The Effects of a Universal Child Care Reform on Child Health – Evidence from Sweden

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Abstract: This paper studies the effect of a Swedish universal child care reform on child health outcomes. We draw on a unique set of merged population register data from the province of Skåne, following over the period 1999-2008. It contains merged information at the individual level from the population register, the income tax register, the medical birth register and the inpatient and outpatient registers. The outpatient register contains all ambulatory care contacts including all contacts with physicians and therapists. Visits are recorded by day, and diagnoses are recorded for each visit. Our identification strategy relies on a sibling sample design that allows to compare the impact of the reform across siblings within households. Despite exploiting a rather general measure of the reform impact, we additionally make use of detailed information on household-specific monthly child care fee. Our results suggest that children being fully affected by the reform have better physical health at ages 4–5 and 6–7, are significantly better off in development and psychological conditions at age 6–7. These effects are particularly distinct for children from low income families, being in line with the literature on early child interventions. Changes in child care prices also predict better physical health for younger children. The results are mainly driven by two mechanisms, a crowding out effect of informal care and an income effect, and are strongly supported by the so called hygiene hypothesis. The findings imply that child care prices play a crucial role in the provision of universal child care.

JEL classification: I12, J13, J14, C23, C25, C83

Keywords: child health, preschool reform Sweden, register data, child care fees

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1 Introduction

In the last decade, European countries have started to expand child care programs in order to influence children's development and well-being at an early stage, and to stimulate maternal labor supply. Early life conditions are very important for the development of human capabilities, as they do not only have short-run effects on human development but persist into the future by determining educational attainment, earnings and health. While small scaled child care programs targeting at children from disadvantaged families are favored in the US, such as Head Start or the Perry Preschool Program, more and more European countries are implementing universal child care arrangements. The idea of the latter concept is that all children benefit from attending an universal child care program in terms of social, physical, cognitive and noncognitive development, regardless of the family background.

A large body of literature studies the importance of child investment through universal preschooling for in early childhood development. Felfe and Lalive (2013) find significant positive effects of center-based child care before age of three on school readiness indicators for children with foreign parents or less educated mothers for Germany. Moreover, Dustman *et al*. (2013) show that children of immigrant ancestry significantly benefit from a universal German child care program. In contrast, Baker *et al*. (2008) provide evidence for negative short run effects of the introduction of highly-subsidized universal child are in Quebec, Canada, on children's behavior. Using Danish data, Gupta and Simonsen (2010) do not find any effects of child care enrollment at age three on child outcomes at age seven. Exploiting a child care reform in the 1970s in Norway, Havnes and Mogstad (2011) find strong positive effects on children's long term education and labor market outcomes. The same team of authors show in a follow-up study that long-term reform effects are heterogeneous along the earnings distribution (Havnes and Mogstad (2014)). Using a regression discontinuity approach, Black *et al*. (2014) estimate the effect of child care prices on child outcomes in Norway. They find a significant positive effect of lower child care prices on children's schooling performance, suggesting a potive income effect due to eligibility to lower fees. Despite the mixed results found in the literature, almost all of these studies exclusively focus on cognitive and noncognitive measures of child development. Evidence on the effect on child health however is scarce.

In this paper we examine the impact of a major reform of universal child care in Sweden in January 2002 on child health. The centerpiece of the Swedish child care reform is the introduction of a maximum fee rule which led to considerable cuts in the child care fees for public formal care (Brink *et al*. (2007)). Before the reform each municipality was eligible to set the price for child care by its own as long as the price was reasonable. The introduction of the maximum fee rule imposed a ceiling on child care charges and set a fixed price structure common to all municipalities. As a main consequence, child care prices significantly dropped and the price variation across municipalities collapsed (Mörk *et al*. (2013)).

Our identification strategy exploits two sources of variation in the maximum fee rule reform within the household,, allowing us to control for all sources of (un)observed heterogeneity at the household level. First, we compare health outcomes of siblings at the same age being subject to the reform or not within households. We group health outcomes for age 1–3, 4–5, and 6–8. In addition, we directly use information on calculated child care prices. Since child care prices itself depend on household income, thus being endogenous, we exploit the variation induced by the introduction of the maximum fee rule. Our empirical strategy allows us to assess on the one hand whether being subject to the reform has consequences for child health throughout childhood. Second, we can make a more distinct conclusion on the effectiveness of price changes as an instrument to improve child health.

We are the first who analyze the consequences of an universal preschool reform along different dimensions of physical and psychological child health. To our knowledge only the study by Baker *et al*. (2008) considers few indicators for child health drawn from parental survey reports. The authors find a negative impact of the reform on the incidence of throat, nose and ear infections in the past 12 months at ages 0–4. This result is not surprising but reflect the general observation that children suffer from infectious diseases when starting to attend public child care. The so called hygiene hypothesis makes this prediction for young children (Strachan (1989)). However, it also assumes that after the initial period of having more diseases has been finished, children are immunized against, thus being healthier later on. We can test these predictions with our data. Compared to the health measures used by Baker *et al*. (2008), our health data stem from comprehensive inpatient and outpatient registers over a period of ten years,1999–2008. We can therefore track children for a longer time period, exhibiting potential medium and long term health effects of the universal child care reform.

In addition to the administrative data, our analysis relies on child care formulas which have been collected from the municipalities before and after the reform. Since child care prices depend on a few characteristics which we observe in the register data we can calculate household-specific child care fees throughout the observation period. With this information at hand, we can separate that fraction of the reform effect that may mainly be driven by changes in disposable income.

Turning to the results, we find a strong impact of the maximum fee rule reform on child health at different ages. While effects for very young children are statistically very small, we find considerable physical health effects for both older age groups. For instance, the probability of respiratory diseases by 22% at age 4–5 and decreases by 19% at age 6–7 given baseline risks. The latter age group also experiences significant psychological health improvements if being subject to the reform, having for example a 25% lower probability for developmental impairments in relative terms. Physical and psychological health effects are most prevalent for children from low income families, thus benefiting most from the child care reform. Using child car prices as a measure for the analysis reveals stronger physical health effects at younger ages, while psychological health effects and the impact on health behavior are similar as for the specification with the full exposure measure. We assume that two mechanisms dominate our findings. The reform may induce a crowding out of informal care towards high quality formal care. This increases child care attendance particularly for children from low income families and starts the immunization process, leading to rather adverse health at young ages. However, the child care reform also imposes a drop in child care prices which may have short run income effects and therefore positive influence child health at young ages. The positive income effect and the negative immunization effect net each other out. Thus, we do not find physical health effects at age 1–3 that are significantly different from zero. While for older ages the positive gains of immunization become statistically visible, the direct positive effect from additional disposable income due to lower child care prices may expire. However, the additional income from the drop in child care prices may have been used by parents for additional investments in child quality, thus improving child health in the long run.

The paper is organized as follows: section two documents the Swedish preschool reform that took effect in 2002. Section three highlights the central elements of different data register on which we rely in this study. In the following section four we provide the empirical strategy and show the results from the estimation. Section five concludes.

2 Institutional Background

2.1 Child care

Sweden has a long tradition with universal child care, leading to very high levels of formal child care utilization compared to other European countries. More than 90 percentage of all children in the age group 3-5 attended child care in 2010 (OECD (2010)). The rates are also very high for children in the aged 1-2 years (Mörk *et al*. (2013)). This can be explained by the municipalities' obligations to provide highly subsidized, high quality care to children whose parents are working or studying (during regular office hours). As a result maternal labor supply in Sweden are very high; In 2000, 86% of mothers with pre-school children and 94% of mothers with school children were employed (Björnberg and Dahlgren (2005)). Moreover, majority of Swedish mothers are working full-time (more than 35 hours/week).

In the 1990's, Sweden was afflicted by an economic crisis which led to considerable cutbacks, also in child care. As a consequence municipalities raised the child care fees, and related them more and more to household income and the time children spent at child care. In addition, municipalities introduced different eligibility rules in order to reduce costs[1]. As the municipalities were allowed to freely set their own charges as long as these were "reasonable", child care prices varied widely throughout the country. As a consequence of this policy, some municipalities charged less than SEK 8,000 per year while in other municipalities parents had to pay more than 20,000 SEK per year. The municipalities attitude was to give parents the choice for or against care: they could either choose an alternative care or use it and be prepared to pay high fees.

In 1998, the Social Democrats published an article in a daily newspaper under the title "Halve the fee for day care centers!", proposing a large child care reform with the maximum fee rule as its centerpiece. At the same year, the Social Democrats won the election and the reform bill was passed by parliament in November 2000. They aimed at providing access to child care for all children, improving the economic situation for families with young children and increasing labor supply among parents (Brink *et al*. (2007)). The reform consisted of four parts which have been gradually introduced between January 2001 and January 2003. In a first step, children of unemployed parents received the right for a child care slot for at least 15 hours per week. One year later, this right was extended to children whose parents are on leave. In January 2002 the maximum fee rule was introduced. Even though the

[1] For example, children whose parents became unemployed could not keep their places at preschool. Also, children of parents on leave of absence experienced even greater difficulties in keeping their places. The fact that the preschool was not open to all children became an acute issue.

implementation was voluntary, all but two municipalities introduced the maximum fee rule. On 1 January 2003, the last package of the reform was implemented. It guarantees a universal preschool free of charge for 15 hours per week for all children age 4–5.

The maximum fee rule is considered as being the most important part of the reform and is the one studied in this paper. The price schedule of the maximum fee rule consists of two components: First, charge per child is now determined as a fixed percentage of the household income. Thus, the new child care prices solely vary by household income, and the number and age of children. Second, the prices for child care are capped at a maximum monthly income of 38,000 SEK (≈ 4,100 EUR)[2]. Per household and month, the maximum amount paid for preschool was thus set to 2,280 SEK (≈ 240 EUR, for three or more children; see Lundin *et al*. (2008), Mörk *et al*. (2013)). In contrast to the other parts of the reform the maximum fee reform was not only applied to the preschool but also to after-school care. Table 1 illustrates the new fee schedule for preschool and after-school care.

Table 1: The fee schedule implemented on 1 January 2002

percent of HH income and maximum fees per child, preschool	
1. child	3 percent of HH income – maximum: 1,140 SEK/month
2. child	2 percent of HH income – maximum: 760 SEK/month
3. child	1 percent of HH income – maximum: 380 SEK/month
> 4 children	no charge
percent of HH income and maximum fees per child, after-day care	
1. child	2 percent of HH income – maximum: 760 SEK/month
2. child	1 percent of HH income – maximum: 380 SEK/month
3. child	1 percent of HH income – maximum: 380 SEK/month
> 4 children	no charge

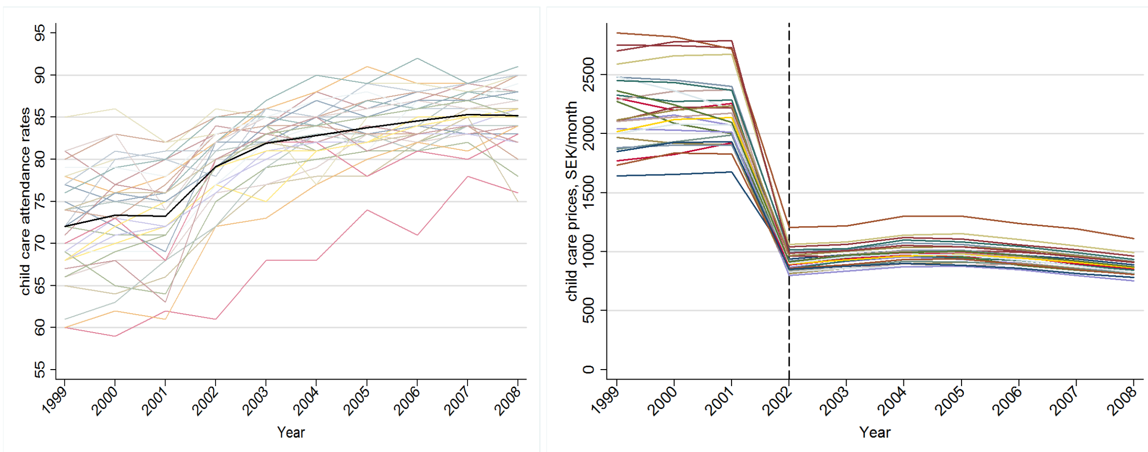
Sources:Skolverket (2003).

