Do Health Interventions Matter in a Decentralized Healthcare System?

A Case Study of the Swedish Female Health Intervention on Maternal Health Outcomes

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Abstract

This thesis evaluates if a countrywide female-related healthcare intervention in 2015 affected Swedish regions' maternal health outcomes differently due to a decentralized healthcare system. By exploiting regions' varying budget dedicated to female-related healthcare before the intervention, the size of the budget increase is estimated. Maternal health outcomes before and after the intervention are compared using two difference-in-differences (DiD) strategies. A majority of the results indicate that the intervention did not translate into health improvements. Due to low statistical power, longer time-periods are needed in order to further explore impacts of health interventions in a decentralized healthcare system.

Keywords*:* c-section, preterm delivery, rupture degree, BMI, female health intervention, difference-in-differences, parallel trends, Sweden.

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Abbreviations

Body mass index: BMI

Central Government: CG

Cesarean section: c-section

Difference-in-differences: DiD

National Board of Health and Welfare: NBHW

Statistics Sweden: SCB

Swedish Association of Local Authorities and Regions: SKR

Table of Contents

1. Introduction

A decentralized healthcare system is based on the idea that smaller organizations, properly structured and steered, are more agile and accountable than larger organizations. Since the Second World War a restructuring process towards this healthcare system has accelerated throughout several countries in Europe. However, lately Nordic countries have started to retreat from the key doctrines of decentralization and instead re-centralized important health system functions (Saltman, et al., 2007). This recent trend raises questions about the overall efficiency of decentralization in the health sector. One reason supporting this development, is that the regional policymakers' healthcare prioritization will differ across regions and possibly give rise to unequal healthcare based on where one lives in the country. In this thesis I evaluate whether this is true by analyzing if a nationwide female-related healthcare intervention in 2015 affected regions' maternal health outcomes differently in Sweden.

The intervention was in the form of a budget expansion, dedicating hundreds of million to the regions in order to improve female-related healthcare. The Central Government (CG) let the regions themselves allocate the funds within the healthcare system but specified that the intervention should mainly focus on strengthening personnel and competence, improving knowledge regarding diseases which are common in women, and improving the maternity care and the care after birth. Hence, the intervention can presumably operate through three channels: by improving general female health, by improving prenatal care, and by improving hospital care.

The budget expansion was allocated in relation to each region's population size. However, even if the funds are allocated equally per capita, the impact of the budget expansion will differ across regions. This is due to the fact that the budget increase will differ in relative terms, due to the regions' previous budget for female-related healthcare. This implies, that the lower the previous budget dedicated to female health is, the larger the impact of the intervention.

In this study, I exploit the differences in these relative changes. By applying two DiD strategies using data from the National Board of Health and Welfare (NBHW) on pregnancy and maternal outcomes aggregated at the region-year level, I exploit the differences in the budget percent increase between regions and compare pregnancy and maternal health outcomes; Caesarean section (c-section) rates; preterm deliveries; the share of overweight pregnancy women; and maternal injuries during the delivery; before and after the intervention. In the first approach, I apply the *binary model* in which I split the observations into a treatment and control group based on their treatment intensity being above or below the median. In the second approach, I apply the *continuous model* in which I exploit the whole distribution of treatment intensity.

The results from the binary model do not exhibit any significant effects from the intervention. Contrary, the findings from the latter model suggest that for regions which faced a larger budget expansion impact with respect to 2014, c-section rates decreased. These results should however be interpreted carefully as the statistical power of the data may not be very high and the marginally significant result is not very robust. Given that the majority of the outcomes are insignificant, this points in the direction that the intervention did not translate into health improvements. To further explore this relationship longer time-periods are needed. Hence, future research on health interventions in a decentralized healthcare system is recommended.

The essay is structured as follows: in the coming chapter the institutional background of the Swedish healthcare system, the Swedish healthcare delivery system, and a detailed review of the intervention is described. Thereafter, theoretical considerations of how the intervention can affect female-related healthcare is examined. In the fourth section, previous literature on similar topics is presented. Then, a description of the data and variables used is provided. The empirical strategy, including regression specifications and identifying assumptions is presented in the sixth section, followed by identification checks, regression results, and robustness checks. Moreover, regression results are discussed in section ten, and lastly this paper is summarized in chapter eleven.

2. Background

For this essay it is important to grasp the structure of Swedish healthcare in order to understand how the budget expansion can affect different health divisions. First, I elucidate the institutional background of Swedish healthcare. I continue with describing the Swedish healthcare delivery system and the difference between primary and specialized care. Thereafter, I explain how female health is related to each described health unit. Next, a more detailed review of the intervention is specified. Finally, the relationship between previous care programs and the examined intervention is discussed.

2.1 Institutional Background of the Swedish Healthcare System

Since the 19th century, Swedish healthcare has gone through numerous reforms, ultimately leading to today's framework, in which the healthcare system is decentralized (Ministry of Finance, 2005). At the national level, the Swedish Parliament together with the CG, set the political agenda for healthcare and medical care through laws and ordinances. The ministry which organizes the part of the national budget dedicated to public health and healthcare is the Ministry of Health and Social Affairs. The department operates in the interest of the Swedish Parliament and the CG and aim to provide the Swedish population with efficient, customized, and high-quality healthcare. In addition, the ministry is obliged to ensure that the care is equal, gender equal and accessible, regardless of one's population registration address within the country (Regeringskansliet, n.d.).

However, the share of the national budget purposed to public health and healthcare only make up for around 20 % of the healthcare revenues. Swedish healthcare is primarily subsidized through regional taxes, since healthcare is provided and mainly managed at the regional level. Sweden is divided into 21 county councils which are in charge of providing its residents with healthcare in line with nationally agreed guidelines. The regional councils are political bodies whose representatives are elected by the region residents every four year (Swedish Institute, 2021). Moreover, the county councils are responsible for the overall healthcare planning and allocation of healthcare resources (Socialstyrelsen, 2020). The key concept of a decentralized healthcare system is to distribute and prioritize resources to particular local conditions, in order to use existing supplies more efficiently (Ministry of Finance, 2005). Nevertheless, this also indicates that the availability of certain healthcare services may vary across regions. Additionally, according to the Swedish Pregnancy Register there are still crucial differences between the regions' healthcare policies even after accounting for the regions' varying patient constellations (Vårdanalys, 2019). This may imply that the patient groups have limited meaning in explaining regional differences in healthcare, which in turn undermine the purpose of a decentralized healthcare system.

The final level at which the healthcare is administrated is at the municipal level. Sweden is further split into 290 municipalities where each is in charge of the local care for the elderly in the home or in special accommodation, as well as of the care for people with physical disabilities or psychological disorders. In addition, the municipalities are responsible of providing support and services to people released from hospital care, and school healthcare. This part of the healthcare sector is financed via municipal taxes. The extent of responsibility which the municipalities have is regulated by the Health and Medical Service Act (Swedish Institute, 2021).

2.2 The Swedish Healthcare Delivery System

The Swedish healthcare delivery system consists of four divisions. The base of the system is the primary healthcare, which is the first instance a patient turns to in the event of suspected sickness. According to the Health and Medical Services Act, the primary healthcare is defined as a health and medical-care instance at which non-institutional care is given the patient without any restrictions regarding the patient's disease, age, or patient group (Kliniska Studier, 2020). If a patient cannot get the correct treatment or diagnosis at the primary care instance, the physician makes a referral to a suitable specialist. Henceforth, the primary care is authorized to provide fundamental medical treatment which does not require medical nor technical resources, or any other special competence. The Swedish primary care consists of over 1000 district healthcare instances. To access one of these wards, each region has an instate care center-system, which gives the residents in the area the opportunity to choose a nearby primary healthcare provider. At the healthcare centers, physicians – trained in general medicine – work together with nurses, physiotherapists, occupational therapists, and welfare officers.

