Suicide and Primary Health Care in Swedish Regions

Do Increasing Number of Healthcare Centres Prevent Suicides?

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Abstract:

Suicide is a public health concern in Sweden and suicide preventive work is being made in many areas. This study aims to examine the relationship between suicide rates and primary health care. The study exploits a set of reforms implemented in Swedish regions between 2007-2010, that aimed to increase patients' choice of health care provider and the competition in the primary health care market. In order to estimate a causal relationship between primary healthcare centres and suicide rates, we examine the effect of the reforms on suicide rates using panel data over Sweden's regions between 2006-2018. We also examine first stage effects of the reforms on health care personnel and health care visits, to further study the relationship between suicide and primary health care. The study finds no causal effect of healthcare centres on suicide rates but finds a significant negative effect of the reforms on suicide rates. The study also finds that the reforms increased visits to general practitioners but not to other professions, and the number of health care personnel did not increase after the reform. The study concludes that a negative effect of primary health care on suicide rates should be expected, but due to a limited data set, the effect is not significant in this study. The increase in access to general practitioners support this conclusion, but the lack of increase in access to other professions suggests that the effect of primary health care on suicide rates should be of low magnitude.

Bachelor's thesis in Economics, 15 credits

Fall Semester 2019

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Introduction

Suicide has for a long time been a public health concern in Sweden, and still is. The mortality rate due to suicides has generally been high in Sweden, with an average suicide rate similar to other EU countries (Folkhälsomyndigheten, 2016). In general, there has been a downward trend in suicide rates in Sweden and in EU in general, however, this is not true for certain groups of the population. For males in ages 15-45, suicide is the most common cause of death, and for females in the same age group the second most common cause of death (Folkhälsomyndigheten, 2016).

In this study, we want to examine the relationship between suicide and primary health care. Psychic disorders are very common among suicide victims and they are often treated at primary healthcare centres (Folkhälsomyndigheten, 2008). In theory, improving primary health care could then be a way to prevent suicides. Improvements can be done in many ways, such as increasing access to health care for patients, or improving efficiency among health care providers. One common argument in economic theory is that competition in markets generally creates efficiency. However, health care markets are often assumed to differ from other competitive markets, mainly due to uncertainty and asymmetric information (Bhattacharya, Hyde, &Tu, 2014). It is therefore not always clear if and how competition in health care markets affect different aspects of efficiency and quality. The aim of this study is specifically to examine the relationship between suicide rates and number of primary healthcare centres within Swedish regions[1]. To do this, we exploit a set of reforms that were implemented in order to increase competition and efficiency in primary health care in Swedish regions between 2007-2010, which will allow us to examine the causality of number of healthcare centres on suicide rates.

The Public Health Agency of Sweden[2] are responsible for coordinating suicide preventive work in Sweden and have created a specific action programme for suicide prevention. The programme consists of suggestions for nine different areas of actions to reduce suicide rates in Sweden and focuses on both an individual and population level (Folkhälsomyndigheten, 2008). One of these areas for action is called "Improving the medical, psychological, and psychosocial work" (Folkhälsomyndigheten, 2008, p. 6) in which the aim is to improve the care for persons who are at risk for suicide. Many studies have shown that psychic disorders are highly prevalent among people who commit suicide (e.g. Ginley & Bagge,

[1] In this thesis, region and county council (Sv.: *Landsting*) will be used interchangeably. For the purpose of this thesis, there is no real difference between the terms.

[2] In Swedish: *Folkhälsomyndigheten*.

2017; Mann et al., 2005). It has been suggested that over 90% of patients who have attempted suicide suffered from psychic disorders, where depression is among the most common diagnosis (Daidano, Yusfani & Daidano, 2018). As the action programme for suicide prevention suggests, it is reasonable to believe that improving health care would help with preventing suicides.

Guidelines for treatment of depressions and anxiety in Sweden are provided by the Swedish National Board of Health and Welfare[3] (2019), who are the central national authority for health services. They state that most patients with depression and anxiety seek health care in primary healthcare centres, and over 70% of patients with these problems receive care within the primary health care. However, what the treatment consists of may be different between regions. The national guidelines suggest that depressions should primarily be treated with psychological therapy, and secondly with medical treatments prescribed by physicians. The psychological treatment is mainly provided by psychologists, but also by other professions such as nurses and social workers. However, the competence of who provides psychological treatment varies between regions (Socialstyrelsen, 2019). Several aspects may therefore affect how efficient the health care is in terms of suicide prevention, such as access to health care, or the quality of the health care provided.

Since 2007, a set of reforms have been implemented gradually in Swedish regions, which aimed to increase the freedom for patients to choose primary health care providers, and to increase competition between providers. This was later mandated by law in 2010. Although it's not entirely clear if the set of reforms increased quality within the primary health care (Dietrichson, Ellegård, & Kjellsson, 2016), they generally increased the number of primary healthcare centres within the regions.

Aim of the study

The aim of this study is to examine the relationship between suicide rates and number of primary healthcare centres within regions. The hypothesis is that increasing number of primary healthcare centres will decrease the suicide rate. We will use the set of reforms aimed at improving competition in health care that was implemented in Swedish regions between 2007-2010, in order to examine a causality between suicide rates and number of healthcare centres. The study will then examine in more detail what effects the reforms had, in order to better understand the relationship between suicide rates and primary health care. Specifically,

[3] In Swedish: *Socialstyrelsen.*

we aim to examine if and how the reforms increased access to health care, and how this relates to suicide prevention.

Previous studies have found a relationship between access to health care and suicide (Tondo, Albert, & Baldessarini, 2006; Pirkola et al., 2009), and others have examined the relationship between suicide and socioeconomic factors such as income and unemployment in Sweden (Magnusson & Mäkinen, 2010). However, we have found no studies of the relationship between primary health care and suicide rates in a Swedish context, which we believe might be important for suicide preventive work.

Overview of the thesis

The *Literature Review* section will present a summary of the literature on studies of suicide, and economic theories on access to health care and competition in health care markets. The *Background* section will then present an overview of the set of reforms implemented in Sweden that is used in this study. The *Data* section will present and describe the data that is used in this study, and the section of *Empirical Approach* will present the different stages of the IV regression model that is used. This section is divided into two parts, where the model of interest is presented first, in which we examine the effect of healthcare centres on suicide rates. In part *B* of the *Empirical Approach*, the alternative models of the first stage are presented, where we examine other effects that the reforms had. The *Results* section will then present the results from the different regressions, and discusses limitations of the models. Finally, the *Conclusion* section discusses how the results are interpreted, and how the findings of this study relates to previous studies. In this section, we argue that while the study doesn't find a significant causal effect of the reforms, we believe that this is due to lack of statistical power. Results from the first stage and the reduced form suggest that we should expect a negative causal effect of number of primary healthcare centres on suicide rates, attributed to increased access to health care.

Literature review

In this section we will present a general overview of theories in studies of suicide. As the subject of suicide can be understood from many perspectives, we will discuss it from a viewpoint of social sciences, and how economic studies of suicide have developed through history. We will also discuss economic theories of competition in health care markets.

Suicide

Emile Durkheim's study of suicide from a perspective of sociology, in which he laid the groundwork for sociologist trying to explain patterns in suicide, is historically important in studies of suicide. He found suicide to be based on two factors - the need of social integration, and imbalances in moral regulation (Durkheim, 1897/2010). Durkheim provided an empirical model for sociologists to study suicide and have been very impactful in this field of study.

Theories of suicide have since then come to include fields other than sociology. Hamermesh and Soss (1974) incorporated economic theory, using a utility maximization model to study reasons for suicide. Their studies suggested that suicide should decrease with an increase in expected life income. Suicide were found to increase with age and unemployment but decrease with income. These studies helped to gain an understanding of a relationship between socioeconomic factors and suicide.

More recent studies have continued the tradition of using socioeconomic factors in studies of suicide, but have also started to include the relationship with health care. Tondo, Albert, & Baldessarini (2006) studied the effect of access to health care on suicide rates in the United States. They found that access to health care, using measurements such as state aid for mental health, and population density of psychiatrists, was associated with lower suicide rates. Other studies have contributed to similar explanations. Owens, Lloyd, & Campbell (2004) found that general practitioners' ability to recognize mental health problems are high. Another study found that Finnish municipalities with higher access to psychiatric out-patient services was associated with lower suicide rates (Pirkola et al. 2009). These studies imply that there is a relationship between access to health care and suicide rates. However, there are few studies investigating this relationship in a Swedish context, and we found no studies that investigated a causal relationship between primary health care and suicide rates.

Access to health care

The definition of access to health care differs between authors. Levesque, Harris, & Russell (2013) have made a synthesis of the most common definitions. They suggested five measures of accessibility; approachability, acceptability, availability and accommodation, affordability, and appropriateness. Access to health care would then be improved by any of these measures. A definition of access to health care is important in order to derive a measure for it that can then be used for analysis. Providing patients with choices of their health care providers might therefore have both positive and negative effects. One study suggested that educated patients with more possibility of travelling had the option to impact their health care,

while poorer patients without the option to travel was stuck with worse care (Fotaki, Roland, & Boyd, 2008). However, more choice can also increase competition and therefore improving quality and shortening queues. Hence access to health care is multidimensional and the set of reforms can affect access to health care in several ways.

Competition in health care markets

In general, suppliers on competitive markets attract customers by lowering prices. However, health care markets suffer from many imperfections, mainly due to asymmetric information (Bhattacharya, Hyde, & Tu, 2014). In Beveridge models for health care systems, which Sweden utilizes, health care services are paid for by the government, with patients paying only a small nominal fee for the services provided. One effect of this is that health care providers must compete for patients with other means than price, such as quality of the health care provided.

In *The Other Invisible Hand* (2007), economist Julian Le Grand discusses how quasi-market models can create competition in a public market, where customers (or in the case of health care markets – patients) do not purchase services directly from the provider. The idea with quasi-markets is to maintain the positive benefits from a competitive market, but within a public market such as the health care market. Le Grand writes that such markets provide autonomy, and promotes adjustments to customers demand, and thereby creates incentives for providers to offer better quality and efficiency. In order for public markets to provide such quality and efficiency, the quasi-market model requires the patient (in this case) to be able to choose, and it also requires competition among providers (Le Grand, 2007). However, as Le Grand points out, such model does not guarantee higher quality or efficiency, it only provides the possibility of increased competition-induced quality and efficiency, if the conditions of the market are properly fulfilled.

The set of reforms of free choice systems can be viewed as an implementation of a quasi-market, which is often referred to as *choice of care* models (Ahgren, 2010). As discussed earlier, the reforms were aimed to allow patients to choose between primary health care providers, and to increase competition by making it easier for private health care providers to establish on the market. To control that a certain quality is offered in Sweden, there is a system of accreditation policies which specify that a certain quality must be upheld by healthcare centres (Norén & Ranerup, 2015). According to Ahgren (2010), choice of care models are effective at reducing waiting time in primary health care. However, there is a risk that it causes fragmentation between primary and secondary care, meaning that the connection between

primary care and specialist care can be disrupted. One form of competition between Swedish healthcare centres is created as they are ranked according to specified quality indicators that are available to the public (Norén & Ranerup, 2015). One example of such indicators is waiting time. Location and opening hours may also create competition. It can be questioned how effective the quality indicators are at creating competition, because providers often lack information on what consumers think of the value of their services (Vengberg, Fredriksson, & Winblad, 2019). Furthermore, quality of care also depends on factors that is not always possible for the patients to observe, that is, health care is a credence good. As the study of Dietrichson, Ellegård, and Kjellsson (2016) showed, the reforms of free choice systems were followed by a modest improvement in patients' self-perceived quality of primary care, but the authors found no significant effect on patients' happiness with access to health, suggesting that the actual effect of the competition-inducing reforms on quality might be ambiguous.

