Increased supply of primary health care services

Did an increase in primary health care services in 2001 have an impact on maternal labour supply and child outcomes?

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Preface

I would like to thank my supervisor Rita Ginja for continuous guidance and help from start to finish. I would also like to thank Merete Thonstad at Statistics Norway for providing me with a dataset from The Brønnøysund Register Centre which sparked the start of this thesis. I would also like to thank my friends for support during the writing of my thesis as well as I want to thank them for many good experiences the past five years. I would like to especially thank my grandmother, Inga H. Andreassen, for proofreading. Finally, I would like to thank my family for supporting me through this process.

Abstract

In 2001 there was a significant increase in the amount of health stations for 0–5-year-olds in Norway with the opening of 85 new health stations. In the same year, the General Practitioner Scheme was induced which gave every citizen a right to have a general practitioner withing their municipality. This resulted in a shock in supply of primary health care services in Norway. Using the thesis question *Did an increase in primary health care services in 2001 have an impact on maternal labour supply and child outcomes?* I analyse the effects of this increase on maternal labour supply and child outcomes.

Using OLS regressions, I analysed whether maternal labour supply and child outcomes were affected by the increase of primary health care services by generating a treatment group for children born in the years after the increase. I then made regressions for the outcome variables maternal income for maternal labour supply and child school results for child outcomes in microdata.no. I then controlled the analysis for municipality level fixed effects right before the increase in primary health care services using STATA 17.0. When controlling for income before birth as well as municipality level characteristics right before the increase in primary health care services I found that the extent of the effect is inconclusive, however the analysis done in microdata indicates that there is some effect on maternal labour supply and child outcome due to the increase of primary health care services in 2001.

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1. Introduction

Primary health care services in Norway are important for both health care and preventative work for all citizens. Health stations for 0-5 years of age offer free help to both parents and children within their municipality, providing significant health care for new-borns and young children. Each citizen also has the right to a general practitioner (GP) in their municipality (Braut 2020). These two offers are two of the main sources for primary health care in Norway. Children are required by law to have access to health checks where both the parents and municipalities have an obligation for the health checks to take place (The Patient and User Rights Act 2001). All health stations offer 14 consultations for all children from 0-5 years old which involve a variety of health checks, vaccinations and discussions about diet, sleep, parental health etc. (The Norwegian Directorate of Health 2020). The use of health stations is free, but there is still an indirect cost through transportation and time spent. Easy access to health stations can therefore increase the use of them as the cost per visit would be less. For the distance to each health station to decrease for the whole population it would require the opening of more health stations. This happened in Norway in 2001.

In this thesis I will be looking at whether the increase of supply of primary health care services had an effect on maternal labour supply as well as if it has an impact on child outcomes. I will study maternal labour supply in the years after childbirth and will focus in particular on investigating whether primary health care services offered to new mothers and their children have the ability to reduce inequalities in labour market outcomes of mother and education of children of more and less disadvantaged families. To investigate this, I will be analysing the maternal labour income of different years as well as school results for children as a factor for child outcomes. Due to this aim, this paper will be based on the research question:

Did an increase in primary health care services in 2001 have an impact on maternal labour supply and child outcomes?

As mentioned, there was a spike in the opening of new health stations in Norway in 2001. 85 new health stations opened[1], indicating that the access to health stations for mothers giving birth after 2001 was significantly easier than before. In addition, the GP scheme was

[1] https://www.brreg.no/

introduced in 2001, giving all citizens in Norway the right to a general practitioner within their municipality (Ministry of Health and Care Services 2021). These changes combined gave a shock in the supply of health care in Norway, especially within the primary health care sector.

1.1 Policy relevance

Some health stations in Norway are about to be turned into "The family house" (Familiens hus) which will reduce the amount of health stations in Norway but increase the quality of each one by joining all health-related services in the same place. "The family house" will include child services, health stations for youths, the child- and family help, occupational- and physical therapy for children and youths as well as health station offers (Andre Myrlønn 2021).

This affects both smaller and larger municipalities. For example, in Bergen, the second largest city in Norway, there are currently seven health stations, but with the introduction of "The family house" the amount of health stations will be reduced to four (Andre Myrlønn 2021). In Bergen there is a health stations for almost every single district, however, with the introduction of "The family house", two and two districts are put together (and in one case three), meaning that the travelling distance for some people will increase significantly (Andre Myrlønn 2021). This will result in additional costs associated with health care such as time, bus fares, gas and time off work. The decreased accessibility of health care services could lead to postponing of consultations or in worst case, skipping of consultations which can increase the risk of medical issues of developmental delays going undetected.

If there is a positive impact by having an increase in health stations, it could be argued that a reduction of these again would be questionable. The aim of "The family house" is to create a "one door in" where its users only need to access one place for several services as well as assuring a closer cooperation between services to improve and make a more complete offer to its users (Andre Myrlønn 2021). Although this can lead to positive outcomes, it can be argued that the accessibility of health care services will become more difficult due to the increased distance to the nearest health care service centre.

1.2 Relevant research

There is a lot of research on topics regarding how health stations contribute to increase in vaccinations etc., but there is less research on whether health stations for 0-5 years have a

ripple effect by increasing mothers' participation in the workforce after giving birth or how it affects child outcomes. To my knowledge there has only been one study on this exact topic by Bütikofer et al. (2019) and the scarceness of this research apart from this paper is part of the motivation for this thesis. There is, however, research on how health stations can affect the outcome of children as well as how the quality of health stations can be affected by funding which will be discussed in this section.

Early life exposure to disease has been shown to have long term effects for adult health, education and labour market outcomes (Bütikofer, Løken et al. 2019). This means that primary health care services can be very important not only to an infant's health, but for the future of the infant and its impact on society. Bütikofer et al. (2019) found that an increased access to mother and child health care centers in the first year of life increased the completed years of schooling by 0.15 years and earnings by 2%. This paper shows that increased access to primary health care services has an effect on both income and school results which is part of what this thesis aims to measure. Bütikofer et al. (2019) also found that the effects of increased access to primary health care were stronger for the children from a low socioeconomic background and it contributed to a 10% reduction in the intergenerational percistence of educational attainment (Bütikofer, Løken et al. 2019). Health stations give information to parents about several child-related topics such as sleep, speech and breastfeeding at each consultation (see appendix table A1). Information about nutrition was found to be an important factor in improved health. This shows that the access of health stations not only has an effect through medical consultations of the infants, but also through conversations with support and information.

In Norway there is paid maternity leave and there were no changes in the duration of maternity leave nor parental leave between 1997 and 2004 (Halrynjo and Kitterød 2016), which is also the period studied here as it contains the years before and after 2001. Halrynjo and Kitterød (2016) state that the more Norwegian mothers work, the more positive they are towards a father's quota in parental leave. A father's quota is a part of the parental leave where only the father can take out the leave (Pedersen and Godal 2022). This indicates that working women in Norway are inclined towards working after giving birth. Halrynjo and Kitterød (2016) also state that with the majority of parents, the fathers use the father's quota, and the mothers use the rest of the parental leave. When the mothers stay at home with the children the longest it is likely that they are the ones attending most of the health station

consultations and thereby the ones that benefit the most from this support along with the children. It is then likely that if health stations influence parents going back to the workforce, the main effect would be on women.

The use of health stations in Norway has been used for research on child development. A study by Valla et al. (2015) showed how the use of health stations could help map how children have different development issues and what the trends were. They saw that in the first year of life the most common development issues were related to the gross motor area and premature infants and boys had the most development issues and should therefore be focused more on. They also found that children of mothers with depression symptoms or non-Scandinavian ethnicity also had developmental issues. Without early interference, these issues would not have been discovered as early, showing the importance of health stations from the early stages of life.

There has been developed a questionnaire that parents can answer at the health stations in Norway in order to map the child's development and whether it is delayed or not (Valla, Wentzel-Larsen et al. 2015). This questionnaire aims to attribute to the development of the research in the health stations on child outcomes. As well as studying the gross motor area, they also study language skills and cognitive abilities. This is an example of how programmes offered at different health stations can vary as training and funding affects whether parents are introduced to such questionnaires. Currently, the programme has successfully tracked children's development, but despite this it is not mandatory for health stations to carry out this questionnaire with their patients. Therefore, the funding of each health station can affect whether this method is induced.

In addition to health stations, there has also been research on the GP-scheme in Norway which was part of the increase in supply of primary health care services in 2001. Aakvik et. al (2010) found that 98% of the residual variation in the length of sickness absenteeism is attributed to individual factors rather than influenced by variation in general practitioner practice or differences in municipality-level characteristics. This is despite the fact that Norway has a high number of people on sickness benefits (Aakvik, Holmås et al. 2010). Their results indicate that the GP scheme has not had a negative impact on the amount of sick leave in Norway. One could argue that the easier access to a general practitioner would lead

to more people having easier access to sick leave, but this study has shown that this was not the case in Norway.

Although every municipality must provide its citizens with a general practitioner and a health station, the level of offers can vary between municipalities. Differences between large cities and other municipalities will therefore be analysed in this thesis. It has been found that patients with the lowest level of education are affected by the placement of their health services while patients with higher education have a negligible effect from it (Godøy and Huitfeldt 2020). Although some municipalities have a low number of health stations in relation to their population, these municipalities are usually denser and thus the travel distance to the nearest health station is not as far. However, other municipalities have many health stations in relation to their population size, but they are not as dense and thus the travel distance to the nearest health station can be significantly larger.