As mentioned above, prices for child care considerably varied across municipalities and household types before the reform. The introduction of the maximum fee rule induced a decline in price differences between municipalities. For example, in 1999 a child care fees for a household of two parents and two children aged 2–4 ranged between 1,558 SEK per month (Säter, Kopparbergs län) and 3,943 SEK/month in the municipality Tranås, Jönköpings län. After the reform, this variation was considerably reduced. The same family type paid between 1,039 SEK and 1,900 SEK per month after the reform took effect. A median household with two children and a rather high income of 46,554 SEK/month experienced an even stronger decrease in child care prices, approximately 53% on average (Skolverket (2003)). The price drop corresponds to a median fee reduction of about 40% for this family type. Even though the price cap was advantageous for medium and high income households, the fees were also substantially lower for low salaried single parents. As a percentage of salary, this group benefited most.

Figure 1 provides the municipality specific development of child care enrollment rates (a) and prices (b) for the

[2] This is the threshold introduced in 2002. In 2004 this value was increased to 42,000 SEK ≈ 4,500 EUR.

years 1999 to 2008. The municipalities considered here all belong to the region Skåne. Panel (a) illustrates the time trend in child care attendance rates by municipality. While they seem to be consistently increasing over time, the slope is steeper around the time the reform was implemented. Panel (b) illustrates the municipality-specific trend in child care fees. It is obvious that prices very different across municipalities before the reform. In 2002, prices experiences are strong drop. After the reform the prices are on a constantly lower level. Given these patterns one can assume that the increase in child care attendance rates in 2002/03 was driven by the sharp drop in child care fees.



(a) annual growth rate health costs & child care costs

(b) annual fraction of health costs on child care costs

Figure 1: Development child care attendance rates and child care prices over time

One general concern with the new price schedule was that quality of care may decline. To prevent this scenario, all municipalities received a granted compensation by the Swedish government in order to implement the reform and to balance the decreased fees[3]. Table 2 provides the development of few child quality indicators, the municipalities' total preschool expenditures, and the intensive and extensive margin of child care supply. As expected the child care quality was kept on a homogeneous level over time, having an average group size of about 5.4 children per case worker. Moreover, half of the personnel was educated with pedagogical training, implying that the quality of staff also did not suffer from the price cap. The municipality expenditures on preschool as well as the number of preschool institutions steadily increased, but the data do not suggest any discontinuities in the time trend. The only indicator that seems to be driven by the reform is the total number of child care personnel. The between 2001 and 2003 the staff rate increased by about 13%, and this trend continues for the remaining observed years. Given these numbers in table 2child care quality seems not to be negatively influenced by the maximum fee rule reform. Rather the increased child care demand has been remedied by a moderate increase in child care staff, not by impairments in child quality though (see also Mörk *et al*. (2013)).

[3] Note that child care was heavily subsidized already before the reform. User charges counted for about 16% of the municipalities' total costs for child care in 1999 and about 10% in 2003 (Brink *et al*. (2007)).

Table 2: Child quality, municipal expenditures and supply in Skåne, 1999-2008

	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
Enrolled children per caseworker	5.3	5.6	5.4	5.4	5.5	5.5	5.4	5.2	5.2	5.3
share of personnel with pedagogical training,%	54	55	55	54	55	54	54	54	54	55
municipal expenditures per child in SEK, 2010 prices	93,695	95,667	97,753	100,777	99,600	99,580	104,199	110,997	113,591	115,351
total number of child care staff	6,537	5,921	6,066	6,474	6,898	7,073	7,677	8,255	8,661	8,901
number of preschool institutions, entire Sweden	.	6,283	6,114	6,371	6,616	6,576	6,769	7,076	7,324	7,447

source: Skolverket, 1999-2008, these numbers refer to public child care facilities

2.2 Health care

In Sweden, health care is mostly public and organized at the region level. Within a region, different municipalities have different health care centers that house all outpatient care. The region of Skåne hosts nine hospitals, 150 local health care centers (primary care units), and one University hospital in the city of Lund. Typically, a rural community has only one center, and larger cities have multiple centers. Every individual is assigned to exactly one health care center which usually is the nearest center. Each center has a team of physicians, first-aid workers, and nurses. In case of a need to see a health care worker, including first-aid and emergency aid, an individual goes to the center and is helped by the next available appropriate health care worker. There is no path dependence in the identity of the health care worker across consecutive contacts. For a given contact reason, on a given day, incoming individuals are dealt with sequentially by the first available health care workers. Workers in the health care sector (from nurses to hospital specialists) are county civil servants. The health care system is funded through a proportional county tax on income. Health care usage is free, with the exception of a small deductible which in our observation window is capped at about 80 euro per adult person per year.

3 Theoretical considerations

The maximum fee reform led to an increase in child care attendance rates by about 10%. We assume that these higher rates reflect an increase in child care demand, rather than a pure supply side effect. Supply side constraints exist if parents are willing to pay the market prices for child care but cannot not find such an arrangement (Blau and Hagy (1998)). However, in the case of Sweden each household could get a child care slot if they were willing to pay the prices set by municipalities. The price changes on the household level induced by the maximum fee reform thus are strongly correlated with municipality level changes in child care demand.

We assume that parents in a household maximize utility by making choices on own consumption and child quality subject to budget and time constraints. Child quality consists of different input factors and is produced by either monetary investments in formal child care and by purchasing market goods for children, or by time investments. Market goods are for instance books, music lessons, or sports. Child health is one dimension of child quality and can thus change if the price for child care has changed. Different mechanisms can be at play: the level of child care before the reform, parental preferences for formal care, as well as income and substitution effects on parental consumption and child quality. Thus, the magnitude and the direction of the price effect on child quality and thus on child health is ex ante ambiguous (Havnes and Mogstad (2014)).

The drop in child care fees associated with the maximum fee reform can affect child health through several channels. First, the availability of affordable child care may decrease the time maternal time investments devoted to child care. The additional time may lead to an increase maternal labor supply. This generates additional household income which can be used for the production of (higher) child quality (Black *et al*. (2014)).[4]. Alternatively, lower maternal time investments in informal child care may increase quality of the remaining time devoted to the child. Moreover, it may be used to produce other household goods that are inputs for child quality. Second, lower child care fees may increase monetary investments in alternative inputs for child quality. For example, the additional income may now be spent on purchasing market goods, such as lessons for playing an instrument or buying more books. In this case, changes in child health are purely driven by the income effect. A third channel may be fertility. If child care fees decrease households could afford more children. Siblings may be an important factor for social development and physical health. The literature has shown that a bigger family size has positive effects on child health, since a greater exposure to infections early in life is beneficial for the immune system (Lundborg *et al*. (2013)). Finally, child health may be influenced by lower child care fees through the direct crowding of informal care arrangements (Havnes and Mogstad (2011)). If quality of formal care is higher than for informal care arrangements, this substitution process may positively influence child development and child health.

Some of these channels have been under investigation. Lundin *et al*. (2008) analyze the impact of the maximum fee rule on mother's labor supply using administrative data from Sweden. They use the same fee schedule as we are using. They do not find a net increase in female labor supply. Havnes and Mogstad (2014) exploit an exogenous increase in child care supply in Norway also finding almost no impact on labor supply of married mothers. Instead this Norwegian child care reform crowds out informal care arrangements (see also Havnes and Mogstad (2011)). In a similar way for Germany, Felfe and Lalive (2013) find a substitution from the time spent with the mother and other informal care provider, to time spent in the child care. Mörk *et al*. (2013) find limited effects of the price changes on the fertility behavior of Swedish families. While they provide evidence for an increase in first birth for formerly childless couples, the authors find only weak effects on timing of higher order births. There is no effect of lower child care fees on total fertility.

In a dynamic context, the child care reform can be viewed as a positive shock on child health investments at an early period in life, producing a higher stock of health at later stages (Almond and Currie (2011)). Heckman (2006) describes two features of this capacity formation. "Self productivity" implies that the stock of good health

[4] For parents that did not buy child care before the reform increased labor supply at the extensive margin represents a reasonable channel for the reform effect. Parents that already had e.g. half-time slots of public child care the positive effects of the price change on child health may work through increased hours of work.

children hold at the end of preschool translates into good health at later ages. In addition “dynamic complementarities” a high level of health makes later investments in health more productive. Together these two features provide the mechanism through which early childhood health begets later childhood or adult health (Cunha and Heckman (2008)). Therefore, a public child care reform may not only have an immediate effect on child health but will persist into schooling age and adolescence. Such a mechanism is broadly consistent with so called hygiene hypothesis (Strachan (1989)). Originally, this hypothesis states that a lack of early childhood exposure to infectious agents increases the susceptibility to allergic diseases by suppressing the natural development of the immune system. The immunization process is considered to be more effective the early exposure has set. Regarding the maximum fee reform, this reversely suggests that child care attendance may lead to less sensitization later in childhood. Accordingly, an early exposure to other children may first increase the rate of diseases, but decreases after the immunization process has been finished. The child care reform can be considered as an initial governmental health investment that compensates early health deficits by improving health in later childhood. If children are sick less often later they may not miss school and therefore not experience lacks in human capital formation.

4 Data and Empirical Strategy

4.1 Data

The analysis is based on a unique set of merged population register data from the province of Skåne, the southernmost and third most populous region in Sweden. This data follows a large subset of the population of Skåne over the period 1999-2008[5]. It contains merged individual level information from the population register, the income tax register, the medical birth register and the out-patient register.

Child health outcomes are derived from individual health care records in the 1999–2008 “patient administrative register systems” PASiS and PRIVA from the region of Skåne. These two registers are administrated by the Regional Council of Skåne and contain detailed records of all occurrences of inpatient and outpatient care for all inhabitants of the region. Here, “inpatient” refers to visits or spells at medical units that include at least one night’s stay. These are mostly overnight hospital treatments. “Outpatient” refers to all other contacts with care providers, i.e., all ambulatory care, such as day-time visits to physicians, dentists, therapists, emergency care units, specialized nurses, and physiotherapists. In addition, it covers consultations by telephone. Visits are recorded by day, and diagnoses are recorded for each visit. The diagnoses are at the highest level of detail of the ICD-10 classification system. The ICD-10 codes cover a large range of physical and mental health diagnoses, injuries as well as health care utilization information such as (preventive) checkups and vaccinations. For our purpose we collapse most of the detailed 3-digit ICD10 codes into 2-digit main categories and construct binary variables that indicate whether a person was diagnosed with a specific disease.