International studies provide some support that choice of care models contribute to improved clinical quality. Bloom et al. (2015) found that introduction of similar choice of care models in the English NHS system resulted in both higher clinical quality, measured as a decrease in mortality rate of emergency heart attacks, and productivity for hospitals. This increase was found to be an effect of increased managerial ability that followed the increase of competition. Other studies have found that policies that induced increased competition between hospitals led to improved clinical quality of hospitals in the English NHS system (Gaynor, Moreno-Serra, & Propper, 2013; Cooper et al., 2011). However, few studies have been done on competition in primary health care. One study found a small increase in clinical quality and patient happiness with primary health care when competition is higher (Gravelle et al., 2019). On the other hand, it has also been found competition leading to lower quality of primary care in Australia (Johar, Jones, & Savage, 2014). This study found that the patient-doctor relationship was affected by competition in a way that decreased the quality of the health care provided.

The available literature about suicide and health care are suggesting that different improvements of access to health care have had an effect on suicide rates in different countries (Tondo, Albert, & Baldessarini, 2006; Pirkola et al., 2009), but studies conducted in Sweden is lacking. Other studies are suggesting that quasi-market models can improve access or quality of health care (Gaynor, Moreno-Serra, & Propper, 2013; Cooper et al., 2011; Gravelle et al., 2019; Bloom et al., 2015). Based on these findings, we can derive a hypothesis that increasing number of primary healthcare centres will have a suicide preventive effect.

Background

Sweden uses a Beveridge model for the health care system, where the health care is mainly government funded through taxes. The 21 different regions are the main providers of primary health care and are responsible to fund and provide health care according to national regulations. The municipalities within the regions are responsible for certain types of health care for certain groups of the population, such as paediatric care and care for elderly. Primary healthcare centres are the first stage of health care, and they are used as gatekeeping to not allow patients to directly visit specialist health care (Norén & Ranerup, 2015). During the last decades, different structural reforms have been done in the Swedish health care system, attributed to economic or ideological reasons (Axelsson, 2000). The focus has shifted between centralization and decentralization in terms of how the health care have been provided and financed.

In this section, we will present the set of reforms in the Swedish health care system, called the *Act on free choice system*[4]. By making it easier for private health care providers to enter the market, and by making patients the "purchaser" of health care by allowing citizens to choose their primary health care provider, the reforms were an attempt to increase efficiency and quality in the Swedish health care market (Ahgren, 2010).

Act on free choice systems

Since the 1990s, patients in Sweden have gradually been provided with possibilities of choosing their health care provider. However, the share of public primary health care providers has been dominating over private health care providers, and in practice, there have been no real financial incentives for public healthcare centres to attract new patients (Anell, 2011). Starting in 2007, a few regions implemented local reforms that aimed to increase competition and to improve the performance of the primary health care in general. Other county councils followed with similar reforms, and in 2009, the national government decided that the type of reforms was to be implemented nationally (Anell, 2011).

Implemented in January 1st in 2010, *Act on free choice systems* (SFS 2008:962) mandated that every citizen have the right to choose the provider of primary health care services, given that government agencies have a contract with the provider (Sveriges Riksdag, 2019). A main difference from before the implementation is that the contracting government agency now had to treat every aspiring contractor equivalently. This meant that private

[4] Swedish: *Lagen om valfrihetssystem*

contractors were to be treated in the same way as public contractors, which in turn was meant to increase the range of choices for citizens through competition. Services that were affected by the *Act on free choice systems* included, but was not limited to, elderly care, primary health care services, and social care services.

This new primary health care system was required to follow the new rules for competition, stated by the *Act on free choice systems*. The idea was to enhance the patients' possibility to choose their own health care provider, by transferring this power from the county councils to the patients. The intention was also to increase competition in the health care market, by making it easier for health care providers to establish on the market (Konkurrensverket, 2009). The system was to be structured according to certain requirements: Every health care provider was to be treated equally, the patient's choice should not be restricted geographically within the county council, and the reimbursement to the health care provider should follow the patient's choice of provider. However, the county councils were allowed to design their own system for how patients choose health care providers, as long as the requirements were fulfilled (Konkurrensverket, 2009).

Table 1: Time of implementation of health care reform

Region	*Time of implementation*
Halland	2007-01-01
Västmanland	2008-01-01
Stockholm	2008-01-01
Uppsala	2009-01-01
Kronoberg	2009-03-01
Skåne	2009-05-01
Östergötland	2009-09-01
Västra Götaland	2009-10-01
Sörmland	2010-01-01
Gävleborg	2010-01-01
Blekinge	2010-01-01
Dalarna	2010-01-01
Kalmar	2010-01-01
Norrbotten	2010-01-01
Västernorrland	2010-01-01
Jämtland Härjedalen	2010-01-01
Örebro	2010-01-01
Västerbotten	2010-01-01
Gotland	2010-03-23
Värmland	2010-05-03
Jönköping	2010-06-01

Source: Konkurrensverket (2012)

The implementation of the reforms is summarized in Table 1. Most of the county councils implemented the system in 2010, but eight county councils had implemented the system in previous years.

In a report, the Swedish Competition Authority[5] (2012) assessed that the reforms of systems for health care choices had a positive effect on how citizens perceived their access to and ability to choose health care providers. The report stated that 92% of Swedish citizens knew about the possibility to choose primary health care providers, and that a majority of citizens have at least two primary healthcare centres within reasonable distance (Konkurrensverket, 2012).

One study has suggested that the set of reforms led to increased access to general practitioners, but found that it is unclear if this was explained by reduced visit length or due to other effects (Sveréus, Kjellsson, & Rehnberg, 2018). Dietrichson, Ellegård, & Kjellsson (2016) found in another study that the reforms slightly improved patients' satisfaction with the health care overall, but that it is not clear if the reforms had actual effects on overall access to health care or if the quality had improved.

These reforms were mainly implemented to increase competition among providers, but it is plausible to believe that they also increased access to health care. In this study we will also investigate if the reform increased access to health care. Since we believe that access to health care might have an effect on suicide prevention, this will be important in understanding what the effect of increasing primary healthcare centres is on suicide rates.

Data

Our main outcome variable is suicide rates. Data of suicide rates in Swedish regions was retrieved from Swedish Cause of Death register[6], which is provided by The National Board of Health and Welfare in Sweden. This data consists of registered deaths by confirmed suicides (ICD codes X60-X84). This means that there might be an underestimation of suicides due to uncertain cases. The study uses a measurement of suicides per 100 000 in the population, and the data of suicide-related mortality is reported in this study by gender and in three age-groups: 15-29, 30-64, & 65+. This makes interpretation of the result easier, while still maintaining the possibility to measure effects between age-groups and gender. Another reason is that using

[5] Swedish: *Konkurrensverket*

[6] Swedish: *Dödsorsaksregistret*. See Socialstyrelsen (2019).

more age-groups might be too demanding because of too few observations in each age-group, given our sample size.

Table 2: Number of healthcare centres per region, pre- and post reform:

	Pre-reform				*Post-reform*			
	Average	*SD*	*Min*	*Max*	*Average*	*SD*	*Min*	*Max*
Halland	18.6	0.0	18.6	18.6	18.7	0.6	17.8	19.7
Västmanland	14.5	0.2	14.4	14.6	13.7	1.0	11.9	15.1
Stockholm	10.8	0.2	10.7	10.9	11.5	0.4	10.8	12.1
Uppsala	12.6	3.1	10.7	16.2	14.2	1.1	12.2	15.6
Kronoberg	17.0	0.3	16.7	17.2	20.3	0.6	19.6	21.4
Skåne	12.6	0.4	12.3	13.1	14.2	0.2	14.0	14.4
Östergötland	11.9	0.1	11.9	12.1	11.6	0.4	11.1	12.2
Västra Götaland	12.2	0.1	12.1	12.4	14.9	1.1	13.3	16.9
Sörmland	9.8	0.3	9.4	10.0	11.3	0.3	10.6	11.6
Gävleborg	15.0	2.0	12.0	16.7	17.3	1.0	14.9	18.0
Blekinge	16.2	0.4	15.6	16.5	16.2	1.0	15.1	17.8
Dalarna	12.0	0.6	11.6	12.8	12.4	0.8	11.7	14.1
Kalmar	22.5	0.7	21.7	23.2	19.2	2.1	17.1	23.1
Norrbotten	15.5	0.0	15.5	15.6	15.1	1.9	12.7	17.9
Västernorrland	15.7	2.0	12.7	17.0	15.5	0.2	15.1	15.7
Jämtland Härjedalen	24.5	0.5	24.2	25.2	24.4	1.0	23.3	26.1
Örebro	12.5	0.1	12.4	12.6	12.2	0.3	11.7	12.7
Västerbotten	16.8	0.9	15.7	17.5	17.1	0.3	16.9	17.6
Gotland	15.9	1.9	14.4	18.5	14.5	2.0	12.0	16.4
Värmland	15.1	0.1	15.1	15.2	16.1	0.4	15.7	17.2
Jönköping	12.0	0.5	11.5	12.4	16.9	1.6	14.2	18.5
All regions	15.0	3.8	9.4	25.2	15.6	3.3	10.6	26.1

Notes: Pre-reform includes the years up until, but not including, the year of the reform. Most county councils implemented the reform January 1st, but a few did so later in the year. However, since we still observe a change in healthcare centres the same year, we choose not to treat these regions different from the others. Sources: Swedish Competition Authority (2012), SKR (2019).

To estimate the effect of the number of healthcare centres on suicide rate we obtained data from Swedish Association of Local Authorities and Regions[7]. These includes data of number of healthcare centres per region, and per year from 2006-2018. We transform this data to healthcare centres per 100 000 of the population, using data of population in Swedish regions. Both private and public primary healthcare centres are included, and in order to limit the study, we assume no difference in quality or in other respects, between private and public primary healthcare centres. This means that the study uses data from 21 regions over 13 years, which

[7] Swedish: *Sveriges Kommuner och Regioner (SKR)*. See Sveriges Kommuner och Regioner (2019).

yields 273 observations. We were unable to retrieve data from earlier time periods, since they were not available in digital form.

Because the reforms of systems for health care choices were implemented between 2007 and 2010 in the different county councils, we are able to exploit these reforms to examine a possible causal effect of an increased number of healthcare centres on suicide rates. The reform is used here as an instrument for number of healthcare centres per 100 000 of the population in each region. Table 2 shows descriptive statistics of number of primary healthcare centres per 100 000 of the population, before and after the reforms were implemented in every region. There was an increase of total number of primary healthcare centres in the post-reform period on average, which indicates that the reform had an effect on number of healthcare centres. This is especially true for the larger, and more urban regions, while in some rural regions, the number of healthcare centres per 100 000 of the population decreased after the reform.

Figure 1: Average number of primary healthcare centres for all regions in Sweden.

