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The effects of day care on health during childhood: evidence by age

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The effects of day care on health during childhood: evidence by age[a]

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Abstract

This paper studies the effects of day care exposure on behavioral problems and mental health as well as on various aspects of physical health, at various ages during childhood. We draw on a unique set of comprehensive individual-level outpatient and inpatient health care register data from Sweden over the period 1999-2008 merged with other population register data. By exploiting variation in day care exposure by age generated by a major day care policy reform, we estimate cumulative and instantaneous effects on child health at different ages. We find beneficial cumulative impacts on behavioral and mental health at primary school ages, and substitution of the incidence of infections from primary school ages to low ages. The evidence suggests that the behavioral effects are mostly driven by children from low socio-economic households. Day care usage affects health care utilization and leads to a moderate reduction in health care costs.

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1 Introduction

During the past decades, many countries have pursued policies to stimulate day care attendance of young children. The empirical evidence on effects of day care[1] attendance on child outcomes has almost exclusively focused on cognitive abilities as measured by school marks or the level of education. However, day care can also affect the health and non-cognitive abilities of children, and those outcomes may have impacts over the full life span as well. Starting with Baker, Gruber and Milligan (2008), a number of pioneering studies has been using the introduction of subsidized day care in Quebec as a natural experiment, focusing on child health outcomes. Later in this section we discuss these and other studies and we compare differences in terms of outcome measures, data used, and types of day care programs.

Our paper studies the effects of day care exposure on behavioral disorders including social disorders and mental and physical health development during childhood. We draw on a unique set of population register data from the province of Skåne (i.e., South Sweden) over the period 1999–2008. This includes merged information at the individual level from the inpatient and outpatient registers, the population register and the income tax register. The out-patient register contains all ambulatory care contacts with physicians and therapists including all visits and telephone calls. Contacts are recorded by the hour, and comprehensive diagnoses are recorded by the health care providers in real time for each contact. The in-patient register contains all contacts with the medical sector that lead to overnight hospital stays. The population register and income tax register capture individuals' labor market status and earnings. The multigenerational register provides the connections between children, each of their parents, and their siblings.

The diagnoses are expressed at the 4-digit level of detail of the comprehensive "International Statistical Classification of Diseases and Related Health Problems" (ICD) system (version 10). This distinguishes between thousands of possible diagnoses. Naturally, this includes the diseases that are common in childhood, such as various infections and worms. It also includes diagnoses of anti-social behavior, ADHD, problems with aggression control, problems with concentration (such as a limited attention span), anxiety, depression, eating disorders, and schizophrenia. Typically, each contact leads to more than one recorded ICD–10 code, to fully capture all features of the diagnosis.

Our empirical analysis exploits a major national day care reform in January 2002, called the maximum fee rule reform (or "maxtaxa"). The centerpiece of this reform was the introduction of a rather low upper bound for fees, effectively reducing day care fees for most children 1–5 years old by a large amount (Brink, Nordblom, and Wahlberg (2007)), jointly with an expansion of supply through the building of new centers and training of new day care workers. As it happened, the reform led to a rapid increase

[1] Throughout the paper, in line with the literature, we use the terms "day care" and "child care" interchangeably. "Pre-school" is sometimes used as an equivalent term as well.

in attendance from about 70% to about 85% without any major rationing or queuing. The Swedish day care program is recognized by the UN to be the best in the world (Bremberg, 2009). It follows a so-called "educare" concept in which care and education are combined and in which cognitive as well as non-cognitive skills are to be trained. It includes a healthy breakfast and a warm lunch, and these are mostly freshly prepared. There is also some education on hygiene. Previous work has soundly established that there were no reform effects on female labor supply at the intensive or extensive margin (Lundin et al., 2008) and virtually no effects on fertility (Mörk et al., 2013).

Our identification strategy exploits the variation in children's age of first day care exposure that is generated by the maximum fee rule reform. By using children's month of birth, we specify the age at which a child was exposed for the first time. Since the reform took place in 2002 and first exposure is at age 1, children born after 2002 were fully exposed from age 1. Children aged 2-5 years in 2002 were partly exposed; Children aged 6 years and older were not exposed. We compare age-specific health outcomes of exposed and non-exposed children. Outcomes right after the reform are informative on instantaneous effects, whereas outcomes some years later are informative on effects of cumulative exposure over specific age intervals. Our data do not inform us at the individual level whether a child actually attends day care. Therefore our estimates are intention-to-treat (ITT) effects. We also use external information on day care fees per municipality and household type before and after the implementation of the maximum fee rule reform to examine the monetary aspect of the effect in more detail. In addition, we perform sibling fixed-effects analyses dealing with selectivity at the household level.

We now introduce our main outcome categories in more detail and we discuss previous empirical evidence regarding them. As noted above, parts of the vast array of ICD–10 codes in our data are informative on non-cognitive abilities and behavioral disorders. These are important features of child development. It is well-documented that many non-cognitive abilities can be acquired in early childhood, i.e. at the typical day care attendance ages. Non-cognitive abilities are determinants of a wide range of late-life outcomes such as earnings, further educational attainment, and criminal behavior (see for instance Conti, Heckman, and Pinto (2016), Cunha and Heckman (2008)). We should point out that our data do not provide observations of all non-cognitive *abilities* among all children. Rather, they contain observations in real time by health care professionals on behavioral disorders, anti-social behavior, and mental health issues. For children without symptoms in a given time interval, the non-cognitive abilities that we observe in that interval are simply that such symptoms or diagnoses are absent. A small number of studies has examined day care effects on non-cognitive outcomes in generally.[2] These

[2]See e.g. the pioneering study by Datta Gupta and Simonsen (2010). They consider Danish day care and do not find average effects on children's non-cognitive outcomes while outcomes of boys from poorer households seem to deteriorate. Pingault et al. (2015) presents a correlational study on day care attendance and social behavior and includes a summary of literature that has found a positive

outcomes are typically recorded by way of surveys. They may be subject to underreporting or non-response or to variability in the perception or definition of outcomes across children or parents. With behavioral and social disorders, parents or schools may feel embarrassed disclosing problems through questionnaires or interviews. Naturally, surveys can only record information retrospectively. That complicates a precise analysis of the age of onset and the identification of sensitive ages, which are within the realm of our study design.

