UNIVERSITY OF GOTHENBURG
SCHOOL OF BUSINESS, ECONOMICS AND LAW

# The Impact of Digital Healthcare

- A study that examines the effects of digital healthcare services on performance in primary healthcare in Sweden

Bachelor Thesis in Economics

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# Abstract

This paper examines what effect digital healthcare has on primary healthcare in Sweden. Using aggregated register data from Jönköping county council and datasets, from väntetider and from hälsokollen a difference- in difference (DiD) analysis is conducted. The main result of this paper shows that digital healthcare has a statistically significant effect on accessibility in primary healthcare regarding in-patient visits. Results on the estimated effects on accessibility regarding phone call to a primary care center were not statistically significant. Since the results are mixed for our two outcome variables, *phone* and *visits* there is reason to believe that there is not enough evidence to conclude whether the effect is positive or negative. This paper has nevertheless contributed to the research field by adding a strategy to measure the effect of digital healthcare.

Keywords: Digital Healthcare, Primary healthcare, Waiting List, Substitute, Healthcare Market, Demand for Healthcare, Difference-in-Difference approach

# Acknowledgement

After writing this paper we would like to express a great deal of gratitude to our supervisor. Not only did he give us useful feedback throughout the process but he also inspired us in the field in general which has given us useful knowledge for the future.

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# 1. Introduction

Digitalization manifests itself in every part of society. Technologies like computers, smartphones and new conversation applications have made life simpler. One part of society where digital development could have an immense impact is healthcare services. One potentially interesting area is how this could affect primary healthcare.

Digital healthcare is in its developing stages in most countries and it could turn out to be the common way people receive medical treatment in the future. Several studies such as Shigekawa et al. (2018); Schildt et al. (2017) argue that digital healthcare is suitable for treating a wide range of health conditions. Nevertheless there are difficulties in measuring the effect of digital healthcare. First of all primary healthcare is a highly segmented market which means that it takes time to see improvements after implementing reforms or new technologies. Secondly there is in general a lack of trustworthy data regarding digital healthcare. Mostly due to insufficient methods to measure the effect of digital healthcare.

This study tries to measure the effect of digital healthcare by looking at how visits to digital healthcare providers impact the accessibility for primary care centers in Sweden. *Phone* and *visits* are measurement tools for accessibility in primary healthcare. *Phone* measures accessibility in primary healthcare regarding answered phone calls to a primary care center. *Visits* measures accessibility in primary healthcare regarding in-person visits to primary care centers.

The strategy is to use a difference - in difference (DiD) approach to look at the effect of digital platforms on our outcome variables *phone* and *visits*. This approach enables for measurement of the accessibility for primary care centers in 2015, the year where we can generalize digital visits to 0, and in 2017, which is the first year where there is enough digital visits to measure the effect. Furthermore, the approach also makes it possible to control for differences in effect between municipalities.

Our hypothesis is that the use of digital platforms increase accessibility to primary care centers.

The main results of the analysis show a minimal yet significant increase in accessibility for *visits*. However regarding the accessibility for *phone* the result showed an opposite and statistically insignificant effect. These findings have opened up possibilities for

future research, especially with respect to the question if digital healthcare is to be viewed as a substitute for primary healthcare. The theory of substitutes as well as possibilities regarding digital healthcare will be presented in chapter 3 and chapter 7. To clarify, this paper mainly focuses on digital platforms' effect on accessibility to primary care services. Although the discussion regarding substitutes is relevant since it could explain the reason behind potential effects.

## 1.1 Research Question

*Does the usage of digital healthcare platforms affect the accessibility to primary care centers in Sweden?* The purpose of this paper is to investigate if the recent development of digital healthcare platforms could assist the primary care centers in fulfilling their waiting time guarantees. Since it in Sweden has become a common problem to wait in line when needing medical assistance we find it both relevant and interesting to examine the development of digital healthcare platforms and its potential role in primary healthcare. We believe that increased usage of digital platforms could affect the municipality's ability to fulfill their waiting time guarantees by working as substitutes for primary healthcare.

As measurement for accessibility we use the waiting time guarantee of 0 days(*phone*) and 7 days(*visits*) because both of these guarantees together represents primary healthcare. As a measurement for digital healthcare we use digital visits which is visits to digital platforms per 1000 citizens. For these 3 variables we have data per municipality and with the use a our Difference in Difference approach we are able to present the effects of digital healthcare on primary healthcare.

## 1.2 Road Map

Chapter 2, Background, describes primary healthcare in Sweden. First there is a short explanation about Swedish primary healthcare and its development in the recent years. This is followed by a part describing digital healthcare and its development in Sweden. Chapter 3, Theoretical Framework, includes a part on how supply and demand operate in the healthcare market. In this section there is also a discussion about the characteristics of this healthcare system and what kind of problem this may cause. Lastly some explanations of the relationship between primary healthcare and digital healthcare, all relating to previous research. Chapter 4, Data, explains the data sources, in particular where the variation in the data is gathered from and their specific attributes. Lastly, a discussion regarding advantages and disadvantages on the data collected to conduct our analysis. Chapter 5 outlines the empirical strategy and describes what kind of method is being used and how the different equations are set up. Chapter 6, Result, is divided into three sections. These sections follow the empirical strategy in Chapter 5. This chapter provides some guidelines describing in what way the result of the analysis should be interpreted. After that the results of the different regressions are explained in more detail for *phone* and *visits*. Chapter 7, Discussion, here we explain where this paper fits into the research area of previous studies in the topic of the effect digital healthcare has on primary healthcare. Chapter 8, Conclusion, summarizes the findings of our paper.

# 2. Background

The following chapter will describe the background of primary healthcare in Sweden. First, a short explanation about Swedish primary healthcare and its development in the recent years. This chapter is then followed by a section describing the development of digital healthcare in Sweden.

## 2.1 Swedish Primary Healthcare

Swedish healthcare is governmentally funded and administration of the healthcare system is divided between Sweden's 20 county councils. There are both private and public primary care centers. Every primary care center is controlled by the government, since they are required to contract themself with a county council which has control over how prices are decided in the healthcare market (Socialstyrelsen, 2016). Sweden has universal health insurance with a modest copayment (The Swedish Institute, 2018). There is a fixed price representing a part of the actual price that Swedish citizens pay for a visit to a primary care center. Like many other countries with universal health insurance, Sweden is faced with a high demand for healthcare services (Bhattacharya et al. 2014). According to Björnberg, (2017) the waiting lists in Sweden are among the longest in Europe, and this has been a problem for the Swedish healthcare system during a long time. The care provided is highly ranked internationally, but accessibility and care continuity continues to be a problem (Blix and Jeansson, 2018).

