Effects of Universal Child Care on Long-Run Health

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Abstract

We examine the long-run health outcomes of children affected by a reform which led to a large scale expansion of subsidized universal child care for children 3 to 6 years old in Norway in the late 1970s. Using administrative population data and exploiting variation in the implementation across municipalities over time, we find that individuals with increased access to child care have more GP more consultations related to psychological diagnoses and depression and higher probabilities of GP consultations related to musculoskeletal and psychological diagnoses, and overweight. However, we also find that they have lower probabilities of GP consultations related to cardiovascular diagnoses and asthma. When it comes to certified sick leave, we find that exposed individuals have higher probabilities of certified sick leave related to psychological and respiratory diagnoses. We also find that they have fewer hospital visits related to respiratory illnesses, lower probabilities of hospital visits related to cardiovascular and psychological illnesses, but higher probability of hospital visits related to metabolic diseases.

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1 Introduction

Today, the majority of children in developed countries enrol in child care or preschool and most European countries[1], including the U.K., France, Germany, and all Nordic countries offer publicly provided universal child care programs (Cornelissen et al., 2017). At the same time, evidence on how large-scale provision of universal child care affects children's long-run development remains scarce. Particularly, evidence on the effects on adult health and healthy behaviour is limited.

In this paper, we examine the long-run health outcomes of children affected by a reform from 1975, which led to a large scale expansion of subsidized universal child care for children 3 to 6 years old in Norway in the late 1970s. The reform was introduced by the Norwegian Government as a response to a growing demand for child care driven by increased female entry into the labour market during the 1960s and 1970s. The aim of the reform was to create positive arenas for child development, as well as to free up labour market reserves among mothers. However, there could also potentially be wider ranging effects of universal child care. Our main research question is therefore whether, and to what extent, universal child care has long-term effects on adult health outcomes. We examine four main outcomes: primary doctor visits (purpose of visits and actions taken), hospitalization (both in- and out-patient visits), mortality, and certified sickness absence from work. For all of these indices we have the related diagnoses (given by ICPC-02 and ICD-10 codes respectively).

Although the child care reform was planned centrally, the responsibility for child care were assigned to the municipalities. This led to a staged expansion of child care coverage across Norway's (at that time) 445 municipalities. In the period after the reform, child care coverage rates increased from less than 10 percent in 1976 to above 28 percent in 1979. We exploit the variation in expansion between different municipalities in this period to examine long-run health effects of child care. Our empirical strategy thus follows a difference-in-difference approach and compare adult health outcomes of children 3 to 6-year-old before and after the reform, from municipalities where child care expanded a lot and municipalities with little or no increase in child care coverage.

We find that individuals exposed to the reform have more GP more consultations related to psychological diagnoses and depression and higher probabilities of GP consultations re-

[1]At the Barcelona Summit in 2002, the European Council set targets for providing childcare in EU Member States, specifying that at least 90 per cent of children between 3 years old and the mandatory school age should have access to formal childcare provision. Mills et al. (2014) show that the Barcelona target of 90 per cent of children between 3 years old and the mandatory school age was met or surpassed in 11 Member States in 2010.

lated to musculoskeletal and psychological diagnoses, and overweight. However, we also find that they have lower probabilities of GP consultations related to cardiovascular diagnoses and asthma. When it comes to certified sick leave, we find that exposed individuals have higher probabilities of certified sick leave related to psychological and respiratory diagnoses. We also find that they have fewer hospital visits related to respiratory illnesses, lower probabilities of hospital visits related to cardiovascular and psychological illnesses, but higher probability of hospital visits related to metabolic diseases.

A growing body of evidence shows that early childhood programs generally have significant influence on children's development (for an overview, see e.g. Almond and Currie (2011); Almond et al. (2017)). On the positive side, psychological research and neuroscience research has found that learning is easier in early childhood than later in life, making investments in human capital in this period relatively cheaper. Also, the earlier such investments are made, the longer becomes the payoff period. In addition, investments in human capital have dynamic complementarities, implying that learning begets learning (Heckman and Carneiro, 2003). Evidence on the social determinants of health further suggests that a strategy of prevention may be more effective than treatment later in life (Marmot and Wilkinson, 2006), recognizing the dynamic nature of health capital formation and viewing policies aimed at shaping early life environments as effective tools for promoting health (Conti and Heckman, 2014).

On the other hand, young children can be vulnerable to separation from their primary caregivers, raising concern about whether early child care enrolment may have adverse effects on children's development (Drange and Havnes, 2015). For example, research from the health and psychology literature suggests that children's cortisol levels are higher in day care than at home, indicating that attending child care can be stressful for the child (Vermeer and Groeneveld, 2017).

Attending formal child care in early life can affect long-term health outcomes via several channels. Being in child care could affect the immediate health of the child, potentially both to the better and to the worse and both physical as well as mental health, and this could have long term consequences as early health conditions can be quite persistent throughout the life cycle. A priori it is not clear whether we should expect negative or positive health effects. On the one hand, early traits and habits have been found to be determinants of lifestyle later in life (Conti et al., 2016), thus healthy behaviour adopted in day care can for example form the basis for healthy behaviour later in life and ultimately lead to better health. On the other hand, if attending child care causes worse health in childhood this may

persist into adulthood.

A more indirect mechanism through which child care can affect long-run health is through potential effects on income and educational attainment. Havnes and Mogstad (2011b) use the same reform as us and do indeed find that subsidized child care had positive effects on children's educational attainment and labour market participation as well as reduced welfare dependency. A challenge is however, that better health during childhood and adolescence may lead to higher educational attainment and better labour market outcomes, making it difficult to disentangle the direct health effects form the more indirect ones.

We start our analysis by examining the average effects on the whole population. However, the average effects may hide important differences across subgroups of the population. In the second part of the analysis we therefore examine whether child care may have heterogeneous effects on groups of the population that have been identifed as more and less vulnerable in earlier studies. In the current version we provide results focusing on differences by gender, maternal education, and ethnicity.

By examining the long-run health effects of child care we contribute to the literature in several ways. Firstly, our study examines the effects of a government-run universal policy focused on early childhood. Currently, there are debates in many countries about a move towards subsidized, widely accessible child care and preschool. Although there are a number of studies showing that early educational programs can generate learning gains in the short run and, in many cases improve the long-run prospects of children from poor families, much of the previous literature on early childhood programs comes from targeted programs that focus resources on selected families and children and have potentially limited relevance for the universal programs.[2] Secondly, although there is a growing literature on long-run effects of child care, the majority of these studies focuses exclusively on cognitive and non-cognitive measures of child development.[3] In spite of this growing number of studies finding effects

[2]Evidence show that targeted programs like Head Start, the Perry Preschool Project (PPP) and the Abecedarian Project (ABC) have generated positive long-term effects on outcomes such as behavioural problems, prevalence of chronic conditions, and obesity for the participants (Currie and Thomas (1995); Carneiro and Ginja (2014); Conti et al. (2016)).