Next, consider physical health outcomes. The age of first massive exposure to infections may have important long-run consequences. On the one hand, according to the so-called hygiene hypothesis (Strachan, 1989), infections at young ages foster the development of the immune system, thus improving health at higher ages, in particular regarding asthma and allergies.[3] To the extent that good health at schoolgoing ages reduces sickness absence at school, a substitution of infectious diseases from schoolgoing ages to earlier ages may lead to an improved cognitive development.[4] On the other hand, infections often lead to the usage of antibiotic medication. There is ample evidence that day care attendance is associated with a dramatically higher number of antibiotics prescriptions (e.g. Thrane et al, 2001) and that the usage of antibiotics at very young ages is associated with obesity and other health problems later in life (see for instance Mbakwa et al., 2016, or Li et al., 2016, for a recent discussion).

Various literatures provide evidence on the relation between day care and physical health development during childhood. A number of epidemiological and pediatric studies examine the association between day care attendance and sickness and medication usage, but much of this literature does not take the endogeneity of day care attendance into account (see e.g. Rasmussen and Sundelin, 1990, and Côté et al., 2010). Hedin et al. (2007) find that the strength of the association depends on which other covariates are controlled for. Anecdotal evidence suggests that infectious diseases are particularly common in the first year of attendance, but this leaves scope for more causally oriented evidence. In the economics literature, a number of studies perform causal inference by using the introduction of subsidized day care in Quebec as a natural experiment, starting with Baker, Gruber, and Milligan (2008). These studies find negative short-run and long-run effects on child health (Baker, Gruber, and Milligan (2008), Kottenlenberg and Lehrer (2014b), Kottenlenberg and Lehrer (2014a), Baker, Gruber, and Milligan (2015)). Hong, Dragan and Glied (2017) exploit a discontinuity in eligibility for a day care program in New York City and find adverse effects on the diagnosis of a range of specific physical health outcomes but not on infectious diseases. These findings stand in contrast to those in a range of association studies from other disciplines that do not find any

association.

[3]However, in general such protective effects are rather expected to take place at ages beyond those in our dataset; see e.g. Hagerhed-Engman et al., 2006.

[4]See Blau and Currie (2006) for an overview of the evidence for positive effects of day care on cognition in primary school.

negative (and, indeed, find positive) associations between cumulative exposure to day care and later child health (see for instance Ball et al., (2000), Ball et al., (2002), Bradley and Vandell (2007), Dunder et al., (2007), and Côté et al., (2010)). This contrast can be due to methodological differences, but in this context it is also useful to point out that the Quebec program featured rather mediocre care quality (see e.g. Japel et al., 2005). Below, wherever we make comparisons to other studies, it is important to keep in mind that the quality of the Swedish day care system is unsurpassed according to the literature cited earlier in this section and in Subsection 2.1. As such, the comparisons serve as inputs for discussions of day care quality aspects.

The extent to which the estimated effects vary with parental socio-economic status (SES) has been addressed in studies examining cognitive outcomes. Notably, the cognitive gains from German public day care programs are largest among children from disadvantaged backgrounds and immigrants (see Felfe and Lalive (2018) and Cornelissen, Dustmann, Raute, and Schönberg (2018)). In our paper we aim to shed light on the extent to which day care effects on health and behavioral disorders vary by SES. Without observation of actual attendance, ITT analyses are of limited value in this respect. We advance on this by exploiting attendance data at the local regional level that are informative on variation by SES.

Our data contain a health care cost variable for each and every contact between a child and a health care provider. This enables us to assess the effect of day care on these costs. In particular, we can study intertemporal substitution of costs from later ages to earlier ages, as a result of day care. Existing studies on the societal costs for care and treatment of illnesses of children in day care often ignore the fact that such costs may be compensated by savings when the child enters primary school (see e.g. Enserink et al., 2014).

The paper is organized as follows. Section 2 describes the Swedish day care system and the maximum fee rule reform as well as Swedish health care, and it discusses potential channels for health effects. Section 3 describes our data and the empirical strategy. Section 4 presents the main empirical findings. Section 5 discusses potential mechanisms. Section 6 presents results from the empirical analysis of health care utilization. Section 7 concludes.

2 Institutional background

2.1 The Swedish day care system and the January 2002 "max-taxa" reform

Sweden has a long tradition of widespread public day care, leading to very high levels of day child care utilization compared to other European countries. In recent years, more than 90% of all children in the age group 3–5 attended day care (OECD (2010)).

Rates are similarly high for 1–2 years old children (Mörk, Sjögren, and Svaleryd (2013)). Municipalities are obliged to provide highly subsidized, high-quality care to children whose parents are working or studying during regular work hours. Maternal labor supply in Sweden is high; in 2000, 86% of mothers with pre-school children and 94% of mothers with school children were employed (Björnberg and Dahlgren (2005)), and the majority of Swedish mothers is working full-time (more than 35 hours/week).

Section 1 already listed some distinguishing features of the Swedish day care system. Day care availability lasts until entry into the school system at age 6. Due to the lengthy mandatory parental leave period, day care attendance before age 1 is virtually absent. Day care centers are open from 6.30 am until 6.30 pm. The average number of hours attended per week and per child is 32 (see the annual reports of the National Agency for Education and studies cited in this subsection).

In the decades before the 2002 reform, the national government had delegated the design and implementation of the day care price schedule to municipalities (Hanes, Holmlund, and Wikström (2009), Mörk, Sjögren, and Svaleryd (2013)). In the early 1990s, Sweden was hit by an economic crisis which led to considerable cutbacks in public spending, also in the child care sector. As a consequence municipalities raised day care fees and connected the fee levels more strongly to household income and the time spent in day care. In addition, municipalities introduced more stringent eligibility rules in order to reduce costs.[5]. There was a considerable variation in fees charged by municipalities. For instance, the annual fee for a family with two children on an average income in 2002 could vary by SEK 50,000 (about 5,300 Euros in 1999), depending on the municipality in which the family lives (Skolverket (2003)). It should be noted that in all years, day care was heavily subsidized. User fees counted for only 16% of the municipalities' total costs for day care in 1999 (Brink, Nordblom, and Wahlberg (2007)).

In 1998, the left-wing Social Democrat party won national elections and announced a major reform of day care. The reform bill was passed by parliament in November 2000. Its cornerstone was the maximum fee rule or "maxtaxa" which came into place in January 2002. Implementation was voluntary at the municipality level but virtually all municipalities adopted it. As mentioned in Section 1, this was accompanied by a concurrent massive expansion of day care availability. Municipalities received a granted compensation by the Swedish government to implement the reform, to balance the lower fees, and to ensure constant child care quality. After the reform, user fees only covered 10% of the total day care costs (Brink, Nordblom, and Wahlberg (2007)). Other aspects of the reform were that children of parents who are unemployed or on leave received the right for a day care slot for at least 15 hours per week (see Vikman, 2010; Aalto, Mörk and Svaleryd (2019), which appeared concurrently to our paper, analyze effects of this for the children of the unemployed). On January 1, 2003, a universal pre-school slot

[5]For example, children whose parents became unemployed could not keep their day care slots. Also, children of parents on leave experienced great difficulties in keeping their slots.

free of charge for 15 hours per week was guaranteed to all 4–5 year old children. As we explain below, our data sources lead us to focus primarily on the key reform measure, which is the fee reduction in January 2002 in conjunction with the expansion of day care availability.