This study focuses on primary healthcare which according to healthcare law (SFS: (2017:30)) is: open healthcare services that is provided to the citizens regardless of age, patient group or disease. Primary healthcare services include, apart from basic medical treatment, caring services as well as preventative measures (Riksdagen, 2018). There is a statutory definition of what primary healthcare is, however there is no statutory definition on how it should be provided or organized. Instead, the responsibility of providing is as mentioned in the hands of the county councils. This results in a primary healthcare system that differs in administration between county councils (Socialstyrelsen, 2016).

Even if primary healthcare is administered differently between county councils there is a joint decision that every member of society should be guaranteed primary healthcare within a limited time period. This limited time period is decided on a national level and divided into 0-7-90-90 days (SKL, 2018). The 0 days guarantee implies that if a patient contacts the primary care center today the patient should be connected with a primary care center or a medical advisor on this day**,** either through a visit at a primary care center or by a phone call. The 7 days waiting time guarantee that after assessing the nature of a health condition and if medical care is determined necessary, an option to visit a doctor should be possible within one week (Ibid.). The time periods of 90 days regards specialist healthcare services and operations and is not a focus in this paper.

There are however some exceptions where the waiting time guarantee is invalid. The first exception is if it is considered wiser from a medical standpoint to wait longer than the guaranteed waiting time period before receiving treatment. The second exception is if a proposal from another primary care center has already been rejected. The third exception is regarding X-ray treatment or other types of medical examinations where resources often are limited. The last exception when the waiting time guarantee is invalid is a revisit that is due to the same health condition as the previous visit (Ibid.).

The fee for seeing a doctor at the primary care center is between 100 SEK and 300 SEK, depending on county council (The Swedish Institute, 2018). In Västra Götalands county council, for example, the cost of visiting your registered primary care center is 100 SEK, while visiting another center will cost 300 SEK. (Vårdguiden 1177, 2018).

## 2.2 Digital Healthcare

Digitalization of the healthcare market provides a wide range of opportunities. Especially in a country like Sweden where 93 percent of the population had access to internet in 2015 (Embassy of Sweden, 2018). As a matter of fact, Sweden is a country whose population is assumed to be one of the most digitally mature in the world (Socialstyrelsen, 2018). As of today there is still no established definition of digital healthcare. However, the definition of digital healthcare used in this paper is the same as how The National board of Welfare (2018) define it in their recent report, dating back to the summer of 2018 where they state:

“Healthcare that is provided through some kind of digital communication between patients and healthcare personnel in two different physical spaces”.

Sweden has a goal of becoming best in the world at utilizing opportunities given by digital health by year 2025.

Today many different digital platforms already exist in Sweden that try to improve healthcare. In Sweden individuals can for example make digital appointments, and receive the help needed via digital platforms like Kry, Mindoktor and Vårdguiden 1177. These digital platforms help the patient to skip waiting times, ease the first visit to the doctor and increase the chances of detecting a condition in time to prevent and to cost manage it (Embassy of Sweden, 2018). Contributing to this, Sommarlund et al. (2018) state that with digital platforms it is possible to help more people with less resources. According to Blix and Jeansson (2018) the approximate fee for a visit to a digital doctor is 200 SEK. During the year of 2016 digital healthcare developed and became a part of the healthcare market. Figure 1 shows the increase in digital visits between 2016-2018 (Socialstyrelsen, 2018). Since there is a limited amount of digital visits in the beginning of 2016 that year is treated as a development year in this paper.

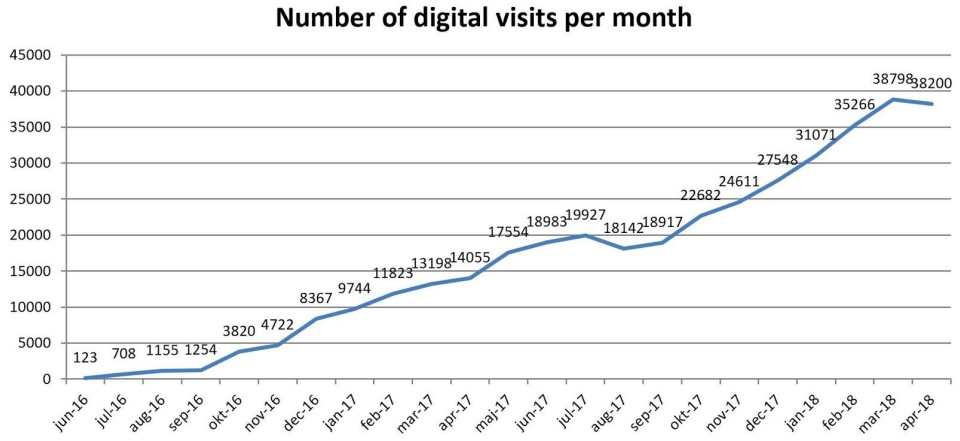


Figure 1: Number of digital visits per month between June 2016- April 2018.

The National Board of Welfare (Socialstyrelsen, 2018) has also outlined which conditions are more commonly treated via digital doctors. The analysis gathered data from 88 012 patients in Stockholms county council. Results showed that infections together with skin diseases make up for 49 percent of all visits. Contributing to that only 13 percent of all visits were non somatic, consisting of 3 percent accounted for mental illness and 10 percent for follow-ups

and examinations. In the US, visits to digital doctors regarding mental illness has had strong growth in relation to total visits during the last couple of years. Eventhough results are mixed Huskamp et al. 2018, show that visits with digital doctors are comparable or in some cases superior to in-person care regarding mental illness.

An interesting fact for this study is in what part of Sweden digital visits are most frequent. According to National Board of Welfare (Socialstyrelsen 2018), 43 percent of all visits in 2017 were conducted in Stockholm´s county council. This becomes relevant for this study since in the sample for *phone* Stockholms county council is excluded.

# 3. Theoretical Framework

This chapter will include a part on how supply and demand work in the primary healthcare market. In this section there is also a discussion about the characteristics of this healthcare system and what kind of problems this may cause. Lastly some explanations of the relationship between primary healthcare and digital healthcare.

## 3.1 Demand for Healthcare

There are two randomized experiments that has had sizable impact on the theory behind the demand for healthcare. Their results confirm that the demand is downward sloping. Experiments referred to are the RAND Health insurance Experiment (HIE) (Rand Health care , 2016) and the Oregon Medicaid Experiment (OME) (Baicker, K et al. 2013). The downward slope of the demand curve suggests that individuals are sensitive to the price of healthcare. Knowing this is important to address how sensitive individuals are to price changes regarding healthcare services. According to Newhouse (1993) and Gwartney et al. (2008), the elasticity for healthcare is inelastic, meaning that a change in price will have a small effect on demanded quantity.