Next in the pipeline is the county healthcare. There are approximately 20 county hospitals and 40, so-called, county-share hospitals in Sweden. The county hospitals are often competent enough and medically equipped in order to treat most diagnoses (Nationalencyklopedin, n.d.). The county-share hospitals on the other hand, are smaller and cover less specialties compared with the county-hospital (Nationalencyklopedin, n.d.). At these types of healthcare institutes, both outpatient and inpatient care are available.

Sweden is further divided into six healthcare regions, each of which has at least one university hospital. The counties which do not have a university hospital have access to the nearest region's university hospital. At these facilities, highly specialized care is offered, where all complicated, rare and severe conditions of illnesses and injuries are treated. Additionally, these hospitals collaborate with medical universities and thus educate future personnel and practice medical research (Socialstyrelsen, 2018).

At the end of the pipeline, Sweden has what is called national highly specialized care, which is funded by the regions as well as the state. At these hospitals, only the rarest diagnoses are treated, and most advanced healthcare is practiced. This type of healthcare is, compared to the system as a whole, centralized to very few health facilities in the country, in order to obtain high-quality care, where front-edge competence and advanced medical supply often is needed in order to achieve a more optimal use of resources (Socialstyrelsen, 2021). The purpose of concentrating this type of healthcare, is to ensure patients the best possible healthcare, regardless of where one lives (Region Skåne, 2021). To summarize, all healthcare divisions except for the primary care, offer hospital care, that is, specialized care which is not provided by the primary care (Holmström, 2019).

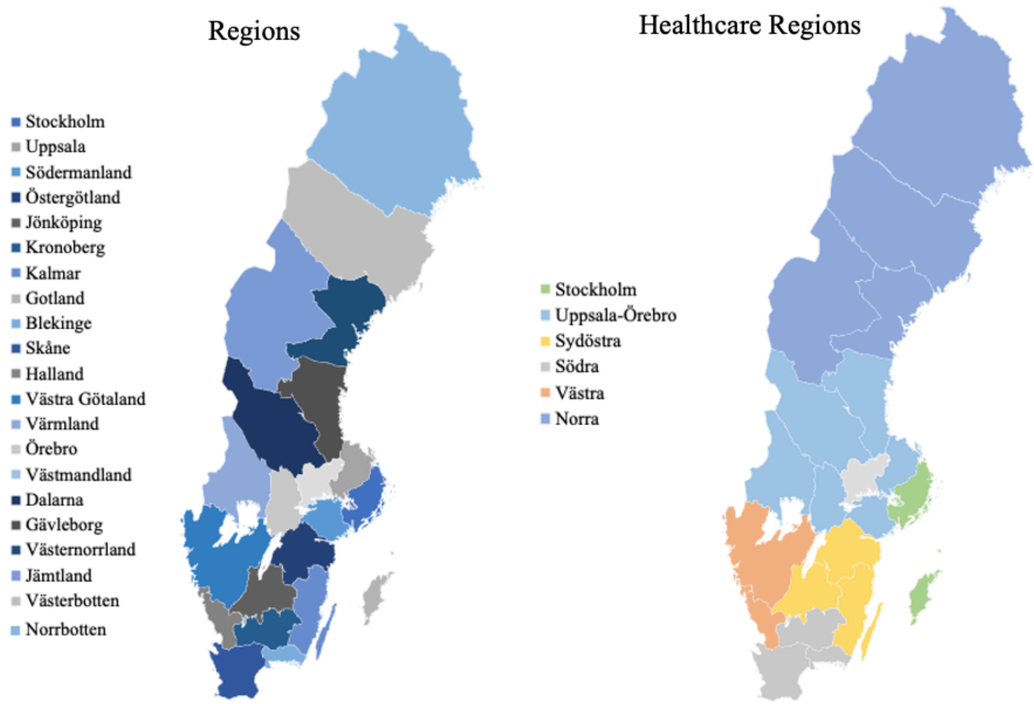


Figure 1. Sweden divided by regions (left) and by healthcare regions (right). Source: author and MSB (2016).

2.3 Female-Related Healthcare

Female-related healthcare is offered within all four divisions. In the primary care women can among others access midwife clinics and physicians in general medicine. The primary care can for example provide women weekly pregnancy controls of the fetus's health, prenatal diagnosis, gynecological pap tests, tests for sexually transmitted diseases, and counseling regarding reproductive health and menopause (Region Skåne, n.d.). Sometimes, the primary care facilities offer access to a gynecologist, however, as the healthcare is decentralized, this is not always the case.

Within the county healthcare, women can access obstetricians and gynecologists. The county healthcare takes for example care of birth deliveries, cases of endometriosis, birth traumas, involuntary childlessness, and cell changes (Region Skåne, n.d.). Furthermore, within the six healthcare regions, cases of for example gynecological cancer surgery and complicated cases of endometriosis are treated (Region Skåne, n.d.). Finally, within the national highly specialized care women with for example cervical cancer, avery cancer, vulvar cancer, and ovarian cancer receive medical treatment and surgery (Region Skåne, 2018).

2.4 Investment in Maternity Care and Female Health

In 2015, the Swedish CG disbursed 200 million Swedish Crowns (SEK) to Sweden's 21 regions, with the intention to improve the Swedish maternity care and female health (Socialdepartementet, 2019). The money was distributed in relation to each region's population size (see allocation in *Appendix A.1)*. During the time-period 2016 – 2019, an additional 400 million SEK/year were distributed in order to strengthen and promote female healthcare, and 130 million SEK/year were exclusively invested in the primary care with focus on low socioeconomic status areas (Socialdepartementet, 2016).

The CG together with the Swedish Association of Local Authorities and Regions (SKR), specified that the central focus of the intervention between 2016 – 2019 was: to strengthen personnel and competence; to improve knowledge regarding diseases which are common in women; and to improve the maternity care and the care after birth. Furthermore, for the period 2018 – 2019, the authorities also dedicated their budget grant to be used for improvements of neonatal care (Vårdanalys, 2020).

In order to decrease the stated health-inequality between genders, and in turn counteract the demonstrated high number of sick leaves among women, a concrete goal of the investment was to offer women between 40 – 74 years free mammographies, and to offer free contraceptives to women under 21 years. Moreover, the defined intention of the investment was linked to healthcare regarding pregnancy, birth, and diseases related to the female reproductive system. Even though the purpose of the investment was at the central level, the regions had autonomy to decide how to allocate the additional funds due to the decentralized healthcare system. This implies that the regions themselves were obliged to identify which areas within the healthcare they considered the money would make the most use. As previously described, the goal with a decentralized health is the possibility for regions to adjust the care after the characteristics of their population.

The most common type of implementation which the regions carried out in order to endorse female health was change of working methods, operational development, and quality improvements (Vårdanalys, 2020). A smaller number of the actions regarded implementations of care programs. Nevertheless, the regions have not announced how much of the subsidy they used for each intervention.