Table 1 summarizes the day care fee schedule after the reform. It consists of two components. First, the fee per child is now determined as a fixed percentage of the household income. Thus, the new day care prices only vary with household income and the number of children. Second, the prices for day care are capped at a maximum monthly income of 38,000 SEK (≈ USD 4,520)[6]. Effectively, the highest possible fee was set to 2,280 SEK per month (see Lundin, Mörk, and Öckert (2008), Mörk, Sjögren, and Svaleryd (2013)).

Table 1: The maximum fee rule schedule, January 2002

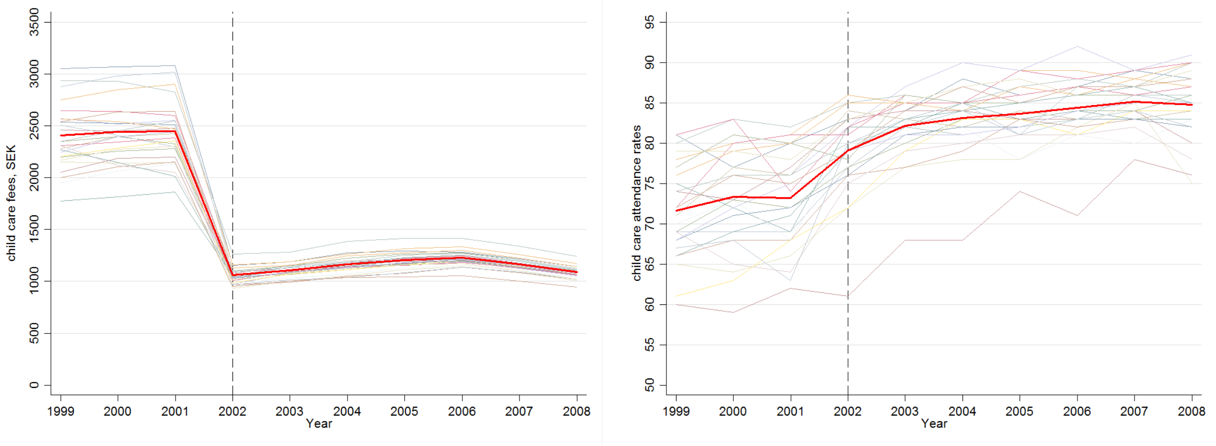
	percent of HH income and max fee / child aged 1-5
1st child	3 percent of HH income – maximum: 1,140 SEK/month (∼ USD 135)
2nd child	2 percent of HH income – maximum: 760 SEK/month (∼ USD 90)
3rd child	1 percent of HH income – maximum: 380 SEK/month (∼ USD 45)
4th child and up	no charge
maximum total fee per HH	2,280 SEK/month (∼USD 270)

Sources: Skolverket (2003).

The reform affected actual day care prices in Sweden. For a full-time working household with two children and an average income, the average monthly price across municipalities decreased from about 2,800 SEK to 1,800 SEK, corresponding to a fee reduction of about 12,000 SEK per year. This corresponds to a median fee reduction of about 40% for this household type (Skolverket (2003)). Before the reform, this household type faced a range of price differences across municipalities of 2,400 SEK per month. After the reform, this dropped to about 850 SEK per month. The day care fees are calculated from the survey information for each household in each municipality in our sample.

Figure 1 provides (a) the municipality specific development of day care fees and (b) day care enrollment rates, for the years 1999–2008. The thin curves in the background are municipality-specific trends. The solid curves in the front are the municipality averages. Panel (a) illustrates that day care fees vary considerably before the implementation of the reform but only exhibit small differences after 2002.

[6] This is the threshold introduced in 2002. In 2004 this threshold was increased to 42,000 SEK ≈ USD 4,820.



(a) Average day care fees per household (b) Aggregated day care attendance, age 1–5

Figure 1: Day care attendance rates and day care prices per municipality over time, region of Skåne (sources: see Subsection 3.3 and Section 4).

This panel also shows the size of the drop in fees due to the reform. Panel (b) shows that in 1999, about 72% of the children in the region of Skåne attended public day care. Directly after the reform this increased substantially, and eight years on it had increased to nearly 85%. Average attendance times per child did not change after the reform (see Mörk, Sjögren and Svaleryd, 2013).

Table 2 provides the development of day care quality indicators, the municipalities' total day care expenditures, and municipal day care supply. The average group size and the fraction of educated staff have been constant over time. The municipality-specific expenditures as well as the number of day care facilities increase over time. Not surprisingly, the total number of day care personnel increases along with the expansion of the system. In sum, the quality of public day care does not appear to have suffered from the reform (see also Mörk, Sjögren, and Svaleryd (2013)).

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

	1999	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**
Enrolled children/careworker	5.3	5.6	5.4	5.4	5.5	5.5	5.4	5.2	5.2	5.3
Share personnel with training in pedagogics, %	54	55	55	54	55	54	54	54	54	55
Annual municipal expenditure/ child in 1000 SEK	94	96	98	101	100	100	104	111	114	115
Total number of staff	6,537	5,921	6,066	6,474	6,898	7,073	7,677	8,255	8,661	8,901
Total number of day care centers Sweden	.	6,283	6,114	6,371	6,616	6,576	6,769	7,076	7,324	7,447

Source: annual reports of the National Agency for Education in 1999-2008; see e.g. Skolverket (2002), these numbers refer to public day care facilities. Expenditures are calculated in 2010 prices.

2.2 Health care

In this subsection we outline the Swedish health care system in the years covering our observation interval. Health care is mostly public, organized at the county level. Within a county (such as Skåne), different communities have different health care centers (or primary care units) that house all out-patient care. Here, "out-patient" refers to all contacts with care providers that do not include at least one night's stay, i.e., it refers to all ambulatory care, such as visits to physicians, dentists, therapists, emergency care units, specialized nurses, and physiotherapists. In addition, it covers consultations by telephone. Typically, a small rural municipality has only one such health care center. Larger cities have multiple centers. "In-patient" care, as opposed to out-patient care, refers to visits or spells at health centers or hospitals that include at least one night's stay. These are mostly overnight hospital treatments.