Although the research of Norwegian health stations is limited, there is significant research on how Medicaid in the United States, which increases the accessibility of health care, affects different factors which could have a similar result to an increase of the supply of health care services in Norway. For example, it has been found that expanded health insurance eligibility among women that were 15-44 years old resulted in a decrease in infant mortality of 8.5% thus the increase in health care had a significant effect on infant health (Currie and Gruber 1996). After low-income women who were not already connected to Medicaid in the 1980s got expanded access it has been found that health interventions experienced *in utero* at this time even had an effect on the next generation's health (East, Miller et al. 2022). It has also been found that a home visiting program in Denmark in 1937 led to long term health benefits such as enjoying higher age/specific survival rates during middle age (45-64), fewer hospital nights and less likelihood of being diagnosed with cardiovascular disease (Hjort, Sølvsten et al. 2017). This further supports the idea of primary health care having effects beyond infant health benefits.

In summary, despite the limited research on Norwegian health stations there is significant research on similar health care offers which supports the idea that an increase in health care leads to improved health which can further lead to an effect on maternal employment and child outcomes. In addition, the research that does exist about Norwegian health stations showed that increased access to primary health care had a positive effect on child outcomes in terms of an increase in income and years of schooling (Bütikofer, Løken et al. 2019).

2. Institutional background

Norwegian health care

The Norwegian health care system splits the responsibility of different sections of health care between the government (state) and the municipalities. The government is responsible for specialised health care through The Ministry of Health and Care Services, the education of health care workers and research within medicine and health. The government is also responsible for health policies through The Ministry of Health and Care Services and the Norwegian Directorate of Health (Braut 2019). The municipalities are required by the law of health and care services to manage their primary care services which include health stations, general practitioners as well as health-promotion and preventative work (Braut 2019). There are also private health services in Norway, but there are not many private health stations, and they are thus not regarded in this thesis. In 2018, the Confederation of Norwegian Enterprise found that 89% of municipality level health care services (which includes health stations) were public health care services (Østebø 2021), supporting the idea that the effect of private health stations is not high.

Brief history of health stations

Initially, health stations were founded in Norway as a measure to fight infant mortality in the 1890s. There were two stations provided in Norway before the health stations were founded. Those were child care centres that were provided by different religious groups and infant clinics provided by Norwegian Women's Public Health Association (Kjelvik 2007). In 1972 there were around 1400 health stations for 0-5 years in Norway, but only around 400 of them were publicly funded. Since then, 281 health stations from 0-5 years have opened in Norway, all government funded (Kjelvik 2007). Each municipality is required by law to have one health station (Regulations on the health station and school health service 2018), but the access of health stations varies between municipalities as some have more than others [2].

[2] https://www.brreg.no

During the 1980s and the 1990s, there was a significant decentralisation of health services in Norway (Braut 2019). The decentralization resulted in the municipalities being required by law to provide primary health care such as health stations, GPs, school health services etc. (Braut 2019). A report from The Norwegian Board of Health Supervision from 2014 found that that a lack of staff has a negative impact on the work of the health stations. It has resulted in skipping research programmes as well as staff not having sufficient competence for their tasks (Norwegian Board of Health Supervision 2014). This shows that not only the presence of health stations is important, but the funding of each health station as well.

Health stations 0-5 years

Health stations in Norway are important for healthcare and preventative work. Health stations for 0-5 years of age offer free help to both parents and children within their municipality from birth up until starting primary school (The Norwegian Directorate of Health 2020). Children are required by law to have access to health checks, where both parents and the municipalities have different responsibilities when it comes to giving children the access to these health checks. (The Patient and User Rights Act 2001). All health stations offer 14 consultations for all children at the ages 0-5 which involve a variety of health checks, vaccinations and discussions about diet, sleep, parental health etc (The Norwegian Directorate of Health 2020). For overview of the contents of these consultations see appendix table A1. It is mandatory for each health station to offer these 14 consultations (The Norwegian Directorate of Health 2020).

It is mandatory for every municipality in Norway to provide health stations for 0-5 years for children and mothers (Regulations on the health station and school health service 2018). It is mandatory through the Patient and User Rights Act for parents to provide their children with health checks, but it is not mandatory to have all the health checks at a health station as they can use their general practitioner (The Patient and User Rights Act 2001). In the health stations, the children and mothers are considered patients and the fathers are considered next of kin. The consultations are free, and the health stations offer help from doctors, nurses and physiotherapists. The health stations offer help from psychologists as well, but these consultations are not a part of the fixed programme at the health stations. It is also possible for parents to go to the health stations outside of the consultations and it is supposed to be a low threshold offer for its patients (The Norwegian Directorate of Health 2020).

Health stations have a fundamental part in health-promoting work for children as well as strengthening parents in their parental roles (Norwegian Board of Health Supervision 2014). The Norwegian board of Health Supervision (2014) states that there has been a lower amount of care takeovers in municipalities where the health stations function correctly. This is an indication of how health stations not only help children, but also affect the parenting and actions of the parents. However, they also state that there has been a significant lack in training of staff, and that lack of staff increases the risk of defective care. The risks related to lack of training and staff illustrates the importance of funding of health stations. The risks of defective care also include flawed medical journaling and cuts in programmes offered.

Amount of staff etc.

Small and decentralised municipalities have more staff per citizen and spend more money per citizen than the larger municipalities (Kjelvik 2007). In 2020 there were 1605 employees divided by sub-services and share distribution in health stations for 0-5 years which accounts for 31,6% of employees in health stations in Norway (The Norwegian Directorate of Health 2022). The majority of the employees are health nurses and in 2016 health nurses were 60,4% of the employees while 12,7% were other health personnel and 6,4% were doctors (Haugan and Hartvedt 2016). At this time there were 1860 employees (man-years) in the health stations for 0-5 years in Norway (Haugan and Hartvedt 2016).

Women's participation in the workforce in Norway

As maternal labour supply is analysed in this thesis, a graph for women’s participation in the workforce in Norway has been included in order to illustrate the labour market situation in Norway around the time of the analysis.

Figure 1

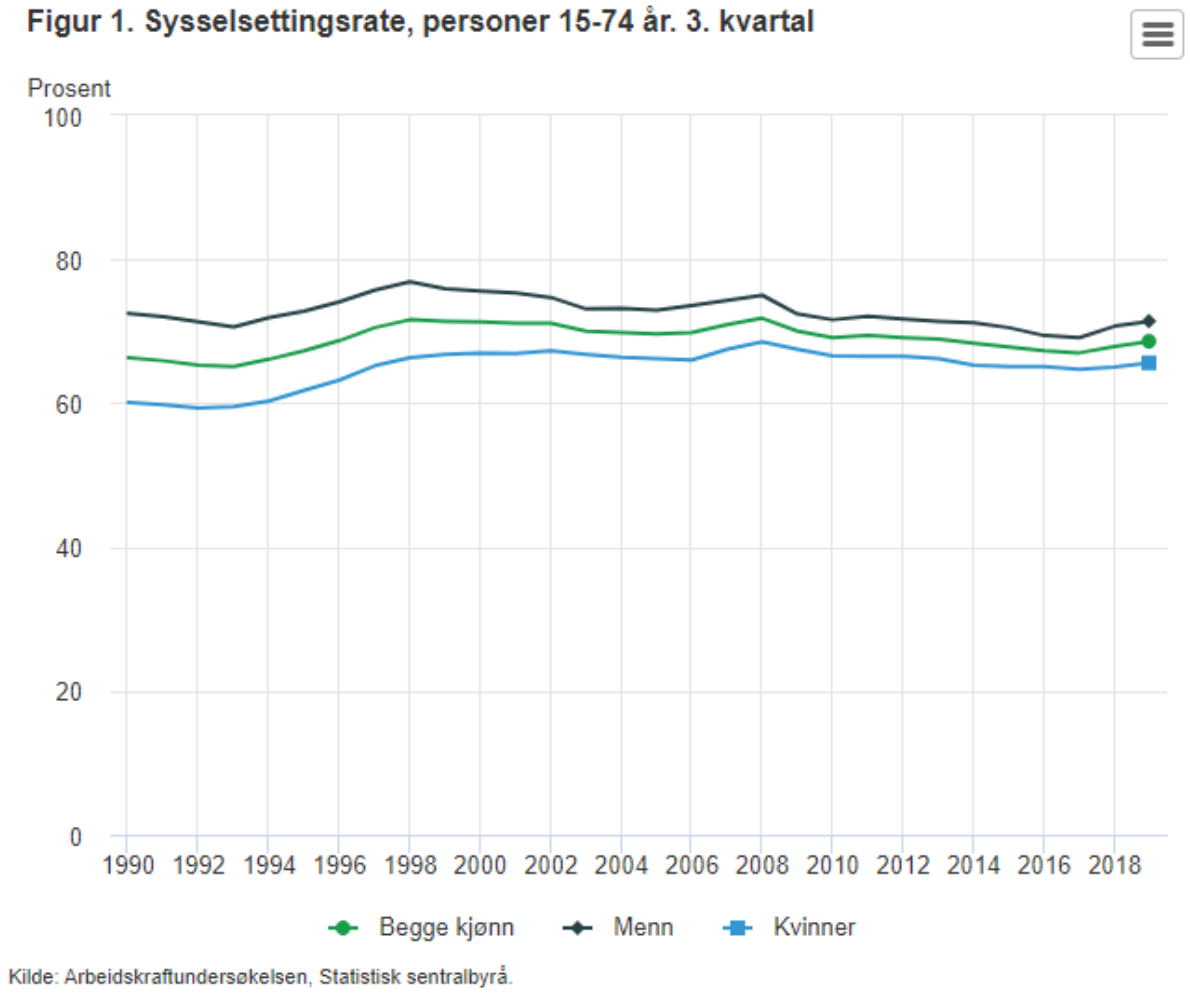

Figure 1: Employment rate of people 15-74 years old. Green is both genders, black is men and blue is women. Collected from SSB (Lien 2019).

