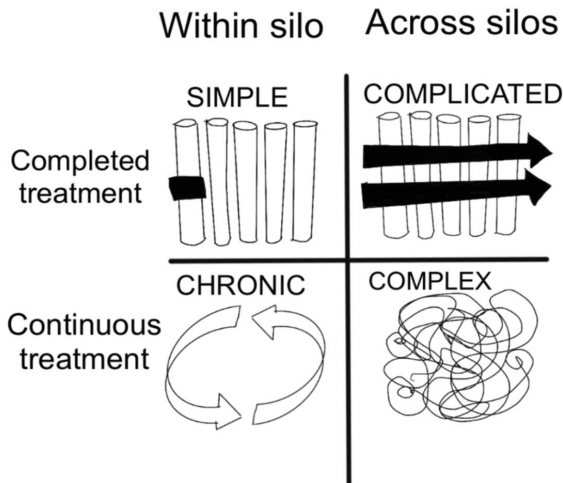


Figure 5. Patient groups with different needs for continuity (66).

The type of continuity that is of particular interest in this thesis is informational continuity. Informational continuity is affected by the accessibility and contents of patient information (67). Informational continuity is especially important for patients in the categories “complex” and “complicated”, who are treated in multiple silos in the healthcare system. The importance of informational continuity has increased over time. A contributing cause is the increasing specialization and fragmentation in healthcare. Many patients need to see several different caregivers, and caregivers must increasingly work together to provide high-quality care (68). Previous studies indicate that the discharge information between hospital-based providers and primary healthcare centers is often delayed or insufficient, which may adversely affect patient care (69, 70).

An indicator that targets the informational continuity between hospital care and primary healthcare is recorded diagnosis or “detection degree.” The indicator is used for follow-up in Region Stockholm (71). The indicator measures the proportion of individuals, within a number of chronic conditions, who have had their diagnosis recorded in primary healthcare. The idea underlying the indicator is that the recorded diagnosis forms a basis for following patient groups along the healthcare chain. A recorded diagnosis is assumed to be beneficial for the patient. However, the effects of the measure have not been thoroughly investigated.

5.3 EQUITY ASSUMPTION: TELEMEDICINE CONSULTATIONS ARE USED TO A GREATER EXTENT BY INDIVIDUALS WITH LOWER HEALTHCARE NEEDS

Expanded patient choice might increase inequities in access to care due to a number of reasons. Uptake of choice might differ systematically between groups in the population, with better educated and wealthier subgroups potentially being more aware of the choices that are available to them and more likely to exercise choice (72). Equity may further be threatened if the services offered are more suited for the needs or demands of the advantaged than those in greatest need (73).

Divergence in quality of care between socioeconomic groups is regarded as a major issue in the Swedish healthcare system (10) and the equity implications of the increased choice offered by telemedicine providers has been a debated aspect of the transition of the primary healthcare market (74, 75). Telemedicine providers have been considered to be either the future of healthcare or something that stands in contrast to both medical ethics and needs-based distribution of healthcare resources (24). The third assumption investigated in the thesis is the assumption that telemedicine consultations are used to a greater extent by individuals with lower healthcare needs which could increase disparities in health.

Equity in health can be defined as *“the absence of systematic disparities in health between social groups who have different levels of underlying social advantage/disadvantage”* (76). In healthcare, a distinction can be made between horizontal and vertical equity. Horizontal equity refers to equal treatment for equal needs and vertical equity refers to unequal treatment for unequal needs. Those in greater need should have greater access to healthcare (77).

Swedish legislation prescribes equal access for equal needs, for the entire population. However, individuals may differ in their access to healthcare for a number of reasons. First, availability of healthcare services may differ between different population groups. Physicians may have differing propensities to offer certain treatments to certain individuals, irrespective of whether or not their needs differ. Second, the quality of the healthcare services offered to different groups may vary. Third, costs associated with healthcare services may vary between population groups, and fourth, knowledge about the availability of different services may vary between population groups (78).

A potential difference in access to telemedicine consultations in different population groups could be explained by several of the previously mentioned factors. Availability of telemedicine could differ either because a healthcare provider might consider a telemedicine consultation inappropriate for a certain individual and withhold that option in a follow-up contact, or because the patient lacks the technological prerequisites to access the health services, such as an electronic identification (Bank ID). The cost of the consultations may also influence different individuals to differing extents. Healthcare consultations in Sweden are publicly funded and patient fees are heavily subsidized. Still, previous studies have shown that more socioeconomically disadvantaged individuals refrain from seeking care even if they have a perceived need (79-81). Refraining from seeking a telemedicine consultation due to the patient fee might be more common than refraining from seeking a face-to-face consultation for the

same reason. A telemedicine consultation could potentially be regarded as relatively more expensive, because the value of the interaction is perceived as less than that of a face-to-face consultation (82).

Previous research indicates that the use of telemedicine is associated with factors other than greater healthcare needs. In qualitative studies and survey studies, primary healthcare physicians have expressed concern that telemedicine consultations may increase demand for healthcare services among predominantly young, presumably healthy individuals, possibly at the expense of the elderly and multimorbid, thus increasing healthcare disparities (82-84). Previous empirical studies further suggest that users of telemedicine are younger and more often female compared with the population as a whole and with users of face-to-face consultations in primary healthcare (2, 85-90). Regarding socioeconomic factors, previous studies have generally found a positive association between telemedicine use and income (91-93). However, the evidence is inconclusive. There are also studies showing no association between socioeconomic factors and use of telemedicine (88, 94) and studies that found that telemedicine use was associated with living in a poorer community (86).

It is important to investigate the effects of the provision of telemedicine on different population groups further. DTC telemedicine providers that are detached from traditional primary healthcare centers may provide services primarily to the generally healthy population and exclude vulnerable groups with multimorbidity and long-term conditions. Although this could free up resources at traditional primary healthcare centers that can focus on those in higher need, it might also generate new demand and drive up unrealistic expectations (95).

5.4 DEMAND ASSUMPTION: USE OF TELEMEDICINE CONSULTATIONS WILL INCREASE OVERALL HEALTHCARE CONSUMPTION

The fourth, and last, assumption investigated in the thesis is the assumption that use of telemedicine consultations increases the overall consumption of primary healthcare. The convenience of telemedicine consultations in combination with economic incentives leading to produce many visits, might incur a risk of overutilization.

Access to primary healthcare consultations varies significantly between the face-to-face and telemedicine settings. Telemedicine providers in Sweden have offered almost instant access to qualified assessments by physicians or other healthcare professionals. The immediate access has been perceived as one of the most positive aspects of telemedicine (89). In contrast, access to a face-to-face consultation is more complicated. During the study period, the first step to access a face-to-face physician consultation was to contact a nurse at the primary healthcare center, who assessed the need for a consultation by phone. After this triage, the patient would either get an appointment or get advice for self-care (96). Telemedicine providers facilitated access by eliminating these gatekeepers. In addition, they provided consultations with more generous opening hours, at reduced time costs and no travel costs. For individuals aged 18 or 19 in Region Stockholm there was no patient fee for a telemedicine consultation, during the study period, whereas they had to pay for a face-to-face visit. The patient fee is determined by

the region of utilization and the threshold for patient fees is 18 years in Region Stockholm and 20 years in Region Jönköping, where the telemedicine providers were located during the first years.

The reduced threshold for accessing primary healthcare – with clear benefits for patients – raises concerns regarding inappropriate use. Reduction in price or other constraints can create moral hazard, i.e., an increase in demand as a consequence of removed barriers (97). Moral hazard is one of the most important imperfections in healthcare markets. In healthcare systems where costs are covered by pooled resources (whether it is social health insurance, private insurance or tax-based financing), the third-party payer reimburses the majority of the costs at the point of utilization and the patient pays only a small fraction. The fact that the consumer only carries a part of the costs might lead to excessive consumption (98), which can be further increased through the removal of constraints.

The large accessibility to telemedicine providers may create a demand for follow-up contacts that potentially are not medically motivated. Telemedicine providers may in turn be more responsive to such demand given the economic incentives that they have which stimulate a high level of production (99). Due to the agreement between regions regarding “out of county care”, telemedicine providers are reimbursed via the external county reimbursement and therefore have other economic incentives than primary healthcare centers operating in a patient’s home county. During the study period, direct-to-consumer (DTC) telemedicine providers were reimbursed based on a fee-for-service principle, a reimbursement model which may lead to problems with cost containment and overproduction of care (37). The dominating reimbursement form for primary healthcare centers during the same period was capitation which, on the other hand, might encourage undertreatment (40).

The potential impact of telemedicine consultations on overall healthcare utilization is twofold and can be illustrated by the following questions:

- Would the encounter have taken place without the telemedicine option?
- Do telemedicine consultations lead to increased health-seeking behavior?

This thesis focuses on the second question and investigates if telemedicine consultations lead to more subsequent healthcare consumption than face-to-face consultations. However, when interpreting the results, it should be considered that it is likely that not all telemedicine consultations would have become face-to-face consultations in the absence of the digital option.

There are several mechanisms that could lead us to expect that a telemedicine consultation leads to more additional healthcare consumption than a face-to-face consultation. First, it is possible that a digital interaction is not sufficient for solving the problem. It might be necessary to conduct a physical examination in order to determine the next step in the medical treatment. Second, the fee-for-service reimbursement of DTC telemedicine providers creates stronger economic incentives for a high level of production than the capitation reimbursement of primary healthcare centers. Third, DTC telemedicine users may adapt their healthcare-seeking behavior and add DTC telemedicine as a complement to their regular healthcare consumption.

There is also a potential mechanism working in the other direction. Due to the lower threshold for accessing healthcare through DTC telemedicine, it may be the case that the health conditions of users of telemedicine are less severe than the health conditions of users of face-to-face consultations and that their number of subsequent consultations is lower due to lesser need.

Previous studies report varying results regarding how access to telemedicine affects overall healthcare consumption. Some studies indicate that telemedicine triggers additional face-to-face consultations or has a minor impact on the consumption (92, 100-103), whereas other studies suggest that telemedicine consultations have the potential to replace face-to-face consultations, at least partially (96, 104, 105).

5.5 QUESTIONS TO INVESTIGATE FURTHER

Several assumptions about patient behavior have been brought to light during the transition of the primary healthcare market. However, the evidence base for these assumptions is in many cases limited or inconclusive.