[3]Havnes and Mogstad (2011b) find positive impacts on educational attainment and labour market participation, measured when the children are in their early 30s. In a related paper, the same team of authors find that the positive effects of the child care expansion are driven by children in the lower and middle part of the earnings distribution, and negative for children in the uppermost part (Havnes and Mogstad, 2015). Datta Gupta and Simonsen (2016) find positive effects on children's test scores in ninth grade. Felfe and Lalive (2014) and Cornelissen et al. (2017) find positive effects on school readiness indicators for children of immigrant ancestry. Also Rossin-Slater and Wust (2017) find positive effects on schooling. On the other hand, Baker et al. (2008) find no effects on cognitive outcomes, but negative effects on children's non-cognitive outcomes. Gupta and Simonsen (2010) find that compared to home care, being enrolled in

on human capital development, stringent evidence on the causal effects on health remains scarce. By taking advantage of highly detailed administrative population register data, we can examine a wide range of health outcomes and health care consumption related to an array of both physical and psychological diagnoses.

Our findings are relevant for ongoing policy debates in the US and Canada, as well as in many European countries, about a move towards subsidized, universally accessible child care or preschool. In addition, they speak to the discussion of how the authorities can control the soaring health care costs in many countries. For example, the main focus of the discussion is often the provision of health care to cure or improve the health of patients. However, an increased focus on ways to prevent diseases for example by promoting healthy behaviour, can potentially save the society and individuals large costs. Chronic diseases represent a large share of the increased health care costs in many countries. Such conditions are the main causes of premature death, and managing them effectively requires that patients make lifestyle changes by adhering to healthy behaviours. However, while prevention is crucial for lifelong health, changing behaviour in adulthood may be challenging (Conti et al., 2016), and early life interventions like child care may prove to be more efficient behaviour shifters.

The paper proceeds as follows. Section 2 gives background information on the relationship between health and child care. Section 3 gives background information about the 1975 child care reform and organization of formal child care in the period examined. Section 4 describes the data applied, while section 5 describes the empirical strategy. Section 6 presents our results, and section 7 the robustness checks, before we conclude in section 8.

2 Child Care and Health

Recent evidence from both the biological and social sciences points to the importance of the early years in building the foundations for lifelong health, and investments in early childhood have consequently been shown to have high returns (Knudsen et al., 2006). We now recognize that human development is a dynamic process that starts in the womb and that early-life conditions affect the emergence and evolution of human traits, which in turn affects a variety of adult outcomes, including health (Almond and Currie (2011); Conti and Heckman (2010)).

According to Conti et al. (2016), the literature on early life interventions suggests both direct and indirect mechanisms through which early childhood experiences might affect long-term health outcomes. On the one hand, child development might directly affect adult health, both because early health conditions are quite persistent throughout life cycle (Millimet and

preschool does not lead to significant differences in child non-cognitive outcomes.

Tchernis, 2013), and because early traits are determinants of lifestyle (Conti and Heckman, 2010). On the other hand, child development might affect adult health indirectly, by improving socioeconomic determinants such as education, employment and income (Heckman et al., 2010) – factors which might also have an independent effect on health, as documented by a large literature (Deaton (2003); Heckman and Mosso (2014); Lochner (2011)).

2.1 Previous Literature

When it comes to health effects of child care, most of the evidence comes from studies that focus on child care programs targeted at disadvantaged children. For example, Conti et al. (2016) examine the effects on health and healthy behaviours of two targeted early childhood interventions, the Perry Preschool Project (PPP) and the Abecedarian Project (ABC). Both interventions randomly assigned enriched environments to disadvantaged children. They find that boys randomly assigned to the treatment group of PPP have significantly lower prevalence of behavioural risk factors in adulthood compared to those in the control group, while those who received the ABC intervention have better physical health. The impacts on girls is considerably weaker for both programs, although they find that both the PPP and the ABC substantially improved the healthy habits of women who were randomized to the treatment groups; they engaged in more physical activity, ate more fresh fruit, and drank less alcohol. However, these programs are not only targeted at disadvantaged children, they also include both schooling and a mix of interventions such as home visits in the PPP and interventions to improve health, nutrition, and parent involvement in the Head Start program.

The literature on effects from large-scale publicly provided universal child care on health remains scarce, and the findings are mixed. The two studies that are closest related to our study were conducted in Sweden and Canada. In the Swedish study van den Berg and Siflinger (2015) examines the effect of a child care reform which led to considerable cuts in child care fees for formal public child care. Children affected by the reform showed better physical health, measured as respiratory illnesses, ear diseases, and other childhood illnesses at ages 4-5 and 6-7, and better developmental and psychological conditions at age 6-7. Baker et al. (2008) and Baker et al. (2015) investigate the introduction of a large scale subsidized child care program in Quebec, Canada, in the late 1990s, and find more or less the opposite from van den Berg and Siflinger (2015); the introduction of the universal child care program led to negative effects on children's non-cognitive outcomes both on the short-term and long-term, and significant declines in self-reported health and life-satisfaction, as well as behavioural problems and criminal activity among boys on the long-term.

The health literature provides evidence that attending child care is associated with a range of illnesses, such as asthma and other respiratory illnesses, higher cortisol levels caused by stress (Vermeer and Groeneveld, 2017), as well as mortality, health care use, healthy behavior, such as smoking and exercising, overweight, obesity, blood pressure, and mental health illnesses (D'Onise et al., 2010). A limit of most of these studies however is their lack of empirical strategies that allow for causal interpretations.

2.2 Conceptual Framework

A priori it is not clear whether we should expect negative or positive health effects of child care. On the one hand, early traits and habits have been found to be determinants of lifestyle later in life (Conti et al., 2016), thus healthy behaviour adopted in day care can for example form the basis for healthy behaviour later in life ultimately leading to better health. On the other hand, if attending child care causes worse health in childhood this may persist into adulthood.

Physical Health Outcomes. The existing evidence on long-term physical health effects of child care remains scarce. In economics, as we have seen in the previous section, most papers have focused on cognitive and non-cognitive outcomes when estimating effects of child care, and few have studied the physical health effects in adulthood.

However, a hypothesis that have been investigated substantially in the medical literature is the hygiene hypothesis. This hypothesis states that lack of early childhood exposure to infectious agents suppresses the natural development of the immune system and increases the susceptibility to develop allergies and diseases later on. That is, early exposure to other children may first increase the incidence of diseases, but then decrease the rate later when the immunization process has finished, causing less sickness in older ages (Strachan, 1989). If the hygiene hypothesis holds, sending more kids to child care, making sure they are properly exposed to infectious agents could reduce the number of kids developing for example Asthma, or on a more moderate level, reduce the severity of Asthma related problems. This is a praticularly interesting example since asthma is the leading chronic condition among children and is known to be one of the leading causes of paediatric emergency room utilization, hospitalization, and school absence Currie (2009). Studies from the medical literature have provided contradictory evidence on the role of early childhood infections in the development of asthma and other allergic diseases during childhood up to adulthood; some results have been consistent with a protective effects (Rantala et al. (2015); Illi et al. (2001); Ball et al. (2000); Busse et al. (2010); Nafstad et al. (2005)). We follow up on this

and investigate the effects of increased access to universal child care on GP consultations related to asthma and other respiratory illnesses.