Figure 1 is collected from SSBs labour force survey and depicts the employment rate of both genders from 1990 to 2019 (Lien 2019). As seen in the graph, the employment rate of women in the analysis (2002-2004) is fairly similar. There is, however, a slight increase later in 2008 followed by a decrease until around 2017. Overall, the trend of women's participation in the workforce is positive over time, but with a few exceptions.

The increase of health stations in 2001

As mentioned in the introduction, there was a significant increase in the amount of health stations in Norway in 2001. Given by a dataset from The Brønnøysund Register Centre about

health stations for 0-5 years I found that a total of 85 health stations opened in 2001[3]. This increase is the basis of the analysis in this thesis where I investigate if this increase in supply of health stations has had an impact in terms of women's participation in the workforce after giving birth as well as an impact on child outcomes.

There was also an increase of health stations in 2004. Although this increase is not included in the analysis it can potentially have been an additional contributor to the results as it can have had an effect on children born in 2004 which are included in the analysis. There was limited data on the closing of health stations, and I have therefore made the assumption that the closing of health stations has not been significant during the years in the analysis.

Figure 2

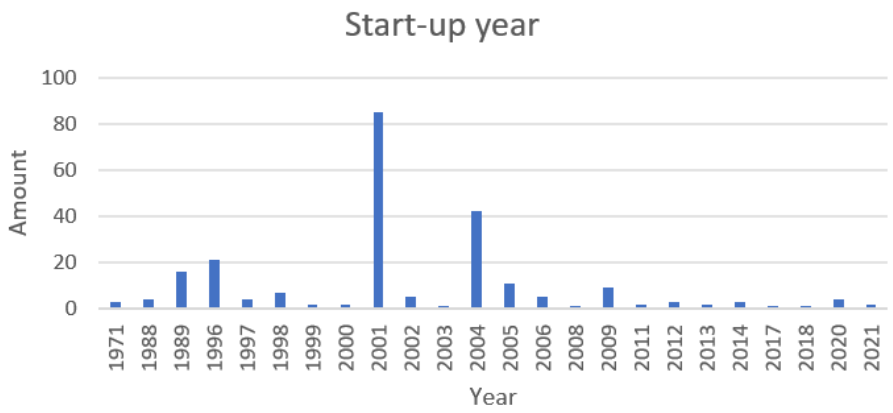

Figure 2: Start-up year of each health station for 0-5 years.

Due to the increase in health stations in 2001 which is illustrated in figure 2, I should ideally have analysed children born right before and right after the openings of the health stations. However, due to lack of data I will be analysing the children born between 2002-2004 as a treatment group as they were born after the policy changes took place. This will then be controlled by municipality level characteristics in Norway (in 2000) before the opening of the health stations. The amount of child births decreased by 8847 in the period 2002-2004 (166 231) in comparison to the period before the opening of the health stations in 1997-1999 (175 078) (Statistics Norway 2022). This means that along with there being more available health stations per new-born child, the ratio between health stations and new-borns increased further

[3] https://www.brreg.no

due to fewer childbirths. The numbers are the number of childbirths and not the number of children born, thus some births are twin births or more though the amount of twin births in the two time periods do not vary significantly.

Other primary health care services

The GP scheme was introduced in 2001 giving all citizens of Norwegian municipalities the right to a general practitioner (Ministry of Health and Care Services 2021). The aim of the GP scheme is to ensure that all citizens have the necessary general practitioner services of good quality at the right time, and that people living in Norway get a fixed general practitioner to relate to (Regulations on GP schemes in the municipalities 2012). The aim is also to ensure greater safety and satisfaction with a stable patient-doctor relationship (Braut 2020). This improvement in Norwegian health care may have had a further impact on mothers giving birth after 2001 as well as their children's outcome. The induction of the GP scheme did not change the role of health stations as the health checks for infants/children and mothers remain practised at the health stations for 0-5 years. However, the overall access to health care increased in 2001 due to this combination of new health stations opening as well as the GP scheme thus there was an increase in the supply of health care after 2001.

A general practitioner can function as both an advocate for its patient's health as well as a gatekeeper for further reference to specialists. The legal definition of a general practitioner in Norway is a doctor that enters into an agreement with a municipality about participation in the GP scheme, independent of whether the doctor is employed in the municipality or is self-employed (Regulations on GP schemes in the municipalities 2012). The operations of the GP scheme work on a municipality level where each municipality is required to offer a general practitioner to all its citizens (Ministry of Health and Care Services 2021).

The general practitioner should, if needed, refer its patients to the specialist health service and to other municipality level health- and care facilities (Regulations on GP schemes in the municipalities 2012). In this way, the general practitioner works as a gatekeeper to other health care options for its patients. The law states that a general practitioner's referrals to the specialist health services should support professionally correct divisions of task and good interaction between the treatment levels in line with law, regulations and local cooperation agreements (Regulations on GP schemes in the municipalities 2012). General practitioners

sort patients to their necessary treatment by referring them to specialists and exclude patients from referrals if they do not require further treatment.

The Patient and User Rights Act

The Patient and User Rights Act was induced in 2001 and among other patient related rights states that children have the right to health consultations. The municipalities are responsible for providing the possibility for the consultations, but the parents are obliged to participate in making their child have health consultations. The consultations at health stations for 0-5 years are not mandatory to participate in, however, as it is the parents' duty to ensure that the child participates in health consultations, the parents are required to utilise other options for health consultations such as general practitioners (Regulations on GP schemes in the municipalities 2012).

The role of GPs in health stations

As mentioned, The Patient and User Rights Act ensures that children receive medical health checks. The fact that the use of health stations is volunteer means that health stations and general practitioners can cooperate with following through the required medical checks. The health services can thereby, to a certain extent, be overlapping services. Even referrals to specialists can be given through the health stations. The choice of which offer to use depends on the parent's personal preferences. Some people might already have a close relationship with their general practitioner and therefore choose to continue the majority of their health checks with them. However, in 2005 it was found that the majority of parents prefer doing the health checks at the health stations as they valued the contact with health nurses and other parents (Seierstad and Straand 2005).

3. Dataset

3.1 Microdata

The analytical tool used in this thesis is Microdata (microdata.no). It is an analytical tool for statistical analysis which was launched by Statistics Norway in March 2018 (Microdata). It contains various variables from the Norwegian population that are collected by Statistics Norway and other sources. Research institutions, ministries and directorates can apply for access and then further register their participants. What separates microdata from other data sources is that microdata does not require formal applications for pre-accepted research nor

applications for use of specific variables. Microdata has legal basis to treat personal information with legal basis in The Privacy Act (Microdata). In order to maintain rights to privacy, microdata only offers access to metadata while individual data stays hidden in order to anonymize (Microdata). It is not possible to import other data into microdata and thus the main analysis in this thesis contains only data given directly from microdata. However, in the validity of empirical strategy chapter, STATA 17 has been used to analyse municipality level characteristics using data from The Brønnøysund Register Centre and The Municipal Database. Excel was used to transport the data from The Brønnøysund Register Centre and the data from the Municipal Database to STATA 17. Excel was also used to create figure two and three.

3.2 Database

Microdata currently contains 379 variables with the earliest dating from 1900 and the latest 2022. The data registers are from the population register, national education database (NUDB), income- and tax data, labour market data and the progress database FD-trygd amongst others.

3.3 Dataset

The dataset is collected through SSBs database in microdata. The data is register data, meaning that it is a population sample that should be representative for the Norwegian population. The variables related to education are collected from the national education database. In order to compare results after the increase in primary health care services in 2001 occurred, a treatment group was generated. I wanted to analyse for children born just before and right after 2001 in order to make the analysis as accurate as possible. However, due to sample size and uncertainty around the exact time of implementations in 2001, I adjusted the focus group slightly. Therefore, when analysing maternal labour supply and outcome of children, the treatment group was children born in 2002-2004 and their mothers. The dependent variables in the analysis are income for maternal employment and school results for child outcomes.

3.4 Descriptive statistics

The main variables for the analysis are explained in this section. Variables for interaction effects are explained in empirical strategy.

3.5 Maternal variables

There are several factors that influence a mother's decision to work after giving birth and their children's outcomes. In this analysis, I have incorporated three variables with maternal characteristics that can influence maternal employment and child outcomes. These are independent variables.

Mother with higher education

A variable for mothers with higher education was generated to control for whether resourceful mothers have had a different effect of the increase of health stations. For instance, the children of parents without higher education tend to have poorer results at school (Norwegian Institute of Public Health 2020). A study published in 2020 by The Norwegian Institute of Public Health found that among children whose parents did not have further education than middle school, there were 30 out of 100 had difficulties with reading and maths. To the contrary, among children whose parents had higher education, 10 out of 100 had the same difficulties (Norwegian Institute of Public Health 2020). Due to differences such as these, a dummy variable to analyse for mothers with higher education was generated where if the dummy=1, the mother had higher education. The definition of mothers with higher education in the analysis was defined by mothers making between 600 000 NOK and 900 000 NOK per year. Although some mothers without higher education can make this amount as well as mothers with higher education can make less, it is the most representative wage level and thus was chosen as the definition of the variable.