As noted earlier in the paper, most health care is public. However, some care providers (notably dentists) are

[5] Specifically the data set contains all people born between 1940 and 1985 and their family trees.

private. PASiS contains all publicly provided care, whereas PRIVA contains all privately provided care. The information in PASiS and PRIVA includes dates of admission and discharges, as well as detailed diagnoses and DRG-based costs. These registers have previously been used by Kristensson *et al*. (2007) and Tertilt and Van den Berg (2014). At the county level, the health care registers are collected because they determine the monetary streams from the county to the various health care centers and hospitals. At the same time, at the national level, the register data are collected as part of the so-called "National eHealth" endeavor to improve efficiency in health care. Here, institutional variation in the health care systems across counties is used for "natural experiments" in the analysis of the connection between health care diagnoses and treatments and health outcomes. For this reason, the national health authorities place great value in the collection of reliable health-care diagnosis records.

In Sweden, each individual has a unique identifier which is used to record all contacts with the health care system as well as the general public administration, tax boards, employment offices and so on. We use this to match the above-mentioned health care registers to individual information on socio-economic and demographic conditions. Specifically, we merge these registers to a data set that itself consists of a number of different registers. It includes variables from the annual LISA register on income by type, work absence days, detailed education measures, as well as information on date of birth, marital status, vertical family connections across different individuals, and migration status. This data set is annual, in the sense that each variable is only recorded once a year. This data set has been used before by Meghir and Palme (2005) and covers all persons born in Sweden between 1940 and 1985, their parents, and all their children.

We augment the data with information from Statistics Sweden, namely municipality-specific unemployment rates and population density. This is important information, since they may determine the child care fees before the maximum fee rule was introduced. We construct a panel data set in which we observe each child born between 1993–2004 and living in the region of Skåne between 1999–2008[6]. We restrict our analysis to household with parents that are married or cohabiting[7]. We set up a sibling sample, containing all remaining households with at least two and a maximum of four children. In order to prevent our estimates to be confound by the part of the reform addressing children with unemployed parents, we additionally drop households with at least one parent being unemployed before the reform. The corresponding sibling sample consists of 191,653 observations for 46,453 siblings observed at the same age 1–7, and a maximum of 10 waves.

As outcomes, we select a number of diseases as outcomes children have been diagnosed with and we categorize them along three different groups. The first group one denotes physical health outcomes which can be broadly divided into infections, ear diseases, respiratory diseases, skin diseases, accidents from intoxication or fractions, and other diseases. In addition, we consider few specific subcategories: viral infections, middle ear infections, and chicken pox. We select these health outcomes, since they record typical child diseases that are not innate. The second group are psychological health outcomes. Since the incidence of such diagnoses are rarely made during early childhood, we only take measures of developmental impairments and general psychological health. The lat-

[6] We are aware that this excludes all children from the sample that did not have any contact to a medical provider.

[7] Unfortunately, we do not observe new partners of children' parents. Moreover, we do not have any information on alimony payments. Thus we cannot calculate the child care fees for families with separated or divorced parents.

Table 3: Descriptive statistics: health outcomes & health beavhiors

	age 1–3		age 4–5		age 6–7	
	N = 69,805		N = 63,538		N = 58,310	
	mean	sd	mean	sd	mean	sd
viral infect	0.09	0.29	0.05	0.22	0.03	0.18
middle ear infect	0.18	0.39	0.15	0.35	0.10	0.30
chicken pox	0.01	0.07	0.00	0.06	0.00	0.04
infections, all	0.15	0.35	0.08	0.28	0.06	0.23
ear diseases	0.19	0.39	0.16	0.37	0.12	0.32
respiratory diseases	0.30	0.46	0.22	0.41	0.17	0.38
skin diseases	0.08	0.27	0.07	0.25	0.06	0.23
other diseases	0.10	0.30	0.08	0.27	0.08	0.27
intoxications & fractions	0.10	0.30	0.09	0.29	0.09	0.28
developmental impairment	0.01	0.12	0.08	0.27	0.04	0.20
psychological, all	0.02	0.14	0.09	0.27	0.06	0.24
preventive visit	1.62	2.26	0.81	0.88	0.30	0.59
diagnoses per year	2.40	4.06	2.30	4.35	1.86	3.58
visits per year	6.46	6.31	4.69	5.37	3.47	4.85

ter category comprises diagnoses on ADHD and intellectual problems. Health behaviors define the third category of outcomes. We analyze preventive health behavior as well as the number of medical visits and the number of diagnoses made per year. Table 3 displays the mean incidence of the outcomes by age group.

4.2 Empirical Strategy

Our analysis relies on sibling sample design. To estimate an overall reform effect we compare health outcomes of siblings in households that were fully affected by the reform versus siblings that were only partly or not affected by the reform. Since the reform took effect in January 2002 for all children aged 1–8 years, those born after December 2000 were subject to the reform at each age. Birth cohorts born before January 2001, were partly covered by the reform. We choose three different age groups for which health effects are measured: 1–3, 4–5, and 6–8. This allows us to assess the persistence of the initial reform effects. We set up a linear model that links health outcomes of child i in household j and municipality m at year t to dummy of full reform exposure $(born\_aft)_{ijm}$ and covariates.

$$Y_{ijmt,age=a} = \alpha_j + \beta(born\_aft)_{ijm} + X_{ijmt}\delta + \vartheta_t + \varphi_m + \epsilon_{ijmt}. \quad (1)$$

In this specification, α_j is a household fixed effect, ϑ_t is a linear time trend, φ_m is a municipality fixed effect, X_{ijmt} are covariates and ϵ_{ijmt} is an iid error term[8]. Importantly this equation is estimated separately for each age group, obtaining outcomes $Y_{ijmt,age=1-3}$, $Y_{ijmt,age=4-5}$, and $Y_{ijmt,age=6-8}$. While individual and household specific covariates are also determined by the observed age group, the dummy $(born\_aft)_{ijm}$ does not vary over time. Equation (1) estimates a linear probability panel model in which fixed demeaning is applied on the household level, obtaining an intention to treat (ITT) effect of full reform exposure on the probability of getting diagnosed with specific diseases at particular ages.

While the coefficient β measures an overall reform effect, child care prices can be used to evaluate a more detailed price effect of the reform. This allows to draw conclusions on a potential income effect being released through changes in child care prices. Thus, we directly use information on child care fees available to us to predict changes in child health. For calculating the child care fees in the years before and after the introduction of the maximum fee reform we exploit municipality-specific price formulas[9]. The household-specific child care fee in each municipality is a function of household income, age and number of children (Lundin *et al.* (2008), Mörk *et al.* (2013)):

$$P_{jmt} = f((\text{HH income})_{jt}, (\text{age children})_{jt}, (\text{no children})_{jt}), \tag{2}$$

where m denotes the municipality, j refers to a specific household and t is the calendar time. Prices can be calculated for all households with at least one child aged 1–9 years in the register data[10]. Since we do not observe child care attendance rates on the individual level we assume that children of childcare eligible age are enrolled in full-time childcare. Tracing back to the sibling level and taking the logarithm of the calculated child care prices, leads to the following specification linking log child care prices and child health.

$$Y_{ijmt,age=a} = \alpha_j + \gamma \log(fee)_{ijmt} + X'_{ijmt}\delta + \vartheta_t + \varphi_m + \epsilon_{ijmt}. \tag{3}$$

The coefficient γ provides us with the information on how many percentage points the probability of being diagnosed with any disease changes if we increase the child care prices across siblings at the same age by one percent. Since the child care reform significantly decreased child care prices, we expect that higher child care prices go along with higher adverse health risks. Consequently, lowering child care prices improves child health.

A difficulty when using child care prices directly is that they may be endogenous due to their determinants. In particular, we have to assume that household income is not exogenously determined on observables. In addition, the family income clearly affects child health at each age. It has been shown that investments in child health depends on disposable family income (see for instance Case *et al.* (2002), Currie and Stabile (2003)). Consequently, any

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[8] Given a linear time trend, we expect differences across children at the same age not to be driven by calendar time. Under this assumption it is sufficient to control for a linear time trend over ages only.

[9] Child care prices were collected by Eva Mörk and colleagues via an email-request sent to all Swedish municipalities asking for the exact price formulas. They received complete information from 220 of Sweden's 290 municipalities. For the region of Skåne 26 of 33 municipalities provided this information. Thus we exclude the municipalities Svalöv, Burlöv, Vellinge, Östra Göinge, Höör, Klippan and Lund from our analysis

[10] Due to our data restrictions we only analyze children's health outcomes below age of 8.

unobserved changes altering household income and child health may also change the child care prices. We reply to this issue by exploiting the fact that the timing of child care reform induces exogenous variation in the child care prices.

$$\log(fee)_{ijmt,age=a} = \alpha_j + \pi(timing\_ref)_{ijmt} + X'_{ijmt}\delta + \vartheta_t + \varphi_m + \zeta_{ijmt}. \quad (4)$$

In this first stage equation (4), the variable $(timing\_ref)_{ijmt}$ is the reform dummy which take the value at the time that reform had been implemented, and is zero otherwise. As in the second stage, we account for household fixed effects, municipality fixed effects and a linear time trend. We expect a strong negative shift of the child care prices stemming from the timing of the reform.

5 Results

We estimate equations (1) and (2) for age groups 1–3, 4–5 and 6–7 separately. We account for these age groups for several reasons. First, we think that children at different ages suffer from different diseases. Second, health of the youngest cohort may be negatively affected by the reform due to the predictions of the hygiene hypothesis. Children aged 4–5, however, may already be immunized against diseases that occur particularly at the age when first being exposed to other children. Finally, children aged 6–7 are at preschool or elementary schooling age. Positive health effects for these children could be interpreted a medium-run gains from the child care reform[11].

5.1 Main reform effects

Table 4 displays the results from the household fixed effects panel regression of equation (1). Being fully affected by the reform decreases the probability of middle ear diseases by 1.2 percentage points and general ear diseases by 1.4 percentage points. While effects for this age group are only suggestive, the impact of the reform on physical health seem to become more prevalent and stronger at older ages. For children being completely subject to the reform the probability of suffering from viral infections decreases by 1.2 percentage points, from middle ear infections by 2.2 percentage points, and from chicken pox by 0.2 percentage points. In addition, we find significant lower probabilities of suffering from general infections (1.9 percentage points), ear diseases (2.8 percentage points), respiratory diseases (2.5 percentage points) as well as from other disease (1.5 percentage points). The findings in table 4 indicate that full exposure to the reform is beneficial for physical child health at older ages. The pattern is consistent with the hygiene hypothesis that an immunization process is at work throughout childhood.

The results for psychological health effects and health behaviors are presented in table 5. At age 1–3 the probability of being diagnosed is by 0.5 percentage points lower if a child was subject to the reform. The probability of having a preventive visits increase by 9.8 percentage points for this age group, and also the number of visits per year seems

[11] We also estimated all regressions by defining two age groups only: 1–5 and 6–7. The results are available upon request.