We also investigate the effect on GP visits related to cardiovascular problems in general and elevated blood pressure in praticular, and on visits related to weight problems. Based on the previous sections and (D'Onise et al., 2010).

Mental Health Outcomes. As with physical health effects, child care can have both positive and negative effects on long-term mental health. On the one hand, research from the medical literature has shown that children's cortisol levels are higher in day care than at home, indicating that attending child care can be stressful for the children (Vermeer and Groeneveld, 2017). Studies of stress response pathways, allostatic load, neuronal development, and, more recently, epigenetic mechanisms, have shown that the environment can become biologically embedded in the body in ways that can affect (also through latent pathways) health across the life course. The mechanisms through which adverse conditions early in life induce changes in brain structure are not yet fully known, there are indications that these environmental stressors can affect epigenetic programming of long-term changes in neural development and behaviors (Conti and Heckman, 2013).

On the other hand, the fact that children are exposed to a stimulating and suitable environment that supports cognitive and non-cognitive development may have positive effects on mental health. First, an environment that stimulates communication, creativity, and motor skills have been shown to enhance a child's prospects in life. Second, attending child care, where there is an emphasis on routines can help children develop abilities. Third, professionals at the centre can also support parents in identifying developmental problems and can help find strategies for dealing with them earlier than would have been the case if the child did not attend child care (Heckman and Masterov, 2007).

As previous research has shown evidence of effects on a range of non-cognitive outcomes and mental health outcomes of child care, we focus on diagnoses related mental symptoms and diagnoses in general, and to depression and anxiety in particular. (Baker et al. (2015); D'Onise et al. (2010)).

3 Institutional Background

3.1 The 1975 Child Care Reform

The Kindergarten Act, passed by the Norwegian Parliament in June 1975 introduced universal subsidized child care for children 3 to 6-year-old in Norway. The act regulated the

authorization, operation and supervision of formal childcare institutions across the country. According to the act, local authorities were responsible for building and operating child care facilities, while the responsibility for the overall regulations of formal child care was held by the Norwegian Ministry of Administration and Consumer Affairs.

The background for the political process that led to the 1975 child care reform was that in the post-World War II years in Norway, the gradually entry to the labour market of particularly married women with children, caused a growing demand for out-of-home child care. In the years prior to the child care reform of 1975 there was severe rationing in formal child care. The reform was proposed in a 1972 Kindergarten White Paper, published by the Norwegian government, where they proposed an introduction of a child care system open to everyone. Before the 1975 reform, the focus was on children with special needs. The arguments for making the program universal were at the time to create positive arenas for child development and to free further labour market reserves among mothers (Norwegian Ministry of Administration and Consumer Affairs, 1972).

The reform created a significant positive shock to the supply of formal child care, which had been severely constrained in the years before the reform. The aim of the reform was reaching 100,000 child care places by 1981, and municipalities with relatively low child care coverage rates were awarded the highest subsidies. As Figure 1 shows, the coverage rate increased substantially in the years following the reform. By 1979 the child care coverage rate increased to above 28 percent from a coverage rate of less than 10 percent for 3 to 6 year olds in 1975. This corresponds to more than a doubling of total child care places over this period. In the analysis, we follow Havnes and Mogstad (2011b), and focus on the child care expansion from 1976 to 1979, which likely reflects the sudden increase in supply of child care places because of the reform, instead of a spike in the local demand for child care (Havnes and Mogstad, 2011b).

3.2 Organization and Contents of Child Care in the 1970s

In the 1970s child care institutions in Norway were jointly financed by the central government, the municipalities and the parents, and were run either by the municipalities, public institutions, private organizations, or private firms under supervision of the municipality. All officially approved child care institutions, public or private, received operating subsidies from the central government, determined on the basis of the number and age of children, and the amount of time they spent in child care. The majority of institutions were open during normal working hours, and all children were eligible for a slot that was in general allocated according to length of time on the waiting list and the child's age. Only under

special circumstances could a child gain priority on the waiting list (Leira, 1992).

The day-to-day management was supervised by an educated preschool teacher, and there were federal requirements on educational content and activities, group size, staff skill composition, and physical environment, regardless of ownership. In terms of educational content, a social pedagogy tradition dominated the child care practices. In practice this meant that children were supposed to develop social, language, and physical skills mainly through play and informal learning.

As documented by Havnes and Mogstad (2011a), the 1975 Kindergarten Act caused centre based care to crowd out informal care, and lead to almost no net increase in maternal labour supply. The results in this study can as a consequence be thought of as consequences for children of moving from informal care, rather than parental care, into relatively high quality formal care. The fact that the reform had little, if any effect on maternal employment also means that it is unlikely that increased family income is the driving factor behind our results.

4 Data

We apply data from administrative registers provided by Statistics Norway (SSB) covering the entire resident population of Norway from 1967-2014. For each year, we have individual demographic information (including gender, immigration status, date of birth, municipality of residency) and socioeconomic data (education and earnings). The data contains unique identifiers that makes it possible to match children to their parents and their siblings.

The Norwegian Social Science Data provides information for each of the 445 municipalities on the annual number of kids in formal child care by the age of the child from 1973 onward. They also provide information on the total number of kids at different ages, which allows us to calculate coverage rates. Ideally we should have had imndividual information about whether a child was attending formal child care and for how many hours, but this information is unfortunately not available.

The health data come from three different registers: Hospital records from the Norwegian Patient Record (NPR) measured in 2008-2014, general practitioners registers (Fastlegedatabasen and KUHR) measured in 2006-2014, and the cause of death register (DÅR) measured in 2006-2014. Our long term health outcomes are thus measured when the individuals are between 30-47 years old.

We explore a number of different outcomes related to health and health care use, including GP consultations, GP certified sickness absences, hospital admissions (both inpatient and

outpatient admissions) and mortality. For all of these measures there is information about the main diagnose (given by ICPC-02 and ICD-10 codes respectively) related to each episode.

We define the adult health outcomes in two different ways. First we define the outcomes as totals over the period 2006-2014 (2008-2014 for the hospital data). These outcomes show how many times an individual uses different health care services, and are thus well suited to measure changes at the intensive margin. Secondly, we define the outcomes as an indicator variable that is equal to 1 if an individual had any use of health services or any certified sickness absesence at all during the period of 2006-2014 (2008-2014 for the hospital data), and can at an aggregated level be thought of as the probability to experience any such episode. This measure thus picks up changes at the extensive margin.