2.5 Previous Interventions: Care Program for Pregnant Women suffering from Overweight

A potential confounder for determining the effect of the intervention, is already implemented programs with the purpose to improve maternity care and female health. One of such character is the care program for pregnant women suffering from overweight, which was asymmetrically implemented in six Swedish regions between 2014 – 2017 (see *Appendix A.2*). Today, the obesity epidemic is one of Sweden's most challenging public health concerns (Odlind, 2020). In 2020, around half of Swedish women suffered from overweight or obesity, facing severe health consequences (Folkhälsomyndigheten, 2021).

In the event of a pregnancy, overweight and obesity may increase the probability of thrombosis, pre-eclampsia, stillbirth, and increased birthweight. At birth, the risk for complications, for example hemorrhage, is enhanced as well. Due to these risk factors, pregnant women with overweight usually have a c-section delivery (Mödrahälsovårdsenheten Region Stockholm, 2020). In order to decrease the health complications under these circumstances, some regions have introduced care programs designed for pregnant women suffering from overweight or obesity. The programs take place at the maternal healthcare centers, and *inter alia* offer extra controls of the pregnant woman's health, additional ultrasounds, weight controls, information and motivational dialogues in order to promote healthy eating habits and physical activities (Friedl, 2021).

3. Theoretical Considerations: Impacts of a Female Health Intervention

As this study aims to analyze the effect of the intervention on pregnancy outcomes, it is essential to distinguish through which mechanism the female health intervention in terms of a budget expansion can affect maternal health outcomes. In this section I therefore identify and address three channels through which the intervention operates: 1) via general female health; 2) via prenatal care; and 3) via hospital personnel and resources.

The budget expansion can improve *general female health* in order to prevent adverse pregnancy outcomes. By detecting medical conditions which may cause poor birth outcomes if not treated, maternal and infant health can be improved. An example of a condition of such character is vulvodynia. The diagnosis, which causes pain around the female genitalia, is generally underreported in Swedish health statistics, and thus suspected to have a large, estimated number of unknown cases (Socialstyrelsen, 2019). In the event of a pregnancy, women suffering from vulvodynia run an increased risk of having a c-section and severe vaginal ruptures. Nevertheless, if the medical condition is detected and treated, most women suffering from the disease are fully recovered (Sjöberg, 2019). Another diagnosis which can lead to undesired maternal and infant outcomes, is hypothyroidism. If this hormonal disease stays untreated during pregnancy, the risk for having a miscarriage and preeclampsia increase, and the probability for stillbirth and low birthweight rise (Olivius, 2020). Moreover, as previously mentioned, overweight is a common cause that leads to birth complications. Women who are overweight run a greater risk to get preeclampsia, gestational diabetes, miscarriage, stillbirth, preterm delivery, and undergoing c-section (Socialstyrelsen, 2019). Naturally, overweight can be treated with a change of lifestyle, however, underlying medical conditions such as hormonal diseases and/or mental illness, can also cause weight gain and consequently be the actual factor causing overweight and thus adverse pregnancy outcomes (Uddén, 2020). Overall, the intervention could lead to improvements in these outcomes through expansions of preventative care.

To further prevent poor maternal health, the budget expansion can *improve prenatal care*. Prenatal care is offered to pregnant women and has the purpose to prevent birth complications and reduce infant and maternal mortality (Karolinska Institutet, n.d.). At the maternity ward, the pregnant woman's obstetric, medical, and psychiatric history as well as her heredity, lifestyle, and social situation is evaluated (SFOG, 2016). Based on her assessment, she receives tailor-made prenatal care. Examples of this type of care are health consultation, screening for infections and diabetes, measures of blood pressure, ultrasound in order to follow the fetus's development, access to prenatal diagnostics, and ultrasound screening of inner organs (SFOG, 2016).

Finally, the budget expansion in female health can affect pregnancy outcomes via *improvements in the hospital care*. By investments in hospital personnel in terms of employments and competence enhancing programs, as well as in medical devices, maternal delivery outcomes can improve. For example, by promoting hospital personnel's knowledge regarding the pelvic floor and techniques to identify different degrees of vaginal ruptures, life-long complications of severe vaginal ruptures – such as chronic pain and faecal incontinence – can be avoided (SFOG, 2019; Jonsson, et al., 2021).

In summary, the impacts of the female health intervention can operate through investments in general female health, prenatal care, and hospital care. However, due to Sweden's decentralized healthcare system in combination with the intervention's broadly defined focus-area, identifying which channel each region decide to operate through – and subsequently identifying which field within that channel the region decide to finance – is practically impossible to map out. Consequently, the methods undertaken in order to improve female healthcare will differ across regions (Vårdanalys, 2019).

4. Literature Review

In this literature review I begin with presenting research that study the effect on birth outcomes due to budgetary changes in maternity healthcare spending. I continue with reviewing articles which investigate possible channels through which a health intervention would affect pregnancy outcomes. Finally, I summarize previous studies and clarify how my thesis can contribute to the general literature on interventions that affect pregnancy outcomes.

Bertoli, et al. (2020) aim to evaluate what impact a budgetary restriction in maternity care services may have on pregnancy outcomes. The authors focus on the quality of birth care – proxied by the incidence of c-sections – in Spain. Using a DiD model at the hospital level, Bertoli, et al. (2020) show that the budget cut led to a three percent increase in c-sections. In relation to my thesis, one could hence assume that a budget expansion in maternity care services would lead to a decrease in c-sections. Moreover, Bekemeier, et al. (2014) undertake a multivariate panel time-series design in order to assess how local health department investments in maternal and child health services influence health outcomes in the United States. The authors find that the local investments are likely to reduce poor birth outcomes, such as infant mortality and low weight births, indicating that funds in maternal healthcare improve birth outcomes. However, in previous research there is a gap of literature covering the effects on pregnancy outcomes due to a nationwide budget expansion in female healthcare. Therefore, my thesis may contribute to previous research by filling that gap.

In order to disentangle the mechanisms through which a budget expansion in female healthcare might affect pregnancy outcomes, it is relevant to evaluate previous literature on the effects of prenatal care on maternal and infant health. Smith Conway & Kutinova (2016) estimate the effects of prenatal care on measures of maternal health in the United States and *inter alia* show that receiving timely and adequate prenatal care may increase the probability of maintaining a healthy weight after birth. This supports that a budget expansion would improve maternal health and birth outcomes via improved prenatal care. Another paper which further endorses this argument is by Cygan-Rehm & Karbownik (2020). In their study, the effects of the timing of early prenatal care on infant health are investigated. Using a DiD design, the authors find that early prenatal care have positive effects on neonatal health, and that it also may improve maternal health-related knowledge and behaviors during pregnancy.

The female health intervention could further affect maternal and infant health outcomes via better hospital care at the time of the delivery. Improved hospital care could for example be higher midwife coverage per patient and improved medical technology. In a study by Nove, et al. (2021) the potential impact of midwives on reducing maternal and neonatal deaths and stillbirths is estimated. The authors find that midwives can substantially reduce maternal and neonatal mortality and stillbirths in low-and middle-income countries. Nevertheless, the authors clarify that in order to do so, the midwives need sufficient skills, competencies, and to work in enabling environments. The paper therefore underlines that maternal healthcare personnel is important, nevertheless, challenges to achieve the potential of this personnel are just as important. Hopefully, my thesis can contribute to this literature as well, since the health intervention I study *inter alia* aims to increase competence and knowledge among maternal healthcare personnel. Additionally, a paper by Lazuka (2018) evaluate the long-lasting economic effects of access to better health services at birth, using openings of maternity wards throughout Sweden as an early-life quasi-experiment. Lazuka (2018) finds that the intervention reduced neonatal mortality and improved long-term health for the survivors. These results further suggest that maternity wards in general improve the health status for infants and thus emphasize the importance of maternal healthcare.