Table 4: Effects of reform exposure on children's physical health

	viral infect	middle ear infect	chicken pox	infections all	ear diseases	respiratory diseases	skin diseases	intoxications fractions	other diseases
					age 1–3				
born_aft	-0.003	-0.013*	0.002	0.002	-0.014*	0.008	0.010*	0.006	0.007
	(0.005)	(0.007)	(0.001)	(0.006)	(0.007)	(0.008)	(0.006)	(0.006)	(0.005)
N×T	62,164	62,164	62,164	62,164	62,164	62,164	62,164	62,164	62,164
N	13,380	13,380	13,380	13,380	13,380	13,380	13,380	13,380	13,380
					age 4–5				
born_aft	-0.012***	-0.024***	-0.003**	-0.018***	-0.030***	-0.026***	-0.010**	-0.006	-0.017***
	(0.0004)	(0.007)	(0.001)	(0.005)	(0.007)	(0.007)	(0.005)	(0.006)	(0.005)
N×T	58,355	58,355	58,355	58,355	58,355	58,355	58,355	58,355	58,355
N	17,406	17,406	17,406	17,406	17,406	17,406	17,406	17,406	17,406
					age 6–7				
born_aft	-0.007*	-0.024***	-0.001	-0.009*	-0.024***	-0.032***	-0.011*	-0.015**	-0.018***
	(0.004)	(0.007)	(0.001)	(0.005)	(0.007)	(0.008)	(0.006)	(0.006)	(0.006)
N×T	54,038	54,038	54,038	54,038	54,038	54,038	54,038	54,038	54,038
N	14,946	14,946	14,946	14,946	14,946	14,946	14,946	14,946	14,946

standard errors are clustered on the household level; *** p<0.01, ** p<0.05, * p<0.1; sibling fixed effects regression and control for a linear time trend and municipality fixed effects. Controls: gender, annual household income, number of kids in household, unemployed father after reform, number of older siblings, child moved, log birth weight, twins, private doctor visit, acute visit, outpatient visit, unemployment rate and population density in municipality.

to increase (12.7 percentage points). Intuitively, this result is in line with the assumption that children are ill more often when starting child care. Moreover, child care stuff may make parents more aware of their children's health condition, explaining the increase in preventive visits. While no beneficial psychological health effects can be found for age 4–5, the probability of having psychological impairments significantly decreases by 1.4 percentage points at age 6–7. In addition we find a 1.0 percentage point decrease in the probability of being diagnosed with developmental problems in this age group. Health behaviors at both age groups seems to be significantly influenced by the reform. The probability of having a preventive visits significantly decreases by 3.1 and 5.1 percentage points, and also the number of diagnoses per year and the number of medical visits per year are significantly lower for children fully affected by the reform.

Table 5: Effects of reform exposure on children's psychological health and health behavior

	developmental impairments	psychological all	preventive visits	diagnoses per year	visits per year
			age 1–3		
born_aft	-0.002	-0.006**	-0.044	0.037	-0.045
	(0.001)	(0.002)	(0.034)	(0.051)	(0.076)
N×T	62,164	62,164	62,164	62,164	62,164
N	13,380	13,380	13,380	13,380	13,380
			age 4–5		
born_aft	0.004	0.002	-0.027*	-0.206**	-0.155*
	(0.006)	(0.006)	(0.015)	(0.081)	(0.090)
N×T	58,355	58,355	58,355	58,355	58,355
N	17,406	17,406	17,406	17,406	17,406
			age 6–7		
born_aft	-0.008*	-0.014**	-0.069***	-0.095	-0.187**
	(0.005)	(0.005)	(0.012)	(0.065)	(0.080)
N×T	54,038	54,038	54,038	54,038	54,038
N	14,946	14,946	14,946	14,946	14,946

standard errors are clustered on the household level; *** p<0.01, ** p<0.05, * p<0.1; sibling fixed effects regression and control for a linear time trend and municipality fixed effects. Controls: gender, annual household income, number of kids in household, unemployed father after reform, number of older siblings, child moved, log birth weight, twins, private doctor visit, acute visit, outpatient visit, unemployment rate and population density in municipality.

The estimates are of considerable size when interpreted along given baseline risks (see table 3), ranging between 6% to 24%. For example, the probability of infections decreases by about 23%, and the probability of ear diseases by about 19% in relative terms at age 4–5. At age 6–7 largest relative percent decrease in probabilities of getting a diagnoses is for psychological outcomes. Given a baseline risk for psychological impairments of 6% on average, the probability of getting diagnosed with such a disease is by about 23% lower if being fully affected by the reform. Overall, the impact of the child care reform on different dimension of child health seems to be very distinct. Children aged 4–5 seem to particularly benefit from the reform, but also children at schooling age. However, it is not clear ex ante whether our results are purely driven by the fact that younger children are less often in child care. In this case the estimated ITT effect is just too weak. Moreover, effects of such a reform on child health may be lagged and benefits appear later even though an early child care attendance is of advantage. Potential mechanisms that are supported by these results are the hygiene hypothesis and the income effect. Both will be discussed in section 5.4.

5.2 Reform effects by income

The main consequence of the maximum fee rule reform was a significant drop in the child care fees municipality could charge parents for. While the introduction of a ceiling in the child care fees led financial discharges for high income household, imposing a fix schedule for child care prices should make child care affordable for all households. Thus, increases in municipality-specific child care attendance rates might be driven by household whose children attend child care only after the reform. Unfortunately, we cannot observe whether a child attended child care or not. However, it is likely the case that children from disadvantaged families show strongest improvements in child health, even though they do not face any positive changes in household income due to the reform.
Table 6 and table 7 provide the results from estimating the reform effects stratified by household income in 2001. Given the structure of the maximum fee rule reform, we assume that strong health effects for low income households is mainly driven by crowding out of informal care and by an immunization process, while positive changes for high income households are due to the increase in disposable income induced by the reform. Health improvements for households that are around the mean of the income distribution in the region of Skåne in 2001, may be the result of a mix of both mechanisms.

The first panel of table 6 shows the effects of the reform for children aged 1–3 years. We find only moderate lower probabilities of being diagnosed with middle ear infections or general ear diseases, and only for children from high income households. In addition, children from median income households that were subject to the reform show higher probabilities for general infections, chicken pox and skin diseases. The reform effect on child health is statistically not different from zero for children from low income households. The results fit in the conjecture that exposure to other children may generate adverse health effects, and that children with relatively advantageous socioeconomic backgrounds are particularly affected.
Estimation results for children aged 4–5 are displayed in the second panel of table 6, clearly being at favor of other findings from the literature for children from low income families. With exception to the categories of other diseases, children clearly benefits from the child care reform in term of physical health. The probability of being diagnosed at age 4–5 significantly decrease by 2.5 percentage points for viral infections, and by 3.1 percentage points for general infections. Moreover, we the risk of suffering from ear diseases decreases by 2.4 percentage points and by 4.2 percentage points for respiratory diseases. Being subject to the reform additionally lowers the probability of middle ear infections (2.0 percentage points), chicken pox (0.3 percentage points), skin diseases (1.8 percentage points) and accidents from intoxication and fractions (1.5 percentage points). Children from median income households also seem to benefit from the reform at age 4–5. They are less likely to be diagnosed with middle ear infections and general ear diseases, as well as chicken pox. They also show a lower probability of being diagnosed with skin diseases (1.8 percentage points) and intoxication or fractions (1.8 percentage points). Compared to the results in table 4 it becomes obvious that the main health effects of the maximum fee rule reform

Table 6: Effects of reform exposure on children's physical health by household income in 2001

	viral infect	middle ear infect	chicken pox	infections all	ear diseases	respiratory diseases	skin diseases	intoxications fractions	other diseases
				age 1–3, by log income in 2001					
$N = 21,122$									
low: $born\_aft$	-0.007	-0.013	-0.001	-0.003	-0.009	-0.005	0.001	-0.006	0.012
	(0.008)	(0.012)	(0.002)	(0.010)	(0.012)	(0.013)	(0.009)	(0.009)	(0.009)
$N = 19,057$									
med: $born\_aft$	0.005	-0.007	0.004*	0.013	-0.009	0.010	0.022**	-0.003	-0.005
	(0.010)	(0.013)	(0.002)	(0.011)	(0.014)	(0.015)	(0.010)	(0.010)	(0.010)
$N = 14,078$									
high: $born\_aft$	-0.010	-0.018	0.006**	0.002	-0.022	0.012	0.009	0.037***	0.002
	(0.011)	(0.015)	(0.003)	(0.013)	(0.015)	(0.017)	(0.011)	(0.012)	(0.012)
				age 4–5, by log income in 2001					
$N = 18,066$									
low: $born\_aft$	-0.025***	-0.023*	-0.004*	-0.030***	-0.026**	-0.047***	-0.019**	-0.007	-0.019**
	(0.007)	(0.012)	(0.002)	(0.009)	(0.012)	(0.013)	(0.009)	(0.009)	(0.009)
$N = 18,746$									
med: $born\_aft$	-0.008	-0.027**	-0.003*	-0.012	-0.036***	-0.019	-0.020**	-0.017*	-0.018**
	(0.007)	(0.012)	(0.002)	(0.009)	(0.013)	(0.013)	(0.009)	(0.009)	(0.009)
$N = 16,663$									
high: $born\_aft$	-0.005	-0.015	0.000	-0.014	-0.022	-0.016	0.016	-0.010	0.000
	(0.008)	(0.014)	(0.002)	(0.010)	(0.014)	(0.014)	(0.010)	(0.011)	(0.010)
				age 6–7, by log income in 2001					
$N = 15,556$									
low: $born\_aft$	-0.010	-0.018	-0.002	-0.010	-0.021	-0.036***	-0.014	-0.009	-0.006
	(0.007)	(0.012)	(0.002)	(0.009)	(0.013)	(0.014)	(0.010)	(0.010)	(0.011)
$N = 18,055$									
med: $born\_aft$	-0.007	-0.026**	-0.000	-0.010	-0.020	-0.018	-0.018*	-0.012	-0.024**
	(0.007)	(0.012)	(0.001)	(0.009)	(0.013)	(0.015)	(0.010)	(0.011)	(0.011)
$N = 18,876$									
high: $born\_aft$	-0.002	-0.019	-0.001	-0.004	-0.025*	-0.053***	-0.008	-0.033***	-0.018
	(0.008)	(0.013)	(0.001)	(0.011)	(0.014)	(0.015)	(0.011)	(0.012)	(0.011)

standard errors are clustered on the household level; *** p<0.01, ** p<0.05, * p<0.1; sibling fixed effects regression and control for a linear time trend and municipality fixed effects. Controls: gender, annual household income, number of kids in household, unemployed father after reform, number of older siblings, child moved, log birth weight, twins, private doctor visit, acute visit, outpatient visit, unemployment rate and population density in municipality. Observations are grouped along tertiles of the log household income in 2001.

are mainly driven by children with disadvantaged background.