4.1 Sample Selection and Descriptive Statistics

To construct our main sample, we start with the entire resident population of Norway born between 1967-1976 that are alive and reside in Norway in 2006. This sample consists of 572,837 individuals. Following Havnes and Mogstad (2011b), we exclude children from families that move between municipalities during the expansion period to avoid migration induced by the reform, which makes up around 5 percent of the above sample. Since moving can be a result of the reform, we include the movers in a robustness check later. Further, we restrict the sample to children whose mothers were married at the end of 1975, which makes up 92 percent of the total sample. The reason for this is that these mothers were quite different from single mothers at that time. To avoid endogenous family formation due to the reform, we condition on pre-reform marital status. Finally, we exclude children whose mothers gave birth before age 16 or after age 49. The final sample then consists of 488,179 children from 310,205 mothers.

Table 2 shows the background characteristics of the individuals in our sample. We divide the sample into three groups based on exposure to the reform. Pre-reform cohorts are born between 1967–1969. They were not exposed to the reform. Phase-in cohorts are born between 1970–1972, they were somewhat exposed to the reform. Post-reform cohorts, which were fully exposed to the reform, are born between 1973–1976. The background characteristics are rather similar for all three groups, indicating that none of these background characteristics are likely to explain any differences in outcomes between the cohorts. 51 percent of the children in the sample are female, and 5 percent of the sample of children are immigrants. The mothers on average gave birth for the first time at age 23, while fathers were on average 26 at first birth. The parents on average have around 12 years of schooling, which corresponds to completing high school, when the child was 2 years old. The children have on average

1.87 siblings, and were on average the second born child.

5 Empirical Strategy

To estimate the effect of an expansion in the availability of subsidized child care on long term health outcomes, we apply a reduced form model that exploits the differential increase in child care coverage in municipalities with different pre-reform levels of formal child care. The 1975 child care reform assigned the responsibility of expanding child care to the municipalities, causing child care to expand a lot in some municipalities, while in others there was little or no increase in the coverage rate. The municipalities that had low coverage rates initially experienced a larger expansion of formal child care than those that already had higher coverage. We use the pre-reform coverage level as a predetermined indicator of the intensity of municipality response to the reform to be sure that the treatment variable is picking up the exogenous shock of the reform, and no other municipality characteristics that change during the expansion period.

In our main reduced form specification, the pre-reform coverage rate is a continuous variable. This assumes a linear relationship between the outcome variables and the pre-reform coverage rate. In Figure 2 pre-reform child care coverage is graphed against the absolute change in child care coverage rates from the pre-reform period (1973-1974) to the post-reform period (1976-1979), and there is a clear pattern showing that the increase in child care coverage after the reform was highest in municipalities that had lowest child care coverage before the reform. This picture is confirmed in Table 1 where we regress pre-reform coverage on post reform coverage, and find that one percentage point lower coverage before the reform is associated with an 77 percentage points increase in the post-reform period.

We define the child care expansion period as the period of 1976-1979. In this period the coverage rates increased from around 10 percent to around 28 percent. Children born in 1967-1969 are the pre-reform cohorts and were not affected by the reform, while children born in 1970-1972 are the phase-in cohorts, which were somewhat affected by the reform. Children born in 1973-1976 are the post cohorts, which were fully affected by the reform.

Our main estimating equation is given by:

$$Y_{ijt} = \beta_1 + \beta_2 PreCov_i + \beta_3 (PreCov_i \times Phasein_t) + \beta_4 (PreCov_i \times Post_t) + \beta_5 X_{ijt} + \theta_j + \gamma_t + \epsilon_{ijt} \quad (1)$$

Where Y is the health outcome of interest, i indexes child, j indexes municipality of residence in 1976, and t indexes the year the child turns three years old. $PreCov_i$ is the pre-reform child care coverage rate in municipality j, measured as an average over the pre-reform years 1973-1974. To ease interpretations, we define $PreCov_i$ as the negative pre-reform level

of child care, so that the parameter β_4 captures the average causal effects of having 1 lower percentage point child care coverage rate in the pre-reform period, which corresponds to an increase of about 77 percentage points in the child care coverage rate in the post-reform period. $Phasein_t$ and $Post_t$ are dummy variables equal to 1 when $t \in [1973, 1975]$ and $t \in [1976, 1979]$ respectively. The vector of covariates X includes parent's education when the child is two years old, the parents' age at first birth, number of siblings, birth order, the child's sex and immigrant status. θ_{ij} is a set of municipality-specific fixed effects, while γ_t is a set of cohort fixed effects. Thus, unobservable determinants of the long-run outcomes, which are fixed at the municipality level, are absorbed by the municipality fixed effects, while common time shocks are controlled for by the cohort fixed effects. Standard errors are clustered at the level of municipality of residence in 1976. As in Havnes and Mogstad (2011b), and Baker et al. (2008), among others, we interpret β_4 as intention-to-treat (ITT) effects, since we do not have information on actual use, and can only estimate reduced form effects.

The identifying assumption is that the change in the health outcomes of interest for 3 to 6 year olds before and after the child care reform would have been the same in municipalities with high and low pre-reform coverage in the absence of the reform. Because municipality fixed effects are included in our specifications, municipality characteristics that may be correlated with both the pre-reform coverage rate and health outcomes will not bias our estimates.

When evaluating the introduction of a reform, there is always a worry about confounding the effects of the reform with those from other reforms or changes taking place in the same period. However, except from a reform from 1977, which introduced paid maternity leave and extended the period of job protection, we have found no other reforms that were introduced in the same period. An extension in maternity leave could possibly influence family size, and in turn matter for child development. However, this reform was implemented at a national level, and should therefore be controlled for by the municipality fixed effects.

6 Empirical Results

The results from our main estimations are presented in Tables 3, 4, 5, 6, and 7. In all tables, the first half shows results from estimations on outcomes defined as totals over the period 2006-2014 (2008-2014 for hospital visits), while the second half shows results from estimations on outcomes defined as probabilities over the period 2006-2014 (2008-2014 for hospital visits). The first row in each table shows the ITT effects on the phase-in cohorts,

which are the cohorts that turned three in the period 1973-1975, while the second row shows the ITT effects of the reform on the post cohorts, which are the cohorts that turned three in the period 1976-1979.

In Table 3 effects on use of health care services and mortality are presented. From this table, we see that there are no overall effects on health care use of the reform. We also see that there is an increased probability of mortality for the phase-in cohorts.

In Tables 4, 5, 6, and 7 effects on GP consultations, certified sick leave, and hospital visits related to different diagnoses are presented. From Tables 4 and 5, we see that for the post-reform cohorts there are more GP consultations related to psychological diagnoses, depression and overweight. They also have higher probabilities of GP consultations related to musculoskeletal and psychological diagnoses, and overweight. We also find that they have lower probabilities of GP consultations related to cardiovascular diagnoses and asthma. For the phase-in cohorts, the results are relatively similar, except that they in addition have less GP consultations related to respiratory symptoms and asthma.