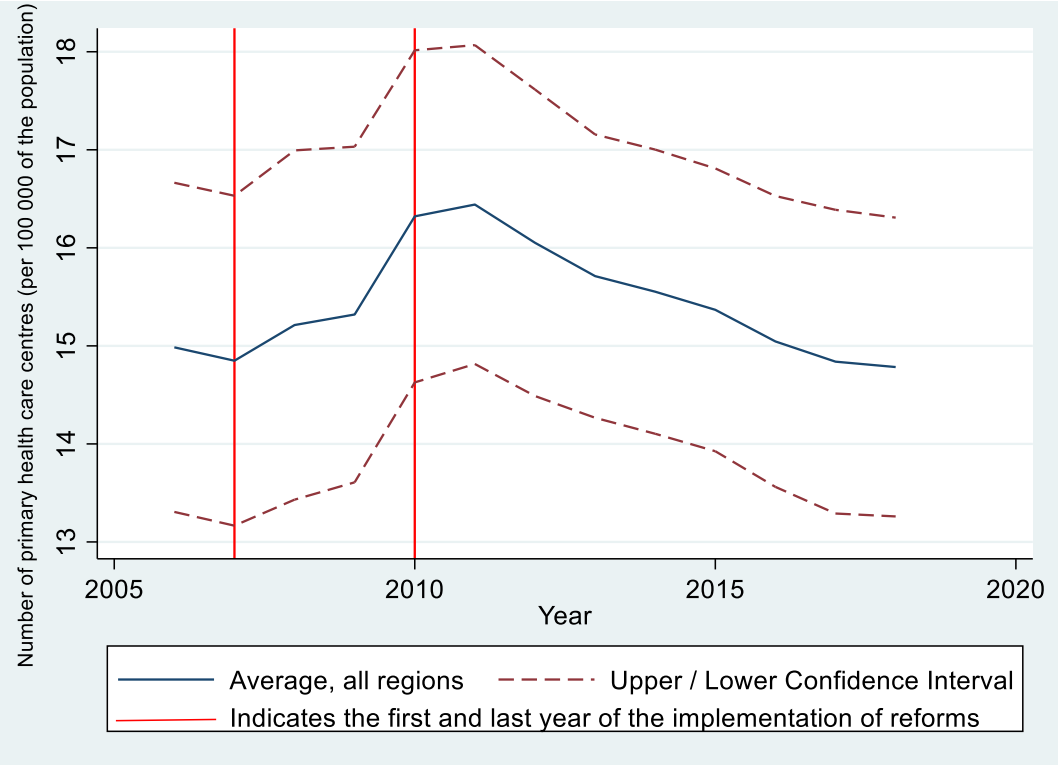
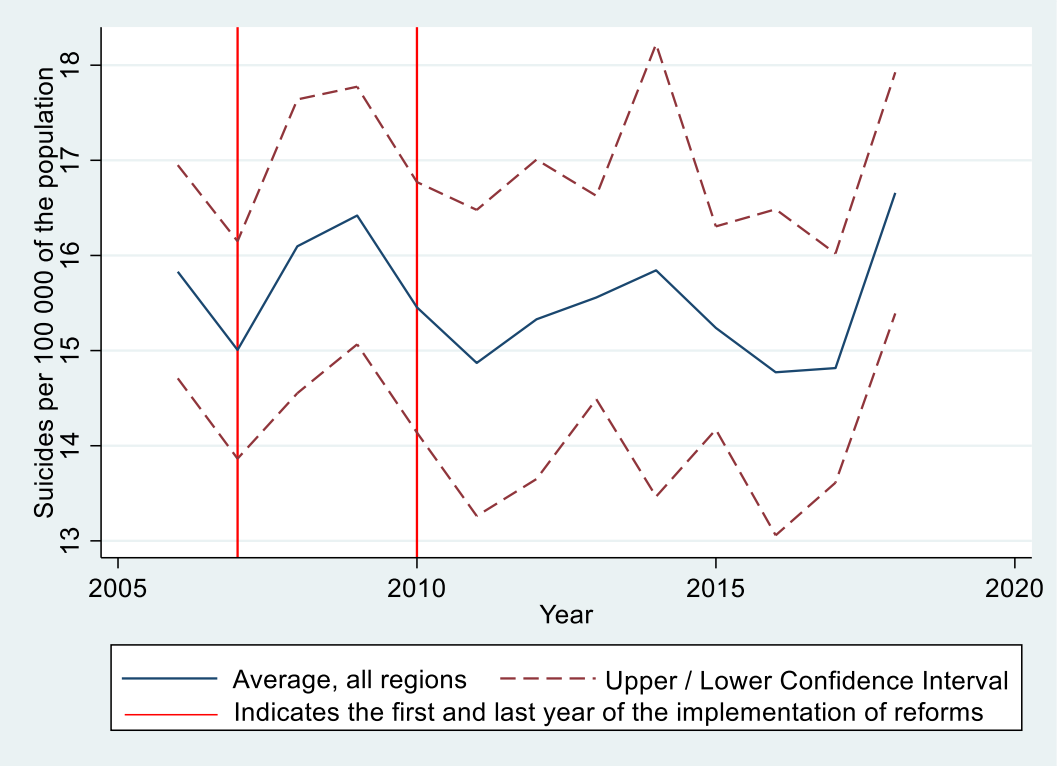


Figure 1 shows that the average number of primary healthcare centres increased during the time of the reforms, which the vertical lines mark the first and last year of implementing, but there is also a decrease a few years after the reforms were implemented. There are two

possible explanations for this: Some of the healthcare centres that opened after the reform, might have had to shut down soon after because the demand was fulfilled. Another explanation is that the population growth was larger than the increase in healthcare centres over time.

Figure 2 shows the average suicides per 100 000 of the population, for all regions, all ages, and both genders. The vertical lines mark the first and last year of the implementation of the reforms. There is a minor downward trend in the average of suicide rates, but it's not obvious if the reform had an effect or not.

Figure 2: Average of suicides per 100 000 of the population (All regions, all ages, both genders)



Previous studies have shown that the effects of different socio-economic variables are often inconclusive and depends on how the study is set up and what data is used (Chen et al., 2012). In the regression models we are using in this study, we have chosen control variables that are commonly used in previous studies, and that we believe are reasonable to include. However, we have been limited to what data has been available for us.

Unemployment has been shown to have an impact on suicide rates (Huikari & Korhonen, 2016; Magnusson & Mäkinen, 2010; Rodríguéz, 2005). Unemployment rate for ages 18-64 is measured here as a share of the population, and data is collected from RKA's[8] database

[8] Swedish: *Rådet för främjande av kommunala analyser.*

Kolada[9]. Previous studies have shown that suicide rates also have a statistically significant relationship with divorce rates and population density (Minoiu & Rodríguez, 2008), net income and alcohol consumption (Magnusson & Mäkinen, 2010), and higher education (Pompili et al., 2013). Data have been collected from Statistics Sweden[10]. Since data of alcohol consumption were not available for our regions and time periods of interest, sale of alcohol per capita and region is used as a control variable. We believe that this will be a good enough approximate for alcohol consumption. Data of education is reported as share of population with higher education than gymnasium.

Table 3: Descriptive statistics

Descriptive statistics for suicides and other covariates in Swedish Regions 2006-2018 (N=21)

Measure	*Mean*			*SD*		
	Female	*Male*	*Overall*	*Female*	*Male*	*Overall*
1. Suicide per 100 000 of population	9.2	23	15.2	4.9	10.7	6
2. Number of primary healthcare centres per 100 000 of population			15.4			3.5
3. Unemployment (%)	6	7.2	6.6	1.5	1.9	1.7
4. Alcohol sold per capita and year (in litres)			5.9			1.4
5. Share of population with higher education (%)	29.5	23.3	26.4	4.6	4.7	4.6
6. Divorces per 100 of population			0.5			0.1
7. Disposable net income per household (1 000 SEK) (- 2017)			175.9			21.9
8. Population per square kilometre	23.6	23.4	47.5	34.2	33.7	68.3
9. Primary health care visits per 100 000 of population, other professions than GP			2178			477.4
10. Primary health care visits per 100 000 of population, GP			1306			187.6
11. Primary health care employees, public			217			75.8
12. Primary health care employees, private			99			50.3

Sources: Statistics Sweden, Kolada, SKR, Swedish Cause of Death Register.

We have also collected data of number of visits to primary healthcare centres per 100 000 of population, and number of health care personnel in public and private healthcare centres per 100 000. The reason for this is that we want to examine other effects than on suicide rates that the set of reforms of health care choices had, which in turn will allow us to understand

[9] See Rådet för främjande av kommunala analyser (2019).
[10] Swedish: *Statistiska Centralbyrån*. See Statistiska Centralbyrån (2019).

the relationship between primary healthcare centres and suicide rates better. Data were collected from Kolada and the Public Health Agency of Sweden[11].

Table 3 shows descriptive statistics for all variables. We see that the standard deviation is relatively high for some variables, such as population density, reflecting large variation between regions in Sweden. For other variables, such as number of visits to general practitioners, the variation is relatively low between regions. Table 3 also shows that the variation of number of primary healthcare centres per 100 000 of the population is relatively low between regions, which possibly reflect similarities in health care access between regions. One other thing to notice is that the average suicide rates for men is double that of women.

Empirical approach

The aim of the study is to examine the relationship between suicide rates and number of primary healthcare centres. To do this we exploit the sets of reforms for choice of care models between 2007-2010, in order to investigate a possible causal effect of number of primary healthcare centres on suicide rates in Swedish regions.

The empirical approach and the results are presented in two parts. In *Part A*, we examine if the set of reforms had an effect on suicide rates, by using the reforms as an instrument for number of healthcare centres. The main assumption is that the effect of the reforms on suicide rates comes from an increase of number of primary healthcare centres.

In *Part B*, we examine the effect of the reform using other measurements as dependent variables. The aim is to further investigate if the effect of the reform comes from other, indirect sources from number of primary healthcare centres.

Part A

This part examines if number of primary healthcare centres have an effect on suicide rates. The study uses panel data of suicide rates per region, gender, and age groups, over a time period from 2006-2018. Our main empirical model is based on the following equation:

$$(1)\ S_{y,r,g,a} = \alpha_0 + \alpha_1 H_{y,r} + X_{y,r,g}\alpha + \mu_r + \varepsilon_{y,r}$$

Where *S* is the outcome of interest: suicide rate per 100 000 of the population, per year, region, gender, and age. *H* refers to primary healthcare centres per 100 000 of the population, and per year and region, which is our independent variable of interest. *X* is our control variables per year and region, and for some variables also per gender. μ is a vector of region-specific fixed

[11] See Folkhälsomyndigheten (2019).

effects. As discussed in the literature review section in this thesis, previous studies have shown that access to health care is associated with lower suicide rates (Tondo, Albert, & Baldessarini, 2006; Pirkola et al., 2009). In this model, we might therefore anticipate a negative coefficient for *H*, indicating a negative relationship between suicide rates and healthcare centres.

The use of a panel data model means that heteroscedasticity will not be too much of a problem. Because too few clusters might cause small sample bias, we will use robust standard errors to control for heteroscedasticity.

A simple OLS-model would most likely suffer from problems with endogeneity, due to region specific or gender specific effects. For example, if we think of suicide as a multi-dimensional problem where not just socio-economic factors will have an effect, but also psychological and cultural, we might believe that especially cultural aspects might vary between regions in Sweden. To deal with such endogeneity problems, we choose to include dummies for regions, gender, and age where it is relevant, in order to control for such time-invariant effects.