At ages 6–7 physical health effects of the reform are more evenly distributed. We find significantly lower probability of suffering from respiratory diseases for children from low income families. For other diseases the sign of the estimates is negative, neither of them is statistically different from zero though. Children from median income households also benefit from the reform in their physical health. They have a significantly lower probability of being diagnosed with middle ear infections by 3.1 percentage points and general ear diseases by 2.5 percentage points, while probability of respiratory diseases decreases by 2.5 percentage points. In addition, children that were subject to the reform face a lower risk of skin diseases and of other diseases at age 6–7. Finally, for fully affected children from high income families the probability of respiratory diseases decreases by 5.7 percentage points, for ear diseases by 2.3 percentage points, for intoxication or fractions by 2.6 percentage points, and by 1.8 percentage points for other diseases.

Table 7 provides us with income specific psychological and behavioral health effects of the maximum fee rule reform. Children from median income household benefits most from the reform in terms of developmental and psychological impairments. Moreover, these children more often have preventive visits and total medical visits per year. The reform effects on health behavior turn in sign for children with disadvantageous backgrounds, leading to statistically less preventive and medical visits per year. One reason for these different effects may be that median and high income children are more often ill, thus have more medical visits. This is mostly supported by the findings on physical health outcomes. The negative effects for low income children my stem from the increased awareness of child health by child care personnel. Turning to the effects at age 4–5 , we find a significantly lower number of diagnoses and medical visits made per year for children from low income families being subject to the reform. In addition, children from median and high income households have less often preventive visits. Finally, children from disadvantaged families show significantly lower probabilities for being diagnosed with psychological impairments if they were fully affected by the maximum fee rule reform. The risk of having a developmental impairment decreases by 1.4 percentage points, and it decreases by 2.2 percentage points for general psychological problems. Moreover, this group of children has less preventive visits and less medical visits per year, but also faces less medical diagnoses per year.

Our findings on the impact of the reform on physical and psychological health outcomes, and health behavior is strongly supported findings from the literature. First, as discussed by Currie (2001) children with low socioeconomic background strongly benefit from early interventions, such as Head Start or the Perry Preschool program. The main goal of such programs is that these children catch up with their peers so that all children of the same cohort hold a similar skill level at school start. A universal, highly-subsidized preschool reform seems to have similar effects with the exception that other children benefit from them as well. Second, For developmental and psychological child measures at schooling age we provide evidence a positive impact of maximum fee rule reform,as also found by a number of other studies (Berlinski *et al*. (2009), Felfe and Lalive (2013), Dustman *et al*. (2013)). Third, our estimates partly replicates the findings of Baker *et al*. (2008). Similarly, we find suggestive evidence of worse physical health for very young children. However, in contrast to their study we can track children for a longer time, thus also analyzing longer term effects as well.

Table 7: Effects of reform exposure on children's psychological health and health behavior by household income in 2001

	developmental impairments	psychological all	preventive visits	diagnoses per year	visits per year
			age 1–3, by log income in 2001		
$N = 21,122$					
low: $born\_aft$	0.002	-0.001	-0.252***	-0.030	-0.459***
	(0.004)	(0.004)	(0.053)	(0.082)	(0.121)
$N = 19,057$					
med: $born\_aft$	-0.007**	-0.015***	0.165***	0.101	0.118
	(0.004)	(0.005)	(0.062)	(0.095)	(0.142)
$N = 14,078$					
high: $born\_aft$	-0.006	-0.004	0.209***	-0.008	0.365**
	(0.005)	(0.006)	(0.075)	(0.104)	(0.149)
			age 4–5, by log income in 2001		
$N = 18,066$					
low: $born\_aft$	0.005	0.005	0.020	-0.308**	-0.287*
	(0.010)	(0.010)	(0.025)	(0.139)	(0.165)
$N = 18,746$					
med: $born\_aft$	0.005	0.002	-0.061**	-0.191	-0.094
	(0.011)	(0.011)	(0.026)	(0.139)	(0.149)
$N = 16,663$					
high: $born\_aft$	-0.005	-0.007	-0.064**	-0.104	0.011
	(0.012)	(0.012)	(0.029)	(0.154)	(0.159)
			age 6–7, by log income in 2001		
$N = 15,556$					
low: $born\_aft$	-0.013	-0.023**	-0.084***	-0.301***	-0.597***
	(0.008)	(0.010)	(0.021)	(0.114)	(0.138)
$N = 18,055$					
med: $born\_aft$	0.001	-0.006	-0.041*	0.073	0.089
	(0.008)	(0.009)	(0.021)	(0.103)	(0.124)
$N = 18,876$					
high: $born\_aft$	-0.007	-0.004	-0.066***	-0.031	0.004
	(0.009)	(0.010)	(0.024)	(0.136)	(0.148)

standard errors are clustered on the household level; *** p<0.01, ** p<0.05, * p<0.1; sibling fixed effects regression and control for a linear time trend and municipality fixed effects. Controls: gender, annual household income, number of kids in household, unemployed father after reform, number of older siblings, child moved, log birth weight, twins, private doctor visit, acute visit, outpatient visit, unemployment rate and population density in municipality. Observations are grouped along tertiles of the log household income in 2001.

5.3 Child care fees

So far, the analysis relies on exploiting full exposure variation across siblings to estimate an ITT reform effect on child health. We now add an empirical analysis in which child care prices are used to assess the impact of child care-prices on child health induced by the reform (this identification strategy is similar to the one used in Lundin *et al*. (2008) and Mörk *et al*. (2013)).

Table 8 presents the results from estimating the first stage equation (4). The relationship between the implementation of the reform and the log child care prices is negative and significantly different from zero in all age groups. The size of the coefficient is similar for all age groups, predicting a drop in child care prices by approximately 44%–49% at the time the reform took effect. The R^2 shows that between 64 and 68 percent of the variation in child care prices can be explained by the reform, and the F-statistics is sufficiently high to assume that the instrument is relevant.

Table 8: First stage regression of maximum fee rule reform implementation on logarithm of child care fees

	log(fee)		
	age 1–3	age 4–5	age 6–7
timing_ref	-0.415***	-0.478***	-0.492***
	(0.004)	(0.005)	(0.004)
N×T	62,050	58,274	53,964
N	13,821	17,397	14,945
R^2	0.746	0.679	0.710
F statistics	13,026	10,671	13,711
p-value	0.000	0.000	0.000

standard errors are clustered on the household level; *** p<0.01, ** p<0.05, * p<0.1; sibling fixed effects regression and control for a linear time trend and municipality fixed effects. Controls: gender, annual household income, number of kids in household, unemployed father after reform, number of older siblings, child moved, log birth weight, twins, private doctor visit, acute visit, outpatient visit, unemployment rate and population density in municipality.

The estimation results from a sibling fixed effects panel regression of the second stage equation (3) are presented in table 9 and table 10. In contrast to the findings from table 4, the impact of the child care fees on physical health outcomes is more pronounced for young ages. A 1% increase in the average monthly child care fees increases the probability of viral infections by 0.6 percentage points, and the probability of middle ear infections by 1.4 percentage points.

The risk for being diagnosed with any infections or with respiratory diseases significantly increases by 2.2 and 2.5 percentage points respectively for a 1% increase in the fees. We also find a higher incidence for accidents from intoxication or fractions as well as for other disease along increasing child care fees. For older age groups, however, the physical health effects of an increase in the child care fees is almost never statistically different from

Table 9: Effects of log child care prices on children's physical health

	viral infect	middle ear infect	chicken pox	infections all	ear diseases	respiratory diseases	skin diseases	intoxications fractions	other diseases
	age 1–3								
log (fee)	0.018**	0.012	0.002	0.020**	0.012	0.032***	0.009	0.013*	0.016**
	(0.008)	(0.010)	(0.001)	(0.010)	(0.010)	(0.012)	(0.007)	(0.008)	(0.008)
K-P statistic	4,932								
F statistic	12,159								
N	61,528								
	age 4–5								
log(fee)	-0.001	-0.011	0.001	0.000	-0.008	0.006	0.011	0.013	0.006
	(0.006)	(0.010)	(0.001)	(0.008)	(0.010)	(0.011)	(0.007)	(0.008)	(0.008)
K-P statistic	4,103								
F statistic	12,256								
N	57,601								
	age 6–7								
log(fee)	0.002	-0.015*	0.000	-0.002	-0.013	-0.012	0.000	0.017**	0.001
	(0.04)	(0.008)	(0.001)	(0.006)	(0.008)	(0.010)	(0.007)	(0.008)	(0.007)
K-P statistic	4,374								
F statistic	14,464								
N	53,576								

standard errors are clustered on the household level; *** p<0.01, ** p<0.05, * p<0.1; IV sibling fixed effects regression and control for a linear time trend and municipality fixed effects. log fees are instrumented by reform exposure dummy. Controls: gender, annual household income, number of kids in household, unemployed father after reform, number of older siblings, child moved, log birth weight, twins, private doctor visit, acute visit, outpatient visit, unemployment rate and population density in municipality.

zero. We only find suggestive evidence for an increased risk of skin diseases with increasing child care fees at age 4–5. For children aged 6–7 the probability of being diagnosed with an intoxication or fraction increases by 1.5 percentage points if the child care fees increase by 1%.

Turning to the estimation results for psychological diseases and health behavior, we find suggestive evidence of a negative impact of increasing child care prices on psychological health at age 1–3. While there are no statistically significant, psychological health effects of the child care prices at age 4–5, it cannot be neglected for age 6–7. An

Table 10: Effects of log child care prices on children's psychological health and health behavior

	developmental impairments	psychological all	preventive visits	diagnoses per year	visits per year
			age 1–3		
log(fee)	0.001	0.005	0.027	0.369***	0.348***
	(0.002)	(0.004)	(0.055)	(0.063)	(0.112)
K-P statistic			4,932		
F statistic			13,159		
N			61,528		
			age 4–5		
log(fee)	0.006	0.008	-0.071***	0.126	-0.116
	(0.007)	(0.007)	(0.024)	(0.088)	(0.097)
K-P statistic			4,103		
F statistic			12,256		
N			57,601		
			age 6–7		
log(fee)	0.016***	0.018***	-0.038**	0.185***	0.062
	(0.005)	(0.007)	(0.018)	(0.069)	(0.085)
K-P statistic			4,374		
F statistic			14,464		
N			54,576		

standard errors are clustered on the household level; *** p<0.01, ** p<0.05, * p<0.1; IV sibling fixed effects regression and control for a linear time trend and municipality fixed effects. log fees are instrumented by reform exposure dummy. Controls: gender, annual household income, number of kids in household, unemployed father after reform, number of older siblings, child moved, log birth weight, twins, private doctor visit, acute visit, outpatient visit, unemployment rate and population density in municipality.

increase in the child care prices by 1% leads to a significant increase in the probability of developmental diseases and psychological problems by 1.6 percentage points each.

The findings support the assumption that monetary endowments play a crucial role for children's cognitive and psychological development (Black *et al*. (2014)). At age 1–3, the number of diagnoses made per year as well as the annual number of medical visits significantly increase as the average child care fees increase by 1%. The former effects are also found for ages 4–5 and 6–7, indicating that high child care fees have an overall negative impact on child health. For older age groups the number of preventive visits significantly goes down, but the number of general checks increases. These results may fit into the assumption of a negative income effect through increased fees which leads to more health diagnoses but makes preventive medical visits less affordable.