In Table 6 certified sick leave and related diagnoses are presented. From the table we see that there are increases in the probability of certified sick leaves related to psychological and respiratory symptoms on the post-reform cohorts, while there are no effects on the phase-in cohorts. In Table 7 hospital visits related to different diagnoses are presented. Here we see that there are descreases in the probability of visits related to cardiovascular diseases. There are also reductions in the total number of visits related to respiratory symptoms, as well as reduction in the probability of visits related to psychological symptoms, but an increase in the probability of visits related to metabolic symptoms.

6.1 Heterogeneity

VERY MUCH WORK IN PROGRESS. One reason why governments offer subsidized universal child care is that they want to counter differences in school readiness between children from different socioeconomic backgrounds, and create equal opportunities for all children. Previous research based on the same reform as we study find that child care has positive effects for children with low socioeconomic status, while it has no or disadvantageous effects for children with high socioeconomic status when it comes to long-term educational and labour market effects (Havnes and Mogstad, 2015). Almond and Currie (2011) show that girls and children with low-educated parents benefit the most from attending child care. Cornelissen et al. (2017) show that children of immigrants experience higher returns to early child care attendance in terms of overall school readiness than native children. Based on these findings, we therefore examine whether health effects of child care differ between dif-

ferent groups of the population. We look at differences by gender (Table 8), ethnicity (Table 9), and maternal education (Table 10).

There is no data on actual take-up rates from this period, and as there may be differences in take-up rates across subpopulations, interpreting the differences in estimates across subpopulations must be done with some caution.

7 Robustness Checks

To check that our results are not just the results of choices made with respect to specification and sample selection, we run a number of robustness checks. First, we explore alternative treatment definitions and alternative sample selection criteria. We include children of unmarried mothers in Table 11, individuals that move between municipalities in the expansion period between 1976-1979 in Table 12. We furthermore drop individual control variables Table 13. In Table 14 municipality specific time trends are included.

8 Conclusion

In this paper, we examine the effects on children's long-run health effects of the introduction of a child care reform in 1975 in Norway, which led to a large-scale expansion of universal subsidized child care for children 3 to 6-year-old in the late 1970s. We apply a reduced form model that exploits the differential increase in child care coverage in municipalities with different pre-reform levels of formal child care, and compare outcomes of children living in municipalities where child care expanded a lot to outcomes of children living in municipalities where child care expanded little in the years after the reform.

We find that individuals exposed to the reform have more GP more consultations related to psychological diagnoses and depression and higher probabilities of GP consultations related to musculoskeletal and psychological diagnoses, and overweight. However, we also find that they have lower probabilities of GP consultations related to cardiovascular diagnoses and asthma. When it comes to certified sick leave, we find that exposed individuals have higher probabilities of certified sick leave related to psychological and respiratory diagnoses. We also find that they have fewer hospital visits related to respiratory illnesses, lower probabilities of hospital visits related to cardiovascular and psychological illnesses, but higher probability of hospital visits related to metabolic diseases.

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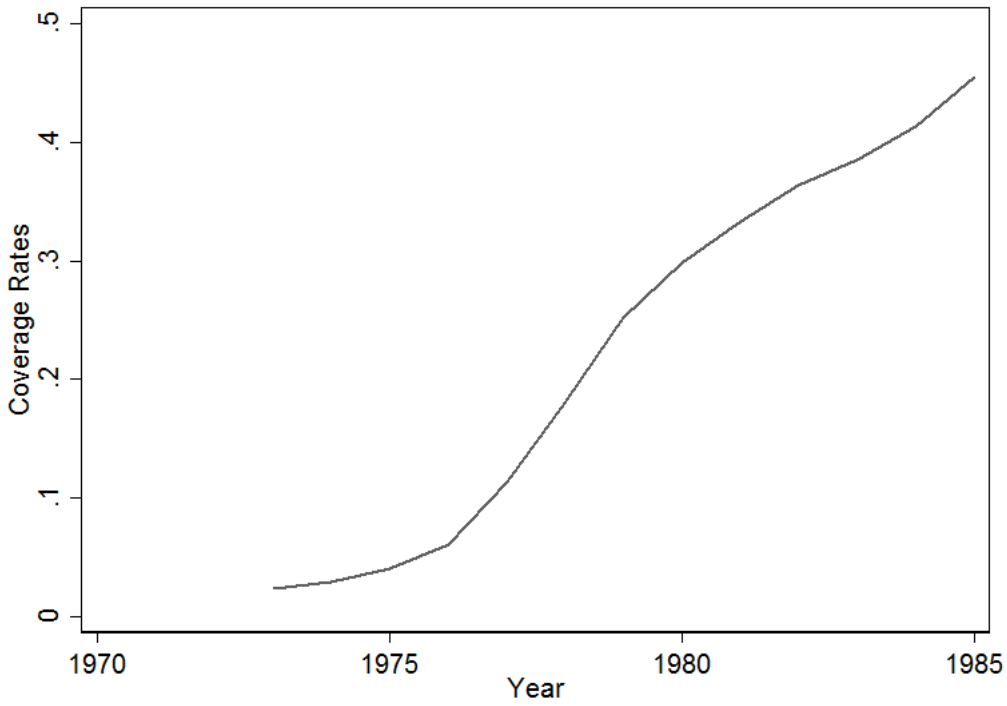
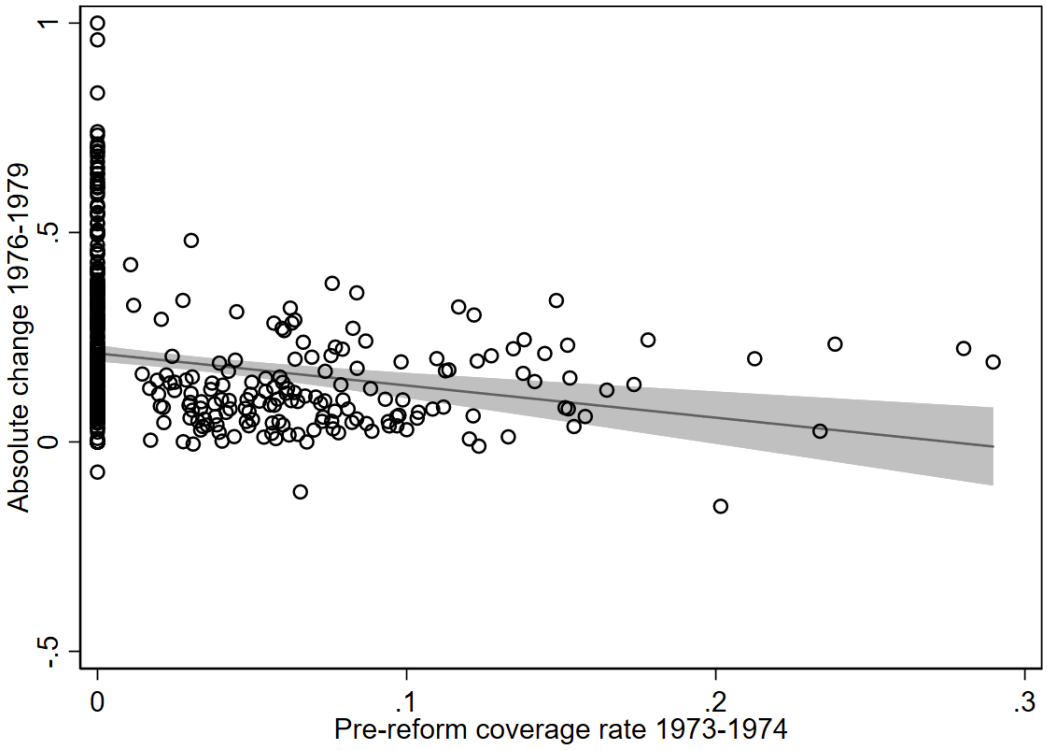
9 Figures and Tables