First, several studies from the hospital sector suggest that patients are influenced by quality in their choice of provider. However, evidence from the primary healthcare sector is scarce. Although survey studies indicate that few Swedish patients use the internet to compare providers, there is little empirical evidence based on the actual choices of patients to investigate if they are sensitive to quality in their choice of provider.

Second, continuity and access are major challenges in Swedish primary healthcare. Several studies have demonstrated the value of relational continuity, but the benefits of informational continuity are less researched. Recorded diagnosis is used as a follow-up indicator, but its effect on health outcomes has not been evaluated.

Third, studies from a variety of settings have found that users of telemedicine are younger and more often female compared with users of face-to-face visits, but the evidence regarding the impact of socioeconomic factors and factors associated with the regular primary healthcare provider is limited, contradictory, or inconclusive.

Lastly, telemedicine is an area under a fast development, but there is still little knowledge about the implications of telemedicine consultation on the subsequent healthcare consumption.

All of these areas are highly relevant from a policy perspective and essential in designing appropriate models for reimbursement and follow-up in primary healthcare, for example.

6 MATERIALS AND METHODS

The thesis includes four empirical studies which were all based on linked register data from regional and national registries. The setting of all studies was primary healthcare in Region Stockholm in Sweden, but also includes adjacent healthcare sectors such as inpatient care in Study II and national telemedicine providers in Studies III and IV. The study populations ranged from patients with stroke, TIA, or acute coronary syndrome in Study II to all individuals registered at a primary healthcare center in Studies I and III. All study populations were based on total population data. An overview of the studies is presented in Table 1.

Table 1. Overview of the study characteristics.

	Study I	Study II	Study III	Study IV
<i>Focus</i>	Association between quality of care and choice of provider	Association between recorded diagnosis and filled prescriptions of recommended pharmacotherapies	Determinants for use of DTC telemedicine in primary healthcare	Healthcare consumption following use of DTC telemedicine
<i>Setting</i>	Primary healthcare in Stockholm, Sweden	Primary healthcare and secondary care in Stockholm, Sweden	National telemedicine provision and primary healthcare in Stockholm, Sweden	National telemedicine provision and primary healthcare in Stockholm, Sweden
<i>Design</i>	Register-based longitudinal cohort study	Register-based longitudinal cohort study	Register-based cross-sectional study	Register-based longitudinal cohort, quasi-experimental
<i>Population</i>	Individuals registered at a primary healthcare center in 2017 with experience of healthcare consumption in 2016–2017	Patients with stroke, TIA, or acute coronary syndrome in inpatient care 2013–2016	Individuals registered at a primary healthcare center in 2018	Individuals with a DTC consultation during the first half of 2018 and matched controls
<i>Data sources</i>	Stockholm regional healthcare database (VAL). The National Patient Survey (NPE).	VAL	VAL, Longitudinal Integrated Database for Health Insurance and Labor Market Studies (LISA), Total Population Register (RTB), National Patient Registry (NPR), Region Jönköping healthcare database, NPE	VAL, LISA, RTB, NPR, Region Jönköping Healthcare database
<i>Data analysis</i>	Conditional logit analysis	Logistic regression analysis	Logistic regression analysis	Interrupted time series analysis

6.1 STUDY CONTEXT

The Swedish healthcare system is characterized by tax-based funding, universal coverage, and decentralized responsibility (21). Primary healthcare is defined in the Health and Medical Services Act (106) as healthcare services in which outpatient care is provided without limitations in terms of diseases, ages, or patient groups. Primary healthcare is usually the first point of contact for patients, although there is no formal gatekeeping function towards specialized care (21). A well-developed primary healthcare is considered to be an important component in the provision of patient-centered, equitable, and accessible healthcare (107) and the healthcare reform aiming at increasing patient choice can be regarded as an attempt to strengthen the role of primary healthcare (1).

The decentralization of the Swedish healthcare system, with regions responsible for the provision and financing of healthcare, means that there are regional variations in the organization of healthcare due to differing healthcare policies and conditions. Region Stockholm is characterized by a large population, a large number of primary healthcare providers, and a higher percentage of private providers than in many other regions. In addition, the number of physician consultations in primary healthcare per capita is higher in comparison to other Swedish regions. The region formerly had a reimbursement model for primary healthcare, with a high level of fee-for-service, which created strong incentives for producing physician consultations. The fee-for-service share of the reimbursement has decreased gradually since 2008. However, the number of physician consultations per capita in primary healthcare remains higher in Stockholm than in other regions. A high utilization of physician consultations among residents of Stockholm is also apparent in telemedicine consultations. The first years' experience showed that the use of telemedicine was higher in Region Stockholm than in any other region in the country (29).

The relatively high number of primary healthcare providers and the use of telemedicine makes Region Stockholm a suitable choice for investigating the consequences of expanded patient choice and the introduction of telemedicine. However, the generalizability of the results to other regions in Sweden is limited due to the special features of the Stockholm primary healthcare market. Still, the development of the telemedicine market in Region Stockholm provides lessons and experience of introducing the technology in a publicly funded health system and the findings can be expected to have relevance in other settings as well.

6.2 DATA AND STUDY POPULATIONS

The studies in the thesis are based on individual-level data that have been routinely collected for administrative purposes. The unique personal identification number allowed us to link individual-level data from regional healthcare registries from Region Stockholm and Region Jönköping to nationwide registries from Statistics Sweden and the National Board of Health and Welfare. The public registries allowed us to study the entire population of Region Stockholm. The different studies had slightly different study populations:

- In the quality study, Study I, we wanted to investigate choice of primary healthcare center for individuals who had some experience of using primary healthcare. The study population therefore consisted of individuals who were registered at a primary healthcare center in December 2017 and who had made at least one visit during the preceding two-year period (n=1.4 million).
- In the continuity study, Study II, we were interested in investigating the effects of informational continuity and therefore selected a study population for which there were clear recommendations about pharmacotherapies which enabled us to construct an outcome measure based thereon. The study population consisted of 19,072 individuals with an inpatient diagnosis of stroke, transient ischaemic attack, or acute coronary syndrome during the period 2010–2013.
- In the equity study, Study III, we wanted to investigate the characteristics of users of telemedicine in comparison to users of other forms of healthcare consumption. In the study population we included all residents of Region Stockholm who were registered with a primary healthcare provider in December 2018 (n=2.0 million).
- In the demand study, Study IV, we wanted to investigate the healthcare consumption in the six-month period following a telemedicine consultation and a face-to-face consultation, respectively. The study population included all individuals who had ≥ 1 physician consultation (telemedicine or face-to-face) during the first half of 2018. Telemedicine users were matched 1:2 to users of face-to-face visits on diagnosis and demographic and socioeconomic variables.

6.3 OUTCOME VARIABLES

The aim of this thesis was to shed light on the consequences of expanding patient choice and introducing telemedicine into primary healthcare by empirically investigating patient behaviors in response to these changes. The patient behaviors investigated all relate to healthcare consumption in various forms. In exploring the four research questions, I investigated choice of provider, filled prescriptions, and telemedicine and face-to-face healthcare consultations as outcome variables in the statistical analyses.

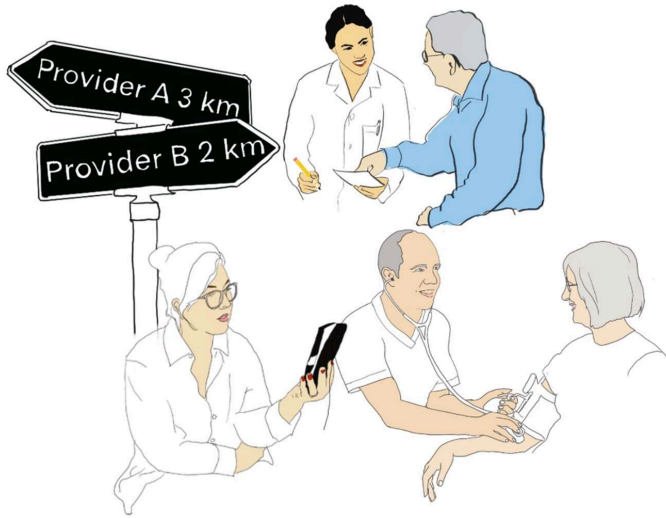


Figure 6. Four types of patient behaviors investigated in the thesis: choice of primary healthcare provider, filled prescriptions, telemedicine consultations, and face-to-face consultations in primary healthcare.

6.3.1 Choice of provider

To investigate whether individuals were willing to make a trade-off between distance to chosen provider and quality of care (Study I), the outcome variable was choice of primary healthcare provider in 2017. The variable was a binary indicator, taking the value 1 for the provider chosen by individual n and taking the value 0 for all other providers in the choice set of individual n . The choice set was defined as the 30 closest providers within 15 km distance. Choice of provider was investigated for all individuals who resided in Region Stockholm in both 2014 and 2017, who were registered at a primary healthcare center in 2017, and who had experience of healthcare consumption in 2016–2017.

6.3.2 Filled prescriptions

To investigate informational continuity and whether a recorded diagnosis in primary healthcare was associated with filled prescriptions of recommended pharmacotherapies in Study II, we followed patients with stroke, TIA, or acute coronary syndrome in inpatient care 2013–2016. The patients were classified as having a recorded diagnosis if they had received the same or a related diagnosis in primary care as they had received upon hospital discharge. Filled prescriptions of recommended pharmacotherapies was used as the outcome variable. The outcome variable took the value 1 if the patient had at least two filled prescriptions in the third year after hospital discharge (the dispensation period), and 0 otherwise. Figure 7 illustrates the time periods in which we measured hospital diagnoses, recorded diagnosis in primary healthcare and dispensation of recommended pharmacotherapies.

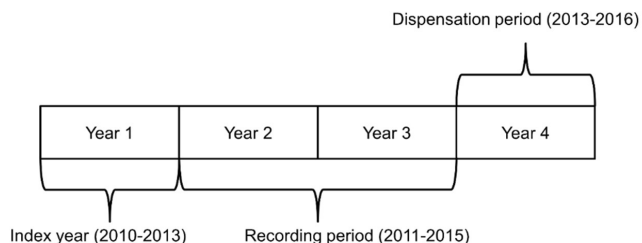


Figure 7. Index year for hospital diagnosis, recording period for recorded diagnosis in primary healthcare, and dispensation period for filled prescriptions of recommended pharmacotherapies.