Foreign mother

In 2009, the middle school grade point average (GPA) for Norwegian-born children was 38,1 and the GPA of all students in total was 39.5 while the GPA of foreign children was 34,4 (Steinkellner 2017). National exams in 2016 showed that children of immigrants and immigrant children scored lower in national exams in maths and reading, while they scored higher in English compared to the average results (Steinkellner 2017). Given differences such

as these, a dummy variable for foreign mothers was generated where if the dummy=1 the child has a foreign mother. Thereby, the differences between foreign mothers and Norwegian mothers can be analysed. In the analysis, foreign mothers are defined as all mothers that are not Norwegian-born with Norwegian parents. This includes mothers with one or more foreign-born parents as well as foreign-born mothers with one or more Norwegian-born parents.

Table 1

- *Distribution of immigrant categories in microdata*

	Percentage
Immigrants	0.73%
Norwegian-born with immigrant parents	7.54%
Foreign-born with one Norwegian-born parent	0.09%
Norwegian-born with one foreign-born parent	9.51%
Foreign-born with two Norwegian-born parents	0.06%
Norwegian-born with two Norwegian-born parents	82.06%

Table 1: Distribution of immigrant categories in dataset.

Table 2

- *Percentage of two maternal variables*

Variable	**Percentage**	**Standard deviation**	**N**
Mother with higher education	21.89%	0.410032	289 384
Foreign mother	17.37%	0.378883	303 062

Table 2: Percentage of mothers with higher education and percentage of foreign mothers.

The percentage of mothers with higher education in the dataset used is 21.89% while the percentage of foreign mothers is 17.37%. The number of observations for both variables is high.

Single mother

Children of single mothers in Norway have not had lower grade point averages. However, when separating for young single mothers, the children have had poorer results. Older single mothers are much more likely to become single following a divorce (Løken, Lommerud et al. 2014). This means that older single mothers are not as likely to be single when giving birth. Given this, a dummy variable for children who had mothers that were single at birth was generated where if the dummy=1 the mother is single at birth. This was generated in order to separate for primarily younger mothers where child outcomes are more affected.

3.6 Education variables

The availability of variables for outcomes of children is limited in microdata. Therefore, I have only included variables on school results as these were the most representative variables for outcomes of children, given the variable options. The main variable in this section is grades which is the dependent variables for the outcome of children.

Grades

The variable grades is the middle school GPA which is the total amount of grade points after completing middle school. This means the sum of grades for 11 subjects for students that are, on average, 15 years of age. The grading scale is from 1-6 and thus 11 is the lowest score and 66 is the highest. Grades is the dependent variable for the analysis of child outcomes.

National exams

National exams are national standardised tests given in 5th grade. The national exams are split into three exams: English, maths and reading. The variables have a scale to illustrate the skills and results for each year where the average is 50 and the standard deviation is 10. The number of points as well as the level of difficulty will vary from year to year and it has thus been introduced a common scale to describe the students' skills with the same number each year despite the fact that the results are from different types of tests. An Item Response Theory model has been used to generate these results in the common scales (Microdata 2022). The national exams were introduced in 2004 (Seland, Vibe et al. 2013) which means

that all children in the analysis have participated in the national exams.

Table 3

Variable	Mean	Standard deviation	N
Grades	42.4	8.168119	323 476
National exams in reading	50.161	9.537765	52 011
National exams in English	48.819	9.74903	52 664
National exams in math	49.491	9.743457	53 055

Table 3: Mean results of education variables

The mean middle school GPA is 42.4 with a standard deviation of 8.168119. The mean for national exams is between 48-50 with standard deviations between 9.54-9.75. The number of observations for all the education variables is high, but the number of observations for grades is significantly higher than national exams. Due to the differences in number of observations, the variable for grades was kept for the main results while the results of the analysis for national exams are in appendix table A.9 and A.10.

3.7 City variable

Born in big city

The city a child is born in will affect its outcomes. It is more common for women to work in larger cities as they have an easier time finding work. This trend can be found with men as well, but it is more significant for women (Wessel and Turner 2020). This means that the analysis can vary between larger and smaller municipalities. As there are several differences between larger and smaller municipalities in Norway, a dummy variable for being born in a big city was generated where if dummy=1 the child was born in a big city. This variable included the four most populated municipalities in Norway: Oslo, Bergen, Trondheim and Stavanger. Oslo and Bergen did not open new health stations in 2001, however the GP-scheme impacted primary health care in Norway on a national level and thus the variable is

still relevant for the analysis. The number of observations for each municipality is significant, however, for other variables in the analysis there have been a higher number of observations.

3.8 Income variables

In order to look at maternal employment, variables connected to income were incorporated in the analysis. The income variable used in microdata is for work income and includes the sum of salary income and net business income. Sickness benefits and maternity benefits are also included in the variable (Mircodata). Maternal income is the dependent variable for the analysis of maternal labour supply.

Example of maternal work income

The table below includes the work income of mothers in 2004.

Table 4

Work income of mothers in year:	**Mean**	**Standard deviation**	**N**
2004	211 948	122 443.9	259 945

Table 4: Work income of mothers that gave birth in 2004.

The mean income in 2004 was 211 948 with a standard deviation of 122 443.9. The number of observations is very high with N=259 945.

Maternal work income at different ages

In order to relate child outcomes to maternal employment, a variable for maternal income at different ages of the child was generated.

Figure 3

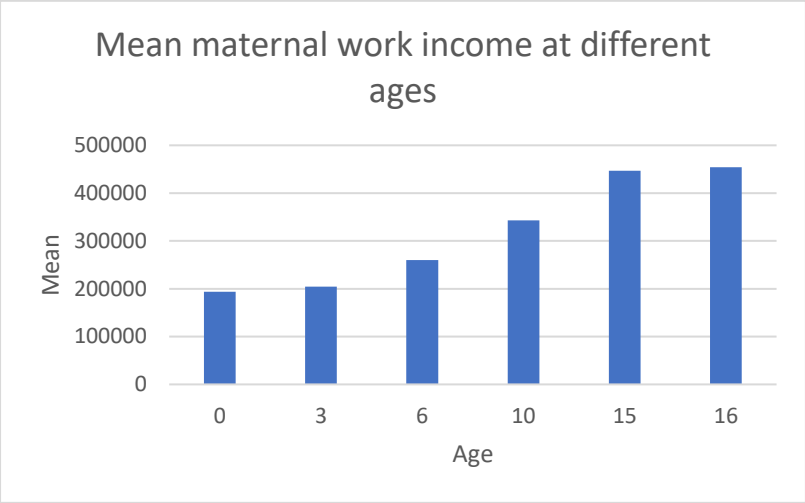

Figure 3: Mean maternal income at different ages

The work income of the mother is given for the same year as the child's age for six different ages. For age zero for a child born in 2002, the maternal income in 2002 is used etc. This has been done for all the years of birth in the analysis for each age group. The number of observations for each age is almost constant up until age 16. Figure 3 shows that the mean maternal income increases as the child gets older. This is in line with regular wage increases people experience in the work force. Women often experience a child penalty in terms of a pay gap after having children relatively to men (Sieppi and Pehkonen 2019). This could explain why the salary development has stagnated over time.

4. Empirical strategy

The increase of health stations and the introduction of the GP-scheme generated a shock in the supply of health services, primarily in primary health care services. The analysis of this thesis is therefore based on a joint supply test. The hypothesis is that there occurred a joint supply effect in which the increase in health services affected women's participation in the workforce after giving birth as well as having an effect on child outcomes.

4.1 Assumptions

For the empirical strategy I have made some assumptions for the analysis. I assume that the increase of health stations increases the demand for health station services, although it may

not have increased equally for all municipalities. Meaning that I assume that mothers that gave birth after 2001 used health stations to a greater extent than mothers that gave birth before 2001 due to the increased access of health stations in 2001. I also assume that the increase of health stations increased the "easy access" to health stations, meaning that the increase of health stations increased the geographical spread of health stations thus making them accessible to more people. Similarly, I assume that the introduction of the GP scheme increased the use of general practitioners due to the increased access to them. Meanwhile I have assumed that the closing of health stations was not significant during the time period of the analysis, due to lack of data on the topic. Given that microdata uses register data, a population size that should represent the population size, I assume that the data given is a realistic representation of the Norwegian population. Some Norwegian municipalities have been merged since 2001. This paper analyses the current municipalities. The merged municipalities that opened health stations in 2001 can be found in appendix.

4.2 Analysis

The analysis is split into two parts, maternal employment and child outcomes. I will be analysing how maternal income, and thus employment, is affected by the increase in health stations and the induction of the GP scheme in 2001. Then I will be analysing the effect on child outcomes through middle school results for children born in 2002-2004 as they are the children born right after the reforms. The analysis is thus based on how health stations can affect child outcomes and not whether maternal employment has an effect on child outcomes. There are several other factors that affect both maternal employment and child outcomes, but this analysis narrows it down to an effect given by the increase in health stations in 2001 and the induction of the GP scheme, thus making the strong assumption that the results given in the analysis are primarily a result of the increase in health stations and the induction of the GP scheme given the robustness checks included. However, the analysis is then controlled for municipality level fixed effects in 2000 as well as maternal income before birth.