However, with this model we might violate the exogeneity assumption of the OLS-model in another way. In general, it is plausible to believe that the causality between suicides and primary healthcare centres could go in both directions. Improving access to health care may be a way to reduce suicides by treating mental health problems, but we might as well believe that increased mental illness increase the demand for health care and therefore more primary healthcare centres in areas with high suicide rates. It would then be difficult to determine the causality. This implies that the exogeneity assumption of the regular OLS would be violated. Formally:

$$[\varepsilon_{y,r} \mid H_{y,r}] \neq 0$$

In order to deal with the exogeneity problems, and to find a possible causality between number of primary healthcare centres and suicide rates, we will exploit the set of reforms of systems for health care choices. If we believe that the reform increased the number of healthcare centres in a way that is unrelated to suicide rates, we can use the reform as an instrument for the number of primary health centres. Formally, this exogeneity assumption is then written as:

$$[\varepsilon_{y,r} \mid [Reform]_{y,r}, X_{y,r}] = 0$$

This would allow us to estimate a causal effect of primary healthcare centres on suicide rates. We will use an instrumental variable regression, using Two Stage Least Squares (2SLS) where equation (2) is the first stage, and where number of primary healthcare centres is instrumented

with exposure to health care choice reform. The reduced form is shown in equation (3). The 2SLS allows us to calculate an IV estimate of α_1 from equation (1) which is a more consistent estimate of the effect since we believe that our main variable of interest is endogenous.

First stage

$$(2)\ H_{y,r} = \beta_0 + \beta_1[Reform]_{y,r} + X_{y,r}\beta + \mu_r + u_{y,r}$$

Where *H* is the number of primary healthcare centres per 100 000 of the population, and per region and year, and *Reform* is a dummy variable indicating whether the region has implemented the reform of systems for health care choice or not. *X* is a vector of control variables, and μ is the region-specific fixed effects. As discussed earlier in this thesis, studies have shown that the set of reforms affected access to primary health care in some ways (Sveréus, Kjellsson, & Rehnberg, 2018), and as Table 2 showed, the average number of primary healthcare centres was higher after the reforms were implemented. The hypothesis is then that exposure to reform is a strong instrument for number of primary healthcare centres.

With equation (2), we want to capture the variation in α_1 from equation (1) that is generated by the regional implementations of the health care reforms. There are two important assumptions for this: that there is no self-selection for the reform; and that the reforms have no other effects on suicide rates than through number of healthcare centres conditional of the control variables – that is, the exclusion restriction.

It could be argued that since the reform was mandated by law, the county councils had no option but to implement the reform of health care choices. This would rule out any self-selection, other than implementing the reform *before* it was mandated by law. We don't expect that the five regions that implemented the reforms before it was mandated by law would violate this first assumption. While these regions had slightly different ambitions with the reforms, there was a broad political support nationally for the reforms. The reforms started as local initiatives in some regions, but was soon followed by the national legislation, which is a common pattern for Swedish reforms (Anell, 2011). This would imply that the five regions didn't have a political ambition that was significantly different from the rest of the country to implement the reforms. The five regions that implemented the reforms earlier did not have a higher suicide rate than the other regions, as shown in Figure 3 in the Appendix, so we would not suspect that there was a particular reason related to public health concerns of suicides that would motivate the regions to implement the reforms.

A possible pitfall regarding the exclusion restriction would be that the reform increased competition regardless of the increase in number of primary healthcare centres within a region. Healthcare centres could potentially increase their performance due to the *threat* of competition rather than actual competition. However, as Le Grand (2007) discusses, it is more plausible to think that choice is a key component to the beneficial effects of competition in markets such as the health care markets. It is when patients actually are able to choose other health care providers, that providers have incentives to increase their quality. It can be argued that patients are now able to choose between existing health care providers. But in a general sense, this would mean that since most health care providers were public before the reforms, the county councils would compete against themselves which would have different effects than in a competitive market.

In a study of a competition promoting reform in the British health care system, it was found that competition had positive effects on clinical outcomes and productivity (Gaynor, Moreno-Serra, & Propper, 2013). Since the study used market concentration as a measure, this evidence could be used as an argument that actual competition increases quality, and not just the "threat" of competition.

Reduced form

$$(3)\ S_{y,r,g,a} = \gamma_0 + \gamma_1[Reform]_{y,r} + X_{y,r}\gamma + \mu_r + \mu_g + \mu_a + v_{y,r}$$

In equation (3) we estimate the effect of implementing the reform on suicide rates *S*, per region, age group, and gender. Included here are dummies for regions, gender, and age groups in order to control for fixed effects. We assume in this model that the effect of the reform on suicide rates comes through a change in number of primary healthcare centres.

Because of limitations in our data, we suspect that even if there is an effect of number of primary healthcare centres on suicide rates, we might have too few observations in our data set, and therefore lack the statistical power to capture a potential effect. Also, since we only have data from 2006, the pre-reform for some regions might contain too few observations to give us sufficient statistical power. Since the main limitation in our dataset is the lack of data of primary healthcare centres before 2006, we are able to use a model of the reduced form that dates back to 2000. This will increase the number of observations before the set of reforms were implemented, and increase the power of the model.

Instrument Variable

Finally, we will be able to estimate the "true" effect of number of primary healthcare centres on suicide rates with our instrument variable regression. If our assumptions for the instrument variable holds, the initial effect we are interested in could then be estimated as:

$$\hat{\alpha}_1^{2SLS} = \frac{\hat{\gamma}_{reduced\ form}}{\hat{\beta}_{first\ stage}}$$

$\hat{\alpha}_1^{2SLS}$ could then be interpreted as a more consistent estimate of α_1, since we believe that number of primary healthcare centres is an endogenous variable.

Part B

In this part we present alternative models of the first stage from the IV-regression. Since it is reasonable to believe that the exclusion restriction holds, based on the discussion above, there should be no other direct effect of the reform on suicide rates than from the change in number of healthcare centres. However, there might be indirect effects of the reform on suicide rates, that in turn comes from the effect on number of primary healthcare centres. This part presents alternative measurements of the reform, which allows a further investigation of the relationship between primary health care and suicide rates.

First, we will examine if the reforms had an effect on number of visits to primary healthcare centres. With this model we want to examine if the reform had an effect on access to health care, in terms of visits to primary health care. This model can be formulated as:

$$(5)\ V_{i,r,y} = \delta_0 + \delta_1[Reform]_{r,y} + Z_{r,y}\delta + \mu_r + u_{r,y}$$

Where *V* is the number of visits to primary healthcare centres per 100 000 of the population, where $i = \{$visits to general practitioners, visits to other professions than physicians$\}$, and *Reform* is a dummy variable indicating whether the region has implemented the reform or not. *Z* is a vector of control variables, and μ is the region-specific fixed effects. The control variables are the same as before for regions, but we now include number of healthcare centres as a control variable, since we believe it correlates with both visits to primary healthcare centres, and exposure to the reform.

We also examine whether the reforms had an effect on primary health care personnel employed within regions. This will provide an explanation to whether a potential increase in visits to primary health care was due to more available health care personnel. The alternative explanation might be an increase in efficiency from increased competition. In this model, we

use number of primary health care personnel per 100 000 for all professions, in public and private sector respectively, and the sum of these. The model can be formulated as:

$$(6)\ P_{i,r,y} = \phi_0 + \phi_1[Reform]_{r,y} + Z_{r,y}\phi + \mu_r + v_{r,y}$$

Where *P* is number of primary health care personnel per 100 000 of the population, $i = \{$public sector, private sector, total of private and public sector$\}$.

These models will give us indications to what aspects of health care the set of reforms affected, for example, if the reform increased health care access through more personnel or efficiency of the health care provided.

Results

Part A

OLS Relationships

Initially, we will provide OLS estimates of the relationship between number of primary healthcare centres and suicide rates, based on equation (1). In Table 4, we compare OLS results from three models where we change the dependent variable. The first column shows the OLS results when regressing suicide rates per regional level, where number of healthcare centres per 100 000 is the variable of interest.

In the second column, we take the natural log of suicide rates. We see that the adjusted r^2 value is slightly higher in this model, and using the logarithmic value will give us more evenly distributed residuals which makes the estimates more reliable.

In the third column, we use the lead of the log of suicide rates with one year. One possibility is that changes in number of healthcare centres do not have an immediate effect on suicide rates, but rather an effect one year later.

We see that model (3) in Table 4 that the adjusted r^2 decreases again. While the change is relatively small, this would imply that the immediate effect of changes in primary healthcare centres is larger than the effect one year later. Table 4 also shows that the standard error is relatively smaller in model (2) compared to model (3). Since this model is intuitive, and explain more of the variation, model (2) will be the preferred model, where log of suicide rate per 100 000 of the population, and per regional level, is the dependent variable.

Table 4: OLS Results, regional level

	Suicide rate per regional level (per 100 000) Year: 2006-2018 (1)	Log of suicide rate per regional level (per 100 000) Year: 2006-2018 (2)	Log of suicide rate per regional level (per 100 000), lead one year. Year: 2006-2018 (3)
Number of Primary Healthcare centres per 100 000 of population	-0.084	-0.008	-0.005
	(0.114)	(0.006)	(0.006)
Share of population with higher education (%)	-0.097	0.001	0.004
	(0.227)	(0.015)	(0.015)
Unemployment (%)	-0.216	-0.005	-0.006
	(0.24)	(0.013)	(0.013)
Divorces per 100 000 of population	5.606	0.185	-0.710
	(7.663)	(0.373)	(0.36)
Alcohol sold per capita (litres)	0.274	0.028	-0.007
	(1.229)	(0.067)	(0.066)
Population density per square kilometre	-0.002	0.000	-0.007
	(0.114)	(0.007)	(0.007)
Disposable income for households (1000 SEK)	0.060	0.002	0.008
	(0.111)	(0.007)	(0.007)
Constant	4.266	1.795	1.567
	(11.476)	(0.72)	(0.726)
Fixed effects	Yes	Yes	Yes
Time trend	Yes	Yes	Yes
N	1399	1399	1402
R2	0.497	0.548	0.541
F	52.078	61.772	60.046

Note: Dummies for regions, age groups, and gender included. Time trend also included. Regressions are run using robust standard errors, shown in parentheses.

**Significant at the 5 percent level. **Significant at the 1 percent level. ***Significant at the 0.1 percent level.*

Table 5 shows the estimates of the OLS model of the relationship between the log of suicide rates for regions, and number of primary healthcare centres. In column (9), which corresponds to model (3) in Table 4, we have included all control variables, and we control for region, gender, and age specific fixed effects and time trends. This model has the highest adjusted r^2-value, and because we suspect trends in the variables of interest, we think it's a good idea to control for time trends. Model (9) will therefore be our preferred model.

When controlling for time trend in model (9) in Table 5, we see that the relationship between suicide rates and number of primary healthcare centres is not statistically significant at the 5 percent level (t = -1.43, p = 0.154). We might however suspect some limitations with this model, such as too little variation between clusters (the regions) or too few clusters to

capture a small effect like this. Table 5 shows that the coefficient of interest is robust between different model specification, in the sense that it does not change in either direction of sign and magnitude. The magnitude of the coefficient (-0.008) would mean that one additional primary healthcare centre per 100 000 of the population is associated with a decrease in suicide rates per 100 000 of the population with 0.8%. While this seems quite low, it is not a completely unreasonable size.