Figure 1: Child care coverage rates in Norway 1970-1985 for 3-6 year olds.



Note: This graph shows the increase in child care coverage rate for 3-6 year olds in Norway in the period between 1973-1985. The reform we examine took place in mid-1975. The greatest increase of child care coverage was in the period 1976-1979, which is the post-reform period we consider.

Figure 2: Child care coverage.



Note: This graph shows the average pre-reform child care coverage in 1973-1974 graphed against the absolute change in child care coverage in the expansion period between 1976-1979. Each dot represents a municipality. The solid line shows the fitted values with a 95 percent CI.

Figure 3: Variation in the child care coverage rate in the pre-reform period (1973-1974).

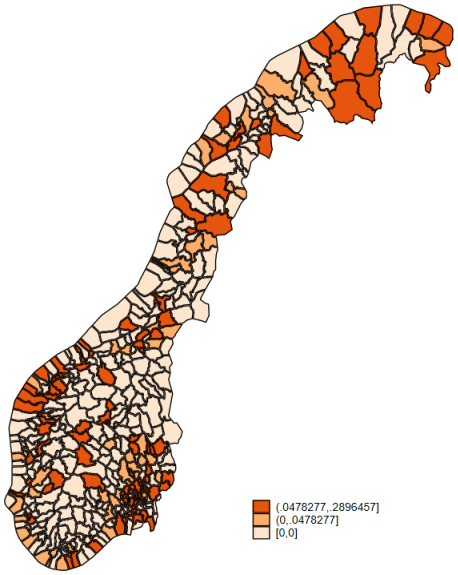


Figure 4: Variation in the child care coverage rate in the expansion period (1976-1979).

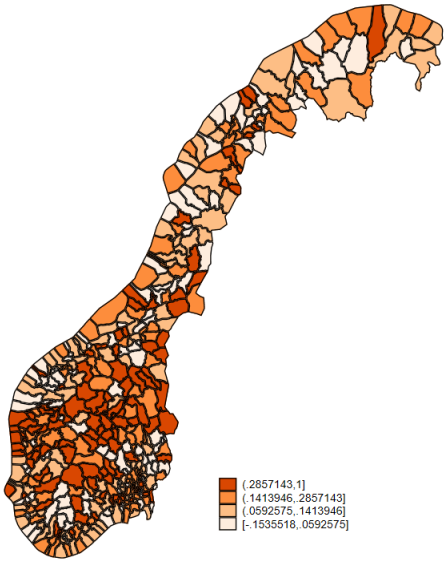


Table 1: Post-reform increase in child care coverage.

	Absolute change 1976-1979
Pre-reform coverage rate 1973-1974	0.7676***
	(0.1783)
Observations	445

Note: This table shows the correlation between pre-reform child care coverage in the period (1973-1974) and increase in child care coverage in the post-reform period (1976-1979) in each of the 445 municipalities. Standard errors are reported in parentheses. * p<0.1, ** p<0.05, *** p<0.01.

Table 2: Descriptive Statistics.

	Pre-reform cohorts		Phase-in cohorts		Post-reform cohorts	
	Mean	St.Dev.	Mean	St.Dev	Mean	St.Dev
Female	0.49	[0.50]	0.49	[0.50]	0.49	[0.50]
Immigrant	0.05	[0.22]	0.05	[0.22]	0.05	[0.22]
Older siblings	1.13	[1.24]	1.04	[1.17]	1.01	[1.08]
Birth order	2.13	[1.24]	2.04	[1.17]	2.01	[1.08]
Mother's age at first birth	23.11	[3.97]	23.01	[3.78]	23.27	[3.77]
Father's age at first birth	26.37	[5.19]	26.01	[4.92]	26.05	[4.71]
Mother's education when child is 2 years old	11.76	[2.03]	11.92	[2.06]	11.85	[1.97]
Father's education when child is 2 years old	12.27	[2.49]	12.32	[2.43]	12.22	[2.26]
Relocated	0.07	[0.26]	0.09	[0.29]	0.12	[0.33]
Observations	174829		166314		147036	

Note: Pre-reform cohorts are born between 1967–1969, phase-in cohorts are born between 1970–1972, and post-reform cohorts are born between 1973–1976. Standard deviations are in brackets.

Table 3: Use of health care services and certified sickness absence.

	Mortality	GP consultations	Sick leave	Hospital visits
Totals				
Phase-in×PreCov		-0.5552		-0.0883
		(1.1975)		(0.1254)
Post×PreCov		-1.3779		0.0722
		(1.2747)		(0.2213)
p-value		0.280		0.744
R-W p-value		0.337		0.638
Pre-reform mean		[22.8]		[1.23]
Probability				
Phase-in×PreCov	0.0091***	-0.0005	-0.0078	-0.0319
	(0.0032)	(0.0059)	(0.0139)	(0.0212)
Post×PreCov	0.0037	-0.0049	-0.0145	0.0055
	(0.0032)	(0.0084)	(0.0151)	(0.0321)
p-value	0.242	0.562	0.336	0.863
R-W p-value	0.789	0.865	0.865	0.865
Pre-reform mean	[.00877]	[.968]	[.686]	[.42]
Observations	488179	488179	488179	488179

Note: OLS regressions. All parameters in one column are from a separate regression of the outcome variable on pre-reform child care coverage. Robust standard errors clustered at the level of municipality of residence in 1976 are reported in parentheses and comparison means in brackets. Controls as listed in Table 2, as well as cohort and municipality fixed effects are included in all regressions. * p<0.1, ** p<0.05, *** p<0.01.

Table 4: GP visits and related diagnoses.