As explained in section 2.1, Sweden has universal healthcare insurance with a copayment giving the price (p) (Sweden Institute, 2018) and a fixed supply of healthcare services. To clarify the government finances Swedish healthcare, and by that control the amount of healthcare services that can be provided. This results in an excess demand for healthcare services which create waiting lists, Also known as the accessibility problem. It is common for countries such as Sweden that have implemented a Beveridge model-alike healthcare system. The characteristics of the Beveridge model are universal single-payer insurance, public health care provision and free care which connects fairly well with the background provided in section 2.1 (Bhattacharya et al. 2014).

The core of the excess demand problem is moral hazard which can be explained as individuals´ behavioral change before, (ex ante) and after, (ex post) an insured event. Putting it into context of a healthcare market, having universal health insurance with a low

copayment will result in a more risky behavior and more exploitation of the insurance coverage from individuals, which leads to higher demanded quantity of healthcare services. The result of this behavioral change is illustrated in figure 2. The insurance with low copayment increases moral hazard and the government limits the access to healthcare services by not meeting the demand. This leads to an excess demand in the grey area which also could be interpreted as the waiting list (Bhattacharya et al. 2014).

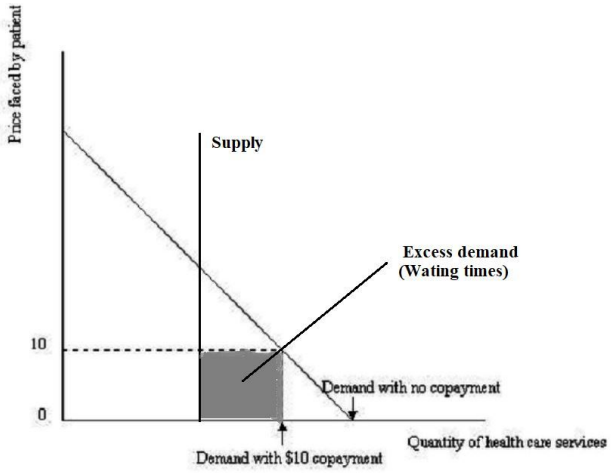


Figure 2: Simplification of the Swedish Healthcare Demand.

Blix and Jeansson (2018) estimate the approximate fee for a visit to a digital platform to be around 200 SEK which is about 100 SEK more than a regular visit to a primary care center in Västra Götalands county council (Vårdguiden 1177, 2018). With this in mind, it is necessary to consider time-cost of waiting for healthcare services. According to the Grossman model[1] each individual has a time constraint of 24 hours that can be divided between working, playing, improving health and being sick. The assumption is that an individual cannot spend time being productive, that is working, playing or improving health if he or she is sick. Time spent working vill produce income which states that time is money in the Grossman model (Grossman, 1972). This suggest that individuals might be willing to pay a higher price for a healthcare service if this results in a lower overall cost, time-cost included.

[1] Grossman model of health demand, outlined in a monograph 1972 with the title: The demand for health: A theoretical and empirical investigation by Michael Grossman (Grossman, 1972).

## 3.2 Digital Platforms, Substitutes for Primary Healthcare

According to Blix and Jeansson (2018), the use of digital healthcare depends to a high degree on how digital platforms are set up. Different digital platforms serve different purposes. Some are mainly designed as complements to enhance the level of quality and others are designed to work as substitutes for primary healthcare. To clarify, digital healthcare would be considered a substitute if a patient visited a digital platform and after that did not feel the need to visit a primary care center. If a visit at a digital platform rendered in a visit at the primary care center it is considered a complement (Perloff, 2014). Blix and Jeansson, (2018) and Shigekawa et al. (2018) argue that digital platforms encompass several different functions and therefore it is hard to draw a conclusion about whether digital platforms are substitutes or complements to primary healthcare. There is criticism against digital healthcare providers arguing that there is limitation to making correct examinations via digital platforms (Andersson et al. 2017). However in Shigekawa et al. (2018), there is indication that for several conditions digital platforms could be considered substitutes for in-person care. Digital platforms generally produce similar or better outcomes than in-person care. However Shigekawa et al. 2018 and Schildt et al. 2017 only establish that digital platforms could be suitable substitutes for some conditions. In order for digital platforms to have an affect on other in-person healthcare services people need to use these platforms as substitutes. Although this might be true it is not clear whether these visits work as substitutes or contribute to utilization due to increased accessibility. A study by Ashwood et al. (2017) on acute respiratory infections estimate that only 12 percent of all examined visits work as substitutes for other providers and 88 percent as new utilizations. This contributes to overconsumption of healthcare services. Ashwood et al. (2017) problematizes the development of digital platforms, stating that the development of digital doctors could lead to higher expenditures for the national healthcare system. This utilization generates a new cost that might not have existed if not for the digital platforms.

There are indications pointing at digital platforms working as substitutes for several different conditions, however the result of digital platforms impact on the use of other in-person healthcare services are mixed. Therefore it is difficult to determine if the use of digital platforms relieve pressure on other in-person healthcare services for example phone

calls or visits to primary care centres or contribute to overconsumption by utilizing the increased access (Shigekawa et al. 2018).

# 4. Data

This chapter of the paper explains the data sources, in particular where the variation in the data is gathered from and their specific attributes. Lastly, a discussion of the advantages and disadvantages on the selected data sources.

## 4.1 Datasets and Registers

Our dataset is constructed by integrating several different datasets and registers. The datasets and registers that we use are from Väntetider, Hälsokollen, SCB and Jönköping county council. The construction of the dataset started with registers for 2015 and 2017 from Väntetider. This dataset includes our two measurement tools which are *phone* and *visits.* As mentioned earlier these two measurement tools are our two outcome variables which are measured dividing number of phone calls/visits within the waiting time guarantee of 0 or 7 days with total number of phone calls/visits per municipality. Giving the municipalities fulfillment of the waiting time guarantee in percent.

The data behind the datasets is collected by the county council organisation (SKL) twice a year, spring and fall, where the measurement period is two months. The measurement includes patient for whom care is necessary to treat a new health condition and patient whose condition has worsened.

In the next step we merged the data from Väntetider together with data on primary care centers municipality collected from Hälsokollen. This gives us a dataset that can present results at municipality level. Further we merge the municipality data with aggregated register data from Jönköping county council. This register includes our measurement for use of digital platforms which is number of digital visits with physicians per municipality, excluding all municipalities within Jönköpings county council.