5.4 Potential mechanisms

Given the observed effects of the maximum fee rule reform on different dimensions of child health, the next question becomes how the results for different reform measures fit together, and what factors are driving these results. First, the findings for physical health outcomes require more attention. One possible explanation for the differences in the results for the reform exposure dummy and the child care price specifications could be that the former presents an overall impact of full reform exposure, whereby latter may be (just) a specific, decomposed price or income effect of it. Then the physical health effects of the child care prices at age 1–3 denote a positive income effect which is canceled out in the total reform effect by the negative impact of the just initiated immunization process. While the positive income effect generated through the maximum fee rule is rather short-term and phases out over time, the health gains from the immunization process begin to take effect. In line with these these mechanisms, we do not find remarkable positive physical health effects of child care prices at older ages, but significantly less physical health diagnoses for the overall reform measure.

For psychological health effects, a combination of income effect and crowding out of informal care arrangements are potentially plausible mechanisms. As shown in the literature, universal care has beneficial effects on child development in the short term as well as in the long term (see for instance Drange *et al*. (2012), Havnes and Mogstad (2014)). The driving factor for these findings is that children are exposed to a stimulating and suitable environment that supports cognitive and noncognitive development. Even though most of these studies have focused on children from poor families, our results suggest that universal child care reforms have a similar, albeit much smaller impact. As the maximum fee rule made child care more affordable for low income families, they switch from informal or private care arrangements to formal care. It is supported by the observations that the maximum fee rule led to an additional increase in the child care attendance rates at municipality level (see panel (a) in figure 1). For families with medium and high income improvements in psychological child health may also be driven by an income effect. Since the maximum fee rule reform increased parental disposable income, additional investments can be made into child quality (given parental preferences for child quality and a moderate substitution effect). For instance, parents may decide to send children to music lessons, sports, or other activities that stimulate child development.

Another further mechanism linking the child care reform and child health may be female labor supply. One goal of the maximum fee rule reform was to improve the families' financial situation by facilitating labor force participation. Intuitively, the reduced child care prices may have an indirect income effect on the household income by increasing increasing the parents' labor supply through increased child care attendance. Lundin *et al*. (2008) analyzed the effects of the maximum fee rule on maternal labor supply. Their results indicated that female labor supply is not affected by the reform. We repeat this exercise by estimating the effect of reform exposure and of the change in child care prices on labor force participation and female earnings. In line with Lundin *et al*. (2008), we do not find significant effects labor supply neither on the intensive nor the extensive margin[12]. This finding additionally underlines the importance of other channels discussed above.

These mechanisms are driving the positive impact of the child care reform on general health at older ages, leading to less health diagnoses per year and to fewer annal medical visits, particularly for children from low income families. It is in line with the literature on dynamic health production, showing that early life health is an important factor for later health, and yields as cross fertilizer for cognitive and noncognitive child development (see Case *et al*. (2005), Currie *et al*. (2010) , Bartling *et al*. (2012)).

5.5 Municipality-specific heterogeneities

As indicated by figure 1 there are strong differences in the price changes due to the maximum fee rule reform by municipalities. In order to investigate these heterogeneities we stratify the sample along the distribution of municipality-specific median changes in child care prices at the 25 and 75 percentile, and interact the resulting three categories with the reform exposure dummy. The reference group denotes children from municipalities with relatively high changes in child care prices. This analysis allows us to infer whether children from municipalities with high prices before the reform benefit relatively more from the maximum fee rule than others.

Table 11 displays heterogeneous effects of a reform exposure on physical child health. For ages 1–3, the main reform effect is negative and significantly different from zero for viral infections, middle ear and general ear diseases as well as for respiratory diseases. This suggests that children affected by the reform and from municipalities with relatively high changes in child care prices experience significantly lower probabilities of being diagnoses with such diseases. This group of children moreover is significantly better off than their counterparts from municipalities with medium or low changes in child care prices. The pattern of heterogeneity is similar for other age groups, and the effects of reform exposure do not disappear.

Table 12 provides the results for psychological health outcomes and health behavior. Similar to physical health outcomes, we find heterogeneities in the reform exposure effect according to the relative child care fee change in the respective municipality group. Children living in municipalities with high price changes are significantly better off in terms of psychological health, they have more medical check ups, and they less often see a doctor at age 6–7 if they have been fully exposed to the reform. Moreover, being exposed to the reform significantly reduces the number of medical diagnoses among these children, irrespective of the age of diagnosis.

The results show that there are considerable heterogeneities in the reform exposure effect displayed in table 4. Children from municipalities with high fees before the reform benefit most from the introduction of the maximum fee rule, while health gains are comparably lower for children from municipalities that experienced medium and low change in prices. The finding is also in line with our conjecture of the channels. While there is a strong overall exposure effect of the reform, those children for which child care prices decrease mostly benefit most from the maximum fee rule reform[13].

[12] Results are available upon request.

[13] We also explored heterogeneous effects across geographical areas. By splitting up the region of Skåne into an urban area (south-west) and a rural area (north-east), we find that children living in rural areas are better off in terms of physical health if they have been fully exposed

Table 11: Heterogeneous effects of reform exposure on children's physical health

	viral infect	middle ear infect	chicken pox	infections all	ear diseases	respiratory diseases	skin diseases	intoxications fractions	other diseases
					age 1–3				
$(born\_aft)$	-0.22***	-0.029***	0.001	-0.015*	-0.032***	-0.024**	-0.007	-0.004	-0.012
	(0.007)	(0.010)	(0.002)	(0.009)	(0.010)	(0.011)	(0.007)	(0.008)	(0.008)
$muni: low \times (born\_aft)$	0.031***	0.033***	0.002	0.030***	0.036***	0.061***	0.032***	0.023***	0.024***
	(0.008)	(0.011)	(0.002)	(0.011)	(0.011)	(0.012)	(0.008)	(0.008)	(0.008)
$muni: med \times (born\_aft)$	0.028***	0.013	0.000	0.016	0.016	0.032**	0.021**	0.005	0.032***
	(0.009)	(0.012)	(0.001)	(0.012)	(0.012)	(0.013)	(0.009)	(0.009)	(0.009)
					age 4–5				
$(born\_aft)$	-0.025***	-0.033***	-0.002	-0.034***	-0.040***	-0.063***	-0.018**	-0.017*	-0.028***
	(0.006)	(0.010)	(0.002)	(0.008)	(0.010)	(0.011)	(0.007)	(0.008)	(0.008)
$muni: low \times (born\_aft)$	0.025***	0.029**	-0.000	0.036***	0.029**	0.081***	0.019**	0.025**	0.020**
	(0.007)	(0.012)	(0.002)	(0.009)	(0.013)	(0.013)	(0.009)	(0.010)	(0.009)
$muni: med \times (born\_aft)$	0.012	-0.003	-0.002	0.008	-0.001	0.025*	0.001	0.003	0.011
	(0.008)	(0.013)	(0.002)	(0.010)	(0.013)	(0.014)	(0.009)	(0.010)	(0.010)
					age 6–7				
$(born\_aft)$	-0.008	-0.028**	-0.002*	-0.014	-0.032***	-0.034***	-0.018**	-0.019*	-0.033***
	(0.007)	(0.011)	(0.001)	(0.009)	(0.012)	(0.012)	(0.009)	(0.010)	(0.010)
$muni: low \times (born\_aft)$	0.002	0.011	0.000	0.010	0.017	0.021	0.017	0.001	0.032**
	(0.009)	(0.014)	(0.001)	(0.011)	(0.015)	(0.016)	(0.011)	(0.012)	(0.013)
$muni: med \times (born\_aft)$	0.001	-0.000	0.001	0.004	0.002	-0.021	-0.002	0.011	0.007
	(0.009)	(0.015)	(0.002)	(0.012)	(0.015)	(0.017)	(0.012)	(0.013)	(0.013)

standard errors are clustered on the household level; *** p<0.01, ** p<0.05, * p<0.1; sibling fixed effects regression and control for a linear time trend and municipality fixed effects. Controls: gender, annual household income, number of kids in household, unemployed father after reform, number of older siblings, child moved, log birth weight, twins, private doctor visit, acute visit, outpatient visit, unemployment rate and population density in municipality. $N_{\text{age 1-3}} : N(N \times T) = 24,204(91,514)$; $N_{\text{age 4-5}} : N(N \times T) = 24,557(75,160)$; $N_{\text{age 6-7}} : N(N \times T) = 22,061(68,296)$.

to the reform. Effects on psychological health and health behavior however seem not to follow a geographical pattern. The corresponding results are available upon request.

Table 12: Heterogeneous effects of reform exposure on children's psychological health and health behavior

	developmental impairments	psychological all	preventive visits	diagnoses per year	visits per year
			age 1–3		
$(born\_aft)$	-0.003	-0.006*	-0.072*	-0.254***	0.015
	(0.003)	(0.003)	(0.042)	(0.064)	(0.095)
$muni : low \times (born_a ft)$	0.000	-0.001	0.346***	0.462***	0.285***
	(0.003)	(0.004)	(0.048)	(0.076)	(0.108)
$muni : med \times (born_a ft)$	0.000	0.000	-0.316***	0.404***	-0.544***
	(0.003)	(0.004)	(0.052)	(0.082)	(0.114)
			age 4–5		
$(born\_aft)$	0.004	0.006	0.036	-0.317***	0.057
	(0.009)	(0.010)	(0.022)	(0.103)	(0.115)
$muni : low \times (born_a ft)$	-0.000	-0.004	-0.033	0.269*	-0.175
	(0.011)	(0.011)	(0.026)	(0.141)	(0.142)
$muni : med \times (born_a ft)$	-0.002	-0.007	-0.150***	0.040	-0.435***
	(0.010)	(0.011)	(0.027)	(0.119)	(0.127)
			age 6–7		
$(born\_aft)$	-0.007	-0.018**	-0.112***	-0.144	-0.104
	(0.008)	(0.009)	(0.017)	(0.095)	(0.101)
$muni : low \times (born_a ft)$	0.002	0.013	0.111***	0.137	-0.034
	(0.009)	(0.011)	(0.023)	(0.130)	(0.134)
$muni : med \times (born_a ft)$	-0.006	-0.002	-0.001	-0.015	-0.223
	(0.009)	(0.011)	(0.023)	(0.121)	(0.142)

standard errors are clustered on the household level; *** p<0.01, ** p<0.05, * p<0.1; sibling fixed effects regression and control for a linear time trend and municipality fixed effects. Controls: gender, annual household income, number of kids in household, unemployed father after reform, number of older siblings, child moved, log birth weight, twins, private doctor visit, acute visit, outpatient visit, unemployment rate and population density in municipality. $N_{\text{age 1-3}} : N(N \times T) = 24,204(91,514)$; $N_{\text{age 4-5}} : N(N \times T) = 24,557(75,160)$; $N_{\text{age 6-7}} : N(N \times T) = 22,061(68,296)$.

5.6 Robustness checks

In the previous analysis we have considered families with at least two and a maximum of four children. The impact of family size on child health however is ambiguous. On the one hand, more siblings suggest that investments per child may be lower negatively influencing child health (see for instance Becker and Tomes (1976)). On the other hand, siblings may have a positive child health effect, since children are exposed to their siblings. This may have a positive long term impact on the immune system as proposed by the hygiene hypothesis. We investigate the robustness of our main findings along this hypothesis by re-estimating equation (1) for families with two children only. The found effects seem to be marginally stronger compared to those in table 4 but qualitatively the very similar (see Appendix table A.1 and A.2). The reform effect seems not to depend on the number of siblings in the household, and is robust to changes in the sample composition.