	C-diagnoses	M-diagnoses	P-diagnoses	R-diagnoses
Totals				
Phase-in×PreCov	-0.0988	0.0385	0.8511*	-0.3851***
	(0.1882)	(0.3652)	(0.4542)	(0.1464)
Post×PreCov	0.1161	-0.0201	1.1205**	-0.0653
	(0.2280)	(0.3296)	(0.4440)	(0.1413)
p-value	0.611	0.951	0.012	0.644
R-W p-value	0.809	0.936	0.111	0.936
Pre-reform mean	[1.44]	[6.01]	[3.99]	[2.9]
Probability				
Phase-in×PreCov	-0.0291	0.0325	0.0279*	-0.0078
	(0.0184)	(0.0202)	(0.0145)	(0.0181)
Post×PreCov	-0.0279*	0.0345**	0.0500***	0.0182
	(0.0161)	(0.0151)	(0.0142)	(0.0161)
p-value	0.083	0.022	0.000	0.258
R-W p-value	0.279	0.199	0.084	0.335
Pre-reform mean	[.297]	[.776]	[.427]	[.69]
Observations	488179	488179	488179	488179

Note: OLS regressions. All parameters in one column is from a separate regression of the outcome variable on pre-reform child care coverage. Robust standard errors clustered at the level of municipality of residence in 1976 are reported in parentheses and comparison means in brackets. Controls as listed in Table 2, as well as cohort and municipality fixed effects are included in all regressions. * p<0.1, ** p<0.05, *** p<0.01.

Table 5: GP visits and related diagnoses.

	Asthma	Anxiety	Depression	Blood pressure	Overweight
Totals					
Phase-in×PreCov	-0.0838*	-0.2390**	0.3886***	-0.0108	0.0779
	(0.0459)	(0.1039)	(0.1497)	(0.0262)	(0.0573)
Post×PreCov	-0.0002	0.0760	0.2571**	-0.0044	0.0853*
	(0.0458)	(0.0994)	(0.1151)	(0.0242)	(0.0452)
p-value	0.997	0.445	0.026	0.856	0.060
R-W p-value	0.984	0.813	0.538	0.873	0.402
Pre-reform mean	[.239]	[.395]	[1.17]	[.0972]	[.185]
Probability					
Phase-in×PreCov	-0.0192	-0.0121	0.0211	-0.0047	0.0175**
	(0.0142)	(0.0079)	(0.0131)	(0.0064)	(0.0069)
Post×PreCov	-0.0171*	-0.0096	-0.0049	-0.0058	0.0222***
	(0.0089)	(0.0070)	(0.0107)	(0.0064)	(0.0074)
p-value	0.056	0.170	0.647	0.362	0.003
R-W p-value	0.255	0.482	0.753	0.450	0.028
Pre-reform mean	[.0694]	[.0544]	[.155]	[.0322]	[.0475]
Observations	488179	488179	488179	488179	488179

Note: OLS regressions. All parameters in one column is from a separate regression of the outcome variable on pre-reform child care coverage. Robust standard errors clustered at the level of municipality of residence in 1976 are reported in parentheses and comparison means in brackets. Controls as listed in Table 2, as well as cohort and municipality fixed effects are included in all regressions. * p<0.1, ** p<0.05, *** p<0.01.

Table 6: Certified sick leave and related diagnoses.

	C-diagnoses	M-diagnoses	P-diagnoses	R-diagnoses
Probability				
Phase-in×PreCov	-0.0057	0.0130	0.0163	0.0163
	(0.0086)	(0.0133)	(0.0139)	(0.0139)
Post×PreCov	-0.0030	-0.0232	0.0309*	0.0309*
	(0.0087)	(0.0143)	(0.0184)	(0.0184)
p-value	0.728	0.106	0.094	0.094
R-W p-value	0.825	0.510	0.394	0.394
Pre-reform mean	[.0732]	[.436]	[.294]	[.294]
Observations	488179	488179	488179	488179

Note: OLS regressions. All parameters in one column is from a separate regression of the outcome variable on pre-reform child care coverage. Robust standard errors clustered at the level of municipality of residence in 1976 are reported in parentheses and comparison means in brackets. Controls as listed in Table 2, as well as cohort and municipality fixed effects are included in all regressions. * p<0.1, ** p<0.05, *** p<0.01.

Table 7: Hospital visits and related diagnoses.

	C-diagnoses	M-diagnoses	P-diagnoses	R-diagnoses	Met-diagnoses
Totals					
Phase-in×PreCov	-0.0206	-0.0007	0.0008	-0.0447***	-0.0078
	(0.0154)	(0.0173)	(0.0119)	(0.0099)	(0.0109)
Post×PreCov	-0.0219	0.0222	-0.0285	-0.0374***	0.0124
	(0.0144)	(0.0308)	(0.0188)	(0.0122)	(0.0097)
p-value	0.128	0.002	0.130	0.201	0.471
R-W p-value	0.565	0.108	0.319	0.566	0.566
Pre-reform mean	[.0611]	[.0738]	[.0182]	[.0314]	[.0138]
Probability					
Phase-in×PreCov	-0.0044	-0.0068	0.0002	-0.0041	0.0006
	(0.0048)	(0.0075)	(0.0032)	(0.0057)	(0.0032)
Post×PreCov	-0.0121***	0.0064	-0.0059*	-0.0038	0.0046*
	(0.0045)	(0.0116)	(0.0033)	(0.0067)	(0.0028)
p-value	0.008	0.574	0.072	0.100	0.582
R-W p-value	0.363	0.785	0.502	0.502	0.785
Pre-reform mean	[.0323]	[.0522]	[.00916]	[.0216]	[.00732]
Observations	488179	488179	488179	488179	488179

Note: OLS regressions. All parameters in one column is from a separate regression of the outcome variable on pre-reform child care coverage. Robust standard errors clustered at the level of municipality of residence in 1976 are reported in parentheses and comparison means in brackets. Controls as listed in Table 2, as well as cohort and municipality fixed effects are included in all regressions. * p<0.1, ** p<0.05, *** p<0.01.

Table 8: Heterogeneity: Gender.

	Mortality	GP consultations	Sick leave	Hospital visits
Totals				
Post×PreCov		8.4232***		1.2807***
		(1.1937)		(0.2808)
Interaction term		-19.7321***		-2.4330***
Female		(3.5793)		(0.8841)
Pre-reform mean		[22.8]		[1.23]
Probability				
Post×PreCov	0.0027	0.0028	0.0950***	0.3583***
	(0.0046)	(0.0080)	(0.0295)	(0.0765)
Interaction term	0.0020	-0.0155**	-0.2205***	-0.7103***
Female	(0.0041)	(0.0066)	(0.0470)	(0.2072)
Pre-reform mean	[.00877]	[.968]	[.686]	[.42]
Observations	488179	488179	488179	488179

Note: OLS regressions. All parameters in one column is from a separate regression of the outcome variable on pre-reform child care coverage. Robust standard errors clustered at the level of municipality of residence in 1976 are reported in parentheses and comparison means in brackets. Controls as listed in Table 2, as well as cohort and municipality fixed effects are included in all regressions. * p<0.1, ** p<0.05, *** p<0.01.