Unfortunately this means that we are not able to include all Sweden's 292 municipalities in this analysis. For *phone,* all of Stockholms county council, Jönköpings county councils and some other municipalities are excluded due to inconclusive data, which results in a sample of 246 municipalities. Regarding *visits,* all of Jönköpings county councils and some other municipalities are excluded due to inconclusive data, resulting in a sample of

273 municipalities. Since the dataset contains data from both 2015 and 2017 it has duplicates of every municipality included in our analysis, which results in a sample size of 492 for *phone* and 546 for *visits*. Figure 3 and Figure 4 show two different maps marking the excluded municipalities for *phone* and *visits*. In the Appendix A there is a detailed list of all excluded municipalities and reason for exclusion.

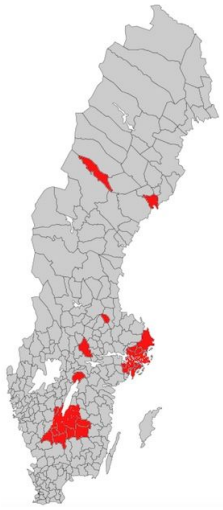

Figure 3 ( *Phone*).

Figure 4 (*Visits)*.

## 4.2 Critical Review of Data

Registers used in this paper to construct the two different outcome variables, *phone* and *visits*, are based on the metrics from SKL. The measurement for *phone* is created by calculating for the relationship between total number of phone calls and the amount of phone calls that were answered on the same day. According to SKL (2019), this measurement is only gathered from primary care centers that either have an automatic telephone system or recall system. The metric for *phone* is carried out under normal hours and covers all phone calls regarding bookings or counseling. One problem with *phone* is that there is no data from Stockholm county council. The reason being that the way Stockholm county council measures accessibility for phone calls is incomparable to the rest of the country. This causes a big decrease in the data, since Stockholm county council is the biggest county council in Sweden regarding population.

The measurement for *visits* is created by calculating the relationship between total number of visits to a physician and the amount of visits that were carried out within one week. Both of these metrics are gathered under one month in spring and one month in fall. It

is however unknown to the public how these two months are chosen (SKL 2019). This creates a risk that the primary care centers have better accessibility during these two measures. According to SKL they are solving this issue by starting to showcase accessibility regarding atleast phone calls for every month through automatic transfers. This is done today by 16 county councils, however the three largest county council which are, Stockholm, Västra Götaland and Skåne still report manually (Ingerö, 2018).

Ingerö (2018) points out several flaws in the metrics for accessibility in primary healthcare. According to Ingerö (2018) it is a problem that not all information from SKL is accessible to the public. He argues that the public has every right to see the complete statistics for accessibility in primary healthcare. In his critical review he states that the metrics for both phone calls and visits in primary healthcare lacks a connection with the patient register. This means that it could be problematic to find a pattern between waiting lists and the amount of visits to a primary care center.

One potential issue we face after writing this research paper is that from 2019-01-01 the waiting time guarantee periods have been changed. Instead of data on 7 days guarantee SKL will collect data on patient getting a medical assessment through qualified primary care within 3 days (SKL, 2019). This means that results regarding *visits* in this paper will not be gathered after 2018. Eventhough this could be an issue for future research, our findings in this paper contribute to a greater understanding about the substituality of digital healthcare.

# 5. Empirical Strategy

This chapter outlines the empirical strategy used in this paper which describes what kind of method is being used and how the different equations are set up. The chapter finishes with a section describing the DiD approach.

## 5.1 Identification Strategy

To be able to test our hypothesis we measure the effect of digital healthcare on accessibility in primary healthcare by constructing three equations.

Equation 1: $Y_{it} = \beta_0 + \beta_1[Digital\ visits]_{it} + u_{it}$

Variable Y stands for the outcome variables measured in 2015 and 2017, these two are *phone* and *visits*. The first contains the number of phone calls being answered on the same day divided by total phone calls being answered during a two-month span in percent. The second contains the number of visits to primary healthcare centers carried out within 7 days divided by total visits to primary healthcare centers during a two-month span in percent. $\beta_0$ is the intercept in the equation. $\beta_1$ is the estimated effect of digital visits. The estimated effect is to be interpreted as one digital visit per 1000 citizens. Furthermore $i$ stands for the specific municipalities and $t$ stands for the specific time.

With equation 1 we conduct regression 1 which gives us the estimated effect of digital visits on our two outcome variables *phone* and *visits*. Regression 1 uses the robust option for standard errors, meaning that the standard errors will be adjusted for heteroskedasticity.

Equation 2: $Y_{it} = \beta_0 + \beta_1[Digital\ visits]_{it} + \gamma + u_{it}$

Because it is reasonable to think that our two outcome variables are dependent of time, equation 2 in contrary to equation 1 adds a dummy for time. Time is constructed as a dummy variable that either takes the value 0 if 2015 or 1 if 2017. This variable is expressed as $\gamma$ and makes it possible for a regression to account for the time effect on accessibility in primary healthcare. With equation 2 we conduct regression 2 which gives us the estimated effect of digital visits on our two outcome variables *phone* and *visits*, where the effect of time is taken into consideration. This regression also uses the robust option for standard errors.

### 5.1.1 Difference in Difference Approach

In the theoretical part of this paper it is explained that primary healthcare is governed and financed by the county councils. It is therefore reasonable to believe that the accessibility in primary healthcare could differ between county councils and therefore municipalities. In order to account for this pattern we construct a DiD analysis. In comparison to a standard DiD approach this analysis differs since it measures the difference in impact of digital healthcare between municipalities. Therefore this DiD analysis does not have a treatment or a control group, instead there are several different treatment groups, represented by municipalities that are impacted unequally by the amount of digital visits. To clarify our regression considers the difference in time between 2015 and 2017 and also the difference between the municipalities level of impact by digital healthcare. The DiD design is therefore somewhat different to the well known study by Card and Krueger (1993)[2].

DiD analysis is as follows:

Equation 3: $Y = \beta_0 + \beta_1[Digital\ visits]_{it} + \gamma + \delta_i + u_{it}$

Equation 3 estimates the effect of digital healthcare on accessibility in primary healthcare using the same variables as equation 2, however also considering fixed effects in $\delta_i$ which is the effect of digital healthcare within municipalities.