Every individual is assigned to exactly one health care center. This is usually 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.

For children aged 0–5 years old primary preventive health care is organized in child health centers (CHC). CHCs cover about 99% of all children in Sweden in this age group and visits are free of charge.[7] The centers are led by either district nurses or pediatric nurses. CHCs offer regular health check-ups and vaccinations and they provide advice and support to parents. Family physicians or pediatricians also have the duty of examining the children 3-5 times during the preschool age. For school children, preventive health services and vaccinations are organized and provided by school nurses within schools. These services cover all children, and they are free of charge. Family physicians or pediatricians visit schools on a weekly basis (see Wettergren, Blennow, Hjern, Söder, and Ludvigsson (2016) for a comprehensive overview on the Swedish system for child health services; see also Gunnarsson, Korpi, and Nordenstam (1999) for a description of care arrangements for children in day care with special needs).

Sweden does not have a compulsory vaccination program. However, all children are recommended to participate in the general vaccination program. This program is free of charge and includes vaccinations against 10 diseases. Diphtheria, tetanus and pertussis

[7] CHCs are financed and organized at the county level.

are given three times in infancy, with a booster vaccination at 5–6 years of age and a second booster vaccination at 14–16 years of age. Polio, haemophilus influenzae type B infection (Hib) and pneumococcal infection are given three times in infancy, with a booster vaccination against polio at 5–6 years of age. Vaccinations against measles, mumps and rubella are given during the second year of life and a booster vaccination at 6–8 years of age. Children who are at high risk of infection are also offered vaccination against tuberculosis and hepatitis B. The vaccination coverage rate is close to 100% for diphtheria, tetanus, pertussis, Hib, polio, measles, rubella and mumps (Anell, Glenngård, and Merkur (2012), Wettergren, Blennow, Hjern, Söder, and Ludvigsson (2016)).

For our purposes, it is important to point out that the health care system did not change around the time of the "maxtaxa" reform, and that health outcomes do not display discontinuities around that time, at least among individuals who are not aged 1–5 and/or who are not directly affected by this reform. If this were not the case then any shift in outcomes of children aged 1–5 may be attributed to an alternative cause. Folkhälsomyndigheten (2014) displays average health outcomes for the full population and health outcomes among adults over the past decades, and it is clear from this material that there were no discontinuities in the years of interest. If anything, outcomes move linearly over time in the years of our observation window.

3 Data and empirical strategy

3.1 Data registers

Our empirical analysis is based on a unique set of population register data from the county[8] of Skåne. It includes individual-level merged longitudinal records from the intergenerational register, the inhabitant register, the income tax register, the medical birth register, the in-patient register and the out-patient register. The in-patient and out-patient registers are from the "patient administrative register systems" from Skåne, administrated by the Regional Council of Skåne. They contain detailed records of all occurrences of in-patient and out-patient care for all inhabitants of the region, covering over one million of individuals for 1999–2008. [9] These registers have previously been used by Kristensson, Hallberg, and Jakobsson (2007) and Tertilt and van den Berg (2015). In the next subsection we discuss their contents in detail.

The health care registers are collected at the county level because they determine the monetary streams from the county to the various health care centers and hospitals. At the

[8]The terms county, province and region are used interchangeably. The same applies to the terms municipality and community. The latter range from a collection of neighboring villages to a single city.

[9]A small number of health care providers (notably dentists) are private. The patient registers are organized by the public/private distinction. PASiS register contains all publicly provided in-patient and out-patient 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.

same time these register data are collected on the national level 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 many countries in the world, individuals have a personal physician, and this is usually also the physician of the household members, including children with, possibly, behavioral disorders. For our purposes, the absence in Sweden of such a personal physician may be an advantage, as it reduces the likelihood that the physician adjusts diagnoses in the light of concerns about stigmatization of the family involved.

We now turn to the other registers. 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 the health care registers to a dataset that itself consists of a number of different registers. This dataset 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. It includes variables from the annual LISA register which in turn builds on the income tax register. For individuals aged 16 and above, it includes employment status, incomes by type, level of education and marital status. This dataset is annual in the sense that each variable is only recorded once per year. It covers the years 1992–2002 and 2004–2006.[10]

As individual unemployment durations are often much shorter than a year, these data contain only limited information on an individual's employment status in a given calendar year. Following Tertilt and Van den Berg (2015), we therefore use two sources of information to characterize the employment status. First, we observe whether the individual is employed in November of a year. Secondly, we observe total annual income from labor and the total amounts of sickness absence benefits, parental leave benefits, disability benefits, and unemployment benefits, received in a year. Accordingly, we define an individual to be unemployed in a year if one of the following two conditions applies. First, the individual receives no labor income, sickness absence benefits, disability benefits or parental leave benefits but does receive unemployment benefits. Secondly, the individual is not employed in November but receives labor income, sickness absence benefits, disability benefits or parental leave benefits during the year.

The dataset also includes the inhabitant register, which we use to obtain detailed residence information for the population in Skåne. Further, the intergenerational regis-

[10]The LISA registers for the years 2007 and 2008 were not available at the time at which we applied for and received the data. Variables from the LISA register for the year 2003 are not provided to us. See SCB (2009) for a detailed description of the variables in the LISA register.

ter allows for linkage of children to their siblings and parents. The intersection of the health care registers and the Meghir and Palme (2005) dataset contains about 1 million individuals, which is the vast majority of inhabitants of Skåne in 1999–2008. The data do not contain school test scores for the cohorts of children that we study.

We augment the data with aggregate statistics on municipality-specific unemployment rates and population density indicators from Statistics Sweden. We finally add information on day care fees per municipality and household type. In Skåne, 26 of 33 municipalities provided the latter. We exclude the other 7 municipalities (Svalöv, Burlöv, Vellinge, Östra Göinge, Höör, Klippan and Lund).

From all this we construct a panel data set which comprises the children born between 1993–2004 and living in the region of Skåne between 1999–2008. The analytic sample consists of 562,874 yearly observations covering 115,034 children observed at ages 1–7 in the years 1999–2008.[11]

3.2 Diagnosis variables

We define measures for health and health care utilization using ICD–10 codes. Since the data set contains more than 7000 ICD–10 codes on a 4–digit level, we collapse them into broader 2–digit and 3–digit categories to obtain the main outcomes of interest. We moreover aggregate them into calendar years and construct binary outcome variables, indicating whether a child has been diagnosed with a specific condition in a given year or not. As an additional outcome we compute the annual number of diagnoses.