6.3.3 Healthcare consultations

Healthcare consultations were used as the outcome variable in the analysis of characteristics of DTC telemedicine users in Study III and in the analysis of the impact of telemedicine use on subsequent healthcare consumption in Study IV.

In Study III, the outcome variables were use of DTC telemedicine consultations, use of face-to-face physician consultations, digi-physical telemedicine consultations, and nurse consultations through *117 on the phone* which is a telephone advice service with the national phone number 1177 (108). All variables were binary, taking the value 1 for all individuals with at least one consultation in each respective category in 2018, and 0 otherwise.

In Study IV, the outcome variables were DTC telemedicine physician consultations and face-to-face physician consultations after an index consultation consisting of a DTC telemedicine consultation or a face-to-face consultation. The number of consultations was added up for each individual and month in the six-month period after the index consultation and in the 24-month period preceding the index consultation.

6.4 STATISTICAL ANALYSIS

Various statistical analyses were applied to study the research questions in the thesis, all using large register datasets. In the first study, conditional logit models were used to investigate the association between quality and choice of primary healthcare provider. In Studies II and III, where we investigated the association between recorded diagnosis and filled prescriptions and the characteristics associated with use of telemedicine, the outcome variables were binary and logistic regression models were therefore used. In the fourth study, we investigated healthcare consumption after use of DTC telemedicine through an interrupted time series analysis.

6.4.1 Conditional logit – combines economic framework with econometric estimations

To analyze the discrete choice of primary healthcare provider among residents in Region Stockholm, conditional logit analysis was used in line with previous research (56, 57, 61, 109). The conditional logit model is a model for describing how economic agents choose among a discrete set of unordered outcomes – in this case choice of primary healthcare center.

The conditional logit framework is organized around the concept of utility maximization and the idea that different choices are associated with different utilities. Through observing the choices that individuals make, the model allows us to describe the utility they get from the characteristics associated with the alternatives. The model assumes that decisionmakers are rational agents who maximize utility, which means that they are assumed to consider all the available alternatives and choose the one that gives the highest utility (110). In discrete choice modelling, the researcher is not aware of this utility. However, the researcher can use observable attributes of the decisionmaker and attributes of the different alternatives to specify a function that relates the observable factors to the decisionmaker's utility.

In the conditional logit model, the beta coefficients in the statistical output represented marginal utilities of the different characteristics of the primary healthcare centers that patients could choose between. To get a meaningful interpretation of the marginal utility, we estimated the marginal rate of substitution, or the willingness to trade distance for a standard deviation increase in other provider characteristics such as quality indicators.

Two quality indicators were used to estimate the quality of primary healthcare centers: avoidable hospitalizations and patient satisfaction. Avoidable hospitalizations are inpatient episodes for conditions for which many hospitalizations could have been prevented if the patients had had access to well-functioning primary healthcare. Consequently, the indicator may reflect insufficient primary healthcare quality. We used the definition of avoidable hospitalizations developed by the National Board of Health and Welfare (111). To measure patient satisfaction, we used data from a large patient survey aimed at patients in primary healthcare. This indicator showed the percentage of respondents who responded that they had a positive overall impression of their primary healthcare visit.

Other provider characteristics that were included in the model were: distance from the residence of each individual, Care Need Index (112, 113) of the individuals registered at the primary healthcare center, size of practice, whether or not the provider was recently established, and if it was privately or publicly owned. Having a full list was included as a confounder in the model since high-quality providers might be unable to accept new registrations due to restricted capacity. We defined full list as providers who had stated a ceiling for their maximum number of registered patients and who had an occupancy rate of 99 percent or more of that level in December 2014.

6.4.2 Logistic regression – suitable choice for binary outcomes

In Studies II and III, logistic regression models were used since the outcome variables – dispensed pharmacotherapies and use of telemedicine and other healthcare consultations – were binary. The logistic distribution is a flexible function that is easy to use and its model parameters provide the basis for clinically meaningful estimates of effect (114).

To facilitate interpretation of the outputs of the logistic regressions, the results were presented in the form of odds ratios. An odds ratio is the odds of an outcome for the investigated group, divided by the odds of an outcome for the reference group. Odds are defined as the probability (p) of an event occurring, divided by the probability of it not occurring ($1 - p$). An odds ratio should be interpreted as the strength of the association between the explanatory variable and the outcome. Odds ratios greater than 1 indicate greater odds of association, while odds ratios lower than 1 indicate lower odds of association.

In Study II, the investigated outcome was filled prescriptions of recommended pharmacotherapies for patients with a previous inpatient diagnosis of stroke, TIA, or acute coronary syndrome. The explanatory variable of interest was a binary indicator of whether the patient had a diagnosis recorded in primary healthcare within the two-year period following the inpatient episode. This variable served as a proxy for informational continuity.

To investigate the characteristics of users of DTC telemedicine, we compared them to users of digi-physical telemedicine consultations, users of face-to-face physician consultations, and users of nurse telephone consultations. The characteristics investigated as explanatory variables were both individual-level characteristics, such as age, sex, income, and education, and provider-level characteristics related to the primary healthcare center that each individual was registered at, such as distance from residence to primary healthcare provider and accessibility as measured in the national patient survey.

6.4.3 Interrupted time series analysis – estimating differences in levels and in trends

In Study IV, we aimed to compare the healthcare consumption after a DTC telemedicine consultation to that after a face-to-face consultation. To approach the aim, we used an interrupted time series analysis. Interrupted time series analysis is especially suitable for analyzing interventions that are introduced over a clearly defined time period and that target entire populations (115). However, the approach has previously been used in examining healthcare utilization after telemedicine consultations (104).

In the study, we applied a robust time series analysis to investigate the research questions. A robust interrupted time series analysis means that a control group is used for comparison. Having a comparison group to serve as the counterfactual is generally considered superior to single-group analysis for investigating intervention effects (116). The underlying assumption in the analysis is that without the exposure, the exposed group – in this case users of telemedicine – would have followed the same change in healthcare consumption as the control group – in this case users of face-to-face consultations.

There are several benefits with an interrupted times series analysis. The approach controls for unobservable time-invariant factors that affects the outcome, the results are easy to stratify, and the analysis provides graphical results that are easy to interpret (117).

Some of the main methodological issues associated with interrupted time series analysis are autocorrelation, and controlling for seasonal trend and time-varying confounders (115). Failing to correct for autocorrelation may lead to underestimated standard errors and overestimated intervention effects (118) while failing to control for seasonal trends and time-varying confounders may induce a selection bias in the results.

6.4.4 Adjusting for confounding variables

Two methods were applied to adjust for confounding variables. In Studies I and II, adjustment was made by including the confounding variables in the regression analysis. In Study III, we were mainly interested in describing the characteristics of users of different types of consultations and none of the variables were therefore considered confounding. In Study IV, direct matching was used to ensure that the two compared groups of users and non-users of DTC telemedicine consultations resembled each other regarding the variables that we assumed would impact the outcome variable (number of primary healthcare consultations) and that we could measure with our data.

The different methods for adjusting for confounders have different benefits. Adjusting for confounders in the regression analysis allowed us to retain all observations in Studies I and II. It also provided information about each confounding variable, such as the direction and the strength of the association between the confounding variable and the outcome variable. Direct matching, applied in Study IV, has the benefit of being an intuitive way of adjusting for confounders. It also enables adjusting for confounders without specifying the relationship between each confounding variable and the outcome. In Study I, matching would not have been possible due to the study design. In Study II, we could have used matching, but considered it to be more important to retain all our observations. In contrast, for Study IV, we considered the pedagogical advantage of the matching approach to be a strength in the analysis and therefore superior to other approaches, even though it led us to lose some of our observations.

6.5 METHODOLOGICAL CONSIDERATIONS

Several years ago, when I presented this research project to a group of doctoral students (before becoming one myself), one of the questions raised was: “*Why don’t you just ask them?*” The approach of asking patients about their behaviors, rather than trying to identify them through register data in population-level databases, could have given me more information about the mechanisms underlying patient behavior. A limitation with register-based research is that one is restricted to the variables collected in the registries. However, a major benefit of registries is that they enable investigation of the behavior of millions of individuals to find patterns at the population level, which is of interest from a policy perspective. Another benefit is that registries reveal actual behavior, rather than stated behavior, which could potentially give a different story. Through linking different registries, I could also incorporate aspects related to

background factors of patients, which added to the analyses. Because of these possibilities, I stuck to the original decision to apply register-based research to this project. However, that decision created several constraints which need to be considered in the interpretation of the results. In this section, four methodological considerations are highlighted: validity, reliability, sources of bias in the statistical analysis, and generalizability.

6.5.1 Validity

The question of validity is central to any research project. Have I measured what I aimed to measure? In Studies I and II of this thesis, I aimed to explore three complex concepts – quality of care, informational continuity, and patient health – and validity could potentially be an issue. In Studies III and IV, the outcome variables – distinct types of healthcare consultations – were less complex and therefore less of an issue from a validity perspective. However, the potential selection bias in Study IV represents a threat to internal validity. These topics will be addressed in the next section.

6.5.1.1 Quality of care

In Study I, I aimed to investigate whether quality influenced choice of primary healthcare provider. Quality is a multi-dimensional and complex concept that can mean different things to different people. One framework for evaluating quality of care is the Donabedian model (119). In this framework, quality of care is structured into three categories: “structure,” “process,” and “outcomes.” Structure describes the attributes of the settings in which care is delivered. Process denotes what is actually done and outcomes describe the impact of care on patient health status.

Another way to define quality is to use the concepts objective quality and subjective quality. Objective quality refers to aspects that can be measured objectively and that determine whether the provider of a service manages to achieve the goals set. Subjective quality, on the other hand, refers to aspects of a product or service that cannot be measured objectively, but nevertheless are important to the recipients of the service. A similar distinction in the healthcare setting is between the quality of the medical care and the quality of the interaction between the patient and the caregiver. The latter contains various service aspects such as participation, responsiveness to patient needs, and quality of patient information (120).

Constructing valid and measurable indicators for quality in primary healthcare is especially challenging because primary healthcare centers meet and treat patients with a wide range of medical conditions, often in complex combinations. In this context, the choice fell on two indicators: one subjective quality indicator – patient satisfaction – and one objective medical indicator – avoidable hospitalizations.