One potential issue with the identification is that the reform does not only directly impact the exposed sibling's health, but also indirectly the other sibling's health. The direction of such an indirect effect however is ambiguous. On the one hand, the reduction in child care prices may lead to a reallocation of financial resources and increase the (health) investment on the non-affected sibling. In this case the estimated health effects of the reform may provide a lower bound estimate. On the other hand, there may by be a spillover effect from the younger sibling to the older sibling's health. For instance, the presence of a younger sibling at age two being affected by the reform may negatively influence the health of the older sibling at age five, possibly changing the subsequent health path. Then, by comparing both siblings' health at age five and later, the positive health effect of the reform might also be driven an unobserved, negative spillover effect on the older sibling's health. In such a setting the positive and direct impact of the maximum fee rule reform on child health might be overestimated. Our data do not allow us to disentangle these types of spillover effects. To nevertheless show that the estimated effects of reform exposure are not likely driven by spillovers or redistribution within households, we estimate the reform exposure effects with single children. Tables A.3 and A.4 provide us with the corresponding results. Even though some of the physical health effects are not significantly different from zero, they still have a negative sign. In addition, psychological health effects remain strongly negative, indicating that single children strongly benefit from the maximum fee rule reform.

Besides direct spillover effects, birth order might play a role for our findings. A number of studies has investigated the effect of birth order on children's development and education. While Garces *et al*. (2002) do not find any differences between the oldest and younger siblings in the effect of Head Start, Black *et al*. (2005) show that birth order rather than family size reveals causes high differences in later educational outcomes. In an analysis of infant health effects on child health, Oreopoulos *et al*. (2008) do not find significant differences in their results when controlling for sibling's birth order. To investigate the robustness of our results, we run a specification in which birth order fixed effects are included. As indicated by tables A.5 and A.6, accounting for birth order does not change our baseline findings in significant ways. Thus, the birth order of the sibling does not confound the overall exposure effect of the maximum fee rule reform. [14]

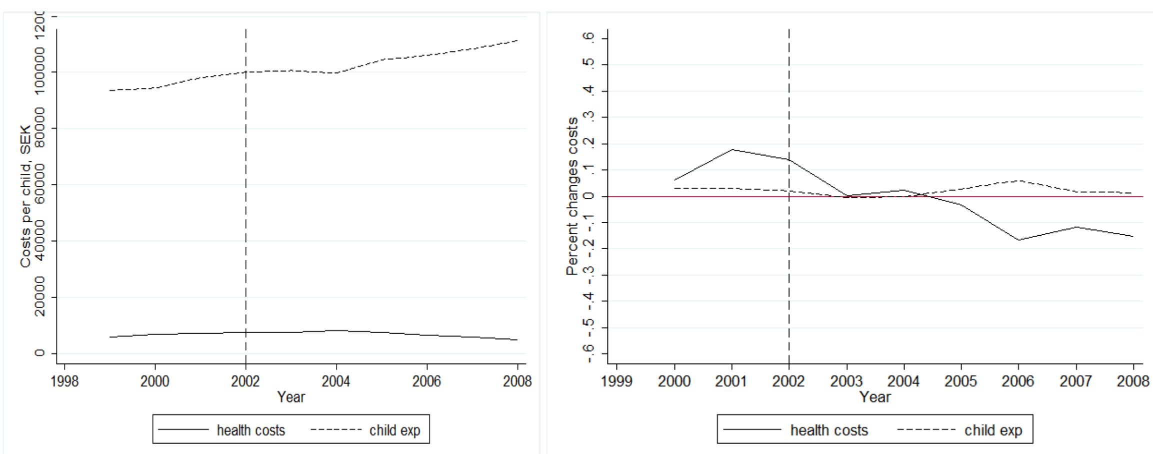
We finally switch the level of clustering the standard errors from the household level to the municipality×year level to address potential issues with grouped error terms. As Betrand *et al*. (2004) state such a specification yields valid standard errors if health development between exposed and non-exposed siblings is the same in the absence of the

[14] We also estimated the effect of being the younger child on child health in a sample of siblings that were all not affected by the maximum fee rule reform. Birth order mostly has a negative effect on children's health or is neutral for all age groups. This indicates that birth order does not play a major role in our setting.

maximum fee rule reform. Based on this assumption, tables A.7 and A.8 illustrate the findings. It becomes clear that changing the level of clustering only marginally changes the baseline results.

5.7 Public child care expenditures and health costs

We finally would like to investigate the effectiveness of the maximum fee rule reform for child health costs. The results of our main analysis strongly support the hypothesis that children that have been fully affected by the reform are healthier along several dimensions than their siblings at the same age. In addition, these children have a lower total number of annual doctor visits than their counterparts. This suggests that the average health costs per child should be lower after the reform has taken place than in the years before. At the same year, however, the implementation of the maximum fee rule reform may have increased the municipalities' expenditures. We investigate the potential health cost-effectiveness of the maximum fee rule reform comparing the changes in health costs and child care expenditures per child on the municipality level. Information on health costs per child and municipality are derived from the administrative outpatient and inpatient data for the region of Skaåne. They contain all costs being generated by medical contact. The child care expenditures are defined as the sum of all costs per child in a municipality including costs for facilities and staff.



(a) annual health costs & child care costs

(b) annual growth rate in health costs & child care costs

Figure 2: Development health costs and child care costs, per child

The left figure of figure2 shows the evolution of overall costs for child health and child care[15]. There is a large differences in the predicted cost levels of the quantities: Municipality expenditures for child care are very high, ranging between 90.0000 and 112.000 SEK/a. Health costs are on a much lower level. They are between 5.000

[15] figure 2 shows predicted values from a regression of health costs and child care expenditures, respectively, on the reform dummy, fractions of population for ages 1-3,4-5,6-15,16-19,65+, a measure of population density, the fraction of low educated, poor children, foreigners, the local income tax base, the total municipalities expenditures, child care staff, municipality fixed effects, and a linear time trend. All costs are deflated to the 2010 level. We also checked the development of local tax rates, finding no changes over time and due to the reform.

and 8.000 SEK/a. While health costs seem to be on a constant level, child expenditure increase over time. The right figure of figure 2 plots annual percent changes of both costs, shedding more light on their evolution. Child expenditures annually increase by about 3% in the years before the reform, but remain almost unchanged in the immediate years after the reform. From 2005, costs seem to increase again by up to 7%. This can be explained by the fact, that each municipality received a grant from the state government to keep the level of child care quality and to implement the maximum fee rule reform. It has been shown by Hanes *et al*. (2009) that the grant significantly improves the situation for the municipality. Child health costs are strongly increasing by up to 20% in the years before the maximum fee rule reform was implemented. However, immediately after the reform health costs accumulations start to decrease and turn to be negative from 2005. In 2006 health costs are almost 20% lower than the pre-annual level. Local health costs per child decrease over time which supports the findings on lower rates of annual medical visits and fewer medical diagnosis per year. We expect that the long-term savings in health costs per child as adult may even be higher.

6 Conclusion

One major goal of universal preschool reforms throughout the world is to positively impact children's physical, cognitive and noncognitive development. This paper presents evidence on how a major universal reform of the Swedish child care system has influenced the physical and the psychological dimension of child health, and health behavior. We have shown that particularly children from low income families are better of in terms of physical and mental health after the reform has been implemented, presumably being driven by a crowding out of informal care arrangements towards public child care. Moreover, we show that the changes in child care prices which represents the major mechanism of the maximum fee rule reform exhibit positive short term effects on physical health, but are beneficial at higher ages for psychological child development.

Our paper adds to the literature of child health development. According to the theory of health production, such positive health returns may persist into adolescence and adulthood (Almond and Currie (2011)). Our study thus may be a first step towards understanding how health develops throughout childhood and how universal high-quality, highly subsidized preschool influences the path of health production.

From a policy point of view our findings suggest that changing child care fees is an effective tool to influence child health. Reducing child care fee is not only beneficial for children from medium or high income families due to increased disposable household income which possibly is invested into child health by parents. Such a policy also makes child care more accessible to those who could not afford child care before. Thus, a policy of low priced universal child care indirectly targets children from disadvantaged background, having a very positive influence on their physical and psychological health.

Finally, the results have shown that the reduction in child care fees leads to a decreasing path of health costs. This raises expectations about the long-term decrease in health from in adulthood. Unfortunately, our data do not allow us to track children into adult age in order to analyze long-term health and effects on other economic outcomes.

However, if child health is indeed a strong predictor of adult health we expect them to perform better economically, suggesting financial benefits for the Swedish social system. Analyzing these long term effects leaves much scope for future research.

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7 Appendix

Table A.1: Effects of reform exposure on children's physical health, two sibling household

	viral infect	middle ear infect	chicken pox	infections all	ear diseases	respiratory diseases	skin diseases	intoxications fractions	other diseases
					age 1–3				
born_aft	-0.003	-0.015*	0.003*	0.000	-0.016*	0.005	0.011*	0.004	0.007
	(0.005)	(0.008)	(0.002)	(0.007)	(0.009)	(0.00)	(0.006)	(0.006)	(0.007)
N×T	45,792	45,792	45,792	45,792	45,792	45,792	45,792	45,792	45,792
N	10,612	10,612	10,612	10,612	10,612	10,612	10,612	10,612	10,612
					age 4–5				
born_aft	-0.011***	-0.025***	-0.003**	-0.017***	-0.031***	-0.029***	-0.009	-0.006	-0.017***
	(0.005)	(0.008)	(0.001)	(0.006)	(0.009)	(0.009)	(0.006)	(0.006)	(0.006)
N×T	42,793	42,793	42,793	42,793	42,793	42,793	42,793	42,793	42,793
N	13,804	13,804	13,804	13,804	13,804	13,804	13,804	13,804	13,804
					age 6–7				
born_aft	-0.0011**	-0.025***	-0.001	-0.017**	-0.028***	-0.029***	-0.009	-0.015**	-0.028***
	(0.005)	(0.009)	(0.001)	(0.007)	(0.009)	(0.010)	(0.007)	(0.007)	(0.008)
N×T	39,949	39,949	39,949	39,949	39,949	39,949	39,949	39,949	39,949
N	11,756	11,756	11,756	11,756	11,756	11,756	11,756	11,756	11,756

standard errors are clustered on the household level; *** p<0.01, ** p<0.05, * p<0.1; sibling fixed effects regression and control for a linear time trend and municipality fixed effects. Controls: gender, annual household income, number of kids in household, unemployed father after reform, number of older siblings, child moved, log birth weight, twins, private doctor visit, acute visit, outpatient visit, unemployment rate and population density in municipality.