Table 5: OLS, Regions

	Dependent variable: Log of suicide rate per regional level (per 100 000) Year: 2006-2018								
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Number of Primary Healthcare centres per 100 000 of population	0.008**	-0.007	-0.007	-0.005	-0.005	-0.005	-0.005	-0.004	-0.008
	(0.003)	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)	(0.006)
Share of population with higher education (%)			0.004	0.006	0.009	0.005	0.007	0.001	0.001
			(0.007)	(0.007)	(0.007)	(0.008)	(0.01)	(0.015)	(0.015)
Unemployment (%)				-0.015	-0.009	-0.010	-0.009	-0.010	-0.005
				(0.011)	(0.012)	(0.012)	(0.012)	(0.012)	(0.013)
Divorces per 100 000 of population					-0.573	-0.658	-0.677	-0.681	0.185
					(0.333)	(0.348)	(0.355)	(0.356)	(0.373)
Alcohol sold per capita (litres)						0.043	0.038	0.021	0.028
						(0.045)	(0.05)	(0.062)	(0.067)
Population density per square kilometre							-0.002	-0.004	0.000
							(0.005)	(0.006)	(0.007)
Disposable income for households (1000 SEK)								0.001	0.002
								(0.002)	(0.007)
Constant	2.335***	2.200***	2.105***	2.076***	2.210***	2.179***	2.217***	2.333***	1.795*
	(0.082)	(0.185)	(0.258)	(0.259)	(0.269)	(0.271)	(0.272)	(0.371)	(0.72)
Fixed effects	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time trend	No	No	No	No	No	No	No	No	Yes
N	1402	1402	1402	1402	1402	1402	1402	1402	1399
R2	0.006	0.541	0.541	0.541	0.541	0.541	0.541	0.541	0.548
F	9.303	75.617	72.995	70.778	68.459	65.965	63.897	61.737	61.772

Note: Dummies for regions, age groups, and gender included. Time trend also included. Regressions are run using robust standard errors, shown in parentheses.

**Significant at the 5 percent level. **Significant at the 1 percent level. ***Significant at the 0.1 percent level.*

First-Stage Results

In the 2SLS, we use the implementations of the reforms of health care choices as an instrument for number of primary healthcare centres. The assumption for using an instrumental variable as a valid method to estimate a causal effect is that the instrument is strong and valid, which means that the reform should have a strong effect on number of primary healthcare centres within a region. Table 6 shows the estimates from the first stage model. The reform had a significant effect on number of primary healthcare centres ($t = 4.12$, $p < 0.001$). On average, there were 1.66 more healthcare centres per 100 000 of the population in a region after the reform was implemented, than before.

Table 6: First stage, Regions[12]

	Dependent variable: Number of Primary Healthcare centres per 100 000 of population
Exposed to reform	1.659***
	(0.402)
Share of population with higher education (%)	0.623
	(0.351)
Unemployment (%)	0.112
	(0.093)
Divorces per 100 000 of population	-1.073
	(4.781)
Alcohol sold per capita (litres)	-0.276
	(0.409)
Population density per square kilometre	-0.009
	(0.018)
Disposable income for households (1000 SEK)	0.001
	(0.04)
Constant	3.285
	(6.988)
Fixed effects	Yes
Time trend	Yes
N	252
R2	0.88
F	375.86

Note: Dummies for regions included. Time trend also included. Regressions are run using robust standard errors, shown in parentheses.

**Significant at the 5 percent level. **Significant at the 1 percent level. ***Significant at the 0.1 percent level.*

The average of number of healthcare centres per 100 000 for all regions is 15.0 in the pre-reform period, as shown in Table 3. This means that the effect of the reforms is relatively

[12] We present the build-up of the model in the Appendix.

large. This effect is robust after adding control variables, region-specific fixed effects, and time trend. The *F* statistic for our model is 375.86, which means that the effect of the reform on number of primary healthcare centres is strong.

Reduced form

If we look at the reduced form, where the natural log of suicide rates is the dependent variable, and the reform is the variable of interest, Table 7 shows in the first column that the reform is not significant in our preferred model at the 5 percent level (t = -1.67, p = 0.095). The sign of the coefficient is however what we expect, indicating that suicide rates decreased after the reform.

Table 7: Reduced form, Regions

	Log of suicide rate per regional level (per 100 000) Year: 2006-2018	Log of suicide rate per regional level (per 100 000) Year: 2000-2018
Exposed to reform	-0.106	-0.158*
	(0.064)	(0.062)
Share of population with higher education (%)	0.000	-0.007
	(0.015)	(0.012)
Unemployment (%)	0.001	0.019
	(0.014)	(0.012)
Divorces per 100 000 of population	0.293	0.576
	(0.386)	(0.415)
Alcohol sold per capita (litres)	0.053	0.045
	(0.069)	(0.033)
Population density per square kilometre	-0.001	0.000
	(0.007)	(0.004)
Disposable income for households (1000 SEK)	0.004	0.001
	(0.007)	(0.004)
Constant	1.117	1.554**
	(0.842)	(0.523)
Fixed effects	Yes	Yes
Time trend	Yes	Yes
N	1399	796
R2	0.548	0.733
F	61.665	93.33

Note: Dummies for regions, and gender included. Time trend also included. Regressions are run using robust standard errors, shown in parentheses.

**Significant at the 5 percent level. **Significant at the 1 percent level. ***Significant at the 0.1 percent level.*

There is an increased risk of a type 2-error because the sample size is relatively small, especially in the time period before the reform. We have therefore included a second model which dates back to the year 2000, using the same control variables. However, we aggregate the data for age groups and gender, which explains that there are fewer observations in this regression.

The second column in Table 7 shows that when increasing the time span, there is a significant effect of the reforms on suicide rates at a significance level of five percent. On average, exposure to the reform is associated with a decrease of 15.8% in suicide rates per 100 000 (t = -2.55, p = 0.011). This would imply that the we suffer from a type 2-error in the first regression because of lack of observations. However, since we lack data of primary healthcare centres from the whole time period, we will not be able to use this model in the 2SLS. It provides an indication to how the results can be interpreted though, and since the marginals are not very different, we think that the extended model is more precise.

IV Results

Since we have established from the first stage regression that the instrument is strong enough, Table 8 presents the IV estimates from the 2SLS, where the outcome variable is the log of suicide rate per 100 000 of the population. We see that the number of primary healthcare centres per 100 000 of the population is not significant (z = -0.54, p = 0.58).

The reform had no statistically significant effect on suicide rates in the IV regression, which could have different explanations. We either lack the statistical power, since the number of observations is limited, or else there is no causal effect of number of primary healthcare centres on suicide rates. The effect is larger in the reduced form than in the IV regression since we scale it with the first stage, but so are the standard errors. This would speak to the idea that we lack statistical power. This is supported by the fact that the estimated coefficient of interest was significant in the reduced form with the extended dataset, indicating that we might have too few observations to observe a causal effect from the IV regression.

Table 8: IV results, Regions

	Log of suicide rate per regional level (per 100 000) Year: 2006-2018
Number of Primary Healthcare centres	-0.017
	(0.032)
Share of population with higher education (%)	-0.012
	(0.04)
Unemployment (%)	-0.006
	(0.014)
Divorces per 100 000 of population	1.215
	(0.668)
Alcohol sold per capita (litres)	0.020
	(0.049)
Population density per square kilometre	-0.001
	(0.002)
Disposable income for households (1000 SEK)	0.003
	(0.006)
Constant	2.621**
	(0.825)
Fixed effects	Yes
Time trend	Yes
N	252
R2	0.338

Note: Dummies for regions are included. Time trend also included. Regressions are run using robust standard errors, shown in parentheses.

**Significant at the 5 percent level. **Significant at the 1 percent level. ***Significant at the 0.1 percent level.*

Table 8 shows that coefficient suggests that one additional primary healthcare centre per 100 000 of the population would decrease the suicide rate per 100 000 of the population with 1.7%. While we can't reject the null hypothesis, the sign of the coefficient is what we anticipated, and the magnitude is of reasonable size.

Part B

So far, the results have suggested that while the instrument is strong, and there are indications that the instrument had a significant effect in the reduced form, we find no significant causal effect from the 2SLS. The question is then if there is no causal effect, or if we lack the statistical power to find it. In Part *B* of the result section, we will investigate other effects of the reform on alternative measures. These results may then be useful in interpreting what the results have shown us so far. First, we will examine if the set of reforms had an effect on number of visits to primary healthcare centres, in order to investigate if the reform increased access to health care. Second, we examine if the set of reforms had an effect on health care

personnel. This will be important in understanding if the reform increased efficiency, or what type of access the reform might have affected.

The results so far have shown that the reform had a positive statistically significant effect on number of healthcare centres.

Table 9: First stage, visits to primary healthcare centres.[13]

	Visits to GP per 100 000 of population	Visits to other professions per 100 000 of population
Exposed to Reform	87.580***	-64.172
	(20.537)	(78.132)
Share of population with higher education (%)	-22.936	125.049
	(21.964)	(131.682)
Unemployment (%)	10.103*	26.165
	(4.598)	(19.197)
Divorces in population (%)	384.336	-1400
	(290.68)	(943.297)
Alcohol sold per capita (litres)	-82.190*	184.347
	(31.722)	(104.004)
Population density per square kilometre	-1.089	29.981***
	(2.152)	(5.606)
Disposable income for households (1000 SEK)	9.489***	-6.199
	(2.573)	(12.5)
Number of primary healthcare centres	1.773**	1.131
	(0.618)	(2.669)
Constant	753.495	-1500
	(431.221)	(2286.964)
Fixed effects	Yes	Yes
Time trend	Yes	Yes
N	249	250
R2	0.857	0.614
F	138.22	30.17

Note: Dummies for regions are included. Time trend also included. Regressions are run using robust standard errors, shown in parentheses.

**Significant at the 5 percent level. **Significant at the 1 percent level. ***Significant at the 0.1 percent level.*

In table 9 we examine if the reform had an effect on number of primary health care visits. Exposure to the reform is here the independent variable of interest. In the first column we estimate the effect of the reform on primary health care visits to general practitioners, and in the second column we estimate the effect of the reform on primary health care visits to other professions than physicians. The visits are reported per 100 000 of the population. We see that

[13] Expanded tables in appendix

the effect had a negative, but nonsignificant effect on visits to other professions than physicians (t = -0.82, p = 0.41). However, there was a significant effect of the reform on visits to physicians. On average, there were 87.6 more primary health care visits to physicians after the reform compared to before (t = 4.26, p < 0.001). The average of visits to general practitioners for all regions in the pre-reform was 1306, as shown in Table 3, which indicates an increase of 6.7% which would be a relatively large effect.

Because visits to primary health care is measured per 100 000 of the population in the regions, the increase in health care visits would have to be larger than population growth, which was true for visits to physicians. This is in line with Sveréus, Kjellsson, & Rehnberg (2018), who found that the number of visits to general practitioners increased after the reform.

However, this in turn might not have had an effect on suicide prevention, because treating mental illness, and specifically depressions, is not always done by physicians. According to National Board of Health and Welfare (2019), treatment of mental illness within the primary care, is often provided by psychologists, and in other cases other personnel educated in psychotherapy. So even if there was an increase in access to general practitioners following the reform, we wouldn't necessarily expect an effect on suicide rates. On the other hand, it is reasonable to assume that if access is improved then more people will reach out when in need, and since physicians' ability to recognize mental disorders are relatively high then more people will receive help when needed (Owens, Lloyd, & Campbell, 2004). The increase in access to general practitioners would then have a negative effect on suicide rates, but this effect would be dampened because access to other professions didn't increase following the reforms.