Whether or not these indicators reflect quality of primary healthcare is debatable. Patient satisfaction is a subjective measure. A problem with subjective measures is that they can be influenced by a range of factors such as patient age, educational attainment, or expectations (121). However, the chosen subjective measure does say something about the quality of the interaction between the patient and the caregiver. The measure was important in this project

because patient satisfaction at different primary healthcare centers is one of the measures that patients could find information about online. The more objective clinical measure avoidable hospitalizations was used as a complement. Avoidable hospitalizations are of course related to a number of factors that are not associated with primary healthcare. However, the use of this indicator to measure primary healthcare quality is widespread and its use supported by a systematic review (122).

6.5.1.2 Informational continuity and patient health

In Study II, recorded diagnosis was used as a proxy for informational continuity and filled prescriptions of recommended pharmacotherapies as a proxy for patient's health. Are these valid measures? It is difficult to determine the mechanisms underlying the variations in recorded diagnosis with registry data, and other methods would be necessary to explore that aspect in more detail.

Regarding the association between patient health and filled prescriptions, several studies report positive effects of good adherence to preventive medications on the risk of future cardiovascular events (123-129). We assumed that there was a correlation between dispensation and actual intake of the drug. However, we could not check that this was the case. In order to increase the probability that the dispensed drug was also used, we defined use as at least two dispensations during the follow-up period.

6.5.2 Reliability

The reliability of measurements taken is just as important as their validity. Can we trust the measurements? Are they correct? The data in this thesis are generated from several Swedish registries. In general, Swedish registries are of very high quality. Sweden has a long history of collecting data and the personal identification number is a key for linking data from different sources. The main register used in the thesis is the Stockholm regional healthcare database VAL. VAL covers all healthcare that is reimbursed by Region Stockholm. Over the years, more and more data have been included in the database. However, there are some deficiencies in the data due to incomplete reporting. Changes in reimbursement models, coding, and organization can affect the reporting and it is therefore important to have knowledge of underlying mechanisms affecting data in order to select appropriate and reliable variables. In this thesis, some variables that could have been of interest were excluded from the analysis due to incomplete coverage. An example of such a variable is telephone consultations at primary healthcare centers. Telephone consultations are not reimbursed and are therefore reported to a limited extent.

The reliability of registry-based research is also affected by the data management process. To minimize errors in the management of data, the code for generating data was checked and revised by my co-authors.

6.5.3 Sources of bias

6.5.3.1 Selection bias

Controlling for time-varying confounders is a major methodological issue associated with interrupted time series analyses (115). In comparing healthcare consumption after a DTC telemedicine and a face-to-face consultation, respectively, in Study IV, we had no available data on symptom severity. Symptom severity is a time-varying confounder which could potentially differ between telemedicine patients and face-to-face patients. If either of these groups had less severe symptoms than the other, a selection bias would have been introduced in the analysis. To control for the risk of selection bias, patients were matched on different variables that we assumed could be associated with symptom severity in the case-control matching. These included age, sex, previous chronic illness, and education. However, without explicit information about symptom severity, we cannot be certain that the groups are comparable. This needs to be taken into consideration in the interpretation of the results. Due to the lower thresholds for accessing a telemedicine provider, such as lower time costs and travel costs and the absence of nurse triage, the telemedicine users might have had less severe symptoms than the controls. In that case, their subsequent healthcare consumption was likely to have been underestimated in the analysis.

6.5.3.2 Reverse causality

Another source of bias is reverse causality. In Study I, we investigated the influence of quality on choice – but could it be that the quality indicators are influenced by the individuals who are registered at a primary healthcare center instead? If they are, there is a risk of reverse causality. To reduce the risk of reverse causality, we used a three-year lag between the point in time when we measured quality and that when we measured choice. However, we could not be certain that the risk was entirely eliminated.

6.5.4 Generalizability

The studies included in this thesis were conducted in Region Stockholm, which had several advantages. The setting enabled us to study unselected and sizable cohorts in a region with more than 2 million inhabitants. Using data from a uniform healthcare system facilitates the interpretation of the studied mechanisms. However, restricting the analysis to one region in one country limits the generalizability to other settings. Due to the decentralization of the Swedish healthcare system, there are regional variations in the organization of healthcare. Access to provider information may vary between regions, as may the level of competition and the ability to exercise choice.

Regarding the indicator recorded diagnosis in primary healthcare, different regions may have different incentives and policies regarding recording of a diagnosis. Some reimbursement models are largely based on Adjusted Clinical Groups – which are based on recorded diagnosis. In such settings, it is likely that more diagnoses are registered. Therefore, the findings of what the effects recorded diagnosis have on subsequent use of recommended pharmacotherapies may not be transferable.

It is known that the propensity to use telemedicine is much higher in Stockholm than in other regions and the results regarding the impact of telemedicine use on subsequent healthcare consumption might differ in other settings. However, the residents of Stockholm might be considered early adopters and the early signals that we have seen when observing the behavior of Stockholm residents might be applicable to other settings in the future.

The generalizability of the findings of the telemedicine studies is also affected by the fact that digitalization in healthcare is a dynamic area undergoing fast development. The study period of the telemedicine studies (Studies III and IV) ended in 2018 and represents a pre-pandemic setting; this could potentially limit the generalizability of the results. The COVID-19 pandemic has contributed to a massive increase in telemedicine use, not only from DTC providers but also from traditional primary healthcare centers. However, it could also be argued that the pre-pandemic findings reflected a “normal state” in healthcare and are therefore more valid than if they had been based on the period during the pandemic when many sought care (and avoided seeking care) due to COVID-19. In addition, fast development should not be an obstacle to conducting research. On the contrary, reliable information from multiple sources applying different methods is important to gain an understanding of a developing area within the publicly funded healthcare system, in order to shape its future role in the system.

6.5.5 Ethical considerations

The data that I have used in the research project are register data which can be tied to individuals are therefore considered to be personal data. The data are pseudonymized and I have had no access to personal identification numbers, but *someone* (Tieto or Statistics Sweden, depending on the study) has the key. Since the data relate to health, they are considered to be sensitive data. The main rule concerning sensitive data is that they cannot be processed. However, there are a few exceptions to this rule. One exception is when the registered individual has given clear consent, another exception is when the purpose of the processing is research that has been approved in accordance with the Act concerning the Ethical Review of Research Involving Humans (130). I have taken the Act into account by sending applications for ethical vetting at the Regional Ethical Review Board which were approved (Dnr 2015/803-31/5, Dnr 2016/1547-32, and Dnr 2018/1643-31).

Under Section 17 in the Act on Ethical Review, research may only be carried out if the subject of the research has consented to the research which concerns them. However, there are exceptions to this rule. If the purpose of the research is to contribute to a result that can be of benefit to the person who is the subject of the research or someone else who suffers from a similar illness or disorder, and the research entails an insignificant risk of injury and discomfort for the person who is the subject of the research, the research may be carried out. For these studies the Ethical Review Board has approved of not seeking informed consent.

In the Nordic countries, informed consent is not generally required for large-scale registry-based studies. There are several arguments in favor of this. First, in many cases, it would be impossible to collect informed consent because of the large number of study participants. Some of my studies included more than 2 million individuals and contacting all of them would not

be possible. Second, requesting informed consent would reduce the number of participants, which could be a threat to the validity of the studies. Third, there is a risk of selection bias if some groups of the population are less likely to respond to a request for informed consent. Fourth, deceased individuals would not be able to give consent, and fifth, the cost associated with collecting consent would be enormous (131).

The research that I performed was based on data of healthcare consumption of individuals in Region Stockholm. Although I was not interested in the behaviors of any specific individual, there is always the risk that the information from one person might be revealed to a third party. However, I believe this risk to be extremely low. I have always processed data on a password-protected computer in a room that was always locked when I was not in it, on a floor that required a key to enter.

Even though someone might suffer from the fact that I used their personal data, that suffering is limited in comparison to the potential harm from an invasive study. My research has not led to any additional collection of data or any contact whatsoever between the included individuals and the research project. They have not been asked to fill out any questionnaires, answer questions on the phone or be exposed to any procedure at all.

The very fact that the data in the registries I used have been collected raises the question whether it is ethical *not* to use them to investigate questions that society could benefit from having answered. I would argue that the benefit of increased knowledge about the consequences of expanding patient choice and introducing telemedicine outweighs the limited risk of personal data getting into the wrong hands.

During the work with this thesis, I have been employed by the research and development unit Centre for Health Economics, Informatics and Health Services Research in Region Stockholm. The setting for the studies is Region Stockholm. However, the region has had no part in the design, results, or conclusions of the studies or the thesis.

7 FINDINGS

7.1 QUALITY SEEMS TO INFLUENCE CHOICE OF PROVIDER BUT THE EFFECT IS SMALL

The first assumption investigated in the thesis is one of the basic assumptions behind healthcare reforms promoting patient choice and increased competition: that patients will be sensitive to quality in their choice of provider and that increased choice therefore will lead to higher quality. The theoretical mechanism behind the assumption is that patients will register with the provider that provides the highest quality care, which will create competition that will spur healthcare providers to improve quality and accessibility.

In order for quality to influence choice of provider, there needs to be mobility on the primary healthcare market. Dissatisfied citizens need to exit their primary healthcare center and re-register with a provider that they expect to provide services of higher quality. In Study I, we investigated the actual choices of 1.4 million individuals and found that around 9 percent of the study population changed providers between 2016 and 2017.

The results further suggested that both objective and subjective quality indicators influenced choice of provider in primary healthcare in Stockholm. The measure avoidable hospitalizations, i.e., medical conditions such as heart failure, chronic obstructive pulmonary disease, hypertension, and diabetes complications for which inpatient care could be prevented with an optimally functioning outpatient and primary healthcare, was used as an objective indicator of quality. A measure of patient satisfaction was used as a subjective quality indicator. The estimations suggested that individuals were willing to trade 54 (95% CI 51–56) meters of distance for one standard deviation decrease in avoidable hospitalizations and 83 (95% CI 81–85) meters of distance for one standard deviation increase in patient satisfaction.

However, in comparison to the average distance to the chosen primary healthcare provider of 1.89 kilometers, the effects are small. We also investigated other provider characteristics and found a stronger effect from a tendency to avoid providers with a high Care Need Index in their registered population. Individuals were willing to trade 158 (95% CI 155–160) meters of distance for one standard deviation decrease in Care Need Index.