Table A.2: Effects of reform exposure on children's psychological health and health behavior, two sibling household

	developmental impairments	psychological all	preventive visits	diagnoses per year	visits per year
			age 1–3		
born_aft	-0.003	-0.007**	-0.078**	0.044	-0.050
	(0.002)	(0.003)	(0.039)	(0.060)	(0.089)
N×T	45,792	45,792	45,792	45,792	45,792
N	10,612	10,612	10,612	10,612	10,612
			age 4–5		
born_aft	-0.002	-0.003	-0.021	-0.229**	-0.091
	(0.007)	(0.007)	(0.018)	(0.091)	(0.094)
N×T	42,793	42,793	42,793	42,793	42,793
N	13,804	13,804	13,804	13,804	13,804
			age 6–7		
born_aft	-0.012**	-0.015**	-0.076***	-0.088	-0.155*
	(0.005)	(0.006)	(0.014)	(0.074)	(0.084)
N×T	39,949	39,949	39,949	39,949	39,949
N	11,756	11,756	11,756	11,756	11,756

standard errors are clustered on the household level; *** p<0.01, ** p<0.05, * p<0.1; sibling fixed effects regression and control for a linear time trend and municipality fixed effects. Controls: gender, annual household income, number of kids in household, unemployed father after reform, number of older siblings, child moved, log birth weight, twins, private doctor visit, acute visit, outpatient visit, unemployment rate and population density in municipality.

Table A.3: Effects of reform exposure on children's physical health, single children household

	viral infect	middle ear infect	chicken pox	infections all	ear diseases	respiratory diseases	skin diseases	intoxications fractions	other diseases
					age 1–3				
born_aft	0.006	0.008	0.003*	0.021**	0.011	0.007	0.004	0.017**	0.020**
	(0.008)	(0.010)	(0.002)	(0.009)	(0.010)	(0.011)	(0.008)	(0.007)	(0.008)
N	31,373	31,373	31,373	31,373	31,373	31,373	31,373	31,373	31,373
R^2	0.111	0.200	0.007	0.142	0.204	0.262	0.048	0.057	0.085
					age 4–5				
born_aft	-0.002	0.001	-0.000	-0.011	0.004	-0.030**	-0.028***	-0.016*	-0.020**
	(0.007)	(0.011)	(0.002)	(0.009)	(0.012)	(0.013)	(0.009)	(0.009)	(0.009)
N	26,927	26,927	26,927	26,927	26,927	26,927	26,927	26,927	26,927
R^2	0.082	0.145	0.008	0.118	0.153	0.214	0.057	0.070	0.079
					age 6–7				
born_aft	-0.000	0.006	-0.000	-0.004	0.002	-0.027**	-0.017**	-0.001	-0.005
	(0.006)	(0.009)	(0.002)	(0.007)	(0.010)	(0.011)	(0.007)	(0.008)	(0.008)
N	26,614	26,614	26,614	26,614	26,614	26,614	26,614	26,614	26,614
R^2	0.058	0.108	0.005	0.084	0.119	0.180	0.050	0.079	0.067

standard errors are clustered on the individual level; *** p<0.01, ** p<0.05, * p<0.1; OLS regression controlling for a linear time trend and municipality fixed effects. Controls: gender, annual household income, number of kids in household, unemployed father after reform, number of older siblings, child moved, log birth weight, twins, private doctor visit, acute visit, outpatient visit, unemployment rate and population density in municipality.

Table A.4: Effects of reform exposure on children's psychological health and health behavior, single children household

	developmental impairments	psychological all	preventive visits	diagnoses per year	visits per year
			age 1–3		
born_aft	0.001	0.002	0.174***	0.189**	0.206
	(0.002)	(0.003)	(0.057)	(0.082)	(0.129)
N	31,373	31,373	31,373	31,373	31,373
R^2	0.022	0.023	0.497	0.378	0.554
			age 4–5		
born_aft	-0.008	-0.009	-0.025	-0.108	-0.023
	(0.009)	(0.009)	(0.024)	(0.102)	(0.108)
N	26,927	26,927	26,927	26,927	26,927
R^2	0.071	0.075	0.308	0.280	0.462
			age 6–7		
born_aft	-0.015***	-0.012*	-0.033**	-0.083	-0.118
	(0.006)	(0.007)	(0.016)	(0.088)	(0.104)
N	26,614	26,614	26,614	26,614	26,614
R^2	0.060	0.068	0.218	0.275	0.448

standard errors are clustered on the household level; *** p<0.01, ** p<0.05, * p<0.1; OLS regression controlling for a linear time trend and municipality fixed effects. Controls: gender, annual household income, number of kids in household, unemployed father after reform, number of older siblings, child moved, log birth weight, twins, private doctor visit, acute visit, outpatient visit, unemployment rate and population density in municipality.

Table A.5: Effects of reform exposure on children's physical health, with birth order FE

	viral infect	middle ear infect	chicken pox	infections all	ear diseases	respiratory diseases	skin diseases	intoxications fractions	other diseases
					age 1–3				
born_aft	-0.003	-0.013*	0.002	0.002	-0.014*	0.008	0.011*	0.006	0.006
	(0.005)	(0.007)	(0.002)	(0.006)	(0.007)	(0.008)	(0.006)	(0.006)	(0.005)
N×T	62,164	62,164	62,164	62,164	62,164	62,164	62,164	62,164	62,164
N	13,830	13,830	13,830	13,830	13,830	13,830	13,830	13,830	13,830
					age 4–5				
born_aft	-0.012***	-0.024***	-0.003**	-0.018***	-0.030***	-0.026***	-0.010**	-0.006	-0.017***
	(0.004)	(0.007)	(0.001)	(0.005)	(0.007)	(0.008)	(0.005)	(0.006)	(0.005)
N×T	58,355	58,355	58,355	58,355	58,355	58,355	58,355	58,355	58,355
N	17,406	17,406	17,406	17,406	17,406	17,406	17,406	17,406	17,406
					age 6–7				
born_aft	-0.007*	-0.024***	-0.001	-0.010*	-0.024***	-0.032***	-0.010*	-0.015**	-0.017***
	(0.004)	(0.007)	(0.001)	(0.005)	(0.008)	(0.008)	(0.006)	(0.006)	(0.006)
N×T	54,038	54,038	54,038	54,038	54,038	54,038	54,038	54,038	54,038
N	14,946	14,946	14,946	14,946	14,946	14,946	14,946	14,946	14,946

standard errors are clustered on the household level; *** p<0.01, ** p<0.05, * p<0.1; sibling fixed effects regression and control for birth order fixed effects, a linear time trend and municipality fixed effects. Controls: gender, annual household income, number of kids in household, unemployed father after reform, number of older siblings, child moved, log birth weight, twins, private doctor visit, acute visit, outpatient visit, unemployment rate and population density in municipality.

Table A.6: Effects of reform exposure on children's psychological health and health behavior, birth order FE

	developmental impairments	psychological all	preventive visits	diagnoses per year	visits per year
			age 1–3		
born_aft	-0.003	-0.006**	-0.041	0.039	-0.036
	(0.002)	(0.003)	(0.051)	(0.051)	(0.076)
N×T	62,164	62,164	62,164	62,164	62,164
N	13,830	13,830	13,830	13,830	13,830
			age 4–5		
born_aft	0.004	0.002	-0.027*	-0.206**	-0.155*
	(0.006)	(0.006)	(0.015)	(0.081)	(0.094)
N×T	58,355	58,355	58,355	58,355	58,355
N	17,406	17,406	17,406	17,406	17,406
			age 6–7		
born_aft	0.008*	-0.014**	-0.069***	-0.091	-0.188**
	(0.005)	(0.005)	(0.012)	(0.066)	(0.060)
N×T	54,038	54,038	54,038	54,038	54,038
N	14,946	14,946	14,946	14,946	14,946

standard errors are clustered on the household level; *** p<0.01, ** p<0.05, * p<0.1; sibling fixed effects regression and control birth order fixed effects, a linear time trend and municipality fixed effects. Controls: gender, annual household income, number of kids in household, unemployed father after reform, number of older siblings, child moved, log birth weight, twins, private doctor visit, acute visit, outpatient visit, unemployment rate and population density in municipality.

Table A.7: Effects of reform exposure on children's physical health, s.e. clustered on municipality×year level

	viral infect	middle ear infect	chicken pox	infections all	ear diseases	respiratory diseases	skin diseases	intoxications fractions	other diseases
					age 1–3				
born_aft	-0.003	-0.013	0.002*	0.002	-0.014	0.008	0.010*	0.006	0.007
	(0.006)	(0.008)	(0.001)	(0.008)	(0.011)	(0.014)	(0.005)	(0.007)	(0.006)
N×T	62,164	62,164	62,164	62,164	62,164	62,164	62,164	62,164	62,164
N	13,830	13,830	13,830	13,830	13,830	13,830	13,830	13,830	13,830
					age 4–5				
born_aft	-0.012**	-0.024**	-0.003**	-0.018***	-0.030***	-0.026**	-0.010**	-0.006	-0.017***
	(0.005)	(0.010)	(0.001)	(0.007)	(0.010)	(0.011)	(0.005)	(0.006)	(0.005)
N×T	58,355	58,355	58,355	58,355	58,355	58,355	58,355	58,355	58,355
N	17,406	17,406	17,406	17,406	17,406	17,406	17,406	17,406	17,406
					age 6–7				
born_aft	-0.007*	-0.024***	-0.001	-0.009*	-0.024***	-0.032**	-0.011**	-0.015**	-0.018***
	(0.004)	(0.006)	(0.001)	(0.005)	(0.007)	(0.009)	(0.005)	(0.006)	(0.006)
N×T	54,038	54,038	54,038	54,038	54,038	54,038	54,038	54,038	54,038
N	14,946	14,946	14,946	14,946	14,946	14,946	14,946	14,946	14,946

standard errors are clustered on the municipality×year level; *** p<0.01, ** p<0.05, * p<0.1; sibling fixed effects regression and control for a linear time trend and municipality fixed effects. Controls: gender, annual household income, number of kids in household, unemployed father after reform, number of older siblings, child moved, log birth weight, twins, private doctor visit, acute visit, outpatient visit, unemployment rate and population density in municipality.

Table A.8: Effects of reform exposure on children's psychological health and health behavior, s.e. clustered on municipality×year level

	developmental impairments	psychological all	preventive visits	diagnoses per year	visits per year
			age 1–3		
born_aft	-0.003	-0.006**	-0.044	0.037	-0.045
	(0.002)	(0.003)	(0.189)	(0.090)	(0.249)
N×T	62,164	62,164	62,164	62,164	62,164
N	13,380	13,380	13,380	13,380	13,380
			age 4–5		
born_aft	0.004	0.002	-0.027	-0.206***	-0.155**
	(0.005)	(0.005)	(0.053)	(0.098)	(0.075)
N×T	58,355	58,355	58,355	58,355	58,355
N	17,406	17,406	17,406	17,406	17,406
			age 6–7		
born_aft	-0.008*	-0.014***	-0.069**	-0.095*	-0.187***
	(0.004)	(0.004)	(0.030)	(0.054)	(0.065)
N×T	54,038	54,038	54,038	54,038	54,038
N	14,946	14,946	14,946	14,946	14,946

standard errors are clustered on the municipality×year level; *** p<0.01, ** p<0.05, * p<0.1; sibling fixed effects regression and control for a linear time trend and municipality fixed effects. Controls: gender, annual household income, number of kids in household, unemployed father after reform, number of older siblings, child moved, log birth weight, twins, private doctor visit, acute visit, outpatient visit, unemployment rate and population density in municipality.