4.3 Empirical model

I am interested in understanding how the supply of primary health care has impacted maternal labour supply and child outcomes. In order to investigate this, I have chosen maternal income as the outcome variable for maternal labour supply and grades as the outcome variable for child outcomes. The main independent variable is the treatment group.

Treatment group

A treatment group was generated by creating a dummy variable for all people in the dataset with date of birth from 2002 to 2004. This is the treatment group in the analysis because these are the children that were first affected by the increase of supply of health services in 2001. Ideally, I would analyse the children born right after the opening of the health stations, but the children born in 2001 were excluded from the treatment group because the opening dates of the health stations varied during the year and thus the effect of the increase in health care varied more between municipalities in 2001 than 2002-2004. In order to get more accurate results, 2001 was therefore excluded from the treatment group. Then the treatment group was used as the main independent variable in the OLS regressions.

Ordinary Least Squares (OLS)

I use OLS to find how much variation in maternal income and child outcomes can be explained by being born in the years shortly after 2001. A premise for using this method is that the key assumptions for OLS regressions, Gauss-Markov assumptions, are valid in the situation studied. This means that the following assumptions are made[4]:

1. The linear regression model is linear in parameters. This means that each parameter in the analysis is multiplied by the independent variable which is the treatment group or one of the control variables which are having a foreign mother, single mother, mother with higher education, male and adjusted for birth municipality. The regression function is then a sum of these parameters times variables which gives the results for the dependent variables which are maternal income and grades.

2. There is a random sample of observations of size n. This assumption is ensured by microdata and thus it can be assumed that the variables used in the analysis come from a random sample of observations.

3. The conditional mean of the error term should be zero. This means that no matter the value of the treatment group or the control variables, the error term in the regression should show no systematic pattern and have a mean equal to zero.

[4] Basis of assumptions collected from Woodlridge (2016)

4. There is no multi-collinearity or perfect collinearity. Thereby none of the independent variables are correlated. There is also not an exact 1:1 correspondence between two of the independent variables in the model. The sample outcomes on the independent variables are thus not all the same.

5. Spherical errors: There is homoscedasticity and no autocorrelation. The error terms in each regression should therefore have the same variance. Error terms of different observations should not be correlated with each other.

OLS regressions are linear regression models that illustrate the relationship between a dependent variable and independent variables. The model aims to minimise the predicted error between the predicted values and the real values (Wooldridge 2016). The sum of squared errors is used instead of the sum of errors because some errors are negative and could thus make the sum of errors equal to zero when the sums are in reality greater than zero (Wooldridge 2016). This model aims to find the relationship between being born in the treatment group (2002-2004) which is the independent variable and the dependent variables grades and maternal income. There is a basic OLS regression made for school results which is grades. Further, there are six different OLS regressions made for maternal income which are regressions for maternal income at ages 0, 3, 6, 10, 15 and 16.

The formula for a basic OLS regression in the analysis where I want to find the effect that being born in the treatment group has on grades is[5]:

$$Y_{grades} = \beta_0 + \beta_{treat}X_{treat} + \beta_{city}X_{city} + \beta_{foreign}X_{foreign} + \beta_{edu}X_{edu} + \beta_{single}X_{single} + \beta_{male}X_{male} + \beta_{birthmun}X_{birthmun} + \varepsilon$$

Where:

Y_{grades} – predicted value of grades

β_0 – variation in grades when effect of treatment group and control variables are equal to zero

β_{treat} – regression coefficient for the independent variable treatment group

X_{treat} – treatment group

β_{city} – regression coefficient for the control variable: being born in a big city

X_{city} – born in a big city

[5] Regression model based on basic regression model from Wooldridge (2016)

$\beta_{foreign}$ – regression coefficient for the control variable: having a foreign mother

$X_{foreign}$ – having a foreign mother

β_{edu} – regression coefficient for the control variable: having a mother with higher education

X_{edu} – mother with higher education

β_{single} – regression coefficient for the control variable: having a single mother at birth

X_{single} – single mother at birth

β_{male} – regression coefficient for the control variable: male

X_{male} – male

$\beta_{birthmun}$ – regression coefficient for the control variable: birth municipality

$X_{birthmun}$ – birth municipality

ε – random error

The regression above is an OLS regression for middle school GPA which is regresses for being in the treatment group. The regression is then controlled for having a mother with higher education, a single mother, child being male and being born in a big city. The regressions are then controlled for by municipality of birth by automizing a set of dummy variables for each municipality where the lowest value is used as reference value. Then I can measure each municipality's effect compared to its reference value. The reference value automatically becomes the lowest value in microdata.

I want to find a value for β_{treat} which is the regression coefficient for being born in the treatment group. By making a regression using the model above, a coefficient for β_{treat} will be given, which gives an indication of the effect of being born in the treatment group. Further, the regression is then made for maternal income at different ages where the aim is again to find a value for β_{treat} in each regression.

This model is used to analyse how much of the variation in the dependent variables can be explained by being born in the treatment group, thus illustrating how being born in a time with greater primary health care offers can affect child outcomes and maternal labour supply. When running the regressions in microdata, a coefficient for each variable is given which explains to what extent the maternal income and school results have been affected by being born in the treatment group.

Interaction effect

After making OLS regressions for both maternal income and school results, I wish to investigate if the change in being in the treatment group has an additional effect by other variables. An interaction effect occurs when the effect of an independent variable on the dependent variable changes depending on the value of one or more independent variables, meaning that the partial effect of one explanatory variable depends on the value of a different explanatory variable (Wooldridge 2016). For example, the effect of being born in the treatment group on child outcomes and maternal labour supply can have a further effect if the child was also born in a big city. Due to this, regressions with interaction variables for some characteristics were added to the analysis.

A model for an interaction effect between the dependent variable grades and two independent variables (treatment group and being born in a big city) is illustrated by the following equation[6]:

$$Y_{grades} = \beta_0 + \beta_{treat}X_{treat} + \beta_{city}X_{city} + \beta_{treat*city}X_{treat}X_{city} + +\beta_{foreign}X_{foreign} + \beta_{edu}X_{edu} + \beta_{single}X_{single} + \beta_{male}X_{male} + \beta_{birthmun}X_{birthmun} + \varepsilon$$

Where:

Y_{grades} – Predicted value of grades

β_0 – variation in grades when effect of treatment group and control variables are equal to zero

β_{treat} – regression coefficient for the independent variable treatment group

X_{treat} – treatment group

β_{city} – regression coefficient for the control variable: being born in a big city

X_{city} – born in a big city

$\beta_{treat*city}$ – regression coefficient for the interaction variable between being born in the treatment group and being born in a big city

$X_{treat}X_{city}$ – Interaction term: Being born in a big city while in the treatment group

$\beta_{foreign}$ – regression coefficient for the control variable: having a foreign mother

$X_{foreign}$ – having a foreign mother

β_{edu} – regression coefficient for the control variable: having a mother with higher education

[6] Regression model with interaction effects based on regression model with interaction effects from Wooldridge (2016)

X_{edu} – mother with higher education

β_{single} – regression coefficient for the control variable: having a single mother at birth

X_{single} – single mother at birth

β_{male} – regression coefficient for the control variable: male

X_{male} – male

$\beta_{birthmun}$ – regression coefficient for the control variable: birth municipality

$X_{birthmun}$ – birth municipality

ε – random error

An interaction term is an independent variable in a regression ($X_{treat}X_{city}$) that is the product of two explanatory variables (X_{treat} and X_{city}) (Wooldridge 2016). The main results come from finding a coefficient for $\beta_{treat*city}$ which is the regression coefficient for the interaction term $X_{treat}X_{city}$. This means that it is the regression coefficient for the interaction effect between being born in the treatment group and being born in a big city. $\beta_{treat*city}$ thus illustrates the additional effect of being born in a big city on grades when it is given that the child is born in the treatment group. This is then repeated for treatment coefficients between the treatment group and having a mother with higher education, a single mother and a foreign mother.

Dummy variables

In order to make the regressions in the model, a variety of dummy variables were generated. A dummy variable is a variable that takes in the value zero or one (Wooldridge 2016). The aim of the dummy variables is to sort each person into their respective categories in order to control for different characteristics in the analysis. A dummy variable for the treatment group was generated in order to place the children born in 2002-2004 into one variable. Further, dummy variables were generated for control variables in order to control the regressions for other variables having an effect on maternal employment and child outcomes further than the child being born in the treatment group. Dummy variables were created for the following:

- Being born in the treatment group
- Being male
- Having a mother with higher education
- Having a single mother at birth

- Having a foreign mother
- Being born in a big city

An example of the dummy variable for having a foreign mother which was generated to control for the variation in results that could occur by having a foreign mother has the following equation:

Average grade rate for a child with a foreign mother[7] (dummy=1):

$$\overline{grades}_{fm} = \beta_0 + \beta_1 treat_i + \beta_2 + \beta_3 treat_i + \varepsilon = \beta_0 + \beta_2 + (\beta_1 + \beta_3) treat_i + \varepsilon$$

Where $treat_i$ = treatment group, here X_2 which is the coefficient for having a foreign mother is equal to one.

Average grade rate for a child with a Norwegian mother (dummy=0):

$$\overline{grades}_{fm} = \beta_0 + \beta_1 treat_i$$

Where X_1 = treatment group and $X_2 = 0$ (as the child does not have a foreign mother)

β_2 thereby illustrates the partial effect of having a foreign mother on a child's GPA if the treatment group did not have an effect.