Even if the literature on the effects of maternal healthcare on birth outcomes is abundant, few studies examine the causal relationships between female health and pregnancy outcomes. As Smith Conway & Kutinova (2016) put it: "In economics, maternal health has been almost completely ignored". In addition, Almond & Currie (2011) conclude that future research should focus on the health of pregnant women and women of child-bearing age, as the key to helping children is helping their mothers. Hence, I aim to contribute to the general literature on policy interventions in health economics with a thesis that aims to study the causal relationship between a nationwide budget expansion in female health and pregnancy outcomes.

5. Data

This thesis exploits yearly data between 2009 – 2019 in order to examine the impact of the health intervention in December 2015 on female health outcomes. The data used is gathered from the NBHW, Statistics Sweden (SCB), the SKR and the CG.

5.1 Data Sources

Data covering information on regional pregnancy outcomes and maternal health is gathered from the database "Statistical Database on Pregnancies, Deliveries and Newborn Infants" (Socialstyrelsen, 2020). It is a yearly data set which *inter alia* includes information on the average incidence of preterm birth, the frequency of c-section, births, maternal body mass index (BMI), and vaginal rupture degree three and four. The data is compiled by the Swedish Medical

Birth Register and includes data on nearly all deliveries in Sweden since 1973. It is compulsory for every health care provider in Sweden to report to the register and the information available is collected from medical records from the prenatal, delivery and neonatal care.

Information of regional characteristics is mainly gathered from SCB. Data on regional population size is collected from the dataset “Population 1 November by region, age and sex. Year 2002 – 2020” (SCB, 2020). Moreover, data regarding whether or not a region has implemented a care program for overweight, pregnant women, is accessed via each region’s website, found at SKR (n.d.). SKR is an organization of which all Swedish regions and municipalities are members. The organization is commissioned to support their members in order to promote regional and municipal development.

In order to access data on healthcare spending dedicated to female-related healthcare, I collect regional information of expenditures from the dataset “Net costs excl. pharmaceuticals in the benefit for regions by activity. Year 2009 – 2020” by SCB (2020), complemented with information on Swedish healthcare production and consumption from the reports “DRG-statistics” by (Socialstyrelsen, 2020)[1]. Finally, information of how much of the budget expansion each region received was found in cabinet decision documents provided by the (Socialdepartementet, 2015). These documents were updated each year between 2015 – 2019 due to yearly varying budget expansions.

5.2 Variable Description

A birth outcome often used as a proxy in order to measure maternal health is the risk for c-section. The risk of undergoing a c-section is among other things related to the woman’s aerobic fitness, muscular strength, but also pregnancy complications such as pre-eclampsia, gestational diabetes, and insufficient intrauterine fetal growth (Bird, et al., 2016; Price, et al., 2012). Therefore, the frequency of c-sections operates as an outcome variable measuring female health. Another pregnancy outcome which reflects both maternal health and the health of the fetus is the prevalence of preterm births (WHO, 2012). Thus, very preterm births – defined as a birth earlier than week 31 – operates as one of the dependent variables in this thesis in order

[1] For a detailed description of how the regions’ budget on female-related healthcare was obtained and calculated, see *Appendix A.3*.

to estimate female health. Furthermore, maternal BMI over 30, interpreted as obesity, will operate as an outcome variable as extremes of the BMI are strongly associated with maternal health status and adverse neonatal outcomes (Liu, et al., 2019). Finally, in order to evaluate whether the intervention has an impact on the overall maternity care quality, the vaginal rupture of degree three and four – which are severe maternal delivery injuries in form of vaginal tears – is used, as the prevalence of vaginal ruptures of degree three and four can be significantly reduced with competence-enhancing programs (Bidwell, et al., 2018).

Moreover, I include regional fixed effects in order to account for socio-economic factors which may affect maternal and infant health (Kim, et al., 2018). I also include year fixed effects. Additionally, covariates are added in order to check if the outcome variables are driven by certain factors, such as maternal age and type of birth. These two controls are chosen since higher maternal age and multiple births has revealed to be related with adverse birth outcomes which may affect maternal and infant health (Bhalotra, et al., 2017).

Finally, in order to obtain my independent variable (the DiD estimator) and attain the regions' varying treatment intensity of the intervention, I estimate each region's budget increase due to the intervention using the following formula:

$$\frac{Region's\ intervention\ spending\ year\ X}{Region's\ budget\ on\ female\ healthcare\ in\ year\ 2014}$$
$$= Size\ of\ region's\ budget\ increase\ in\ female\ related\ helthcare\ year\ X$$

Where $year\ X$ range between 2015 – 2019. This procedure enables me to exploit the regional variation in budget for female health with respect to the regions' budget for female-related healthcare in year 2014. Depending on which year and region, the intervention makes up for around 1 – 5 % of the total budget dedicated to female-related healthcare. In figure 2 the variation in budget in SEK for female-related healthcare per capita before the reform, e.g. in 2014, is displayed.

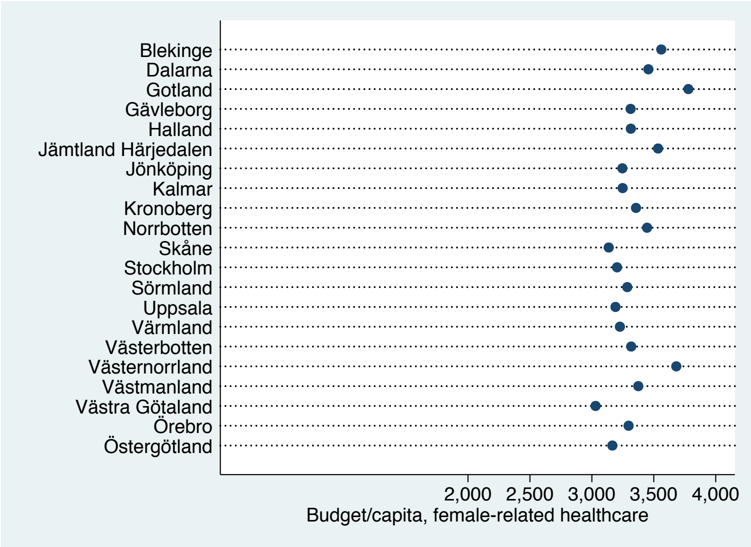


Figure 2. Budget, female-related healthcare per capita in 2014.

6. Empirical Strategy

The female health initiative in 2015 exposed all Swedish regions to a budget increase proportional to their population size. However, even if the intervention was equally distributed per capita, the budget increase will differ in relative terms, due to the regions' previous budget for female-related healthcare. For example, in a region where female health is deprioritized, the relative increase due to the budget expansion is greater compared to a region where the budget for female health is already high. Thus, the lower the previous budget dedicated to female health is, the more intensely treated the region gets, since the budget expansion then makes up a greater proportion of the total budget for female healthcare. In this study, I exploit the differences in these relative changes.

In this essay, I undertake the quasi-experimental DiD design. The DiD combines before-after and treatment-control group comparisons and is widely used in economics when studying public policy and health (Fredriksson & Magalhaes de Oliveira, 2019). The strategy is an evaluation method used in non-experimental setting. The goal of the technique is to estimate the causal effects of a program when there is no obvious control group as treatment assignment is non-random.