Our core physical health measures capture the following three sets of conditions: infections, ear problems, and respiratory diseases. Infectious diseases are categorized in ICD–10 codes A00–B99. This group of diagnoses includes any bacterial infections, general viral infections, viral infections characterized by skin or mucous membrane lesions, mycosis, and infections of the intestines. Ear problems are represented by the ICD–10 codes H60–H95. These codes comprise diagnoses on the internal ear, the middle ear and the external ear. In our sample of children most diagnoses are related to middle ear infections (suppurative and non-suppurative otitis media). Respiratory diseases are represented by ICD–10 codes J00–J99. Typical childhood respiratory diseases are acute upper respiratory diseases (cold, sinusitis, pharyngitis, tonsillitis, croup), lower respiratory infections (bronchitis and bronchiolitis due to RS virus), influenza and viral/bacterial pneumonia, and chronic respiratory diseases.[12] The three sets of codes are mutually exclusive; however, the underlying conditions are closely related. In particular, many diagnoses concern contagious diseases that are common in childhood and that are transmitted by viruses, bacteria or other microbes. These are infections that may go along with respiratory

[11] Note that children enter and leave the observation period at different ages according to their month and year of birth. Thus the panel data set is unbalanced across ages.

[12] An overview of the most commonly diagnosed childhood diseases is in Table A.1 in the Appendix.

problems and subsequent ear problems. Also, some diagnoses in the second and third set concern inflammations resulting from infections. On the other hand, some, like asthma, may be affected by a lack of previous exposure to dirt and infections, at least according to the hygiene hypothesis.

To capture behavioral problems, non-cognitive abilities, and mental health problems, we use the ICD–10 codes F00-F99. Among children, these are mostly disorders of the psychological development (speech, language, scholastic and motor developmental disorders), behavioral and emotional disorders (ADHD spectrum, aggression, neurotics, anxiety, social functioning, tics) that have their onset typically during childhood. Below, for brevity, we occasionally use the term mental health to refer to the full set of behavioral problems, non-cognitive abilities and other problems captured by F00-F99.

An additional set of outcome variables relates to health care utilization. We construct the total number of annual medical contacts as well as the number of annual preventive visits and the number of annual acute visits from our data. Preventive visits mostly comprise general health checks and vaccinations. Acute visits refer to unscheduled sickness visits and ambulatory care. Table 3 provides an overview on the age-specific annual incidence rates of health diagnoses and on health utilization. Incidence rates for physical health diagnoses as well as the numbers for health utilization decrease with increasing age. The incidence rate for mental health condition increases from age 2–3 to age 4–5 and then slightly decreases.

Table 3: Descriptive statistics of measures of mental health, physical health, and health utilization

	age 2–3	age 4–5	age 6–7
	N = 138,276	N = 167,117	N = 164,072
mental health problems	0.023	0.086	0.060
infections	0.142	0.087	0.061
ear problems	0.205	0.161	0.118
respiratory diseases	0.293	0.220	0.176
nr physical health conditions/yr	2.58	2.32	1.19
nr medical visits/yr	5.304	4.681	3.458
nr preventive visits/yr	0.900	0.821	0.282
nr acute visits/yr	1.701	1.196	0.923

3.3 Empirical strategy

To identify the instantaneous effects of day care exposure and the effects of cumulative exposure on children's physical and mental health, we exploit variation in day care exposure across different ages generated by the maximum fee rule reform. More precisely, we compare health outcomes of children being subject to the reform at specific ages to children not being subject to the reform at the same age.

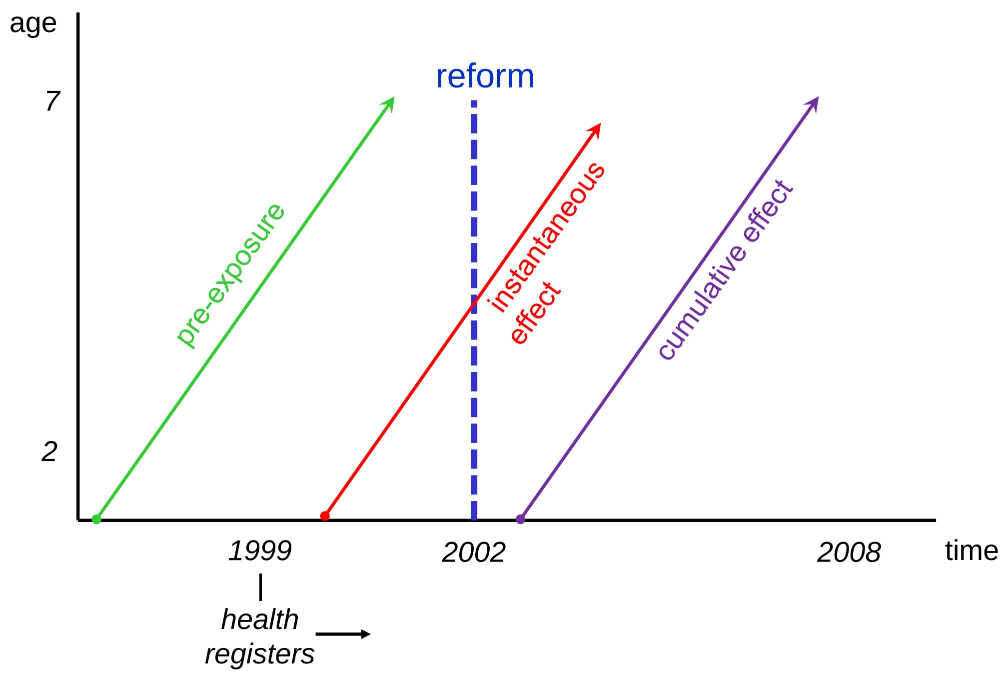


Figure 2: Study design. Note: "cumulative effect" means: effect of cumulative exposure.

Figure 2 illustrates how children were affected by the maximum fee rule. Since the reform took effect in January 2002, children aged 6 years and older at that point in time were never exposed. In contrast, children born after December 2000 were fully exposed to the maximum fee rule at all relevant childhood ages. For this group of children we may estimate effects of cumulative exposure from age 1 until some later age, at any possible later age, including ages beyond day care ages. For sake of brevity, we refer to these as "cumulative effects". For children aged between 1 and 6 in January 2002 we may estimate instantaneous effects on health outcomes that are realized in the year after the reform was imposed. These instantaneous effects cannot be obtained from data on children exposed from age 1, except of course for effects of exposure of the youngest age group on outcomes in the first year after the reform, since in this special case cumulative and instantaneous effects coincide.