Or:

When holding all other variables fixed, the partial effect of foreign mothers on grades is

$$\frac{\Delta grades}{\Delta foreign\ mother} = \beta_2 + \beta_3 treat$$

The effect has been boosted by a level of β_3 for the ones in the treatment group relative to those who are not. If $\beta_3 > 0$ then having a foreign mother yields a higher GPA for the treatment group. If the mother is not foreign (dummy=0), the effect is nulled out and thus not a part of the regression.

[7] Basis of dummy variable model collected from Wooldridge (2016)

4.4 Robustness checks

With the regressions used, the command cluster was not possible to incorporate in microdata. Cluster estimation is used when there is reasonable suspicion that there are systemic dependencies within groups of observations (Wooldridge 2016) such as municipalities. This would be accurate for this analysis in terms of clustering for each municipality, however, it was not possible to convert the variable for municipality of birth and thus it was not possible to cluster it. I, therefore, as mentioned, atomized dummy variables for each municipality. In addition, I used the command robust instead of cluster and thus was able to control for heteroskedasticity. Further robustness checks with controlling for municipality level characteristics can be found in the chapter validity of empirical approach.

5. Results

In this chapter the results of the analysis will be presented. The results in this thesis aim to estimate if the increase in health stations in 2001 had an impact women's participation in the workforce after childbirth and if it had an impact on child outcomes given the restraints of the analysis.

5.1 Main results

Main results for maternal employment

Table 5

Maternal labour income at age:	**Treatment group**	**N**	**R^2**
0	76829*** (390.586)	255487	0.18308
3	88128.5*** (530.62)	253390	0.13857
6	1.2463867e+5*** (632.075)	258392	0.16861
10	1.2823109e+5*** (810.514)	259934	0.12995

15	1.3212971e+5*** (1043.42)	256913	0.10998
16	1.167045e+5*** (1207.26)	211198	0.12707

Table 5: Effect of being in the treatment group on maternal labour income at different ages.

Table 5 shows the results of OLS regressions where maternal income at different ages is the outcome variable. The effect of being born in the treatment group has on maternal income at different ages is illustrated by the given coefficients. One regression has been made for each income at different ages and thus the table illustrates the results for six different regressions. The regressions are all controlled for by gender of the child, having a mother with higher education, foreign mothers, single mothers, birth municipality and robust[8]. The coefficient for age zero is the value of β_{treat} which is the regression coefficient for the treatment group. This regression was then repeated for all ages in the table and all the coefficients are the value of β_{treat}.

All the results for maternal labour income at different ages are statistically significant, although the effect of being in the treatment group has a significantly higher effect on maternal income at age zero and three. Being born in the treatment group increases maternal income by an average of 76 829 NOK per year at age zero and 88 128.5 NOK per year at age three. The remaining years in the analysis also have a positive and statistically significant effect of being in the treatment group, although the coefficients have significantly smaller values. This could be a consequence of child penalty. It has been found that women who have children suffer a child penalty where they experience a pay gap over time relative to men if they have children (Sieppi and Pehkonen 2019).

Main result for child outcomes

Table 6

	Treatment group	**N**	**R^2**
Middle school GPA	3.30277*** (0.03037)	271710	0.16663

Table 6: Effect of being born in the treatment group on child outcomes in terms of grades

[8] It was not possible to use cluster for these regressions in microdata.

Table 6 contains the coefficient of the regressions where the outcome variable is grades and the dependent variable is the treatment group. The regression was controlled for the child being male, having a mother with higher education, foreign mothers, single mothers, birth municipality and robust. The results show that being in the treatment group increases the middle school GPA by 3.30 which is the regression coefficient for the treatment group, β_{treat}. The result is statistically significant. 16.67% of the results can be explained by the independent variables used in the regression.

It has previously been found that an increase in primary health care services in Norway led to an increase in years of schooling by 0.15 years and earnings by 2% (Bütikofer, Løken et al. 2019). This study showed that an increase in primary health care services had a positive effect on child outcomes in terms of years of schooling and income in the same way as the results for grades show a positive effect on child outcomes in terms of their middle school GPA. The results for the effect of being in the treatment group on grades clearly indicates that an increase in primary health care services has had an impact on child outcomes in this regression.

5.2 Interaction coefficients

Example of regression with interaction coefficients

The following results come from an OLS regression where the dependent variable was grades, and the independent interaction variable was being born in a big city times the treatment group which was children being born between 2002-2004. The control variables used were the same as in the previous regressions.

Table 7

	Coefficient
Born in big city	0.44019***
	(0.06124)
treat	3.14893***
	(0.03711)
city	-1.99325*
	(2.60435)

N	271710
R^2	0.16679

Table 7: Additional effect of being born in a big city on grades when in the treatment group

Interpretation of result

Table 7 shows that the effect of being born in a big city while in the treatment group increases grades by 0.44. This means that the additional effect of being born in a big city on grades is 0.44 for a child born in the treatment group. The coefficient of determination is in this case equal to 0.16679 which means that 16.7% of the variation observed for this interaction variable is explained by the regression model. The number of observations is 271 710 which is the same number of observations that all the regressions for grades had, and it is a high number of observations. With a p-value less than 0.001 (p=0), the coefficient is highly statistically significant.

Results from interaction variables

Table 8

	Grades	**N**	**R^2**
Born in a big city	0.44019***	271710	0.16679
	(0.06124)		
Mother with higher education	-2.98948***	271710	0.17143
	(0.06964)		
Single mother	1.65138***	271710	0.16663
	(0.01518)		
Foreign mother	-0.20229*	271710	0.16665
	(0.08884)		

Table 8: Effect of different characteristics on grades in treatment group.

Interpretation of results for grades

Table 8 contains the results for four different regressions with interaction coefficients between the treatment group and the variable denoted in each row in the table. These results show that having a foreign mother and being in the treatment group reduces their GPA further, on average, by 2.99. This result is statistically significant. This means that the additional effect of having a foreign mother on grades while born in the treatment group is -

2.99. This coefficient comes from the value of $\beta_{treat*foreign}$ which is the regression coefficient for the interaction variable $X_{treat}X_{foreign}$. Similarly, the other coefficients are the regression coefficients for each interaction coefficient with the treatment group. This means that all the results in the table, being born in the treatment group is given, and the coefficients show the additional effects of the other variables.

Being born in a big city has a positive additional effect on grades with being in the treatment group and being born in a big city additionally increases the grades by an average of 0.44 points. All coefficients have very low p-values, meaning that they are highly statistically significant. The coefficients for having a single mother and a mother with higher education have high values. This could be because the maternal situation has a large influence on a child's outcome and thus a greater impact than the other variables. However, the coefficients also point in a different direction than expected. These results indicate that having a mother with higher education while being born in the treatment group has a negative effect on grades. The results also indicate that having a single mother at birth had a positive effect on grades. This could indicate that there are some external factors that potentially affect the results.

6 Validity of empirical strategy

6.1 Weaknesses and limitations

The assumptions in the thesis partly illustrate weaknesses in the analysis. The data used in microdata is register data, meaning that it is a sample of the population. Although the population sample should be representative for the Norwegian population, there is a risk that the data given is skewed. There was also a significant number of openings of new health stations in 2004 which may have had an additional impact on the result without being taken into account in the analysis. In addition, there was not sufficient data on the closing dates of health stations which could have had an effect in the supply of primary health care at the time, though with the data collected seems not likely. In the analysis I have looked at maternal income for all ages and thus not analysed age differences between mothers which could potentially have given more detailed results.

There are also external factors such as the economic situation at the time, school reforms or other public measures that are not all considered in the analysis, thus excluding possible explanations for differences in maternal employment and child outcomes. Some of these factors will be discussed in this section. Below I relate the opening of new centres with municipality level characteristics.

6.2 Municipality level characteristics

In order to control for that the results in the analysis were not due to external factors, municipality level characteristics have been taken into account. Municipality level characteristics have been collected in order to analyse the current situation in the municipalities that opened health stations in 2001. I am thereby able to control for time-invariant characteristics through the municipality level fixed effects. Fixed effects do not change over time (Wooldridge 2016) and thus I only control for the municipality level characteristics in the given year. Thereby, this will not control for confounders that are time varying.

I generated a dataset through The Municipality database[9] with municipality level characteristics for all municipalities in 2000 in order to control for the situation in each municipality before the opening of the new health stations. This dataset was merged with the dataset from The Brønnøysund Register Centre which contained the opening dates for new health stations for all municipalities. A variable for the municipalities that opened health stations in 2001 was then generated in order to perform an OLS regression for this variable with all the municipality level characteristics chosen. For list of variable explanations for municipality level characteristics variables, see appendix.

The variables collected are from the year 2000. All variables were divided by 1000 in order to simplify the coefficients, apart from the variable for the living conditions for education. The variable generated for all the municipalities that opened health stations in 2001 was regressed for the variables for municipality level characteristics which gave the results below.