We are also interested in if there was an increase in health care personnel following the reform. An increase of visits to general practitioners might have different explanations that might be relevant for our research question. In table 10, we have used data of total number of health care personnel employed in the primary health care per region. In the first column, the dependent variable is public employed health care personnel per 100 000. In the second column, the dependent variable is private employed health care personnel per 100 000, and in the third column the total of private and public health care personnel. The data consists of number of employed physicians, nurses, and psychologists per 100 000 in the population.

We see in table 10 that the reform had no significant effect on either public (t = -0.33, p = 0.75), private (t = 1.34, p = 0.18), or total number of primary health care personnel (t = 0.33, p = 0.74). Again, we might suspect that we lack statistical power to capture some effect, such as the effect on private employed health care personnel. It is plausible to believe that even if there were no significant increase in total health care personnel following the reform, it would

be reasonable that allowing for more private health care providers should lead to an increase in number of private health care personnel.

Table 10: First stage, employed primary health care personnel[14]

	Public	Private	Public and private
Exposed to Reform	-3.927	6.615	3.642
	(12.06)	(4.952)	(11.049)
Share of population with higher education (%)	11.691	2.747	14.876
	(12.647)	(3.478)	(13.285)
Unemployment (%)	2.055	1.178	2.872
	(3.324)	(1.009)	(3.202)
Divorces in population (%)	-83.58	-33.768	-156.993
	(203.305)	(68.519)	(183.065)
Alcohol sold per capita (litres)	12.895	-12.464	0.385
	(13.992)	(6.741)	(14.542)
Population density per square kilometre	0.729	0.092	0.783
	(0.775)	(0.285)	(0.823)
Disposable income for households (1000 SEK)	-5.108**	1.959**	-3.099
	(1.689)	(0.598)	(1.706)
Number of primary healthcare centres	0.316	0.274*	0.595
	(0.401)	(0.115)	(0.432)
Constant	518.081*	-238.483*	277.987
	(233.955)	(94.707)	(259.122)
Fixed effects	Yes	Yes	Yes
Time trend	Yes	Yes	Yes
N	249	246	252
R2	0.713	0.935	0.731
F	79.131	330.351	59.844

Note: Dummies for regions are included. Time trend also included. Regressions are run using robust standard errors, shown in parentheses.

**Significant at the 5 percent level. **Significant at the 1 percent level. ***Significant at the 0.1 percent level.*

We find it plausible that since the reform increased the share of private primary healthcare centres, there was an increase in the private health care personnel. At the same time, we find it reasonable that the reform didn't increase the number of public health care personnel. We suspect a high demand for nurses, psychologists, and physicians on the labour market, so increasing the number of primary healthcare centres would probably not lead to an increase in health care personnel, at least not in the short run, but rather a redistribution between public and private employees, which is what the results in this study suggest. The increase in access to general practitioners in primary healthcare centres might instead be due to other factors, such

[14] Expanded tables in appendix

as increased efficiency. The increased efficiency as a result of increased competition is supported on a hospitals level as shown in previous studies (Bloom et al., 2015), and the same mechanism might be applicable on primary health care as well, as suggested in a previous study (Gravelle et al., 2019). When competition increases, pressure on managers increase, hence improving their quality. This suggest that choice of care models might improve efficiency in primary care.

The results in part *B* suggest that there was an increase in access to health care to general practitioners, but not to other professions. This increase in access was not due to an increase in health care personnel, suggesting that there was an increase in efficiency in the primary health care.

Relating back to the results in part A, this further strengthen the argument that we should expect a decrease in suicide rates due to the reforms. But the lack of increase in visits to other professions than general practitioners, might reduce the magnitude of the effect of the set of reforms on suicide rates.

Conclusion

This thesis tries to examine the relationship between primary healthcare centres and suicide rates in Swedish regions, and also what other effects might contribute to this relationship. While other studies have found a relationship between other types of health care and suicide rates (Pirkola et al., 2009), we found no statistically significant association between number of primary healthcare centres and suicide rates within Swedish regions. In order to overcome problems with reverse causality, we use an instrument variable regression to examine the causal effect of healthcare centres on suicide rates. Exposure to the reforms of care choice models in Swedish regions is used as an instrument for number of primary healthcare centres.

In the extended panel data, with a longer time series, we found a statistically significant negative relationship between the reforms and suicide rates in the reduced form. That is, there was on average a decrease in suicide rates after implementing the reform.

These two results could be explained in different ways. One explanation would be that the reforms decreased suicide rates through a channel beside that of primary healthcare centres. This would mean that the exclusion restriction for the IV regression would be violated. The main reason for this would be that the quality of the primary health care somehow increased following the reform, while holding the number of primary healthcare centres constant. We believe that this is not very likely, since the main content of the reforms was to make it easier for private actors to enter the health care market, and to make it easier for patients to choose

their health care provider (Sveréus, Kjellsson, & Rehnberg, 2018). As discussed earlier in this thesis, competition will most likely have effects only when other actors *enter* the market – in this case, when the number of primary healthcare centres increases. Instead, we believe that limitations in the data, such as small variations within the clusters and too few observations, increase the risk of accepting a false null hypothesis, thus committing a type 2 error.

The same argument could be used in the 2SLS model, which was used in order to examine a possible causal relationship between primary healthcare centres and suicide rates. We found no significant relationship using the set of reforms as an instrument for number of healthcare centres, but as we discussed in the result section, the magnitude and sign of the coefficient was about what we had anticipated. The reduced form associated with the IV regression showed no significant effect of the reform on suicide rates. However, since the extended panel data showed a significant negative effect of the reform on suicide rates, we suspect that the lack of statistical significance in the IV regression was due to lack of statistical power.

In part *B* of the thesis, we examined different alternatives to the first stage. The reason for this was that we wanted to examine other potential effects that the reform had, that could help us understand the relationship between primary healthcare centres and suicide rates.

The results suggest that the reform had no effect on number of visits to primary healthcare centres to other professions that physicians, but that there was a significant increase in visits to general practitioners after the reform. We believe that the increased access to general practitioners, which we attribute to an increase in efficiency in health care providers, would have a negative effect on suicide rates. Access to other professions than GPs didn't increase, which we believe would reduce the magnitude of the effect of an increase in number of primary healthcare centres on suicide rates.

Our study is limited in several ways. The largest limitation is perhaps the lack of data, which has made it difficult to reach a satisfying statistical power in our models. There are several aspects of the relationship between primary health care and suicide rates that we were not able to examine due to insufficient data. For example, are there gender or age differences in the effect of increased access to primary health care on suicides? Do differences in the structure of the primary health care between regions have different effects? Are there different effects between public and private health care providers? There are also different aspects of health care access that we have not been able to examine in this study. The use of suicide attempts might have been a better variable for measuring the effect of primary health care on suicide, but since the data in this study is aggregated, this is an unreliable measure to use. One

person could be responsible for multiple suicide attempts, which aggregated data would not be able to account for. With a more complete data set, these questions would have provided more insight in our research question.

A further limitation to the interpretation of our results is the difficulty of differentiating between effects of the set of reforms we examined. As Dietrichson, Ellegård, & Kjellsson (2016) writes, competition within primary healthcare centres may have different effects for different aspects, and it is generally challenging to distinguish between effects of competition and access to health care. In this study, we have tried to examine the effect of the set of reforms implemented in Sweden between 2007-2010 and drawn conclusion from these results. While we haven't found a clear causality between primary healthcare centres and suicide rates, we have contributed to better understanding the relationship. We have showed that increasing number of primary healthcare centres does not necessarily increase access to health care – at least not mental health care.

Given the suggestions of the result, this is a topic that needs further investigation to paint a clear picture. Both in regard to the relationship between access to health and suicide, but also to examine if quasi-market models such as CCM can contribute to more efficient primary health care. Treating mental disorders involves many health care services, and studying the effect of changes in other health care services such as specialist health care, would be another suggestion for further studies.

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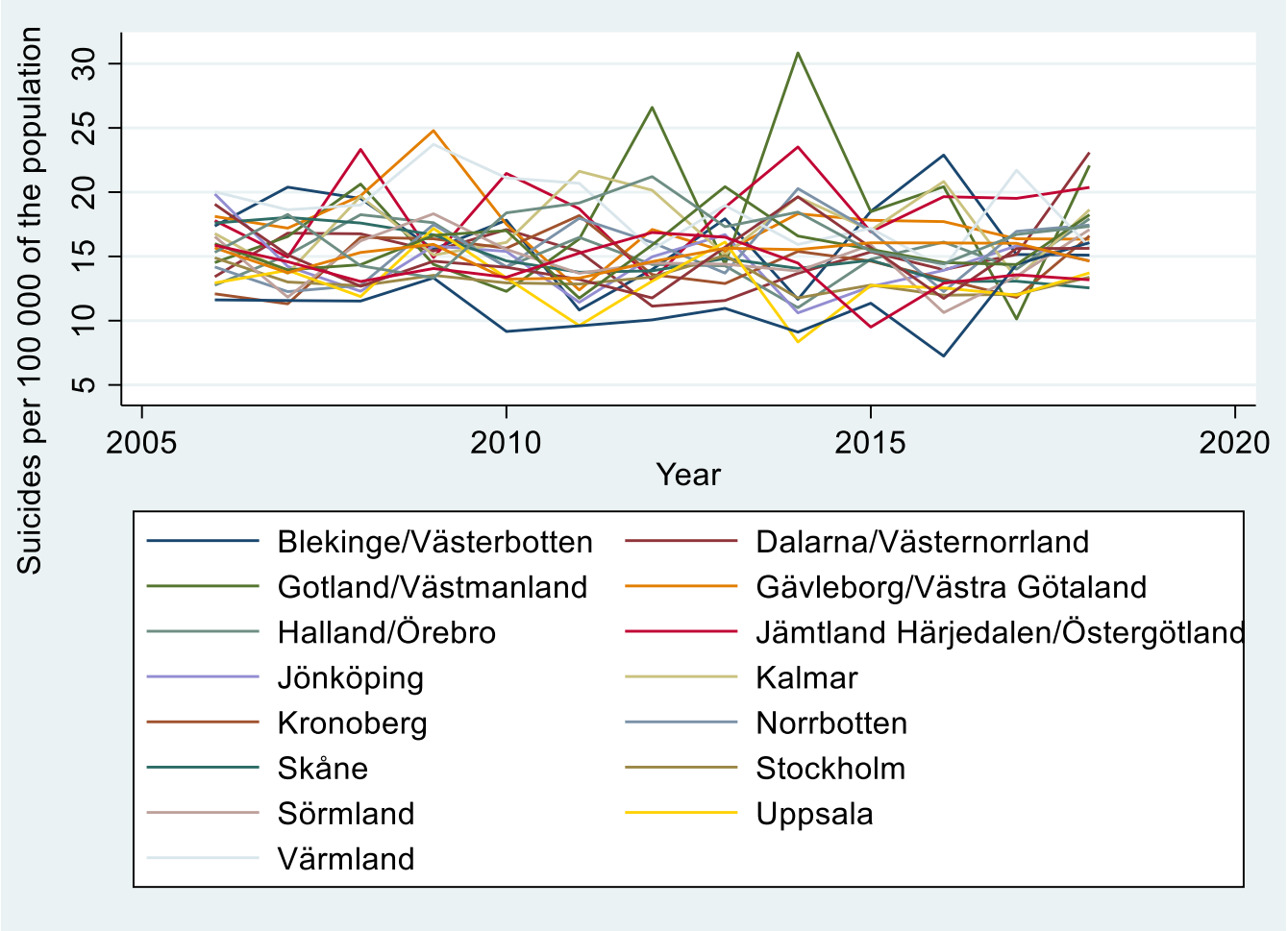
Appendix