Since we do not observe day care attendance of children on the individual level,[13] this empirical strategy provides us with intention-to-treat effects of day care exposure on children's physical and mental health. This effectively interprets the associations between the post-reform regime and the health outcomes as being indicative of effects

[13]Our data share this feature with the existing literature on Swedish day care with merged register data.

of day care attendance on health. This is consistent with the fact that the reform led to an increase in attendance, or, in other words, with a substitution of informal care arrangements by public day care. However, in principle, the fee reduction could also affect child health in other ways. First, it may lead to increased maternal labor supply and the latter may affect health in its own right. However, we already know from Lundin, Mörk, and Öckert (2008) that maternal labor market supply has not been affected by the reform, neither on the extensive nor on the intensive margin. Secondly, it may affect fertility. If day care fees decrease, households can afford more children. Siblings may be an important factor for social development and physical health. However, we already know from Mörk, Sjögren, and Svaleryd (2013) that fertility has not been affected apart from a mild increase in first births for formerly childless couples, but such first newborns after 2002 are not quantitatively relevant in our study design. Thirdly, the ensuing expansion of the day care system could adversely affect its quality and through this the health of the enrolled children. However, recall from Subsection 2.1 that all the available evidence points out that there were no changes in day care quality after the reform, so that this pathway can be ruled out as well. Fourthly, the cap in day care prices may serve as a positive income transfer and the additional disposable income may be used for investments in child quality. For example, the additional income may now be spent on purchasing market goods, such as music lessons or books, affecting child health. However, it should be borne in mind that the fee reductions and the expansion of the system are funded through national taxes that are partly paid by households with small children, thus mitigating the size of the positive income transfer for them (see e.g. Brink, Nordblom and Wahlberg, 2007). To investigate whether this final pathway challenges the exclusion restriction when the reform is interpreted as an instrumental variable for health effects of day care attendance, we augment our analysis with a sensitivity analysis that exploits plausibly exogenous variation in the magnitude of the price drop due to the reform. In addition, our analyses with sibling fixed-effects should be less sensitive to income transfer effects than the baseline analyses.[14]

In most of the analyses we merge children's ages into three age groups, namely age 2-3, age 4-5, and age 6-7. We make this distinction[15] for two main reasons. First the Swedish education system encompasses three curricula: One for pre-school, one for compulsory schooling; and one for upper secondary schooling. The first curriculum covers all children aged 1-5 years, and the second covers all children from age six to ninth grade (OECD (1999)). Second, children suffer from different health conditions at different ages, and

[14]Studies on day care effects on cognitive outcomes in other countries find that the substitution of informal to formal day care is a more important implication of day care supporting policies than changes in maternal labor supply. See in particular Havnes and Mogstad (2011, 2014) for Norway and Felfe and Lalive (2018) for Germany.

[15]It should be pointed out that age 2 includes outcomes of children from age 1.5 to 2.5, etc. It would be problematic to include outcomes at age 1 in the empirical analysis because they include outcomes of children aged between 6 and 12 months who normally do not attend day care.

vaccinations are planned along an age-specific schedule. Measuring children's health by age brackets allows us to evaluate effects that are non-linear in age. Note that our observation window only allows for children's health outcomes below age of 8.

To address the binary nature of our diagnoses we use a latent variable formulation. For each observed binary outcome $y_{imt} = \mathbb{1}(y^*_{imt} > 0)$, the latent health variable y^*_{imt} depends on the cumulative exposure to the reform from age 1 up to age group a for child i in municipality m and year t, controlling for covariates.

$$y^*_{imt} = \sum_{a' \leq a,\ a' \in \mathcal{A}} \beta_{a'} \mathbb{1}(\text{exposed age } a')_i + \boldsymbol{x}'_{imt}\delta + f(t) + \varphi_m + \alpha_i + \epsilon_{imt}, \tag{1}$$

where $\mathcal{A} = \{1, 2\text{-}3, 4\text{-}5, 6\text{-}7\}$ denotes the set of age groups and for convenience we omit the age group index a. In the equation, f is a linear calendar year function, φ_m is a municipality-specific fixed effect, α_i is an individual-specific random effect, $\boldsymbol{x}$ is a vector of covariates and ϵ_{imt} is an i.i.d. error term. The indicator function $\mathbb{1}(.)$ takes the value 1 if and only if its argument is true, i.e. if the child's age in 2002 is in age group a'. The parameters of interest are $\beta_{a'}$, providing us with an estimate of the effect of cumulative day care exposure at different ages $a' \leq a$. For a given individual, the random effect has the same value in different years t at which the individual's age is within the age group a'. Equation (1) is estimated for each outcome variable separately, and, given the outcome variable, for each age group $a \in \{$ 2-3, 4-5, 6-7 $\}$ separately. Thus, we do not impose related individual random effects across outcome variables. To estimate Equation (1) we use a Probit model, and we calculate the average marginal effects (AME) providing us with an estimate of the average impact of exposure at age a'.[16] We allow for clustering of the error terms on the child level in addition to the municipality-specific fixed effects φ_m. Standard errors for AME are obtained from the Delta method.

To target the instantaneous effects, we restrict the sample to children that were exposed for the first time at age a = 4-5 (that is, they turned 4 or 5 in 2002) and to children that turned 5 before the reform, and we measure the outcomes at the same age a. Accordingly, the instantaneous AME are estimated from

$$y^*_{imt} = \beta \mathbb{1}(\text{exposed age } a)_i + \mathbf{x}'_{imt}\boldsymbol{\delta} + f(t) + \varphi_m + \alpha_i + \epsilon_{imt} \tag{2}$$

For a second set of estimates, we use the day care fees per child that are calculated from specific formulas. More precisely, we exploit the variation in the reduction in day care fees across municipalities generated by the maximum fee rule reform. The annual day care fee a household is charged for per child in a specific municipality is a function of household income and the ages and number of children (Lundin, Mörk, and Öckert (2008), Mörk, Sjögren, and Svaleryd (2013)):

$$P_{jm} = f_m \left[\text{HH income}_j, \text{ages children}_j, \text{nr children}_j\right], \tag{3}$$

[16]We also estimate all equations in our paper using linear probability models. The results are available upon request.

where m denotes the municipality and j refers to a specific household. Since we do not observe day care attendance rates at the individual level, we proceed as if all children of day care eligible age are enrolled. We compute the median day care fees per municipality a household was on average charged per child and calculate the reduction in these numbers after the maximum fee rule reform was implemented. Taking the median of this distribution as cut-off value defines municipalities with large and small reductions in day care fees.[17] By interacting the exposure dummy with the municipality group dummy, we obtain an estimate on whether the health effects of cumulative exposure at age 1 are heterogeneous with respect to the magnitude of the reform-induced fee reduction.

$$\begin{aligned} y^*_{imt} &= \beta \mathbb{1}(\text{exposed age 1})_i + \gamma \mathbb{1}(\Delta\text{fee} < \text{med})_i + \theta(\mathbb{1}(\Delta\text{fee} < \text{med}) \times \mathbb{1}(\text{exposed age 1}))_i \\ &+ \sum_{1<a' \leq a,\ a' \in \mathbb{A}} \beta_{a'} \mathbb{1}(\text{exposed age } a')_i + \boldsymbol{x}'_{imt}\delta + f(t) + \varphi_m + \alpha_i + \epsilon_{imt} \end{aligned} \tag{4}$$

Since we cannot calculate the marginal effects of the interaction term in the probit model, we instead compare the predicted probabilities for these different subgroups (at the sample mean). The double difference in outcome probabilities for exposed and non-exposed children at age 1 living in different municipality groups then corresponds to a difference-in-difference framework and can be interpreted as the average treatment effect on the treated (ATT).