Table 9

Variable	**Coefficient**

[9] https://kommunedatabasen.sikt.no/

Population	-0.0000742
	(0.0001276)
Population 0-5 years old	0.5138528
	(0.2650914)
Population of foreign-born people	1.020665*
	(0.4428442)
Population of foreign-born women	-1.959492*
	(0.9042692)
Population of densely populated areas	0.0678929
	(0.1189412)
Population of sparsely populated areas	0.0856014
	(0.1244219)
Employment – all	-0.1698001
	(0.316697)
Employment – women	0.2049497
	(0.5888529)
Gross income – all	-0.0002555
	(0.0013743)
Gross income – women	0.0003691
	(0.0024026)
Living conditions – education	-0.0142968
	(0.0083276)
Shorter higher education – all	0.1863348
	(0.4259053)
Shorter higher education – women	-0.3737107
	(0.7747642)
Longer higher education – all	0.255802
	(0.438197)
Longer higher education – women	-0.521328
	(1.11)
Newly registered women to pregnancy control	-0.5455559
	(0.6028637)

Completed health checks are 2-3 years old	-0.4872404 (0.6641931)
Completed health checks at 5 years old	0.5191639 (0.43210055)
N	344
R^2	0.0871

Table 9: Municipality level characteristics correlated with opening of health stations in 2001

The results above are the results from one OLS regression where the municipalities that opened health stations were the outcome variable.

Population variables

The only coefficient that is statistically significant is the coefficient for foreign-born people and foreign-born women. The opening of new health stations is positively correlated with the population of foreign-born people, but negatively correlated with the population of foreign-born women. This indicates that there are relatively more foreign-born people in the municipalities that opened health stations in 2001, but also relatively less foreign-born women, indicating that there are relatively more foreign-born men in the municipalities that opened health stations in 2001. The results also show that there are relatively more children at the ages 0-5 years old in the municipalities that opened health stations in 2001. Although not statistically significant, it can indicate that municipalities with a lot of small children needed to open more health stations. The total population size of each municipality does not have a significant correlation with the opening of health stations in 2001.

Labour market variables

Gross income for both the total population and women has a very low correlation with the municipalities that opened health stations in 2001. Number of employed people is negatively correlated with the municipalities that opened health stations in 2001, but employment of women is positively correlated. Meaning that municipalities with relatively high numbers of employed women opened more health stations.

Education variables

For the education variables related to women, the coefficients indicate that the municipalities opening of health stations in 2001 negatively correlate with the relative number of women with higher education. This could indicate that the need for more health stations in municipalities with a high relative number of women with higher education was not needed to the same extent as in municipalities with a low relative number of women with higher education. Education for the total population, however, was positively correlated with municipalities that opened health stations in 2001. This could maybe be explained by men's higher education. The educational living conditions variable is negatively correlated with the opening of health stations in 2001. Given that the higher the number of the index, the lower the education in the municipality, the negative correlation might indicate that there opened less health stations in municipalities where the level of education was higher.

Health care variables

The municipalities that opened health stations are positively correlated with the relative number of health checks that were completed at five years old. However, it is negatively correlated with the relative number of women that are newly registered to pregnancy controls and completed health checks at 2-3 years old. This means that, although not statistically significant, health stations were opened in municipalities where there were relatively fewer women registered for pregnancy controls and relatively fewer health checks that were completed at 2-3 years old, both services which are offered at health stations.

The results above enable controlling for both time invariant municipality level characteristics that simultaneously influence outcome and the opening of centres. This means that the outcome variables in the analysis, maternal income and grades, may also be influenced by the municipality level characteristics that took place right before the opening of the new health stations. In summary this means that for the municipalities that opened health stations in 2001, the outcome of maternal income and grades might have, in addition to an increase in primary health care, been influenced by a high population of children at the age of 0-5, a higher number of employed women and a low number of health checks in terms of pregnancy control and checks at 2-3 years old along with the other coefficients illustrated in table 9. Although the results are not statistically significant, the trends for the municipality level

characteristics contribute to give an idea of the situation in the municipalities right before the increase in primary health care.

6.3 Income before birth

Table 10

	Coefficient	**N**	**R^2**
Maternal income one year before birth	78421.6*** (404.951)	261 684	0.17705
Maternal income three years before birth	66969.1*** (376.393)	253 356	0.14641
Maternal income five years before birth	45423.6*** (392.832)	206 411	0.08513

Table 10: Effect of being in the treatment group on maternal income before birth

This table shows that being in the treatment group had an effect on maternal income before birth. The desired result for this robustness check was to find that the coefficient was zero for each year before birth, thus being born in the treatment group would have no effect on income before birth as the increased health care supply had not yet affected the mother. These results are statistically significant and indicate that there are other factors that may have influenced the main results.

7 Discussion and conclusion

The aim of this thesis was to investigate if the increased supply of primary health care services in 2001 had a positive effect on child outcomes and maternal labour supply. The dependent variables used were school results to measure child outcomes and maternal income at different ages as a way to measure maternal labour supply. This was done by generating a treatment group of children born in 2002-2004 and then using OLS regressions to regress school results and maternal income for being born in the treatment group along with a set of

control variables. Further, OLS regressions with interaction effects were used to exclude external effects of the control variables on the results.

The main results indicate that being born in 2002-2004 had a positive impact on middle school GPA and thus supports the idea that an increase in primary health care has an effect on child outcomes. Although the results for national exams do not show a high impact of being born in the treatment group, it has been found in a similar study that an increase in primary health care services does impact school results in a positive way thus supporting the results for middle school GPA (Bütikofer, Løken et al. 2019). The robustness checks with education levels indicate that there were few municipalities with surprisingly high or low levels of education. The larger municipalities tend to have a higher share of people with higher education, but given the trends in the robustness chapter, municipality characteristics in terms of level of education should not have had a great impact on the results.

The main results for maternal labour supply showed a positive impact on maternal income if born in the treatment group for the year of birth as well as three years after. This indicates that the increase in primary health care in 2001 has a positive impact on maternal labour supply. However, over the years the effect stagnated, indicating that it might not be a lasting effect. As mentioned, the stagnation of the effect on maternal income could be related to child penalty as mothers tend to experience a pay gap after having children (Sieppi and Pehkonen 2019).

The results for the interaction effects showed that being born in a big city had a significant additional effect on grades when born in the treatment group. The results also showed that having a foreign mother had a negative effect on grades while being born in the treatment group. Both having a single mother at birth and having a mother with higher education had high significant coefficient, however with surprising results. The effect of having a mother with higher education while being born in the treatment group had a negative effect on grades and having a single mother at birth while being born in the treatment group had a positive effect on grades. The combination of having large and surprising coefficients could be an indicator of that the results have partially been affected by external factors such as some of the municipality level fixed effects that were investigated.

Not all desired robustness check for municipality level characteristics were possible due to lack of data, and thus there could still be external factors that have impacted the results that have not been included in the analysis. Ideally, GP-supply in each municipality should also

have been included, but as the earliest data for this topic was from 2004, it was excluded from the robustness chapter. Although numbers for unemployment in each municipality was included, the level of disposable income could also have been included, but I was not able to access data on this.

Parts of the analysis clearly indicates that the increase in primary health care has had an impact on child outcomes and maternal labour supply. The Norwegian study by Bütikofer et. al. (2019) supports this claim as they found that an increase in primary health care gave an increase of 0.15 completed years of schooling and an increase in earnings by 2%. Although they did not investigate maternal labout supply, they found that better nutrition within the first year of life had a postitive impact on adult height and fewer health risks at age 40 (Bütikofer, Løken et al. 2019). Meaning that there are lasting effects from increased access to health stations.

Althought here is not research, to my knowledge, about how primary health care has an impact on maternal labout supply, there is a lot of research on how better health and income are related to each other. Barstad (2020) found that as health issues increases, income decreases. The groups with the poorest health reported the largest amount of economic challenges (Barstad 2020). Given the positive health impacts health stations and general practitioners can have on maternal health, this research can support the idea that an increase in primary health care has a postive impact on maternal labour supply. Improving maternal health could thus lead to women working more due to less health complications.

The municipality level characteristics analysis showed that the municipalities which got new health stations had a high population of children at the age of 0-5 years old, a low number of women who were newly registered to pregnancy control and a low number of children who completed health checks at 2-3 years old along with other characteristics. This showed the situation in the municipalities that opened health stations in 2001 and gave indications to the characteristics in the municipalities that may have also affected the outcome variables. This means that in addition to being in the treatmen group and the control vairables used, external factors such as the higher population of children at the age of 0-5 might have influenced the results, though the results from the municipality level characteristics were not statistically significant.

It is important to note that when controlling for income before birth, the results were not as expected. This placebo test of checking for the income that should not have been affected by

being born in the treatment group should have indicated that the effect of the treatment group should be equalt to zero as the increase in primary health care services had not yet taken place. However, these results showed that there was an effect on income, thus indicating that external factors could have had an effect on income before birth.

This thesis was based on the research question of whether an increase in primary health care services in 2001 had an impact on maternal labout supply and child outcomes. As mentioned, the main results clearly indicate that the increase in primary health care services had a positive and significant effect on maternal labour supply as well as a positive and significant effect on child outcomes. These results give an affermative response to the research question. Through this thesis I have found that the increase in primary health care services in 2001 has some impact on maternal labour supply and child outcomes, however, the extent of the effect is inconclusive due to the tests of the validity of the analysis show that there may have been other factors that influenced the municipalities at the time which could have had an additional impact on the results.