The causal effect of the 2015 health intervention evaluated in this thesis will be estimated using two DiD strategies, where I exploit the differences in the budget rate increase between the regions and compare the outcomes before and after the intervention. In the first approach, I apply the *binary model* in which I split the observations into a treatment and control group based on their treatment intensity. In the second approach, I apply the *continuous model* in which I allow for different intensities of treatment. The pre-period represents the years between 2009 – 2015 (as the intervention was implemented December 31st in 2015) and the post-period represents the years 2016 – 2019.

6.1 Model Specification

In my model specifications, I undertake a similar strategy as (Lucas & Mbiti, 2012). As the healthcare initiative was implemented simultaneously across Sweden in December 2015, comparing outcomes before and after the intervention will not identify the impact of the intervention, but instead attribute all countrywide change in female health outcomes over time to the program. To overcome this issue, I exploit the pre-program differences in the budget dedicated to female health between the regions. By doing so, the effective intensity of the intervention for a region in a given year, depends on the marginal increase in the budget. Therefore, I include all regions and let all regions be treated proportionally to how much their total budget was increased. Thus, the magnitude of the impact in each region will be proportional to the budget rate prior the health intervention. However, in the first specification I discretize the treatment and in the second I use variation from the whole distribution of intensity.

6.1.1 Binary Model

To evaluate the impact of the budget expansion on female health, I exploit the mean in the budget expansion increase between 2015 – 2019, using a similar strategy as (Bhalotra, et al., 2017). The control group contains the regions which were the least intensely treated by the healthcare intervention (below the mean) and the treatment group contains the regions which were the most intensely treated by the healthcare intervention (above the mean) (see *Appendix A.4*). The following DiD specification is estimated:

$$y_{rt} = \alpha + \beta_1 D_r Post_t + \gamma_r + \lambda_t + \tau_r t + \delta X + \varepsilon_{rt} \qquad \textbf{(1)}$$

where y_{rt} represent the birth outcome in terms of preterm delivery, c-section, BMI over 30, or vaginal rupture degree of level three and four, in region *r* in year *t*. The parameter β_1 is the coefficient of interest, i.e., the DiD estimator which shows the impact of being treated by the intervention after 2015. D_r is the treatment status of a region and $Post_t$ is a dummy variable equal to 1 for years after 2015. The vector γ_r denotes regional fixed effects, λ_t represents year fixed effects, and $\tau_r t$ indicate regional-specific linear trends. Moreover, X is a vector of covariates which controls for multiple births and maternal age. I use regional-specific trends and control variables since I want to account for the fact that there may be regional variation arising over time due to other interventions which may correlate with the initiative or outcomes, or that the composition of female health outcomes in the treated and control areas may change over time for reasons related or unrelated to the intervention. Given the low number of regions, standard errors are clustered at the regional level following the wild-cluster bootstrap procedure (Friedrich and Hackmann, 2020).

6.1.2 Continuous Model

In this specification I exploit variation from the whole distribution of intensity. The following DiD specification is estimated:

$$y_{rt} = \alpha + +\eta_1 I_r Post_t + \mu_r + \rho_t + \tau_r t + \kappa X + \varepsilon_{rt} \quad \textbf{(2)}$$

where the interpretation of the variables y_{rt}, $Post_t$, $\tau_r t$, and X is the same as in (1). However, I_r refers to the intensity of the treatment, i.e., how large the budget rate increase was compared to the budget rate in 2014. Therefore η_1 reflect how female health is affected by the percentage increase in budget. In this model, μ_r and ρ_t are the specific regional and year fixed effects, capturing unobservable regional and year level characteristics. As in the previous model, standard errors are clustered at the regional level.

6.2 Identifying Assumptions

6.2.1 Parallel Trends

The key assumption under a DiD estimation is the parallel trend assumption. This implies that in the absence of treatment, the average change in the response variable – c-section, preterm delivery, BMI over 30, and rupture degree 3 and 4 – would have been the same for both the treatment and control groups. Thus, one would expect the trends in the outcome variable for both groups during the pre-intervention time-period to be similar. In order to validate the assumption I perform a graphical analysis. This means that I plot the mean outcomes for the two groups over time and then evaluate if the lines appear approximately parallel (Wing, et al., 2018).

To further investigate whether the parallel trends assumption holds, I estimate a covariate balance regression to see if differences between the two groups are stable over time and that changes in treatment exposure are not associated with changes in the distribution of covariates, which in my case are maternal age and multiple births. I also check if this holds for the regional population size and births. In order to perform this type of regression, I replace the outcome variable with the covariate and fit the standard DiD regression model. Under the null, the DiD coefficient should be zero, i.e., no compositional changes.

Next, I evaluate causal relationships by performing Granger Causality tests. This is carried out in order to see if, anticipation of treatment, the control or treatment groups change their behavior. This is done by adding leads of the treatment variables in the standard DiD model, as the effect of the treatment may vary with time since exposure. Under the null, no effect from the leads should be observable.

6.2.2 Confounding Interventions

A potential concern with this study is that the results may be driven by other interventions that are correlated with the measure of female health and maternity care intensity. As previously described, some regions have implemented a care program focusing on overweight pregnant women. This implies that these regions may already have lower preterm delivery rates, rupture degrees of level 3 and 4, levels of BMI over 30, and c-section rates. It could also be the case that this type of care program is an effect of the intervention. To examine whether the care program for pregnant women suffering from overweight is a result from the intervention or enhance the effect of the intervention, I run a regression with an indicator for this program as dependent variable.

7. Identification Checks

As previously stated, the parallel trends assumption must hold in order for the regression results to be valid. The graphical evidence, shown in figures 5 and 6, indicate that the control and treatment groups have approximately parallel trends for the outcome variables maternal BMI over 30 and rupture degree 3 and 4. For the dependent variables c-section and preterm delivery, displayed in figure 3 and 4, the trends are not fully parallel.

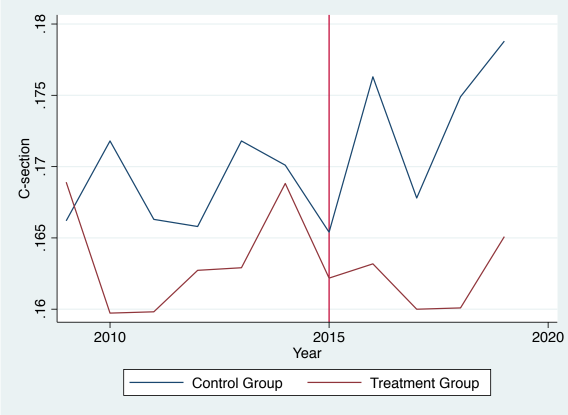


Figure 3. C-section Trend.

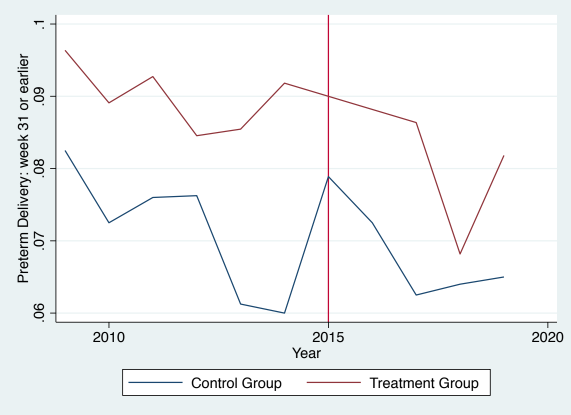


Figure 4. Preterm Delivery Trend.