We add a number of covariates to all specifications: Gender, the annual household income, the number of kids in household, the number of older siblings, the age of the child and the age of mother, whether mother and/or father are unemployed, whether parents live together, whether a child moved, log birth weight, whether children are twins, dummies for the season the diagnoses has been made, the local unemployment rate and local population density.

4 Results

4.1 Cumulative and instantaneous effects

Table 4 displays the average marginal effects (AME) of day care exposure on health during childhood, obtained from estimating Equation (1) using a probit model. At ages 2-3, being exposed to the reform from age 1 on average increases the probability of infectious disease diagnoses by 2.5 percentage points. Moreover, on average these children have a significantly higher probability of suffering from ear problems (3.5 percentage points) and from respiratory diseases (5 percentage points). These negative physical health effects persist into ages 4-5.[18] The results for ages 6-7 suggest that the increased

[17] The change in day care fees varies from a 38% reduction in Bromölla up to a 61% reduction in Hörby.

[18] It has been shown before that day care at such early ages is associated with a higher infectious disease burden, and that this association weakens with age in day care; see e.g. Enserink et al. (2013).

probabilities of being diagnosed with physical health problems at lower ages is to some extent subsequently compensated by a reduction in diagnoses at higher ages. Or, in other words, the children not exposed to day care catch up on their infectious disease load once they go to primary school. In particular, after school entry, the cumulative probability of being diagnosed with ear problems is lower among children exposed to day care than among those who were not. Recall that ear problems are closely connected to infections.

In sum, the results on physical health provide some evidence for a day care-driven intertemporal substitution of illness spells, from the first years of primary school towards the first years of day care. This makes sense: Children become immune to a specific infection once they have had one illness spell, and they are likely to obtain their first illness spells once they are surrounded on a daily base by many other children. If their first classroom-like experiences are at day care, then they experience many infections in their first years of day care and as a result they are immune against infections when they enter primary school. The findings are also in accordance with the hygiene hypothesis: Early exposure to day care initiates an immunization process leading to worse physical health in the short run but better physical health in the longer run.

Table 4: Average marginal effects of cumulative day care exposure on children's physical and mental health

	mental health problems	infections	ear problems	respiratory diseases
N=138,276		age 2–3		
exposed: from age 1	-0.004	0.025***	0.035***	0.050***
	(0.003)	(0.006)	(0.007)	(0.008)
N=167,117		age 4–5		
exposed: from age 1	-0.028***	0.013*	0.017*	0.058***
	(0.008)	(0.007)	(0.010)	(0.011)
N=164,072		age 6–7		
exposed: from age 1	-0.020**	0.001	-0.017	0.013
	(0.010)	(0.010)	(0.013)	(0.016)

Standard errors obtained from delta method; *** p<0.01, ** p<0.05, * p<0.1; Average marginal effects from a probit regression with individual random effects, linear/quadratic time trends, municipality fixed effects and standard errors clustered on the child level. Controls: Gender, annual household income, number of kids in household, number of older siblings, age of child, age of mother, child moved, log birth weight, twins, mother's age, parents unemployed, parents couple, unemployment rate and population density in municipality.

Turning to mental health diagnoses in the broad sense of the word, we do not find a significant average impact of day care exposure at ages 2-3. However, the effect is

That study does not control for selection on unobservables.

beneficial, and as age increases, the cumulative average day care effect becomes more and more beneficial. After age 3, the AME is highly significant. At ages 4-5 and at ages 6-7, the probability of adverse mental health diagnoses on average decreases by 2.8 and 2 percentage points, respectively.[19] Thus, in the first school-going ages, children previously exposed to day care have significantly less mental health problems (i.e., behavioral and social disorders) than those not exposed. Note that it is difficult to explain these results as being driven by increased awareness and reporting of behavioral and social problems by caretakers at day care centers. After all, if the latter were important then one would expect results opposite to those presented in Table 4.[20]

We anchor the estimated AME in Table 4 to the baseline risks of the considered diagnoses. For instance, on average the probabilities of infections, ear problems and respiratory diseases immediately increase between 17% and 18% at age 2-3. In contrast, the likelihood of being diagnosed with ear problems on average decreases by about 11% at age 6–7. The effects are larger for mental health diagnoses. In relative terms these coefficients correspond to an average reduction in the diagnoses of mental health issues by about 33% among children aged 4–5 and a reduction similar in magnitude among children aged 6–7.[21]

Table 5 reports the AME for the instantaneous impact of day care exposure for children aged 4–5 when the maximum fee rule took effect. On average, we find an adverse instantaneous impact on ear problems and respiratory conditions. In contrast, there is an immediate beneficial impact of day care exposure on mental health for these children. For a given baseline risk, this refers to an about 18% reduction in mental health diagnoses. It shows that diagnoses on mental and behavioral problems are already reduced if the child enters at age 4–5 instead of not at all. Also, respiratory diseases increase at the age of first exposure to day care, whether this is at age 2–3 or at age 4–5 (note that at age 2–3 the instantaneous and cumulative effects coincide).[22]

[19]This result is in line with studies finding positive gains of early-life care programs on outcomes during schooling age and later in life (see for instance Campbell, Conti, Heckman, Moon, Pinto, Pungello, and Pan (2014) for the Carolina Abecedarian Project (ABC), Carneiro and Ginja (2014) for Head Start in the US and Dietrichson, Lykke Kristiansen and Nielsen (2018) for a systematic literature review.)

[20]Pingault, Tremblay, Vitaro, Japel, Boivin, and Côté (2015) argue that effects of day care on social behavior may vanish in primary school when children who were in day care before mix with children who were not. This equilibrium effect is important in their setting but in Sweden virtually all children attend day care.