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Appendix

Main content of each health consultations at health stations for 0-5 years:

Table A.1

Consultation	Description
7-10 days after birth: Home visit	Home visit by a health nurse. Topics include breastfeeding, parental roles and sleep patterns. The baby is examined and their weight and head circumference is measured.
4-week check-up	Group consultation with other parents as well as health nurse and physiotherapist. Topics include breastfeeding, crying, distress and colic as well as movement development. Weight and head circumference is measured if needed.
6-week check-up	Consultation with a health nurse and doctor. Topics include vitamin D, sleep and vaccinations. Weight and head circumference is measured. Hearing, movement, language and eye contact is observed. Examination of the baby's body is made by the doctor. Vaccination against rotavirus is offered.
3-month check-up	Consultation with a health nurse. Topics include breastfeeding, language development and movement development. Measurements of head circumference, weight and length. Several vaccinations offered.
4-month check-up	Consultation with a health nurse and a physiotherapist. Topics include sleep, dental health and kindergartens. Examinations include hearing, eye contact and language development.
5-month check-up	Consultation with a health nurse. Topics include dental health, introduction of solid food and parental mental health. Standard examinations are made. Second dose of vaccinations offered.
6-month check-up	Consultation with a health nurse and a doctor. Topics include mobile use, safety and breastfeeding. Standard examinations are conducted along with an examination of the child's body by the doctor.
8-month check-up	Consultation with a health nurse. Topics include preparation for kindergarten, interaction between parent and child and vitamin D. Standard examinations are made if needed.
10-month check-up	Consultation with a health nurse. Topics include breastfeeding, sleep and drug and alcohol use. Standard examinations are made.
12-month check-up	Consultation with a health nurse and doctor. Topics include solid food, vaccinations and airway infections. Standard examinations are conducted along with an examination of the child's body by the doctor.

	Third dose of vaccinations offered.
15-month check-up	Consultation with a health nurse. Topics include diet and meal habits, child's environment and safety and kindergarten. Standard examinations are made. MMR vaccination offered.
17-18-month check-up	Consultation with a health nurse. Topics include interaction between parent and child, sleep and parental mental health. Standard examinations are made.
2-year check-up	Consultation with a health nurse and doctor. Topics include physical activity and playing, mobile- and screen use and sleep habits. Standard examinations are conducted along with an examination of the child's body by the doctor.
4-year check-up	Consultation with a health nurse. Topics include school preparations, language development and sleep habits. Standard examinations are made.

Table A.1: Description of consultation offers (The Norwegian Directorate of Health 2020)

Work income mother – all

Table A.2

Year	***Mean***	***Standard deviation***	***N***
Workincome_mother93	*56116*	*68301.9539*	*211704*
Workincome_mother94	*70949*	*72596.7441*	*22350*
Workincome_mother95	*88360*	*76885.8926*	*233302*
Workincome_mother96	*110255*	*81696.0618*	*239786*
Workincome_mother97	*130305.5*	*85871.51*	*247041*
Workincome_mother98	*144775*	*90933.97*	*253027*
Workincome_mother99	*155829*	*93261.42*	*254467*
Workincome_mother00	*163807*	*102252.6*	*257317*

Workincome_mother01	*183455*	*109882.7*	*260972*
Workincome_mother02	*201862*	*113552.6*	*263456*
Workincome_mother03	*207311*	*117798.1*	*262845*
Workincome_mother04	*211948*	*122443.9*	*259945*
Workincome_mother05	*218622.5*	*131157.3*	*259673*
Workincome_mother06	*241350.5*	*139748.1*	*263987*
Workincome_mother07	*267036*	*148821.5*	*267053*
Workincome_mother08	*284957*	*160363.8*	*269474*
Workincome_mother09	*314925*	*169445*	*269322*
Workincome_mother10	*330122*	*180524.8*	*270764*
Workincome_mother11	*353165*	*190060.9*	*267717*
Workincome_mother12	*375552.5*	*199831.1*	*267214*
Workincome_mother13	*398023*	*210093.8*	*266983*
Workincome_mother14	*418325.5*	*219796.8*	*266395*
Workincome_mother15	*436173.5*	*229337.8*	*266082*
Workincome_mother16	*453276.5*	*236976.8*	*264823*
Workincome_mother17	*471438*	*245694.1*	*263754*
Workincome_mother18	*492129*	*256173.9*	*262813*
Workincome_mother19	*515336*	*268845.9*	*262111*

Table A.2: Work income of mothers for all years in the analysis.

The work income of mothers is collected from SSBs work income data in microdata for each year. Work income is the sum of salary income and net business income during the calendar year. Illness benefits and maternity allowance is included. The number for each variable denotes the year in which the data is collected, meaning that Workincome_mother93 is maternal income in 1993 and Workincome_mother19 is maternal income in 2019 etc.

Population sizes – large cities

Table A.3

Municipality	**Population in 2001**	**N**
Oslo	512 589	53 862
Bergen	233 291	29 055
Trondheim	156 455	18 105
Stavanger	115 781	25 070

Table A.3: population size of the largest municipalities in the analysis which were used to control for being born in a large city.

The merged municipalities that had opened health stations in 2001 are the following (Regjeringen 2020):

Lillestrøm: Skedsmo, Fet and Sørum
Indre Østfold: Askim, Eidsberg, Hobøl, Spydeberg and Trøgstad
Nærøysund: Vikna, Nærøy
Orkland: Orkdal, Meland, Agdenes and part of Snillfjord
Heim: Memne, Halsa and part of Snillfjord
Indre-Fosen: Rissa and Leksvik
Kinn: Flora and Vågsøy
Sunnfjord: Førde, Jølster, Gaular and Naustdal

Interaction variables – more detailed results

Having a mother with higher education

Table A.4

	Grades
Mother with higher education	-2.98948***
	(0.06964)
Treat	3.88981***
	(0.03452)
high_edu_mother	6.13469***
	(0.04286)
N	271710
R^2	0.17143

Table A.4: Additional effect on grades of having a mother with higher education while being born in the treatment group.

Having a foreign mother

Table A.5

	Grades
Foreign mother	-0.20229*
	(0.08884)
Treat	3.32952***
	(0.03226)
foreign_mother	-0.45851***
	(0.06615)
N	271710
R^2	0.16665

Table A.5: Additional effect on grades of having a foreign mother while being born in the treatment group.

Having a single mother

Table A.6

	Grades
Single mother	1.65138***
	(0.01518)
Treat	1.65138***
	(0.01518)
single_0	21.9953***
	(1.60834)
N	217710
R^2	0.16663

Table A.6: Additional effect on grades of having a single mother while being born in the treatment group.

Being born in a large city

Table A.7

	Grades
Being born in a large city	0.44019*** (0.06124)
Treat	3.14893*** (0.03711)
City	-1.99325 (2.60435)
N	271710
R^2	0.16679

Table A.7: Additional effect on grades of being born in a large city while being born in the treatment group.

Main results for national exams

Table A.8

	Treatment group	**N**	**R^2**
National exams in reading	-8.0082427e+11 (9.0633402e+11)	46600	0.03834
National exams in math	4.072395e+12 (3.8605072e+12)	47521	0.04194
National exams in English	9.6010267e+12 (1.0658118e+13)	47167	0.02734

Table A.8: Effect of being born in the treatment group on child outcomes in terms of national exam results.

The results for national exams show a marginal effect of being in the treatment group and the results are not statistically significant. The number of observations for middle school GPA was significantly higher than for the national exams. This could be part of the reason why being in the treatment group had a significant effect on grades and not on national exams.

Interaction effects results for national exams

Table A.9

	National exams in reading	**National exams in math**	**National exams in English**

Born in a big city	-2.8942747e+10 (3.208916e+10)	-5.2331992e+10 (5.0667312e+10)	7.0590957e+11 (8.1532849e+11)
Mother with higher education	0	0	0
Single mother	-5.2697379e+11 (5.9019765e+11)	2.6905926e+12 (2.5892253e+12)	6.0860549e+12 (7.0594858e+12)
Foreign mother	6.777172e+7 (7.6596672e+7)	-7.4617585e+8 (7.0617704e+8)	1.0631419e+10 (1.2393777e+10)

Table A.9: Additional effect of different characteristics on national exam results in treatment group.

The p-values were significantly higher for national exams than for the middle school GPA with no p-values are smaller than 0.05 and thus not statistically significant. The smallest p-value is for the coefficient of being born in a city with large increase and national exams in reading with p=0.05278. This could be because the national exams have a significantly lower number of observations in comparison to the middle school GPA. The number of observations for middle school GPA is 217 710 while for national exams in reading it is 46 600, national exams in math is 47 521 and national exams in English is 47 167. This could be an explanation for the lack of statistically significant results for the national exams.

Variable explanation for the municipality level characteristics used in validity of empirical strategy:

Population variables:

- Population.
- Population of children from 0-5 years old.
- Population of foreign-born people.
- Population of foreign-born women.
- Population of densely populated areas within each municipality.
- Population of sparsely populated areas within each municipality.

Labour market variables:

- Employment – all: number of employed people within the age of 16-74 years old both part-time and full-time.
- Employment – women: number of employed women withing the age of 16-74 years old both part-time and full-time.
- Gross income – all: sum of salary, pension, business income and capital income.
- Gross income – women: sum of salary, pension, business income and capital income.

Education variables

- Living conditions – education: all municipalities are split into 10 equally sized categories of education levels. Level 10 means that the municipality belongs to the 10 percent where the population has the lowest education.
- Shorter higher education – all: higher education up to four completed years.
- Shorter higher education – women: higher education up to four completed years.
- Longer higher education – all: more than five years of completed higher education.
- Longer higher education – women: more than five years of completed higher education.

Health services variables

- Newly registered women to pregnancy control: number of newly registered women who went to pregnancy control at health stations in 2000.
- Completed health checks at 2-3 years old: health checks with health nurse and doctor, only completed checks are counted.
- Completed health checks at 5 years old: health checks at start of school (around 5 years old).