7.2 CLEAR ASSOCIATION BETWEEN RECORDED DIAGNOSIS AND USE OF RECOMMENDED PHARMACOTHERAPIES

The second assumption explored in the thesis was that informational continuity is beneficial for patients' health outcomes. To explore the impact of informational continuity of care, we investigated the association between a recorded diagnosis in primary healthcare and dispensation of recommended pharmacotherapies. We hypothesized that recorded patients would be more likely to utilize recommended medications in the long term and investigated the association between recorded diagnosis and use of recommended medications for a study population of 19,072 individuals with a hospital diagnosis of ischaemic stroke, hemorrhagic stroke, TIA, or acute coronary syndrome in Region Stockholm.

In order to ensure that the exposure (recorded diagnosis) preceded the outcome (filled prescriptions of recommended pharmacotherapies), we created three separate time periods: the index year, in which the hospital diagnoses was recorded, the recording period, in which the primary healthcare diagnosis was recorded, and the dispensation period in which we observed filled prescriptions (Figure 7).

The rates of recorded diagnosis were lower than expected and varied between 15 percent (TIA) to 47 percent (acute coronary syndrome). Except in the case of TIA, a lower percentage of females had a recorded diagnosis compared with males.

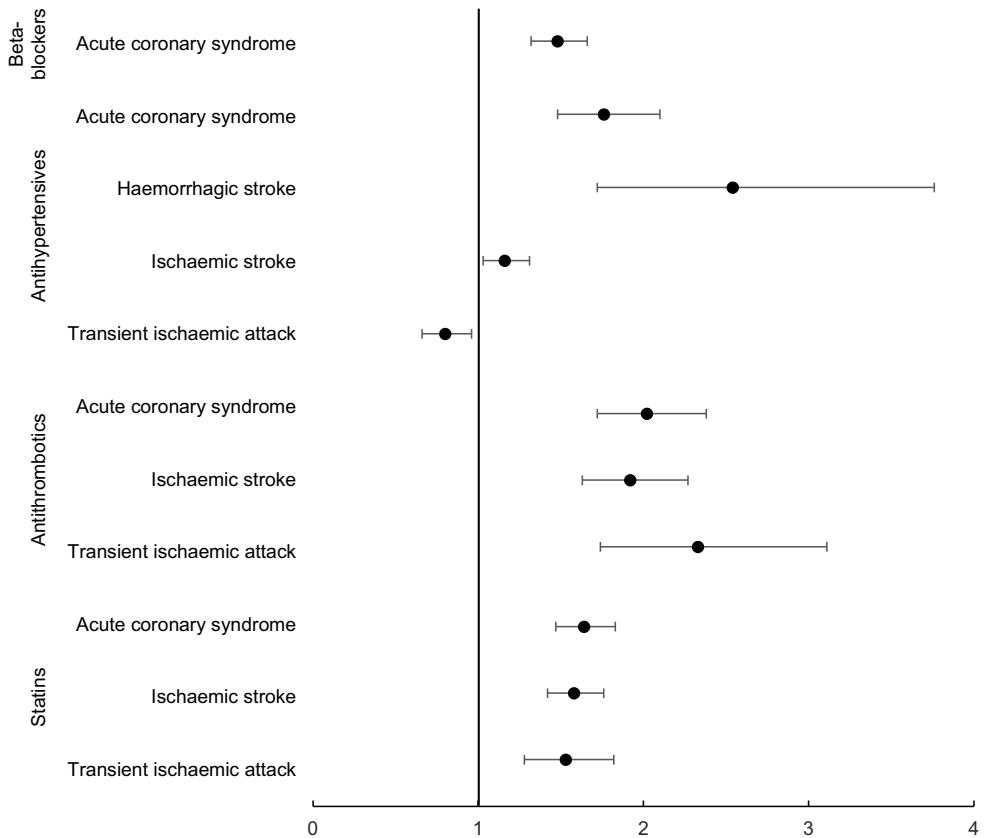


Figure 8. Odds ratios estimates and 95% confidence intervals for the odds of using recommended pharmacotherapies for patients with a recorded diagnosis in primary healthcare in comparison with patients without a recorded diagnosis, by diagnosis.

The results of the analyses further indicated a clear association between recorded diagnosis and utilization of recommended pharmacotherapies in the study population. Four types of pharmacotherapies were investigated: antihypertensives (all patients), statins and antithrombotics (patients with TIA, ischaemic stroke, or acute coronary syndrome), and beta

blockers (patients with acute coronary syndrome). Figure 8 displays the results of the adjusted odds ratios for the odds of having filled at least two prescriptions of recommended pharmacotherapies during the dispensation period for recorded patients in comparison to those without a recorded diagnosis in primary healthcare. Odds ratios and a confidence interval above 1 indicate that recorded patients were more likely to have dispensed recommended pharmacotherapies.

Patients with a recorded diagnosis were more likely than patients without one to use statins in ischaemic stroke, TIA, or acute coronary syndrome. The association was even stronger for antithrombotics, with odds ratios close to 2 or above. For beta-blockers, there was also a higher likelihood of use among recorded patients with acute coronary syndrome. In contrast, the association was more unpredictable for antihypertensives. Patients with TIA and a recorded diagnosis were *less* likely to have filled prescriptions of antihypertensives compared with those without a recorded diagnosis. However, for the remaining three patient groups, patients with a recorded diagnosis were more likely to have filled prescriptions of antihypertensives than patients without one.

7.3 USE OF TELEMEDICINE IS NOT EQUALLY DISTRIBUTED IN THE POPULATION

The third assumption that this thesis investigates is the assumption that telemedicine consultations are used to a greater extent by individuals with lower healthcare needs. If telemedicine providers target and treat other patients than primary healthcare centers do, then a potential consequence is increased disparities in health. Sweden has been one of the frontrunners in adapting to online technology in healthcare. However, concerns have been raised that the new technology will lead to increased inequity in health if its utilization is distributed unequally in the population.

Previous studies have found conflicting evidence regarding the impact of socioeconomic factors in determining the use of telemedicine. In Study III, we added to the knowledge base regarding the evolution and uptake of telemedicine by investigating if there was an association between telemedicine utilization and patient socioeconomic factors and health status, as well as distance to and accessibility of the primary healthcare provider. We compared the use of DTC telemedicine physician consultations to the use of physician office visits in primary care as well as the use of digi-physical physician consultations (telemedicine consultations by providers that also offer office visits) and telephone consultations by nurses.

We used total population data for the entire population of Region Stockholm (n=2.3 million individuals) and found that use of telemedicine options was not equally distributed in the population. In addition, we found that the use was determined by factors generally not associated with greater healthcare needs. There were clear contrasts between the determinants of telemedicine options and the determinants of face-to-face visits. Figure 9 displays a selection of the outputs from the logistic regression models. The figure shows the odds ratios for different population groups in comparison to the reference group for the odds of having made at least

one DTC telemedicine consultation versus at least one face-to-face physician consultation in 2018.

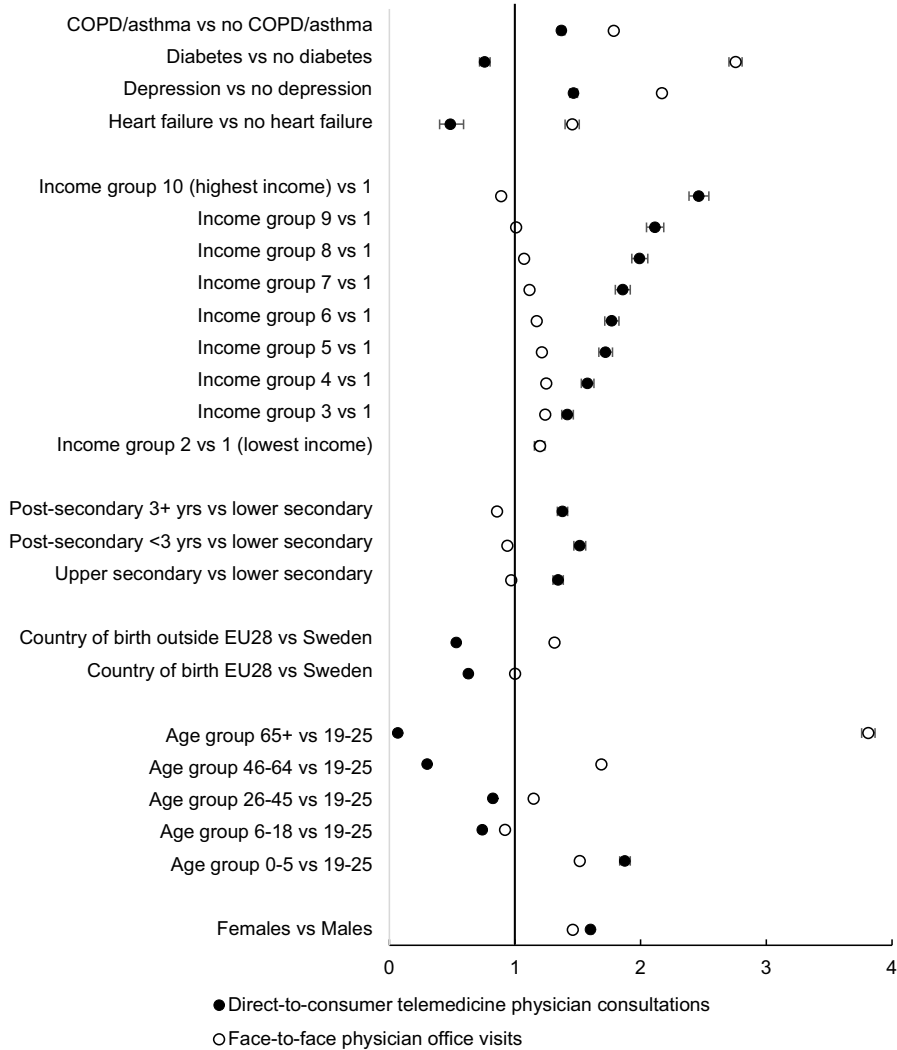


Figure 9. Odds ratio estimates of the odds of having made at least one face-to-face physician office visit versus at least one DTC telemedicine physician consultation healthcare contact in comparison to the reference group in 2018 for the residents of Region Stockholm.