Using equation 3 we conduct three regressions. Regression 3 considers a fixed effect (FE) option. Fixed effect is an important option to consider since whenever using panel data there is a risk for omitted variable bias (OVB). Since county councils administer their own primary healthcare the quality will differ between them and consequently between some municipalities. This is the reason panel data comparisons could be biased when looking at inter variation (panel-municipality) (Blumenstock, 2013). Therefore a key assumption in this regression is the identifying assumption. To clarify, this means that unobservable factors that could affect both accessibility in primary healthcare and digital visits for example quality, are assumed to be time-invariant in this regression. The results of regression 3 is estimated effects where within-municipality variation is considered (Ibid.).

Regression 4 estimates the effect of digital healthcare on accessibility in primary healthcare by using clustered standard error on county council-level. In contrast to regression

[2] Card and Kruger (1993) examines the effect of minimum wage on employment using a case study of the fast food industry in Pennsylvania and New Jersey.

3 this regression considers that this dataset contains municipalities that each are found within a county council. This implies that municipalities which are administered by the same county council could be viewed as similar. After adjusting standard errors to these clusters, the regression 4 accounts for that municipalities within same county council show similar patterns (Angrist and Pischke, 2018).

Regression 5 is the last regression and due to inconclusive data is only possible for *visits*. This regression focuses on the effect of digital visits on accessibility in primary healthcare regarding *visits* using the same samples available for *phone*. It is possible from these results to identify some of the reasons why the results differ between *phone* and *visits.* The idea is to emphasize the impact that Stockholm county council have on digital healthcare since Stockholm county council is excluded for *phone*.

# 6. Results

The results of the paper are divided into four sections. These sections follow the empirical strategy in chapter 5. This chapter provides some guidelines describing how the results of the analysis is interpreted. Thereafter, the results of the different regressions are explained in more detail for *phone* and *visits*. Lastly, a summary of the most important results are presented.

## 6.1 Guideline for Interpretation of our Results

This analysis estimates the effect digital visits have on accessibility in Swedish primary healthcare. The effect is calculated using data on almost every municipality, except for some municipalities that were excluded due to insufficient data.

Table 1 shows the average accessibility in primary healthcare. These numbers could help in interpreting the impact of our findings.

**Table 1 – Average Accessibility in Primary Healthcare**

| | Phone (%) | Visits (%) |
|---|---|---|
| *2015* | 0.89292560975 | 0.90304542124 |
| *2017* | 0.89353414634 | 0.88923113553 |
| *Observations* | 492 | 546 |

In 2017 the average accessibility in primary healthcare regarding *phone* was approximately 89.35 percent. In relation to 2015 the average accessibility per municipality is almost the same, a miniscule increase by approximately 0.06 percent.

In 2017 the average accessibility in primary healthcare regarding *visits* was 88.92 percent. In comparison to 2015 there has been an decrease of average accessibility by approximately 1.38 percent. This trend is expected since there has been no indications that the waiting lists for primary healthcare has decreased, considering a growing Swedish population.

By having these average values in mind when reading the result we believe that the interpretation of the impact of digital healthcare becomes more clear.

## 6.2 Results of Regressions

### 6.2.1 Results for Phone

**Table 2- Accessibility in Primary Healthcare (*Phone*)**

| | Regression 1 | Regression 2 | Regression 3 | Regression 4 |
|---|---|---|---|---|
| *Time* | X | .0497231*** | .0204807 | .0204807 |
| | | (.0135496) | (.0148925) | (.0146417) |
| *Digital visit* | -.000756 | -.0033296*** | -.0009624 | -.0009624 |
| | (.0005602) | (.0008015) | (.0009147) | (.0011136) |
| *Robust str. error* | YES | YES | YES | NO |
| *Fixed effects* | NO | NO | YES | YES |
| *Clustered str. error* | NO | NO | NO | YES |
| *Observations* | 492 | 492 | 492 | 492 |

***Significant at the 1 percent level
**Significant at the 5 percent level
*Significant at the 10 percent level
Standard errors in ()

Table 2 is a summary of all regressions run with *phone* meaning the estimated effects on accessibility regarding the waiting time guarantee of 0 days.

From equation 1 we conduct regression 1 that only measures the estimated effects of digital visits with robust standard errors. The result shows a miniscule effect on waiting time guarantee of 0 days. However the direction shows that digital visits decrease *phone* accessibility by 0.000756 for 1 digital visit per 1000 citizens. However, these results are not significant.

Regression 2 that we conduct using equation 2 includes the dummy variable for time, still using the robust option for standard errors. When accounting for the difference between digital visits in 2015 and 2017 the result differs from regression 1. The effect is larger in regression 2, eventhough it is a small effect, one unit increase of digital visits per 1000 citizens would lead to a 0.0033296 percentage points decrease in *phone*.

Both regression 1 and regression 2 show that digital visits decreased accessibility in primary healthcare regarding waiting time guarantee of 0 days. This contradicts the hypothesis discussed in chapter 1.

Using equation 3 we conduct regression 3 and regression 4 which focuses on reducing bias with the option of fixed effect. The rationale for this was described in section 5.1.1.

Regression 3 similar effects as regression 2 for the two regressors, however the estimated effect is smaller than in regression 2. This is expected since the fixed effect option used in regression 3 accounts for variation within municipalities. Resulting in more robust estimations of the two regressors and their standard errors. On the contrary it was not expected that these findings for fixed effect would be insignificant.

Regression 4 estimates effects on accessibility in primary healthcare using clustered standard errors and the fixed effect option. The estimated effects are the same as in regression 3. Nevertheless as explained in section 5.1.1 by cluster the standard errors the regression accounts for correlation between municipalities within the same county council. This results in adjusted standard errors, leading to more robustness to the results.

The results of regression 3 and regression 4 show that the effect of digital visits on *phone* decreased by 0.0096 percentage points for 1 digital visit per 1000 citizens. This implies that if digital visits increase with 10 per 1000 citizens, this could lead to an average decrease of accessibility for *phone* by 0.096 percentage points. Indicating that these effects are minimal.

Findings from regression 3 and regression 4 were statistically insignificant. As stated in section 2.2, 43 percent of all digital visits were held in Stockholm county councils. For *phone* excluding Stockholm county council from the analysis could be a reason for the statistical insignificance of the coefficients. In the discussion further explanation regarding the insignificance will be provided.