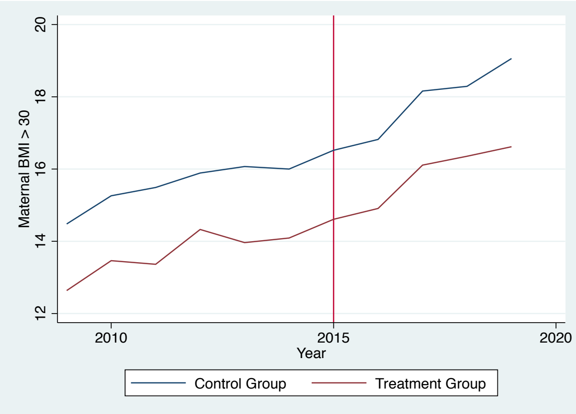


Figure 5. Maternal BMI>30 Trend.

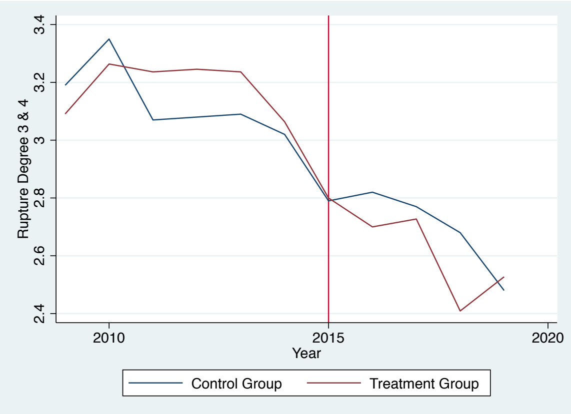
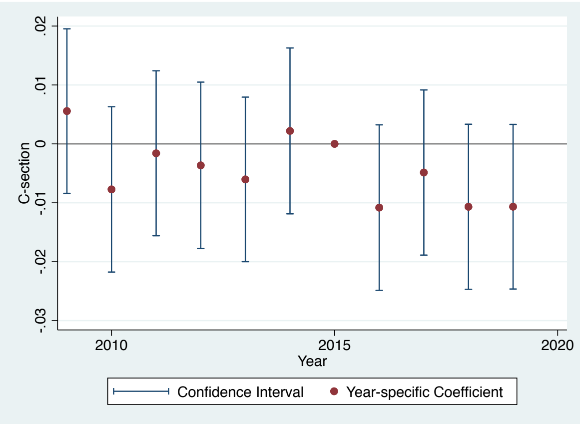


Figure 6. Rupture Degree 3 & 4 Trend.

Thus, to further evaluate whether the trends for c-section and preterm delivery are parallel, I interact the binary treatment variable with year fixed effects, and control for region-specific fixed effects as well as multiple births and maternal age, and then plot the year-specific coefficients. By doing so, I compare the difference between the treatment and comparison group for each year separately with respect to 2015. If the parallel trends assumption holds, the coefficients for all years before the intervention are expected to be around zero. In figure 7 and figure 8, the year-specific coefficients for c-section and preterm delivery are displayed. In figure 7, the year-specific coefficients for c-section in the pre-intervention time are roughly around zero, indicating that the parallel trends assumption may hold. However, in figure 8, the year-specific coefficients for preterm delivery in the pre-intervention time are not around zero, indicating that the parallel trends assumption do not hold. Hence, preterm delivery cannot operate as an outcome variable.



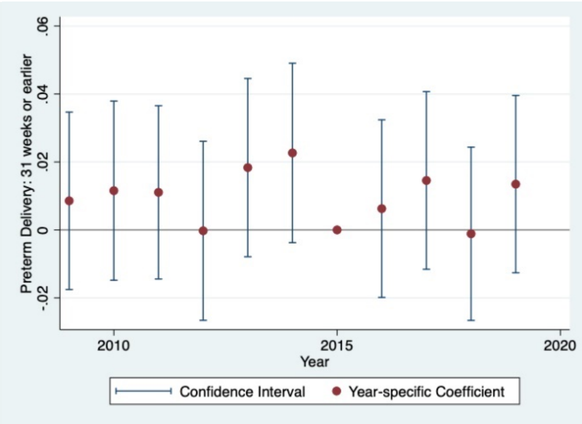


Figure 7. C-section, year-specific coef.

Figure 8. Preterm Delivery, year-specific coef.

To further support the parallel trends assumption, I regress covariate balance regressions in order to evaluate whether changes in treatment exposure are associated with changes in the distribution of covariate included in the regression models, as well as regional characteristics such as the regional population size and births. If it were to be changes in the regional composition, if for example women decided to deliver in regions which received a larger budget expansion as they believe these regions may have better care, this would bias the regression results. None of the DiD-estimators are significant, indicating that changes in the covariates cannot be attributed to changes in treatment exposure, further strengthening the parallel trends assumptions (see *Appendix A.5*).

8. Regression Results

In this section, the regression results are presented. First the outcomes from the binary model are showed, followed by the outcomes from the continuous model. For all dependent variables, regressions are run with and without regional-specific linear trends.

7.1. Binary Model

In table 1 the regression results from the binary model are presented. No significant result is observed in columns 3, 4, 5, and 6, indicating that the control variables and DiD-estimators do not affect the outcome variables in this dataset. Across all regressions the coefficient on the variable of interest – DiD-estimator – has a negative, insignificant sign. As the p-value for the DiD-estimator in column 1 and 2 is rather low (0.204 and 0.196 respectively), it would be of interest to improve the statistical power of the test by expanding the sample size in order to obtain more precise results. Moreover, the confidence intervals of the DiD estimator indicate the expected size of the effect. With an increase in sample size, the range of the confidence interval should become narrower, while the limits of significance remain relatively unchanged (Lee, 2016). This implies that the estimated effects could become more reliable with a larger sample size and that one could expect to obtain more precision from higher level of disaggregation in the data in this study. Further, control variables for all regressions display a positive coefficient except for the regression in column 4. The control variable multiple birth obtains a negative, insignificant coefficient for BMI over 30. Nevertheless, the coefficient is highly insignificant and can therefore not be drawn any conclusions from.

For the dependent variable c-section in column 1, the covariate maternal age is statistically significant at the 5 % level. This implies that as the maternal age increases with one year, the probability of having a c-section increases by approximately 1.6 percentage points. Moreover, the control variable multiple birth is statistically significant at the 5 % level as well. The coefficient means that a one-percent increase in the share of multiple births is associated with an increase in the c-section rate of around 0.6 percentage points. Moreover, when including regional-specific linear trends, R^2 increased for all regressions, and marginally changed the outcomes.

Table 1. Regression results from the binary model specification.

	C-section		BMI > 30		Rupt. Deg. 3&4	
	(1)	(2)	(3)	(4)	(5)	(6)
DiD-estimator	-0.007 (0.204)	-0.008 (0.196)	-0.000 (0.968)	-0.002 (0.410)	-0.003 (0.407)	-0.001 (0.536)
Maternal age	0.016^{**} (0.043)	0.021^{***} (0.003)	0.007 (0.207)	0.004 (0.391)	0.002 (0.603)	0.003 (0.263)
Multiple Birth	0.006^{**} (0.027)	0.006^{*} (0.055)	0.000 (0.840)	-0.001 (0.747)	0.001 (0.544)	0.001 (0.522)
Constant	-0.317 (0.169)	-0.455^{**} (0.025)	-0.059 (0.714)	0.030 (0.833)	-0.026 (0.804)	-0.062 (0.444)
Baseline Value	0.166	0.166	0.147	0.147	0.031	0.031
Observations	231	231	231	231	231	231
R^2	0.883	0.811	0.937	0.928	0.623	0.533
Regional FE	Yes	Yes	Yes	Yes	Yes	Yes

Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Regional-specific linear trends	Yes	No	Yes	No	Yes	No

p-value in parentheses *** p<0.01, ** p<0.05, * p<0.1

7.2. Continuous Model

The regression results for the second specification are presented in table 4. The results in columns 4, 5, and 6 are consistent with those generated from the binary model. Moreover, when running the continuous model with c-section as dependent variable, including regional-specific linear trends, the DiD-estimator yields a negative, statistically significant coefficient at the 10 % level. The result indicates that when the budget expansion increases one percent, the risk of undergoing a c-section decreases by approximately 1.8 percentage points. This is equivalent to a 10.8 % decrease. When dropping the region-specific linear trends this significance disappears, however, these results are much more imprecise. As in the binary model, the control variables maternal age and multiple birth are statistically significant when c-section operates as the outcome variable, however at the 10 % and 5 % level respectively in column 1 in the continuous model.