As shown in the figure, higher income, education, and being a native Swede increased the probability of using a DTC telemedicine consultation and decreased the probability of making a face-to-face visit in traditional primary healthcare. Women were more likely than men to use

both types of healthcare consultation. For age, the pattern diverged for the two types of consultations. Individuals aged 65 years of age or older were much more likely than any other age group to have made at least one face-to-face consultation in primary healthcare. In contrast, their consumption of DTC telemedicine consultations was minimal.

We also investigated telemedicine use among individuals with any of four chronic conditions: chronic obstructive pulmonary disease (COPD)/asthma, diabetes, depression, or heart failure. All of these conditions were associated with higher odds of having made a face-to-face consultation in primary healthcare. In COPD/asthma or depression, this was also the case for DTC telemedicine consultation, while individuals with heart failure or diabetes were less likely to have made a DTC telemedicine consultation than those without those conditions.

7.4 TELEMEDICINE USERS INCREASE THEIR HEALTHCARE CONSUMPTION MORE THAN CONTROLS

In addition to concerns regarding inequity in the use of telemedicine services, there have been concerns that the convenience of the new technology and the limitations of telemedicine interactions will lead to overuse of healthcare services and increased need for follow-ups in the form of office visits. The fourth assumption investigated in this thesis is therefore that use of telemedicine consultations will increase overall healthcare consumption. Since telemedicine is a relatively new phenomenon, rigorous analyses of its effects on subsequent healthcare consumption are scarce. In Study IV, we contributed to the knowledge base regarding the healthcare consumption patterns associated with telemedicine by assessing the short- and intermediate-term impact of DTC telemedicine on subsequent primary healthcare consumption. We did this by comparing healthcare consumption patterns of DTC telemedicine users relative to matched controls in a robust interrupted time series analysis. The results of the analysis revealed that users of DTC telemedicine consultations increased their healthcare consumption more than controls. This effect was mostly short-term (within a month) but the increase in level in consumption was also present in the intermediate-term time span (2–6 months after the initial consultation). The additional consumption in the short-term could be attributed to both additional telemedicine consultations and additional face-to-face consultations.

Figure 10 displays the results from the analysis. The black line shows the predicted values for the healthcare consumption for DTC telemedicine users for each month of the two-year period preceding the index consultation and for the six months following the consultation. The grey line displays the values for the control group. The dotted lines show the values for the observed means for the two groups.

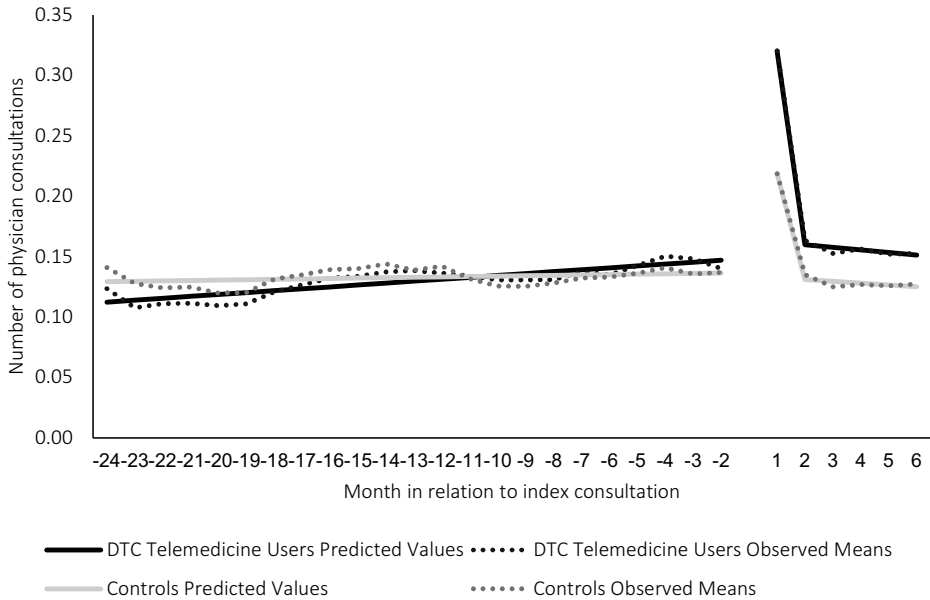


Figure 10. Observed and predicted number of total physician consultations per month in the 24-month period preceding and the six-month period following an index consultation for DTC telemedicine users and a matched control group of users of face-to-face visits in primary care.

The additional increase in level of consumption for DTC telemedicine users relative to the matched controls was 0.09 physician consultations in the first month after the index consultation, followed by an additional 0.02 physician consultations during month 2 to 6. The intermediate term time trend was slightly more downwards sloping for the DTC telemedicine users but was relatively small (-0.002 physician visits per month). The increase in level of consumption for the DTC telemedicine users was more accentuated in the short-term period than in the intermediate-term, and the additional consumption for DTC telemedicine users over the entire six-month follow up period was also more attributed to the short-term effect than the intermediate-term effect. However, there were clear variations across age groups regarding the relation between these two effects. Individuals in the two oldest age groups and individuals aged 19-25 had a relatively large share of their additional consumption attributed to intermediate-term effects whereas the intermediate-term additional consumption was smaller for the age groups 0 to 5 and 26 to 45.

Stratified analysis across index consultations in different diagnostic chapters also displayed some variation. Figure 11 shows the results from stratified analyses for two common categories of diagnoses in telemedicine: diseases of the genitourinary system (for example urinary tract infections) and diseases of the skin. For index consultations related to diseases of the genitourinary system, there was almost no difference in subsequent consumption of

physician consultations between the DTC telemedicine users and their controls at the short-term interval and only a small difference in the intermediate-term interval. In contrast, for index consultations related to diseases of the skin, the additional increase in consumption was substantial for DTC telemedicine users at both the short-term and the intermediate-term interval.

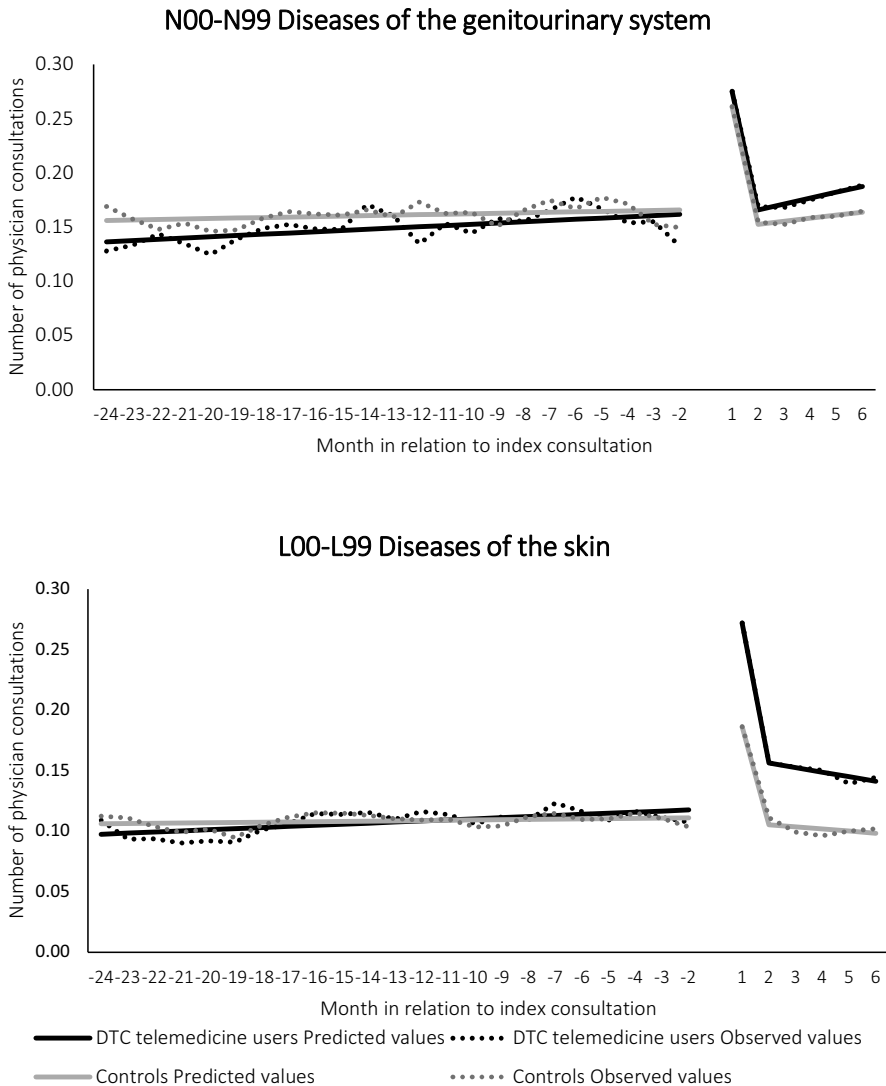


Figure 11. Observed and predicted number of total physician consultations per month in the 24-month period preceding and the six-month period following an index consultation for DTC telemedicine users and a matched control group of users of face-to-face visits in primary care. For index consultations related to diseases of the genitourinary system and diseases of the skin.

8 DISCUSSION

In this thesis, I have empirically investigated patient behavior on a primary healthcare market in transition, with the aim of shedding light on the consequences of expanding patient choice and introducing telemedicine in primary healthcare. I started from four assumptions about patient behaviors and investigated four research questions corresponding to these assumptions. The assumptions and the research questions related to four central themes in healthcare – quality, continuity, equity, and demand – and targeted areas in which the previously existing research evidence was scarce or inconclusive.

8.1 MAIN FINDINGS

The main findings of the thesis lent some support to the assumptions about patient behavior on the primary healthcare market in transition that I intended to study. In Study I, we investigated whether quality influenced choice of primary healthcare provider. The findings suggested that quality did seem to have a small impact on choice of provider. However, other aspects – such as the care needs of the individuals registered with a primary healthcare provider – seemed much more important. In investigating informational continuity in Study II, the findings revealed a clear positive association between recorded diagnosis and use of recommended pharmacotherapies, indicating that informational continuity is beneficial for patient health. Regarding equity and demand in relation to use of telemedicine (Studies III and IV), we found that the use of telemedicine was not equally distributed in the population and that telemedicine users increased their healthcare consumption after a physician consultation more than a matched control group of face-to-face consultation users. In the following sections, the findings are interpreted further and compared with those of other studies.