### 6.2.2 Results for Visits

**Table 3- Accessibility in Primary Healthcare (*Visits*)**

| | Regression 1 | Regression 2 | Regression 3 | Regression 4 | Regression 5 |
|---|---|---|---|---|---|
| *Time* | X | -.0339883*** | -.0343044*** | -.0343044* | -.0201639 |
| | | (.0095274) | (.0111989) | (.0174651) | (.0172629) |
| *Digital visit* | .0001718 | .0013458*** | .0013744** | .0013744* | .0000909 |
| | (.0002681) | (.0003797) | (.0005628) | (.0007139) | (.000695) |
| *Robust str. error* | YES | YES | YES | NO | NO |
| *Fixed effects* | NO | NO | YES | YES | YES |
| *Clustered str. error* | NO | NO | NO | YES | YES |
| *Observations* | 546 | 546 | 546 | 546 | 494 |

***Significant at the 1 percent level
**Significant at the 5 percent level
*Significant at the 10 percent level
Standard errors in ()

Table 3 is a summary of all regressions run on *visits*, thus showing the estimated effects of digital healthcare on accessibility regarding the waiting time guarantee of 7 days.

From equation 1 we conduct regression 1 that measures the estimated effects of digital visits with robust standard errors. In regression 1 the estimated coefficient shows that digital visits increase accessibility regarding *visits*. One additional digital visit per 1000 citizens leads to approximately 0.0002 percentage points increase in *visits*. These results however could be interpreted as non effects and are also insignificant.

From equation 2 we conduct regression 2 that includes the dummy variable for time. When including time the effect of digital visits is on the contrary significant and the effect on accessibility regarding waiting time guarantee of 7 days is almost twice as big. This outcome is in line with our hypothesis that digital visits have a positive effect on accessibility in primary healthcare. Looking at the estimated effect of time it is negative which is expected since both previous theory presented in section 2.2 and the average values in section 6.1 indicate that accessibility to primary care centers has decreased between 2015 and 2017.

Using equation 3 we run regression 3, regression 4 and regression 5 that all include a fixed effect (FE) option since there is a risk of bias when analysing panel data.

Regression 3 with FE shows results in the same direction as regression 2 with some changes in decimals, most likely due to that this regression only estimates within municipality effects.

Regression 4 is similar to regression 3, but instead using clustered standard errors. This regression accounts for correlation between municipalities within the same county council.

The result for regression 3 and regression 4 show that the effect of digital visits on *visits* increased by 0.0013744 percentage points for 1 digital visit per 1000 citizens. This implies that if digital visits increase with 10 per 1000 citizens, it would lead to an approximate increase of accessibility for *visits* by 0.014 percentage points . Subsequently, *visits* would increase from 88.92 percent to 90.32 percent.

These findings from regression 3 and regression 4 were in contrast to *phone* significant, implying that regarding the effect on waiting time guarantee of 7 days the obtainable data sample is enough to adjust for differences in effect within county councils.

Last regression is regression 5 where the difference is that the sample for *phone* is used, meaning that Stockholm county council is excluded. The result shows insignificant effects. This gives further evidence to what was stated in section 6.2.1 regarding insignificant results for *phone* when using the fixed effect option and clustering of standard errors.

## 6.3 Summary of the Results

Summarizing the results, regression 3 and regression 4 contribute with the most valid estimated effects of digital healthcare on *phone* and *visits.* Hence it is these results that are relevant to our discussion. To clarify our results, increased usage of digital platforms would render in lower accessibility to primary care centers regarding phone calls and higher accessibility regarding in-person visits. For *phone* there are no statistically significant estimates from regression 3 and regression 4. However regarding *visits* both the effect of time and digital visits are statistically significant.

# 7. Discussion

This chapter creates a discussion where this paper fits into the research area of previous studies in the topic of the effect digital healthcare have on primary healthcare.

## 7.1 Estimated Effects of Digital Healthcare

This paper tries to investigate if digital healthcare has an effect on primary healthcare. To be able to measure this we used data from Swedish primary healthcare and data on digital visits. Digital healthcare is used as the exogenous variation between the two years of fulfillment of waiting time guarantee. This is possible by regressing the amount of digital visits per thousand citizen per municipality on the fulfillment of waiting time guarantee of 0 and 7 days.

For *phone* the results of digital visits do not produce enough evidence to support our hypothesis that digital visits would increase accessibility to primary healthcare. However the results show that accessibility did in fact increase over time. Nevertheless these results were found insignificant for regression 3 and regression 4. As mentioned in section 2.2, 43 % of total digital visits was conducted in Stockholm county council in 2017. This suggests that the effects of digital healthcare is driven to much extent by Stockholm county council. With the forced exclusion of Stockholm county council from the sample the result show a minimal estimated effect of digital healthcare that can be interpreted as non effects. This is strengthened by regression 5 regarding *visits* which show the same pattern as described, insignificant results that could be interpreted as non effects when excluding Stockholm county council

On the contrary, *visits* showed significant results in line with our hypothesis that digital visits would increase accessibility in primary healthcare. There are a number of different aspects that make this result reasonable. Firstly, regarding the analysis on *visits* the sample is larger. Since in the sample for *visits,* data from Stockholms county council is conclusive. This leads to a more accurate result for *visits.* Secondly, research papers for example Shigekawa et.al (2018) and Schildt et al. (2017), argue that there are a lot of health conditions that could be treated with digital platforms. Emphasizing that digital healthcare could be considered as substitute to in-person healthcare services.

The results from the regressions on *visits* show that between 2015 and 2017 accessibility to primary care centers decreased. In section 3.1 we explain how the demand for healthcare services look in Sweden due to the governmentally funded healthcare insurance. Continuously leading to an excess demand as a result of a governmentally controlled amount of healthcare services and a growing population. This could potentially explain the decrease in accessibility shown in the result.

These results are statistically significant at confidence level alpha 0.1 for regression 4. Which means that the results for *visits* is to consider more trustworthy than for *phone*. However the effect of digital visits on *visits* is small which means that in order for the effect to counteract the negative effect of time, digital visits would need to increase by approximately 25 per 1000 citizen. According to our findings this suggests that the development of digital healthcare platforms has a possibility of relieving pressure on the primary care centers. Although digital platforms are being used, the amount of visits in relation to population is too small right now to generate a substantial effect.

## 7.2 Substituality of Digital Healthcare

The question regarding digital healthcare as a substitute is another topic we want to discuss. Currently, extensive literature Shigekawa et al (2018) and Schildt et al (2017) exist that examine the question whether digital healthcare platforms should be treated as an substitute for other in-person healthcare services. Our study is formed in the way that the results shows if digital visits affect accessibility to primary care centers. Although the effect of digital visits is low for *phone* this does not necessarily mean that digital platforms do not work as substitutes for primary healthcare. Digital platforms could still work as substitutes but instead of relieving pressure on other in-person healthcare services, like primary care centers, the increased accessibility contributes to utilization. The development of digital platforms functioning as substitutes increases the access to care, as a consequence it boosts consumption of healthcare services. Supporting this discussion Ashwood et al, (2017) examining acute respiratory infections which state that only 12 percent of the examined cases could be viewed as substitutes and the remaining 88 percent was concluded contributing to overconsumption of healthcare services. This could explain the low effects of digital visits.