For the outcome variable BMI over 30, the DiD-estimator does not really differ from the regression results generated by the binary model. Either way, the coefficient is highly insignificant and cannot be drawn any conclusions from based on its coefficient.

Table 2. Regression results from the continuous model specification.

	C-section		BMI > 30		Rupt. Deg. 3&4	
	(1)	(2)	(3)	(4)	(5)	(6)
DiD-estimator	-0.018*	-0.004	0.001	-0.003	-0.000	-0.003
	(0.062)	(0.654)	(0.900)	(0.488)	(0.988)	(0.401)
Maternal age	0.014*	0.020***	0.007	0.004	0.002	0.003
	(0.066)	(0.003)	(0.199)	(0.395)	(0.633)	(0.267)
Multiple Birth	0.006**	0.007*	0.000	-0.001	0.001	0.001
	(0.044)	(0.059)	(0.829)	(0.758)	(0.532)	(0.569)
Constant	-0.267	-0.443**	-0.061	0.032	-0.023	-0.061
	(0.240)	(0.028)	(0.706)	(0.819)	(0.829)	(0.450)
Baseline Value	0.166	0.166	0.147	0.147	0.031	0.031
Observations	231	231	231	231	231	231

R^2	0.884	0.806	0.937	0.928	0.621	0.533
Regional FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Regional-specific linear trends	Yes	No	Yes	No	Yes	No

p-value in parentheses *** p<0.01, ** p<0.05, * p<0.1

9. Robustness Checks

In order to account for the robustness of the results I estimate the standard DiD-regression, adding a one-period leading independent variable. Based on the results, no statistical significance is displayed (see *Appendix A.6*). This implies, that one-period future treatment exposures do not predict current outcomes.

Moreover, I examine the impacts of other interventions during the evaluated time-period. When estimating if the care program for pregnant women with overweight might be an outcome of the budget expansion, no significance appears (see *Appendix A.7*). Hence, the care program cannot be proven to be a confounding factor, i.e., a variable that influences both dependent and independent variables.

10. Discussion

In this study I examine if the female health intervention in 2015 affected pregnancy outcomes. More specifically, I analyze whether a budget expansion in female-related healthcare influenced c-section rates, preterm deliveries, maternal overweight, and severe vaginal ruptures. This is done by exploiting the fact that different regions in Sweden were affected to varying degrees by the budget expansion due to their previous spending on female-related healthcare. I use a DiD framework, estimating two models: one in which regions are divided into a treatment and control group, and one in which all regions are treated to varying intensities. The parallel trend assumption does not hold for preterm delivery and is therefore omitted from the regression analysis. My findings from the first specification did not exhibit any significant results from the variable of interest. My findings from the latter model however suggest that for regions which faced a larger budget expansion impact with respect to 2014, c-section rates decreased. The remaining dependent variables appear insignificant, implying that the intervention did not affect these outcomes.

The regression results should nonetheless be interpreted carefully. Firstly, the sample size used contains rather few observations, indicating that the statistical power might not be very high. Secondly, the parallel trend is roughly parallel for the outcome variable c-section, questioning how reliable the results are. Given the low power due to the level of aggregation of the data, I might be unable to detect violations of parallel trends in the pre-intervention period. Even though I perform several tests and graphical evidence to validate the parallel trends, these do not entirely prove that the assumption is not violated. Henceforth, one should not make too strong inferences from my results.

The DiD-estimator in the continuous model indicates that the c-section rate decreased after the female health intervention. As the model include all regions but treat them to different degrees in relation to their respective budget increase compared to 2014, the result imply that the female health intervention did improve maternal health outcomes for regions which in the pre-intervention period spent less on female-related healthcare. This result highlights the backside of a decentralized healthcare system and the inevitable problematic of unequal healthcare across regions. On the other hand, it also illustrates that even "small" budget expansions – as the size of the intervention corresponds to around 1- 5 % of the total yearly spending on female healthcare – may have effects. Though, one could then additionally argue that if the CG specified what the regions should specifically focus on – i.e., promoting a centralized system – this effect could be even greater. Presumably, this type of inequality is the reason for the new Patient Act introduced in 2015, which allows the patient to choose its own outpatient care facility (1177 Vårdguiden, 2015).

Additionally, it is important to recognize that the ideal is not a zero-rate in c-sections as the operation is ultimately used in order to reduce maternal and fetal complications of childbirth (Mogren, et al., 2018). A substantial part of the literature often uses the frequency of c-sections in order to estimate pregnancy outcomes, assuming that "a good result" is a declining rate of c-sections. However, avoiding c-sections and labeling them as "birth complications" may counteract the use of the actual operation and lead to birth complications instead of preventing them. Women under a body length of 155 centimeters for example, run a greater risk of undergoing c-section since short stature is associated with a number of adverse pregnancy outcomes (Mogren, et al., 2018). Hence, a scenario where one denies these women c-sections would be contradictive and possibly lead to an increased risk for birth complications. Thus, a decline in c-sections is not always the best outcome.

Moreover, it is not surprising that the outcome variable BMI over 30 suggestively stays unaffected by the health intervention. This is due to the fact that precautionary measures in order to decrease overweight in the event of a pregnancy, often fall short due to lack of initiative among the expectant parents. In a paper by Eurenius, et al. (2011) the authors let expectant parents who visited antenatal care between 2006 – 2007 self-rate their health. The authors find that the majority of the individuals positively exaggerated their health status and that few participants fulfilled national recommendations with respect to a health-enhancing lifestyle. Moreover, the control variable multiple birth exhibits insignificant signs on BMI over 30. This may be due to the fact that the maternal BMI is measured at the very beginning of the pregnancy. At that state, it may be too early to observe whether multiple birth influence overweight or not (Rask Röyter, 2021).

Furthermore, the insignificant results regarding vaginal rupture degrees may also be attributed to the sample's statistical power. However, it could also be the case that the variable's insignificant result reflects that it takes some time for the intervention to actually have a visible effect. When it comes to health interventions, educational traditions and spillover effects between experienced hospital personnel to less experienced personnel are crucial (Rask Röyter, 2021). Thus, in the event of new knowledge or routines there might be a time-lapse where the personnel learn to master and practice the new procedures, before they are actually implemented. Since the post-intervention period only contains data up to year 2019, it might be the case that the effect therefore is not yet observable. Hence, it is of interest to replicate this study in the future in order to allow for longer time-periods.