Figure 3: Suicide rates per 100 000 of the populations per region and year



Build-up of models:

Table 11: OLS

	Dependent variable: Log of suicide rate per regional level (per 100 000) Year: 2006-2018								
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Number of Primary Healthcare centres per 100 000 of population	0.008**	-0.007	-0.007	-0.005	-0.005	-0.005	-0.005	-0.004	-0.008
	(0.003)	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)	(0.006)
Share of population with higher education (%)			0.004	0.006	0.009	0.005	0.007	0.001	0.001
			(0.007)	(0.007)	(0.007)	(0.008)	(0.01)	(0.015)	(0.015)
Unemployment (%)				-0.015	-0.009	-0.010	-0.009	-0.010	-0.005
				(0.011)	(0.012)	(0.012)	(0.012)	(0.012)	(0.013)
Divorces per 100 000 of population					-0.573	-0.658	-0.677	-0.681	0.185
					(0.333)	(0.348)	(0.355)	(0.356)	(0.373)
Alcohol sold per capita (litres)						0.043	0.038	0.021	0.028
						(0.045)	(0.05)	(0.062)	(0.067)
Population density per square kilometre							-0.002	-0.004	0.000
							(0.005)	(0.006)	(0.007)
Disposable income for households (1000 SEK)								0.001	0.002
								(0.002)	(0.007)
Constant	2.335***	2.200***	2.105***	2.076***	2.210***	2.179***	2.217***	2.333***	1.795*
	(0.082)	(0.185)	(0.258)	(0.259)	(0.269)	(0.271)	(0.272)	(0.371)	(0.72)
Fixed effects	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time trend	No	No	No	No	No	No	No	No	Yes
N	1402	1402	1402	1402	1402	1402	1402	1402	1399
R2	0.006	0.541	0.541	0.541	0.541	0.541	0.541	0.541	0.548
F	9.303	75.617	72.995	70.778	68.459	65.965	63.897	61.737	61.772

Note: Dummies for regions, age groups, and gender included. Time trend also included. Regressions are run using robust standard errors, shown in parentheses.

**Significant at the 5 percent level. **Significant at the 1 percent level. ***Significant at the 0.1 percent level.*

Table 12: First stage

	Dependent variable: Number of Primary Healthcare centres per 100 000 of population								
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Exposed to reform	0.526	0.641**	1.705***	1.258***	1.288***	1.547***	1.545***	1.813***	1.659***
	(0.504)	(0.212)	(0.276)	(0.305)	(0.318)	(0.4)	(0.402)	(0.421)	(0.402)
Share of population with higher education (%)			-0.323***	-0.286***	-0.288***	-0.273***	-0.296***	0.386	0.623
			(0.051)	(0.049)	(0.05)	(0.05)	(0.067)	(0.319)	(0.351)
Unemployment (%)				0.208*	0.211*	0.180*	0.175	0.082	0.112
				(0.084)	(0.086)	(0.09)	(0.091)	(0.095)	(0.093)
Divorces per 100 000 of population					-1.207	-0.560	-0.045	-0.812	-1.073
					(4.263)	(4.292)	(4.425)	(4.761)	(4.781)
Alcohol sold per capita (litres)						-0.427	-0.355	-0.075	-0.276
						(0.274)	(0.325)	(0.406)	(0.409)
Population density per square kilometre							0.011	0.017	-0.009
							(0.013)	(0.014)	(0.018)
Disposable income for households (1000 SEK)								-0.067*	0.001
								(0.032)	(0.04)
Constant	15.034***	15.753***	23.341***	21.027***	21.334***	22.766***	22.369***	15.483***	3.285
	(0.446)	(0.284)	(1.214)	(1.375)	(1.822)	(2.129)	(2.206)	(3.874)	(6.988)
Fixed effects	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time trend	No	No	No	No	No	No	No	No	Yes
N	273	273	273	273	273	273	273	252	252
R2	0.001	0.862	0.875	0.878	0.878	0.878	0.878	0.878	0.88
F	1.09	263.18	341.473	474.665	469.715	579.438	510.144	320.152	375.86

Note: Dummies for regions included. Time trend also included. Regressions are run using robust standard errors, shown in parentheses.

**Significant at the 5 percent level. **Significant at the 1 percent level. ***Significant at the 0.1 percent level.*

Table 13: Reduced form. Regional level (2006-2018)

	Dependent variable: Log of suicide rate per regional level (per 100 000) Year: 2006-2018								
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Exposed to reform	-0.046	-0.035	-0.053	-0.046	-0.060	-0.099	-0.102	-0.098	-0.106
	(0.04)	(0.027)	(0.038)	(0.046)	(0.049)	(0.058)	(0.058)	(0.062)	(0.064)
Share of population with higher education (%)			0.006	0.005	0.005	0.004	0.003	-0.002	0.000
			(0.009)	(0.009)	(0.009)	(0.009)	(0.01)	(0.015)	(0.015)
Unemployment (%)				-0.003	-0.005	-0.001	-0.001	-0.001	0.001
				(0.012)	(0.012)	(0.013)	(0.013)	(0.013)	(0.014)
Divorces per 100 000 of population					0.303	0.260	0.288	0.299	0.293
					(0.352)	(0.354)	(0.374)	(0.385)	(0.386)
Alcohol sold per capita (litres)						0.062	0.068	0.067	0.053
						(0.046)	(0.05)	(0.064)	(0.069)
Population density per square kilometre							0.002	0.001	-0.001
							(0.005)	(0.006)	(0.007)
Disposable income for households (1000 SEK)								0.000	0.004
								(0.002)	(0.007)
Constant	2.620***	1.994***	1.844***	1.879***	1.733***	1.508***	1.466***	1.584***	1.117
	(0.034)	(0.078)	(0.243)	(0.271)	(0.334)	(0.379)	(0.394)	(0.446)	(0.842)
Fixed effects	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time trend	No	No	No	No	No	No	No	No	Yes
N	1518	1518	1518	1518	1518	1518	1518	1399	1399
R2	0	0.538	0.538	0.537	0.537	0.538	0.537	0.548	0.548
F	1.309	81.528	78.612	75.578	73.185	70.539	68.302	63.312	61.665

Note: Dummies for regions, gender, and age included. Time trend also included. Regressions are run using robust standard errors, shown in parentheses.

**Significant at the 5 percent level. **Significant at the 1 percent level. ***Significant at the 0.1 percent level.*

Table 14: Reduced form, 2000-2018

	Dependent variable: Log of suicide rate per regional level (per 100 000). Year 2000-2018								
Variable	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Exposed to reform	-0.054	-0.056*	-0.054	-0.077*	-0.097*	-0.139**	-0.141**	-0.158**	-0.158*
	(0.044)	(0.023)	(0.034)	(0.039)	(0.044)	(0.05)	(0.052)	(0.06)	(0.062)
Share of population with higher education (%)			-0.001	0.002	0.003	-0.001	-0.002	-0.007	-0.007
			(0.008)	(0.008)	(0.008)	(0.008)	(0.009)	(0.012)	(0.012)
Unemployment (%)				0.013	0.011	0.018	0.018	0.019	0.019
				(0.01)	(0.01)	(0.011)	(0.011)	(0.011)	(0.012)
Divorces per 100 000 of population					0.507	0.543	0.554	0.576	0.576
					(0.405)	(0.405)	(0.411)	(0.414)	(0.415)
Alcohol sold per capita (litres)						0.051	0.053	0.045	0.045
						(0.026)	(0.029)	(0.033)	(0.033)
Population density per square kilometre							0.001	0.000	0.000
							(0.003)	(0.003)	(0.004)
Disposable income for households (1000 SEK)								0.819	0.799
								(1.318)	(4.484)
Constant	2.619***	2.038***	2.049***	1.915***	1.691***	1.542***	1.520***	1.552***	1.554**
	(0.031)	(0.072)	(0.174)	(0.204)	(0.284)	(0.299)	(0.305)	(0.31)	(0.523)
Fixed effects	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time trend	No	No	No	No	No	No	No	No	Yes
N	796	796	796	796	796	796	796	796	796
R2	0.001	0.733	0.732	0.733	0.733	0.734	0.733	0.733	0.733
F	1.522	112.381	108.287	105.218	105.743	101.937	99.002	96.308	93.33

Table 17: IV

	Dependent variable: Log of suicide rate per regional level (per 100 000)								
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Number of Primary Healthcare centres	-0.064	-0.034	-0.006	0.017	-0.008	-0.022	-0.022	-0.013	-0.017
	(0.084)	(0.034)	(0.019)	(0.031)	(0.034)	(0.031)	(0.031)	(0.028)	(0.032)
Share of population with higher education (%)			-0.005	-0.001	-0.007	-0.012	-0.014	-0.025	-0.012
			(0.005)	(0.006)	(0.007)	(0.007)	(0.009)	(0.036)	(0.04)
Unemployment (%)				-0.018	-0.016	-0.011	-0.011	-0.008	-0.006
				(0.014)	(0.014)	(0.013)	(0.013)	(0.013)	(0.014)
Divorces per 100 000 of population					1.249*	1.188	1.226	1.230	1.215
					(0.593)	(0.614)	(0.642)	(0.678)	(0.668)
Alcohol sold per capita (litres)						0.029	0.035	0.030	0.020
						(0.029)	(0.033)	(0.046)	(0.049)
Population density per square kilometre							0.001	0.001	-0.001
							(0.002)	(0.002)	(0.002)
Disposable income for households (1000 SEK)								0.000	0.003
								(0.003)	(0.006)
Constant	3.702**	3.340***	3.025***	2.704***	2.900***	3.098***	3.071***	3.144***	2.621**
	(1.297)	(0.556)	(0.344)	(0.512)	(0.516)	(0.471)	(0.46)	(0.522)	(0.825)
Fixed effects	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time trend	No	No	No	No	No	No	No	No	Yes
N	273	273	273	273	273	273	273	252	252
R2	.	0.293	0.322	0.304	0.332	0.322	0.319	0.343	0.338
F									

Note: Dummies for regions included. Time trend also included. Regressions are run using robust standard errors, shown in parentheses.