However, Shigekawa et.al (2018) present that there are mixed findings about digital platforms effects on other in-person healthcare services. Therefore we can not confirm this as the reason behind the low effects.

## 7.3 Validity of Research Paper, Limitations and Future Research

Our results are in line with previous research on the subject of substituality of digital healthcare. Although our research does not directly investigate if digital platforms work as substitutes for primary healthcare, it is reasonable considering discussed theory and literature to assume that if the effects of digital healthcare would have been greater it points to digital platforms working as a substitute. The effects of digital visits on both *phone* and *visits* are minimal and we still have growing use of digital platforms this indicates that perhaps a large part of the digital visits comes from utilization. Leading us to the a similar conclusion as both Ashwood et al (2017) and Shigekawa et al (2018).

While writing this paper we are aware that it has several limitations. First of all, a severe time constraint was imposed on the data collection and analysis. If more time was available it could render in us gaining even more knowledge in this field adding more depth to this paper. Another limitation comes from the nature of the subject, digital healthcare remains a largely unexplored market and is still under rapid growth. Leading to limitations in both data and literature, but we attempted to gather most recent literature and data. Furthermore, we are aware that although some of our results are significant the validity of those results could be questioned. This is because we are unable to control for every aspect relevant to the regression due to resource constraint.

Finally writing this paper developed some interesting thoughts for continued research. We found it interesting to investigate if digital platforms could simplify the access to psychiatrists in Sweden. In section 3.2 Husakamp et.al (2018) states that digital platforms could increase the accessibility to treatment of mental illness, referring to the recent rapid growth of digital platforms offering access to mental health treatments in the US. We believe that digital healthcare has a great potential of decreasing waiting times for mental health conditions, since it according to the National Board of Welfare (2018) only represents 3

percent of all digital visits examined in 2017. Contributing, Shigekawa et al (2018) indicate that digital platforms is as suitable to examine mental health conditions as in-person services.

# 8. Conclusion

This paper tries to measure the impact that digital healthcare platforms have on primary healthcare. The main result suggest that with increasing use of digital healthcare there could be a potential relief of pressure regarding *visits* at primary care centers in Sweden. On the contrary the effect of digital healthcare on accessibility regarding *phone* showed no statistically significant evidence.

More research is necessary to assess the impact of digital healthcare on primary healthcare in Sweden, especially since digital healthcare is emerging in the Swedish healthcare market.

# 9. References


Andersson, O. Sjögren, J. and Åsberg, H., 2017. *Nätläkarbolagen dränerar en underfinansierad primärvård* [Online]: Dagens Nyheter. Available at: https://www.dn.se/debatt/natlakarbolagen-dranerar-en-underfinansierad-primarvard/ [Accessed 2018-12-08]

Ashwood, J, S. Mehrotra, A. Cowling, D and Uscher-Pines, L., 2017. *Direct-To-Consumer Telehealth May Increase Access To Care But Does Not Decrease Spending* [Online]: Health Affairs. Available at: https://www.healthaffairs.org/doi/pdf/10.1377/hlthaff.2016.1130 [Accessed 2018-12-11]

Baicker, K. Taubman, S, L. Allen, H, L. Bernstein, M. Gruber, J, H. Newhouse, J, P. Schneider, E, C. Wright, B, J. Zaslavsky, A, M. and Finkelstein, A, N., 2013. *The Oregon Experiment — Effects of Medicaid on Clinical Outcomes.* [Online] The New England journal of medicine. Available at: https://www.nejm.org/doi/full/10.1056/NEJMsa1212321 [Accessed 2018-12-18]

Bhattacharya, J, Hyde, T., and Tu, P., 2014. *Health economics*. kap 15 London: Palgrave Macmillan.

Björnberg, A., 2017. *Euro Health Consumer Index* [Online] Health consumer powerhouse. Available at: https://healthpowerhouse.com/media/EHCI-2017/EHCI-2017-report.pdf [Accessed 2018-11-27]

Blix, M. and Jeansson, J., 2018. *Nätläkare i primärvården -lindring eller lidande?*[Online]: Ekonomiskdebatt. Available at: https://www.nationalekonomi.se/sites/default/files/NEFfiler/46-3-mbjj.pdf [Accessed 2018-12-06]

Blumenstock, J., 2013. *Mgmt 469 Fixed Effect models.* [Online] Available at: http://www.jblumenstock.com/files/courses/econ174/FEModels.pdf [Accessed 2018-11-27].

Card and Krueger., 1993. *Minimum Wages and Employment: A Case Study of the Fast-Food Industry in New Jersey and Pennsylvania.* [Online] Available at: http://davidcard.berkeley.edu/papers/njmin-aer.pdf [Accessed 2018-12-14]

Grossman, M., 1972. *The demand for health: a theoretical and empirical investigation.* [Online] NBER Books. Available at: https://www.nber.org/chapters/c3484.pdf [Accessed 2019-01-21]

Embassy of Sweden., 2018. *E-health in Australia and Sweden.* [Online] Embassy of Sweden. Available at: https://www.swedenabroad.se/globalassets/ambassader/australien-canberra/documents/e-health-in-australia-and-sweden-2018.pdf [Accessed 2018-11-20]

Huskamp, H, A. Busch, A, B. Souza, J. Uscher-Pines, L. Rose, S. Wilcock, A. Landon, B, E. Mehrota, A., 2018. *How Is Telemedicine Being Used In Opioid And Other Substance Use Disorder Treatment?*. [Online] Health Affaris. Avalibale at: https://www.healthaffairs.org/doi/10.1377/hlthaff.2018.05134 [Accesed 2018-12-12]

Hälso- och sjukvårdslag 2017:30. Stockholm: Socialdepartementet

Ingerö, Johan., 2018. *Vårdköer och väntetider- En kritisk granskning av landstingens insatser för en bättre tillgänglighet. [Online]* Timbro. Available at: https://timbro.se/valfard/vardkoer-och-vantetider/attachment/va%CC%8Ardko%CC%88er-och-va%CC%88ntetider/. [Accessed 2018-11-21]

Gwartney, James D.; Stroup, Richard L.; Sobel, Russell S.; David MacPherson., (2008). *Economics: Private and Public Choice*. Cengage Learning. Available at: http://books.google.com/books?id=yIbH4R77OtMC. [Accessed 2018-12-08]

Newhouse, J. P., 1993. *The Insurance Experiment Group Free For All? Lessons from the Health Insurance Experiment*. Cambridge: Harvard University Press, Cambridge.