Table 9: Heterogeneity: Immgrants.

	Mortality	GP consultations	Sick leave	Hospital visits
Totals				
Post×PreCov		-0.9412		0.1006
		(1.4381)		(0.2409)
Interaction term		-4.4646**		-0.2899
Immigrant		(1.9653)		(0.2569)
Pre-reform mean		[22.8]		[1.23]
Probability				
Post×PreCov	0.0034	-0.0116	-0.0141	-0.0027
	(0.0028)	(0.0072)	(0.0155)	(0.0309)
Interaction term	0.0038	0.0686***	-0.0045	0.0846***
Immigrant	(0.0076)	(0.0177)	(0.0364)	(0.0313)
Pre-reform mean	[.00877]	[.968]	[.686]	[.42]
Observations	488179	488179	488179	488179

Note: OLS regressions. All parameters in one column is from a separate regression of the outcome variable on pre-reform child care coverage. Robust standard errors clustered at the level of municipality of residence in 1976 are reported in parentheses and comparison means in brackets. Controls as listed in Table 2, as well as cohort and municipality fixed effects are included in all regressions. * p<0.1, ** p<0.05, *** p<0.01.

Table 10: Heterogeneity: Mother's education level.

	Mortality	GP consultations	Sick leave	Hospital visits
Totals				
Post×PreCov		-8.0333***		0.4438
		(2.8354)		(0.3055)
Interaction term		9.5919***		-0.1340
Mother's educ. high		(2.6227)		(0.1160)
Pre-reform mean		[22.8]		[1.23]
Probability				
Post×PreCov	0.0010	-0.0175**	-0.0700**	0.0233
	(0.0049)	(0.0084)	(0.0307)	(0.0322)
Interaction term	0.0086	0.0027	0.0647*	-0.0064
Mother's educ. high	(0.0058)	(0.0060)	(0.0341)	(0.0204)
Pre-reform mean	[.00877]	[.968]	[.686]	[.42]
Observations	352846	352846	352846	352846

Note: OLS regressions. All parameters in one column is from a separate regression of the outcome variable on pre-reform child care coverage. Robust standard errors clustered at the level of municipality of residence in 1976 are reported in parentheses and comparison means in brackets. Controls as listed in Table 2, as well as cohort and municipality fixed effects are included in all regressions. * p<0.1, ** p<0.05, *** p<0.01.

Table 11: Robustness - including children of unmarried mothers.

	Mortality	GP consultations	Sick leave	Hospital visits
Totals				
Phase-in×PreCov		-0.8813		-0.0663
		(0.8419)		(0.0993)
Post×PreCov		-0.9181		0.1543
		(1.0525)		(0.2461)
Pre-reform mean		[23.2]		[1.26]
Probability				
Phase-in×PreCov	0.0062**	0.0013	-0.0091	-0.0374**
	(0.0030)	(0.0054)	(0.0135)	(0.0184)
Post×PreCov	0.0024	-0.0044	-0.0137	0.0119
	(0.0027)	(0.0094)	(0.0145)	(0.0315)
Pre-reform mean	[.00921]	[.968]	[.688]	[.424]
Observations	533403	533403	533403	533403

Note: OLS regressions. All parameters in one column is from a separate regression of the outcome variable on pre-reform child care coverage. Robust standard errors clustered at the level of municipality of residence in 1976 are reported in parentheses and comparison means in brackets. Controls as listed in Table 2, as well as cohort and municipality fixed effects are included in all regressions. * p<0.1, ** p<0.05, *** p<0.01.

Table 12: Robustness - including those who move in the expansion period.

	Mortality	GP consultations	Sick leave	Hospital visits
Totals				
Phase-in×PreCov		0.1265		-0.0075
		(1.1014)		(0.1129)
Post×PreCov		-0.5724		0.1518
		(1.1351)		(0.2097)
Pre-reform mean		[22.9]		[1.24]
Probability				
Phase-in×PreCov	0.0092***	-0.0007	-0.0013	-0.0223
	(0.0033)	(0.0061)	(0.0124)	(0.0210)
Post×PreCov	0.0019	-0.0058	0.0023	0.0109
	(0.0029)	(0.0080)	(0.0147)	(0.0329)
Pre-reform mean	[.0088]	[.968]	[.686]	[.421]
Observations	516161	516161	516161	516161

Note: OLS regressions. All parameters in one column is from a separate regression of the outcome variable on pre-reform child care coverage. Robust standard errors clustered at the level of municipality of residence in 1976 are reported in parentheses and comparison means in brackets. Controls as listed in Table 2, as well as cohort and municipality fixed effects are included in all regressions. * p<0.1, ** p<0.05, *** p<0.01.

Table 13: Robustness - no controls.

	Mortality	GP consultations	Sick leave	Hospital visits
Totals				
Phase-in×PreCov		-0.5567		-0.0900
		(1.3063)		(0.1299)
Post×PreCov		-0.9393		0.0827
		(1.2678)		(0.2245)
Pre-reform mean		[22.8]		[1.23]
Probability				
Phase-in×PreCov	0.0090***	0.0008	-0.0061	-0.0323
	(0.0032)	(0.0060)	(0.0141)	(0.0219)
Post×PreCov	0.0037	-0.0006	-0.0040	0.0086
	(0.0032)	(0.0085)	(0.0157)	(0.0328)
Pre-reform mean	[.00877]	[.968]	[.686]	[.42]
Observations	466979	466979	466979	466979

Note: OLS regressions. All parameters in one column is from a separate regression of the outcome variable on pre-reform child care coverage. Robust standard errors clustered at the level of municipality of residence in 1976 are reported in parentheses and comparison means in brackets. Cohort and municipality fixed effects are included in all regressions. * p<0.1, ** p<0.05, *** p<0.01.

Table 14: Robustness - including linear time trends.

	Mortality	GP consultations	Sick leave	Hospital visits
Totals				
Phase-in×PreCov		0.4109		0.0508
		(1.4229)		(0.1868)
Post×PreCov		0.8685		0.3639
		(2.6020)		(0.3508)
Pre-reform mean		[22.8]		[1.23]
Probability				
Phase-in×PreCov	0.0108**	-0.0160	-0.0337	-0.0387
	(0.0043)	(0.0115)	(0.0230)	(0.0258)
Post×PreCov	0.0074	-0.0352	-0.0611	-0.0094
	(0.0076)	(0.0231)	(0.0417)	(0.0476)
Pre-reform mean	[.00877]	[.968]	[.686]	[.42]
Observations	466979	466979	466979	466979

Note: OLS regressions. All parameters in one column is from a separate regression of the outcome variable on pre-reform child care coverage. Robust standard errors clustered at the level of municipality of residence in 1976 are reported in parentheses and comparison means in brackets. Controls as listed in Table 2, as well as cohort and municipality fixed effects are included in all regressions. * p<0.1, ** p<0.05, *** p<0.01.