**Significant at the 5 percent level. **Significant at the 1 percent level. ***Significant at the 0.1 percent level*

Table 16: Alternative First stage, visits to professions other than doctors

	Dependent variable: Number of visits to primary healthcare centres to other professions than GP									
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Exposed to Reform	-200.914*	-207.476***	-96.54	-227.809*	-153.344	-100.615	-109.071	-29.539	-20.651	-44.12
	(77.717)	(53.808)	(70.85)	(87.933)	(88.533)	(100.863)	(93.402)	(82.568)	(83.941)	(81.294)
Share of population with higher education (%)			-33.710*	-22.809	-26.643	-23.621	-92.349***	89.185	91.077	137.838
			(16.566)	(16.418)	(15.48)	(16.03)	(18.712)	(118.979)	(115.878)	(124.382)
Unemployment (%)				61.134**	69.968**	63.547**	48.203*	20.732	21.133	27.171
				(21.284)	(21.678)	(21.837)	(20.651)	(19.943)	(20.23)	(19.332)
Divorces in population (%)					-3.0e+03**	-2.9e+03**	-1400,000	-1400,000	-1400,000	-1400,000
					(1086.654)	(1052.234)	(958.549)	(936.405)	(937.168)	(939.285)
Alcohol sold per capita (litres)						-86.786	123.316	222.421*	222.053*	183.258
						(80.074)	(74.809)	(99.916)	(99.837)	(102.515)
Population density per square kilometre							32.800***	35.208***	35.291***	30.456***
							(4.29)	(4.433)	(4.519)	(5.268)
Disposable income for households (1000 SEK)								-18.599	-18.927	-6.157
								(11.458)	(11.013)	(12.429)
Number of primary healthcare centres									-4.901	-8.248
									(20.069)	(19.785)
Constant	2326.097***	2395.468***	3186.465***	2505.749***	3273.869***	3565.191***	2402.979***	507.312	583.193	-1700,000
	(72.23)	(84.861)	(402.103)	(460.124)	(473.468)	(530.474)	(497.996)	(1392.043)	(1516.959)	(2249.218)
Fixed effects	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time trend	No	No	No	No	No	No	No	No	No	Yes
N	273	273	273	273	273	273	273	252	252	252
R2	0.031	0.499	0.505	0.518	0.529	0.529	0.593	0.614	0.612	0.614
F	6.683	23.379	21.745	24.278	21.873	21.151	31.279	30.138	28.798	29.325

Note: Dummies for regions included. Time trend also included. Regressions are run using robust standard errors, shown in parentheses.

**Significant at the 5 percent level. **Significant at the 1 percent level. ***Significant at the 0.1 percent level.*

Table 17: Alternative First Stage, visits to GP:

	Dependent variable: Number of visits to primary healthcare centres GP									
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Exposed to Reform	54.111*	21.075	129.109***	102.029***	93.805***	133.007***	132.878***	116.814***	96.792***	82.446***
	(21.591)	(11.695)	(16.179)	(19.581)	(21.328)	(24.168)	(23.708)	(22.696)	(22.456)	(20.561)
Share of population with higher education (%)			-33.000***	-30.761***	-30.318***	-27.824***	-30.151***	-39.453*	-43.837*	-16.546
			(4.44)	(4.394)	(4.393)	(4.767)	(6.232)	(18.653)	(19.004)	(21.425)
Unemployment (%)				12.621**	11.569*	6.635	6.125	6.405	5.56	9.220*
				(4.409)	(4.589)	(4.702)	(4.763)	(4.858)	(4.598)	(4.507)
Divorces in population (%)					337.043	442.817	492.664	438.375	444.447	407.339
					(303.706)	(314.294)	(312.182)	(307.411)	(296.105)	(284.692)
Alcohol sold per capita (litres)						-65.580**	-58.592*	-55.338	-54.417	-77.853*
						(21.731)	(22.926)	(29.326)	(29.113)	(31.83)
Population density per square kilometre							1.078	2.896	2.713	-0.156
							(2.325)	(2.191)	(2.182)	(2.215)
Disposable income for households (1000 SEK)								1.25	1.997	9.533***
								(1.892)	(1.915)	(2.595)
Number of primary healthcare centres									11.039**	9.084*
									(3.614)	(3.577)
Constant	1266.351***	1261.656***	2036.378***	1896.131***	1810.533***	2024.703***	1987.781***	1935.035***	1765.659***	425.957
	(16.126)	(20.428)	(106.909)	(114.765)	(139.808)	(140.36)	(151.641)	(225.299)	(237.874)	(403.731)
Fixed effects	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time trend	No	No	No	No	No	No	No	No	No	Yes
N	269	269	269	269	269	269	269	249	249	249
R2	0.013	0.776	0.823	0.826	0.827	0.835	0.834	0.844	0.849	0.857
F	6.281	103.186	100.229	103.429	104.835	95.38	91.918	102.9	108.448	138.746

Note: Dummies for regions included. Time trend also included. Regressions are run using robust standard errors, shown in parentheses.

**Significant at the 5 percent level. **Significant at the 1 percent level. ***Significant at the 0.1 percent level.*

Table 18: Alternative First stage, Public and private health care personnel:

	Dependent variable: Number of health care personnel, public and private providers									
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Exposed to Reform	36.339***	30.518***	-1.711	-13.586	-9.586	-1.558	-1.654	3.173	7.113	9.928
	(9.918)	(7.608)	(8.365)	(10.995)	(11.743)	(10.788)	(10.802)	(10.608)	(12.358)	(11.939)
Share of population with higher education (%)			10.435***	11.230***	11.065***	11.487***	10.874***	24.774*	25.612*	20.002
			(1.769)	(1.693)	(1.723)	(1.798)	(2.372)	(11.539)	(12.132)	(13.097)
Unemployment (%)				5.683	6.283	5.548	5.431	3.66	3.838	3.114
				(3.385)	(3.434)	(3.265)	(3.3)	(3.292)	(3.36)	(3.282)
Divorces in population (%)					-177.971	-161.756	-152.755	-158.805	-160.57	-154.251
					(177.082)	(177.816)	(182.623)	(182.544)	(184.408)	(186.537)
Alcohol sold per capita (litres)						-13.762	-11.786	-3.969	-4.133	0.522
						(11.08)	(12.982)	(14.518)	(14.441)	(14.404)
Population density per square kilometre							0.308	0.439	0.476	1.056
							(0.614)	(0.629)	(0.634)	(0.829)
Disposable income for households (1000 SEK)								-1.401	-1.547	-3.079
								(1.178)	(1.289)	(1.698)
Number of primary healthcare centres									-2.173	-1.771
									(3.172)	(3.203)
Constant	287.722***	247.904***	2.934	-55.001	-11.666	35.319	24.645	-123.943	-90.305	184.086
	(7.859)	(10.125)	(43.386)	(46.014)	(68.089)	(72.011)	(78.183)	(132.473)	(125.816)	(232.262)
Fixed effects	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time trend	No	No	No	No	No	No	No	No	No	Yes
N	252	252	252	252	252	252	252	252	252	252
R2	0.04	0.701	0.724	0.728	0.728	0.729	0.728	0.729	0.729	0.73
F	13.424	59.966	86.503	75.137	68.767	64.966	59.918	61.389	58.852	55.115

Note: Dummies for regions included. Time trend also included. Regressions are run using robust standard errors, shown in parentheses.

**Significant at the 5 percent level. **Significant at the 1 percent level. ***Significant at the 0.1 percent level.*

Table 19: Alternative First stage, Public health care personnel:

	Dependent variable: Number of health care personnel, public providers									
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Exposed to Reform	-5.694	-0.917	-8.309	-20.364	-18.591	-16.107	-15.955	-8.96	-3.798	1.353
	(10.264)	(7.573)	(8.139)	(11.172)	(12.509)	(11.486)	(11.548)	(11.392)	(12.94)	(12.841)
Share of population with higher education (%)			2.387	3.189*	3.114	3.245	4.151	24.426*	25.546*	15.13
			(1.659)	(1.578)	(1.614)	(1.677)	(2.247)	(11.117)	(11.83)	(12.504)
Unemployment (%)				5.833	6.061	5.831	6,000	3.425	3.622	2.283
				(3.605)	(3.581)	(3.369)	(3.403)	(3.42)	(3.457)	(3.382)
Divorces in population (%)					-77.366	-72.682	-86.424	-94.583	-100.063	-85.709
					(198.954)	(200.072)	(204.871)	(203.193)	(205.803)	(207.332)
Alcohol sold per capita (litres)						-4.252	-7.174	4.212	3.915	12.606
						(11.506)	(13.604)	(14.575)	(14.51)	(13.904)
Population density per square kilometre							-0.454	-0.263	-0.22	0.863
							(0.54)	(0.557)	(0.56)	(0.778)
Disposable income for households (1000 SEK)								-2.044	-2.233	-5.102**
								(1.138)	(1.262)	(1.687)
Number of primary healthcare centres									-2.81	-2.073
									(3.058)	(3.036)
Constant	221.361***	199.944***	143.930***	84.728	103.883	118.476	134.354	-82.618	-38.148	473.448*
	(8.448)	(8.707)	(40.901)	(43.262)	(71.829)	(75.226)	(82.645)	(128.2)	(120.251)	(212.675)
Fixed effects	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time trend	No	No	No	No	No	No	No	No	No	Yes
N	249	249	249	249	249	249	249	249	249	249
R2	-0.003	0.7	0.7	0.705	0.704	0.702	0.702	0.706	0.707	0.714
F	0.308	90.439	96.96	76.667	73.774	71.686	67.82	61.924	66.592	95.81

Note: Dummies for regions included. Time trend also included. Regressions are run using robust standard errors, shown in parentheses.

**Significant at the 5 percent level. **Significant at the 1 percent level. ***Significant at the 0.1 percent level.*

Table 20: Alternative First stage, Private health care personnel

	Dependent variable: Number of health care personnel, private providers									
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Exposed to Reform	42.531***	32.557***	7.571**	6.596	8.086	13.256*	13.035*	10.981*	9.65	7.451
	(5.323)	(2.707)	(2.82)	(4.582)	(5.095)	(5.59)	(5.307)	(5.125)	(5.232)	(5.14)
Share of population with higher education (%)			8.021***	8.083***	8.023***	8.365***	6.796***	0.328	0.015	4.331
			(0.695)	(0.718)	(0.72)	(0.708)	(0.774)	(3.238)	(3.311)	(3.452)
Unemployment (%)				0.466	0.676	0.216	-0.09	0.665	0.599	1.156
				(1.186)	(1.148)	(1.158)	(1.105)	(1.055)	(1.06)	(1.013)
Divorces in population (%)					-63.976	-49.034	-27.805	-27.075	-26.35	-31.401
					(63.578)	(67.62)	(69.479)	(69.235)	(68.855)	(67.987)
Alcohol sold per capita (litres)						-10.077	-4.657	-7.768	-7.719	-11.986
						(6.177)	(7.027)	(6.965)	(7.013)	(6.835)
Population density per square kilometre							0.770**	0.720**	0.709**	0.23
							(0.242)	(0.245)	(0.243)	(0.291)
Disposable income for households (1000 SEK)								0.646*	0.698*	1.963**
								(0.31)	(0.318)	(0.6)
Number of primary healthcare centres									0.738	0.422
									(0.715)	(0.715)
Constant	67.941***	47.009***	-140.989***	-145.633***	-129.948***	-97.301**	-124.907**	-56.658	-67.791	-285.523**
	(3.665)	(3.125)	(16.839)	(20.591)	(26.95)	(34.471)	(38.056)	(50.658)	(52.696)	(86.775)
Fixed effects	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time trend	No	No	No	No	No	No	No	No	No	Yes
N	246	246	246	246	246	246	246	246	246	246
R2	0.14	0.891	0.926	0.926	0.926	0.928	0.93	0.931	0.931	0.934
F	63.834	88.533	248.305	240.169	229.051	285.08	264.927	235.995	233.844	290.713

Note: Dummies for regions included. Time trend also included. Regressions are run using robust standard errors, shown in parentheses.

**Significant at the 5 percent level. **Significant at the 1 percent level. ***Significant at the 0.1 percent level.*