Perloff, Jeffery M., 2014. *Microeconomics with calculus.* third edition. p. 94-96. London: Pearson

Rand Health Care., 2016. *40 years of the RAND Health insurance experiment* [Online] RAND Health care. Available at: https://www.rand.org/health-care/projects/HIE-40.html [Accessed 2018-12-18]

Riksdagen., 2018. *Primärvårdens uppdrag borde definieras* [Online] Riksdagen. Available at: http://www.riksdagen.se/sv/aktuellt/2018/apr/24/primarvardens-uppdrag-borde-definieras/ [Accessed 2019-01-23]

Schildt, J. Flodin, J. Nilsson, M. Rodhe, A and Stolt, R., 2017, *Videobesök spelar viktig roll i framtidens vård* [Online] Dagens Nyheter. Available at: https://www.dn.se/debatt/repliker/videobesok-spelar-viktig-roll-i-framtidens-vard/ [Accessed 2018-12-08]

Shigekawa, E. Fix, M. Corbett, G. Roby, D, H. and Coffman, J., 2018. *The Current State Of Telehealth Evidence: A Rapid Review*. [Online] Health Affairs. Available at: https://www.healthaffairs.org/doi/full/10.1377/hlthaff.2018.05132 [Accessed 2018-12-12]

Socialstyrelsen., 2018. *Digitala vårdtjänster riktade till patienter*. [Online] Socialstyrelsen. Available at: https://www.socialstyrelsen.se/Lists/Artikelkatalog/Attachments/20984/2018-6-15.pdf [Accessed 2018-11-27]

Socialstyrelsen., 2016. *Primärvårdens uppdrag- En kartläggning av hur landstingens uppdrag till primärvården är formulerade. [Online]* Socialstyrelsen. Available at: https://www.socialstyrelsen.se/publikationer2016/2016-3-2 [Accessed 2018-11-19].

Sommarlund, P., 2018. *En personlig och digital vårdupplevelse - Framtidens primärvård* [Online] SP Sveriges Tekniska Forskningsinstitut. Available at: https://www.inrikta.se/files/rapport-l-ngversion.pdf [Accessed 2018-12-06]

Sveriges Kommuner och Landsting(SKL)., 2018. *Tillgänglighet i vården, vårdgaranti.* [Online] Sveriges Kommuner och Landsting. Available at: https://skl.se/halsasjukvard/kunskapsstodvardochbehandling/tillganglighetivardenvardgarantin.889.html [Accessed 2018-11-19].

Sveriges Kommuner och Landsting(SKL)., 2019. *Väntetider i vården- vårdgarantin.* [Online] Sveriges Kommuner och Landsting. Available at:http://www.vantetider.se/veta-mer/vardgaranti/[Accessed 2018-11-19].

The Swedish Institute., 2018. *Healthcare in Sweden.* [Online] The Swedish Institute. Available at: https://sweden.se/society/health-care-in-sweden/ [Accessed 2018-12-11]

# 10. Appendix A

**Table 4- Excluded Municipalities**

| Municipality | Phone | Visits | Reason for exclusion |
|---|---|---|---|
| Aneby | X | X | No data on digital visits (Jönköping county council) |
| Askersund | X | X | No data on waiting time guarantee |
| Botkyrka | X | | No data on waiting time guarantee (phone) (Stockholm county council) |
| Danderyd | X | | No data on waiting time guarantee (phone) (Stockholm county council) |
| Dorotea | X | X | No data on waiting time guarantee |
| Ekerö | X | | No data on waiting time guarantee (phone) (Stockholm county council) |
| Eksjö | X | X | No data on digital visits (Jönköping county council) |
| Gislaved | X | X | No data on digital visits (Jönköping county council) |
| Gnosjö | X | X | No data on digital visits (Jönköping county council) |
| Habo | X | X | No data on digital visits (Jönköping county council) |
| Haninge | X | | No data on waiting time guarantee (phone) (Stockholm county council) |
| Hofors | X | X | No data on waiting time guarantee |
| Huddinge | X | | No data on waiting time guarantee (phone) (Stockholm county council) |
| Järfälla | X | | No data on waiting time guarantee (Stockholm county council) |
| Jönköping | X | X | No data on digital visits (Jönköping county council) |
| Lidingö | X | | No data on waiting time guarantee (phone) (Stockholm county council) |
| Mullsjö | X | X | No data on digital visits (Jönköping county council) |

| | | | | |
|---|---|---|---|---|
| Nacka | X | | | No data on waiting time guarantee (phone) (Stockholm county council) |
| Nordmaling | X | X | | No data on waiting time guarantee |
| Norrtälje | X | | | No data on waiting time guarantee (phone) (Stockholm county council) |
| Nykvarn | X | | | No data on waiting time guarantee (phone) (Stockholm county council) |
| Nynäshamn | X | | | No data on waiting time guarantee (phone) (Stockholm county council) |
| Nässjö | X | X | | No data on digital visits (Jönköping county council) |
| Salem | X | | | No data on waiting time guarantee (phone) (Stockholm county council) |
| Sigtuna | X | | | No data on waiting time guarantee (phone) (Stockholm county council) |
| Sollentuna | X | | | No data on waiting time guarantee (phone) (Stockholm county council) |
| Solna | X | | | No data on waiting time guarantee (phone) (Stockholm county council) |
| Stockholm | X | | | No data on waiting time guarantee (phone) (Stockholm county council) |
| Sundbyberg | X | | | No data on waiting time guarantee (phone) (Stockholm county council) |
| Sävsjö | X | X | | No data on digital visits (Jönköping county council) |
| Södertälje | X | | | No data on waiting time guarantee (phone) (Stockholm county council) |
| Tranås | X | X | | No data on digital visits (Jönköping county council) |
| Tyresö | X | | | No data on waiting time guarantee (phone) (Stockholm county council) |
| Täby | X | | | No data on waiting time guarantee (phone) (Stockholm county council) |
| Upplands-Bro | X | | | No data on waiting time guarantee (phone) (Stockholm county council) |
| Upplands-Väsby | X | | | No data on waiting time guarantee (phone) (Stockholm county council) |

| | | | |
|---|---|---|---|
| Vaggeryd | X | X | No data on digital visits (Jönköping county council) |
| Vallentuna | X | | No data on waiting time guarantee (phone) (Stockholm county council) |
| Vaxholm | X | | No data on waiting time guarantee (phone) (Stockholm county council) |
| Vetlanda | X | X | No data on digital visit (Jönköping county council) |
| Värnamo | X | X | No data on digital visits (Jönköping county council) |