8.2 QUALITY AND CHOICE OF PRIMARY HEALTHCARE PROVIDER

In line with the findings in Study I, in which we investigated quality and choice of provider, empirical studies from the hospital sector have generally found a positive association between quality measures and the likelihood of being chosen (48, 51, 56, 57, 109, 132). The same applies to the findings of Santos and co-authors, who used a similar methodology and context as ours, regarding choice of primary healthcare provider in England (61).

However, in comparison to other empirical studies, our findings are less pronounced, showing a willingness to trade less than 100 meters distance for a standard deviation increase in each of the two quality measures. There could be several potential explanations for these diverging results. One significant difference between Study I and most other empirical studies is the primary healthcare setting. It is possible that close distance is valued relatively more when it comes to choosing a primary healthcare provider that you expect to visit more frequently than a hospital. It might also be the case that a hospital choice is associated with a surgery or a treatment which involves a greater element of risk than the healthcare provided at a primary healthcare center. Therefore, the quality aspects could be given more consideration in choice of hospital. Another significant difference between Study I and most other empirical studies is the Swedish setting. The Swedish healthcare system has a long tradition of central planning

with a focus on equity and has historically limited choice for patients. The long tradition of limited choice and heavy focus on equity may mean that the choice is not perceived as important. There may be an expectation of limited variation in quality between different providers in a system that has placed heavy emphasis on equity and little emphasis on choice.

The effect sizes of the findings of Study I indicated that the tendency to make informed choices based on clinical quality was limited. This interpretation is supported by findings from Swedish survey studies. Results from a study by Wahlstedt and co-authors indicated that few Swedish patients used the internet to search for information for comparison of different providers (133). Hoffstedt and co-authors found that just a small fraction of patients searched extensively for information (17% of those who switched care provider and 7% of potential switchers) (134) and that respondents mainly sought basic information such as how to choose a provider and the geographical location of providers, while quality information – for instance providers' accessibility and medical results – was of considerably less interest (135).

Another potential explanation for the small impact of quality on choice of primary healthcare provider in Region Stockholm could be that quality information is not available. Previous research findings suggest that quality information does have an impact on patients' choices if it is easily accessible. Results from a randomized field experiment indicated that patients who received quality information by post for comparison of providers were more likely to switch provider (136). One measure to encourage informed choices among patients could therefore be to improve the accessibility of quality information, which was also suggested by a Governmental Inquiry, Governance for more equitable care (28). However, the approach for public reporting should be evidence-based. Simply putting all the available quality information in the public domain is unlikely to lead to well-informed choices (137).

The weak association between choice and quality that was found in Study I indicated that the possibility for patients' choices to influence quality was limited. Still, even if stronger associations had been found, it is not certain that quality would improve, since patient behavior is only one part of the equation. On the supply side, providers need to be informed about patients' choices and respond to them with quality-enhancing measures. According to previous research, there is no evidence that choice and competition enhance Swedish primary healthcare providers' clinical quality. Responding to patients' choices is difficult due to a lack of information regarding those choices (44).

The findings of Study I also suggested some potential adverse effects of choice. The observed aversion towards a high Care Need Index was stronger than the observed preference towards the two quality measures. These findings indicate a risk that choice enhances inequity in healthcare. To interpret the result, it is important to take into consideration that there is an association between Care Need Index and patient satisfaction (138) and that quality might affect this variable. However, the strength of the association between choice and Care Need Index indicated that there were other explanatory factors as well. Such factors could be that individuals expect that a healthcare center in an area with a low socioeconomic profile will have lower quality. Another potential explanation is that high levels of care need might put high pressure on the scarce resources of a primary healthcare center. This pressure could lead

to a poor working environment, which could result in a high staff turnover and reduced accessibility and continuity of care.

If the ability to make a choice is not equally distributed in the population, a potential adverse effect of increased choice could be increased inequity in the system. Being female, younger, and more highly educated are factors associated with information-seeking in healthcare (133, 134). These results are also consistent with the findings of Study III, which described the characteristics of telemedicine users. Users of telemedicine – who are likely to have engaged in information-seeking in healthcare, since they have adopted a new technology – are more often female, more highly educated, and younger than users of face-to-face consultations. To further investigate the equity implications of increased choice, the socioeconomic status of the individuals who bypass providers with a higher Care Need Index should be examined in future studies.

8.3 INFORMATIONAL CONTINUITY AND USE OF RECOMMENDED PHARMACOTHERAPIES

A potential policy response to the findings of Study I of a limited influence of quality on choice of primary healthcare provider could be to produce more accessible quality information or to monitor quality in other ways. Regardless, the challenge of measuring quality in primary healthcare remains. One of the aims in Study II, in which we investigated the association between recorded diagnosis in primary healthcare and dispensation of recommended pharmacotherapies, was to explore if the measure “recorded diagnosis” could be used as a quality indicator in primary healthcare. The indicator is a measure of informational continuity and was already in use as a follow-up indicator in Region Stockholm. However, whether or not a recorded diagnosis was associated with improved health had not been thoroughly investigated before.

The value of continuity in healthcare has been demonstrated in several studies. Continuity has been shown to be associated with patient outcomes such as reduced mortality, fewer emergency department visits, and increased patient satisfaction (139-142). Most studies target relational continuity and further research is required to determine if informational and management continuity improves outcomes (141).

In Study II, we attempted to investigate informational continuity by constructing the indicator “recorded diagnosis.” Previous studies have reported that insufficient or delayed communication between hospitals and primary healthcare providers after discharge is common (69). The results from Study II – that a remarkably low percentage of patients with stroke, TIA, or acute coronary syndrome had a recorded diagnosis in primary healthcare – were in line with these findings.

A version of the indicator is already in use as a follow-up indicator in Region Stockholm. With our selection of a study population with clearly recommended life-long pharmacotherapies, we could observe the effects of a recorded diagnosis. The results from Study II indicated that a recorded diagnosis in primary healthcare was associated with filled prescriptions of recommended pharmacotherapies for patients with stroke, TIA, or acute coronary syndrome.

This is not a health outcome measure, but adherence to the studied pharmacotherapies is associated with decreased risk of future cardiovascular events (123-129).

The association between recorded diagnosis and dispensation of recommended pharmacotherapies suggests that the measure has potential as a quality indicator in primary healthcare. However, more research is needed to confirm that all requirements for quality indicators – acceptability, feasibility, reliability, sensitivity to change, and validity (143) – are met for this measure. To do so, it would be necessary to learn more about the mechanisms underlying the measure. What leads a physician to record a diagnosis and how can that mechanism be influenced? A clear advantage of the indicator is that it is easy to extract from data already collected in the Stockholm regional healthcare database. Therefore, the indicator does not increase the administrative burden in healthcare. The indicator could also be useful from a healthcare center perspective, since it could serve as a description of their patient population and could be used to improve the care provided.

8.4 EQUITY IN USE OF TELEMEDICINE VERSUS FACE-TO-FACE CONSULTATIONS

In Study III, we explored the theme of equity by investigating the characteristics of users of telemedicine – a new technology in healthcare with several advantages for patients such as high accessibility, eliminated travel costs, and reduced time costs. The impact of market mechanisms, like patient choice, on equity in tax-based healthcare systems is somewhat unclear. Increased choice may increase the possibility for all groups to leave an unsatisfactory healthcare provider. However, a potential threat to equity is that increased patient choice may increase inequity in access to care if different subgroups of the populations differ in their propensity to exercise choice. Another threat to equity is if healthcare providers select more profitable patients, who may be younger, more highly educated, and have a better health status than average (144).

Provision of DTC telemedicine could potentially be a threat to equity, both because of the reimbursement model and the technology. DTC telemedicine providers were, during the study period, reimbursed according to a fee-for-service model that was not differentiated based on the need of the patient. In contrast, primary healthcare centers were reimbursed in accordance with a need-adjusted capitation model. The fee-for-service reimbursement could potentially lead DTC telemedicine providers to target individuals with lower healthcare needs who might be processed at a lower cost. This mechanism could be a threat to equity. Another threat to equity could be the technology itself. Use of DTC telemedicine comes with technological prerequisites, such as having some form of electronic identification, which it is less common among the elderly (145). There could also be large variation across population groups in how comfortable they are in using digital alternatives and how suitable remote consultations are for their healthcare needs.

The results from Study III showed that users of telemedicine were younger and more often female than users of face-to-face consultations in primary healthcare. These results are consistent with previous findings in both Swedish and international settings (2, 85-90). Further,

the results indicated that users of telemedicine had higher levels of education and income than users of face-to-face consultations. These findings are consistent with some studies from the Swedish and US settings (91-93). However there are also previous studies indicating that telemedicine use was associated with living in a poorer community (86) and studies that have found no association between use of telemedicine and socioeconomic factors (88, 94).

The results from Study III clearly indicated that users of telemedicine differed from users of face-to-face consultations. However, the implications of these findings are not evident. Previous research suggests that telemedicine consultations cost less to produce than face-to-face consultations (146-148). If telemedicine consultations constitute less expensive substitutes for face-to-face consultations, then it may be beneficial and cost-effective for the system if less complicated cases are treated through digital channels. Disproportionate use is not necessarily problematic if users of telemedicine – who are predominantly younger – have healthcare needs that are more suited for remote interactions compared with the more complex healthcare needs among the elderly. However, if telemedicine consultations mainly substitute face-to-face consultations and are a cost-effective alternative, efforts should be made to determine the situations in which telemedicine consultations are appropriate. It is highly likely that such consultations could reach larger groups than they do today.

The differing patient populations of telemedicine users and face-to-face users constitute a bigger problem if telemedicine consultations complement face-to-face consultations rather than substituting them. Telemedicine consultations might trigger additional visits and be associated with increased costs and workload in primary care (94, 101). In that case, healthcare resources are most likely being transferred from individuals with higher healthcare needs to those with lower needs through increasing use of telemedicine. In addition, many of the benefits of telemedicine consultations are only available to parts of the population. A potential problem with differing use in different population groups is that increased digitalization might create a digital divide. Some subgroups of the population lack access to the digital tools necessary to utilize digital healthcare services and may therefore risk being left out of important parts of healthcare provision.