Presupposing that my results hold, the quality of Swedish female healthcare seem to differ across regions in terms of preventative care services for maternal health outcomes. However, since I estimate the difference in outcomes for regions that were spending less versus more before the intervention, it could be that the intervention improved outcomes for all regions but did so equally. Thus, to answer the title of this essay: it is ambiguous, but points in the direction that they probably do not, suggestively due to regional policymakers' prioritization of resources.

However, due to a small sample size and a limited time-period, more research on the effects of nationwide health interventions in a decentralized healthcare system is needed. In addition, I suggest future research to focus on the long-term effects of a decentralized healthcare system regarding pregnancy outcomes in order to account for time-lapses when the intervention is implemented.

11. Conclusion

This thesis evaluates effects on pregnancy outcomes of the female health intervention in 2015. Using a DiD-framework, I exploit the fact that Swedish regions were affected to different degrees by the budget expansion due to their previous spending on female-related healthcare. My findings suggest that regions which spent comparatively less on female healthcare experienced a relative decrease in c-sections as a result of being more intensively treated by the intervention. However, overall my results point in the direction that the health intervention did not affect maternal health outcomes. Due to low statistical power, one should not make too strong inferences from the results. Hence, future research regarding health interventions in a decentralized healthcare system is suggested in order to estimate the impacts over longer time-periods.

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Appendix

Appendix A.1: Distribution of Intervention

Distribution of Intervention (thousands of SEK)						
Region	**2015**	**2016**	**2017**	**2018**	**2019**	**Total**
Stockholm	45 100	113 147	179 446	377 960	332 021	1 047 673
Västra Götaland	33 486	83 664	132 231	277 157	242 177	768 715
Skåne	26 446	66 139	104 592	220 310	192 936	610 424
Östergötland	9 071	22 639	35 743	75 038	65 378	207 870
Uppsala	7 160	17 961	28 542	60 399	53 307	167 369
Jönköping	7 064	17 656	27 898	58 560	51 107	162 285
Halland	6 374	15 955	25 307	53 208	46 649	147 493
Örebro	5 912	14 786	23 313	48 979	42 811	135 801
Sörmland	5 759	14 396	22 753	47 781	41 741	132 430
Gävleborg	5 745	14 322	22 505	46 917	40 586	130 076
Dalarna	5 723	14 269	22 473	46 961	40 678	130 103
Värmland	5 636	14 013	22 053	46 020	39 869	127 592
Västmanland	5 370	13 427	21 156	44 465	38 799	123 217
Västerbotten	5 383	13 406	21 031	44 059	38 265	122 145
Norrbotten	5 129	12 714	19 834	41 267	35 480	114 425
Västernorrland	4 987	12 419	19 423	40 446	34 766	112 041
Kalmar	4 834	12 058	19 068	39 975	34 655	110 590
Kronoberg	3 881	9 712	15 368	32 385	28 312	89 658
Blekinge	3 163	7 922	12 514	26 193	22 618	72 410
Jämtland Härjedalen	2 601	6 470	10 167	21 309	18 453	59 000
Gotland	1 175	2 923	4 584	9 609	8 392	26 682

Appendix A.2: Regions with Care Program for Pregnant Women Suffering from Overweight

Regions with Care Program	**Year Implemented**
Stockholm	2015
Gotland	2015
Blekinge	2014
Skåne	2017
Örebro	2017
Jämtland Härjedalen	2017

Appendix A.3: Regions' Spending on Female-Related Healthcare

Regions' spending on female-related healthcare

The dataset "Net costs excl. pharmaceuticals in the benefit for regions by activity. Year 2009 – 2020" by SCB-D (2020), contains information of regions' spending on female-related healthcare within the primary care, maternity care, and public health. It also contains information of the region's spending on specialized care, however not on how much within this care that is related to female healthcare. Thus, in order to also account for female-related health care within the specialized care I gather additional information from the reports "DRG-statistics" by NBHW (2018).

The DRG-statistics contain information of Swedish healthcare production and consumption sorted by diagnostics and are based on information from NBHW's patient registry. The information in these reports *inter alia* contains how much of the specialized care that is dedicated to female-related issues (in percentage).

So, in order to isolate how much of the specialized care female-related healthcare make up for, I use the following formula:

$$(Region's\ total\ spending\ on\ specialized\ care) \times (percentage\ spent\ on\ female\ related\ issues)$$
$$= Region's\ spending\ on\ female\ related\ specialized\ care$$

The information on percentage spent on specialized female healthcare is not at a regional level, but instead an average. This implies that *all* regions are assumed to on average spend around 23 % on female-related healthcare within the specialized care. Moreover, these statistics only go back to year 2015. Thus, in order to get information on how much that was spent on female-healthcare previous years, I take the average spending for the years 2015 – 2019 (as the percentage spent is very stable over these years) and I apply it on the previous years. I then summarize each region's spending on female-related healthcare within each area to get each region's total spending on female-related healthcare.

Appendix A.4: Control and Treatment Groups

Control Regions	**Treatment Regions**
Blekinge	Dalarna
Gotland	Halland
Gävleborg	Jönköping
Jämtland Härjedalen	Kalmar

Kronoberg	Skåne
Norrbotten	Stockholm
Sörmland	Uppsala
Västerbotten	Värmland
Västernorrland	Västra Götaland
Västmanland	Örebro
	Östergötland
Σ=10	Σ=11

Appendix A.5: Covariate Balance Regression

Covariate Balance Regression, regional characteristics

	Maternal Age (1)	Multiple Birth (2)	Tot. Births (3)	Population Size (4)
DiD-estimator	0.016	-0.064	0.000	0.022
	(0.675)	(0.520)	(0.422)	(0.422)
Constant	29.326***	1.297***	0.003***	0.318***
	(0.000)	(0.000)	(0.000)	(0.000)
Observations	231	213	231	231
R^2	0.960	0.246	0.546	0.553
Regional FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
Regional-specific linear trends	No	No	No	No

p-value in parentheses *** p<0.01, ** p<0.05, * p<0.1

Appendix A.6: Leading DiD-estimator

One-period leading treatment variable

	C-section (1)	Preterm Delivery (2)	BMI > 30 (3)	Rupt. Deg. 3&4 (4)
1 lead DiD-estimator	0.003	-0.008	0.002	-0.001
	(0.574)	(0.397)	(0.570)	(0.526)
DiD-estimator	-0.008	-0.001	-0.001	-0.002
	(0.140)	(0.922)	(0.813)	(0.459)
Maternal age	0.016**	-0.010	0.007	0.002
	(0.047)	(0.469)	(0.180)	(0.618)
Multiple Birth	0.006**	-0.011	0.001	0.001
	(0.004)	(0.197)	(0.741)	(0.591)
Observations	230	212	230	230

R^2	0.882	0.829	0.937	0.624
Regional FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
Regional-specific linear trends	Yes	Yes	Yes	Yes

p-value in parentheses *** p<0.01, ** p<0.05, * p<0.1

Appendix A.7: Confounding factor, Care Program for Pregnant Women with Overweight Program Obesity as outcome variable

	Care Prog. Overweight	
	Binary Model	Continuous Model
DiD-estimator	0.055	0.018
	(0.571)	(0.945)
Maternal age	0.097	0.102
	(0.315)	(0.316)
Multiple Birth	0.067	0.065
	(0.285)	(0.302)
Constant	-3.047	-3.146
	(0.291)	(0.295)
Observations	231	212
R^2	0.817	0.816
Regional FE	Yes	Yes
Year FE	Yes	Yes
Regional-specific linear trends	Yes	Yes

p-value in parentheses *** p<0.01, ** p<0.05, * p<0.1