The study period for Study III was 2018, which means that the results represent a pre-pandemic setting. Clearly, a lot has happened since then due to the COVID-19 pandemic. During the first wave of the pandemic, the number of telemedicine consultations increased dramatically. Simultaneously, the number of face-to-face consultations in primary healthcare decreased (149). The socioeconomic differentials in the use of telemedicine continued to be present during the pandemic. However, in comparison to 2018, they decreased somewhat. In contrast, the age differential in the use of telemedicine had been accentuated. Older individuals continued to have the lowest use of telemedicine even though they had the largest decrease in face-to-face consultations. On the other hand, individuals in the age group 19–25 years increased their use of telemedicine consultations to the extent that their total number of primary healthcare consultations was higher in 2020 than in 2018 (150).

8.5 IMPACT OF TELEMEDICINE ON SUBSEQUENT HEALTHCARE CONSUMPTION

In order to investigate the impact of telemedicine on overall healthcare utilization, two questions need to be answered: First, does telemedicine lead to new healthcare consumption for patients who would not have sought physical healthcare without it? Second, do telemedicine consultations lead to increased health-seeking behavior? In this thesis, I investigated the second of these questions.

The findings of Study IV suggested that telemedicine consultations led to more follow-up contacts than face-to-face consultations. The effect was most evident in the first month following a consultation and was attributed to both additional consumption of face-to-face consultations and DTC telemedicine consultations. The finding that DTC telemedicine users consumed more face-to-face consultations in the short-term interval indicates that DTC telemedicine consultations are less efficient than face-to-face consultations in solving the acute health problem. The additional short-term consumption of face-to-face consultations for DTC telemedicine users were robust across age groups and diagnostic chapters, with the exception for diagnoses related to diseases in the genitourinary system (chapter N).

Another potential explanation to the additional consumption for DTC telemedicine users could be the reimbursement model. DTC telemedicine providers were, during the study period, reimbursed according to a fee-for-service model which creates economic incentives for a high production. The level of DTC telemedicine consultations in the short-term follow-up period indicate that DTC telemedicine users have a high propensity to offer follow-up consultations. However, the majority of the follow-up consultations for DTC telemedicine users were face-to-face consultations.

A potential explanation for the additional consumption in the intermediate-term interval could be that the DTC telemedicine users adapt their health-seeking behavior and add DTC telemedicine as a complement to their regular healthcare consumption. If this effect was present, it was not as accentuated as the short-term effects. The effect was more apparent in younger age groups and in some diagnostic chapters, such as diseases of the skin.

In Study IV, we used matching to adjust for confounding factors that we could observe and used an interrupted time series analysis to adjust for time-invariant differences between the groups that we could not observe. However, we could not control for unobservable time-varying factors. A time-varying factor that might potentially lead to a selection bias in our results is symptom severity. We matched DTC telemedicine users to users of face-to-face consultations on index-consultation diagnosis, but it is possible that there was variation in symptom severity within those diagnoses. DTC telemedicine users might have had less severe symptoms than their controls due to the lower thresholds for accessing a telemedicine provider, such as lower time costs and travel costs and the absence of nurse triage. If that was the case, then the additional healthcare consumption that we estimated for the DTC telemedicine users in comparison to their controls was likely to be underestimated.

The results from Study IV were consistent with studies suggesting that DTC telemedicine visits increase short-term follow-up visits within one month from the initial visit (100, 151-154). The results were also consistent with studies suggesting that DTC telemedicine increases overall healthcare consumption (92, 96, 100-103). In line with our results, Nymberg and co-authors (99) found that the number of subsequent consultations was larger for telemedicine consultations than for face-to-face consultations. The authors investigated the number of follow-up contacts within 30 days of an index contact during the first wave of the COVID-19 pandemic in 2020 and in corresponding time periods in 2018 and 2019. The number of follow-up contacts was larger after telemedicine consultations provided by traditional primary healthcare centers than after DTC telemedicine consultations. In 2020, there were 0.60 follow-up contacts per face-to-face consultation, compared with 0.90 follow-up contacts for telemedicine consultation with traditional providers, and 0.69 follow-up contacts per DTC telemedicine consultation.

In Study IV, we followed the study design of McGrail and co-authors (104) closely. However, our results differed somewhat from theirs. McGrail and co-authors found that patients with a telemedicine consultation had a lower trend in healthcare expenditure and physician visits during the follow-up period than their matched controls, which indicated that expenditure among the telemedicine users was lower at the end of the follow-up period. They found a similar trend when they investigated physician consultations rather than expenditure. In contrast, our results indicated that telemedicine users increased their healthcare consumption more than controls in the short term and in the intermediate term. We also found a negative trend for physician consultations among the telemedicine users in comparison with the controls, but the effect was small and did not eliminate the increase in healthcare consumption that telemedicine users had after their index consultations. A difference in approach between the two studies is that McGrail and co-authors did not use index diagnosis as a matching criterion, which could mean that the need for follow-up visit was impacted to differing extents in different patients.

The analytical approach that we used in analyzing the impact of DTC telemedicine consultations on subsequent healthcare consumption healthcare has the advantage that it can easily be stratified to analyze the impact for different groups of the population or for different diagnoses. In addition, the analyses can be repeated to monitor the development of the area over time. The analyses at the population level may contribute to the understanding of when telemedicine consultations are appropriate. However, a limitation with the analytical approach is that it primarily gives us information on what happened after a visit – not if the visit would have taken place in the absence of telemedicine. This aspect needs to be further studied with other study designs.

8.6 STRENGTHS AND LIMITATIONS

8.6.1 Major strengths

A major strength of the thesis is the total population data that the studies were based on. The linked registry data allowed me to observe the behaviors of an unbiased study population of

over 2 million individuals and contributed to the understanding of patient behaviors on a primary healthcare market in transition. The registry-based approach allowed me to reveal actual behavior, rather than stated behavior, which could potentially give a different story. The linking of registries from regional healthcare databases from Regions Stockholm and Jönköping created a unique database which allowed for analyses that would not have been possible within a single region. In addition, the linkage to data from Statistics Sweden enabled inclusion of relevant background factors, which strengthened the analyses. The large study populations further contributed to reliable and valid findings. The analytical approach allows for replications in different areas or in different time periods. This is useful since the area of study is under development.

8.6.2 Major limitations

The thesis also has some limitations. A major limitation of using registry data is that in-depth information on content of care, lengths of visits, and healthcare outcomes generated is generally not available. An example of an information that was lacking, which would have been useful in the analyses, was information about symptom severity within a diagnosis. Lack of such information potentially generated a selection bias in the findings. Further, we did not have information about healthcare needs. A study based on survey data or interviews could have given us more information about the mechanisms that we intended to study. However, such an approach would have generated other problems such as smaller sample sizes and potential recall bias.

Another limitation is the generalizability of the findings of the thesis. Region Stockholm differs substantially from other regions in Sweden and the provision of publicly funded on-demand telemedicine is quite unique for Sweden. However, the Region Stockholm setting could also be considered a suitable setting for analyzing the early experiences of telemedicine in primary healthcare. It is highly possible that the findings revealed in Stockholm can provide lessons and experiences that are relevant for other settings as well.

8.7 POLICY IMPLICATIONS

The findings of the thesis have several policy implications. First, the market mechanism of patient choice seems to have little effect on quality in primary healthcare. The mechanism might be enforced by better information to patients but quality should be ensured through other measures. Second, informational continuity in healthcare across providers seems beneficial and should be encouraged. Third, the findings of an uneven distribution of use of telemedicine in the population indicate that some groups in the population might need more support in accessing digital healthcare services. In addition, alternatives to digital solutions must be available to those who are unable to access them, to limit the risk of a digital divide. Finally, the findings suggested that telemedicine increases healthcare utilization. In combination with the uneven distribution of use of telemedicine, this is likely to lead to healthcare resources being transferred from older individuals to younger ones. The results call for measures to investigate the cost-effectiveness of telemedicine consultations, so that the potential of digital technology is used to improve health outcomes. Telemedicine

consultations have several benefits, as the convenience of the consultations can improve access to care and there are less costs incurred for patients in terms of travel and time off work (155). In addition, telemedicine options have the potential to reduce patient failure to attend an appointment (156). However, the convenience of the consultations is also associated with a risk of overuse. Consultations for minor issues that patients would normally not see a physician for should be discouraged (96).

9 CONCLUSIONS

The title of this thesis asks: Do patients behave as expected on a healthcare market in transition? In regard to most of the research questions, I have found support for the assumptions made about patient behaviors. Patients do seem to take quality into account in their choice of provider. However, the effect is small. Informational continuity, measured as a recorded primary healthcare diagnosis after an inpatient hospital episode, does seem to affect patients' health, or at least their propensity to dispense recommended pharmacotherapies. Use of telemedicine is not equally distributed in the population and telemedicine users increase their primary healthcare consumption more than matched controls.

The thesis has also yielded some unexpected findings. An aversion to primary healthcare providers with high care needs among their registered patients seems more important than quality in choice of provider. Recording of a diagnosis in primary healthcare is remarkably limited for some conditions and females are less likely than males to have a diagnosis recorded. Regarding use of telemedicine, I found that digi-physical and DTC telemedicine options resemble each other more than expected regarding patient characteristics. It was also noteworthy that the short-term healthcare consumption after a telemedicine consultation is mainly attributed to face-to-face consultations rather than to further telemedicine consultations. The findings indicate that the need for a physical examination is stronger than the increased incentives that telemedicine providers have to provide follow-up appointments. The physicians' incentives to provide follow-up appointments may also be weaker than the providers' incentives to reach new patients.

The implications of these findings are relevant in the continuing transition of healthcare. The findings suggest that the market mechanism "choice" is not sufficient to ensure quality in primary healthcare and that policymakers should rely on other measures as well. Informational continuity seems beneficial for patients and should be encouraged. The measure recorded diagnosis does seem to have a valid role as a follow-up indicator in primary healthcare and the level of diagnosis recording could most likely be improved. Regarding telemedicine, it is important to ensure that the fast technological development does not create a digital divide in healthcare. Telemedicine consultations are undoubtedly here to stay, and it will grow increasingly important to ensure that those who need an alternative to a digital channel – whether it is for seeing a physician or booking an appointment – are not deprived of that alternative. In addition, some groups in the population might need more support in accessing digital healthcare services. Telemedicine and digital innovations have a lot of potential but are also associated with a risk of overuse. The research highlights the need to investigate the costs and benefits of telemedicine – so that its use can be promoted when it is most cost-efficient and discouraged when it is not. A primary healthcare market in transition requires continuous review of its performance. The methods applied in this thesis may be useful for monitoring some of the market's future developments.

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