[21]Since we do not observe individual attendance rates, we cannot estimate the average treatment effect (ATE) or the ATT. A potential solution is to scale the ITT by the aggregate percent change in treatment in order to obtain an estimate on the ATT. In doing so, we would obtain substantial average treatment effects on the treated. Note that such a procedure rules out equilibrium effects.

[22]Our results on instantaneous and cumulative effects on physical health are in line with Côté, Petitclerc, Raynault, Xu, Falissard, Boivin, and Tremblay (2010). They observe actual attendance but do not control for possible selection on unobservables regarding attendance. Health outcomes are based on subjective and retrospective assessments with survey data.

Table 5: Average marginal effects of instantaneous day care exposure on children's physical and mental health

	mental health problems	infections	ear problems	respiratory diseases
N=77,246		age 4–5		
exposed: from age 4–5	-0.016***	0.002	0.009*	0.018**
	(0.004)	(0.003)	(0.005)	(0.006)

Standard errors obtained from delta method; *** p<0.01, ** p<0.05, * p<0.1; Average marginal effects from a probit regression with individual random effects, linear/quadratic time trends, municipality fixed effects and standard errors clustered on the child level. Controls: Gender, annual household income, number of kids in household, number of older siblings, age of child, age of mother, child moved, log birth weight, twins, mother's age, parents unemployed, parents couple,unemployment rate and population density in municipality.

4.2 Detailed diagnoses on physical and mental health and behavioral disorders

In the previous analysis, we have focused on rather broad categories of physical and mental health outcomes. However, for policy makers it might be of predominant interest which childhood diseases are responsible for the found pattern. The ICD–10 codes are available in 4-digits – the highest available detail for medical diagnoses. For each of the main outcomes, that is mental health, infections, ear problems, and respiratory diseases, we select those subcategories that represent the most common childhood diseases (see Table A.1 in the Appendix for an overview). For mental health diagnoses, these are developmental and behavioral impairments starting in early childhood as well as mental retardation. For infections, we consider intestines, viral infections characterized by skin or mucous membrane lesions, other viral infections, bacterial infections, and mycosis. Ear infections are mostly characterized by middle ear infections. Subcategories of respiratory diseases are acute upper and acute lower respiratory infections, chronic upper and chronic lower respiratory infections as well as influenza and pneumonia. For completeness, we also consider impetigo as a skin-related infection and meningitis infections.

Table 6 displays the results for the average marginal cumulative exposure effect at age groups 2–3, 4–5, and 6–7. We do not find any negative impacts of day care on children's diagnoses for developmental or behavioral disorders. Indeed, the results suggest an improvement in the developmental dimension already at age 2–3. Being diagnosed with developmental disorders strongly decreases by 2.7 percentage points at age 4–5. To a large extent, the positive mental health development up to age 6–7 initiated by day care is driven by a reduction in behavioral disorders (-1.1 percentage points) and in mental retardation (-0.3 percentage points).[23] This result is consistent with other findings in

[23]Behavioral disorders mainly are ADHD-related and hyper-kinetic impairments. Mental retardation

the literature, stressing the component of cognitive and social stimulation of day care programs (see Nores and Barnett (2009) for a systematic review).

The detailed analysis of physical health outcomes reveals a strong immunization effect in particular for bacterial as well as viral infections, and for acute respiratory diseases at age 2–3. This result is not unsurprising because those measures contain highly contagious conditions that are common among toddlers and pre-school children in day care, such as fifth/sixth disease, mc virus, a common cold or tonsillitis. The AME for diagnoses related to middle ear diseases is also large and statistically significant, providing additional evidence on the onset of an immunization process due to day care. One exception here are intestines: An early day care exposure leads to a reduction in intestines-related diagnoses, such as infections due to Rota/Noro virus or other viral diarrhea.

The impact on physical health is rather mixed at age 4–5. At age 6–7, children exposed to day care as of age 1 on average have a significantly lower probability of 1 percentage point of being diagnosed with specific viral infections, and they are less likely to be diagnosed with middle ear infections (-2 percentage points). We also consider accidents as a placebo measure of child health as they are unlikely linked through developmental or biological factors although, admittedly, accidents may be more common if day care is used due to the commuting between day care and home. In any case, we do not find evidence of correlations between accidents and day care exposure.

Given the large number of health outcomes used in the analysis, one might argue that multiple-hypothesis-testing issues arise. We address this by applying a stepdown bootstrap procedure with resampling from the empirical distribution to the single physical and mental health outcomes (Romano and Wolf (2005)). We set the family-wise error rate to a nominal level of $\alpha = 0.05$ and generate 30 bootstrap samples for $k = 14$ hypotheses per age group. While the multiple hypothesis method broadly confirms our findings in Table 6 of correctly rejecting the null hypothesis on the 5% level at young ages, we find more statistically significant coefficients at age 6–7. On the one hand, the significant reduction in diagnoses on specific viral infections is confirmed and the reduction in middle ear infections is highly statistically significant. On the other hand, diagnoses for acute respiratory infections increase significantly after taking account of the multiple hypothesis problem (the results are in Table A.2 in the Appendix). This suggests that long term immunization effects are heterogeneous with respect to the specific condition.

is also known as intellectual disabilities (D) or general learning disabilities.

Table 6: Average marginal effects of cumulative day care exposure on detailed mental and physical health diagnoses

	age 2–3	age 4–5	age 6–7
mental health			
developmental disorders (F80-89)	0.000 (0.001)	-0.027*** (0.007)	-0.008 (0.008)
behavioral disorders (F90-99)	-0.004*(0.003)	-0.002 (0.002)	-0.011* (0.006)
mental retardation (F70-79)	-0.004*(0.003)	-0.002 (0.002)	-0.003* (0.002)
infectious diseases			
intestines (A00-09)	-0.009*** (0.003)	-0.001 (0.003)	0.001 (0.003)
viral infections, skin/mucous membrane lesions (B00-09)	0.008*** (0.002)	0.003 (0.003)	-0.010*** (0.004)
other viral infections (B25-34)	0.028*** (0.005)	0.014** (0.006)	0.011 (0.007)
bacterial infections kids (A30-49)	0.004*** (0.002)	-0.004* (0.002)	0.000 (0.003)
mykosis (B35-49)	-0.000 (0.001)	-0.000 (0.001)	-0.002 (0.002)
ear diseases			
middle ear diseases (H65-H75)	0.034*** (0.007)	0.015* (0.009)	-0.020 (0.013)
respiratory diseases			
acute upper resp. infections (J00-J06)	0.053*** (0.007)	0.048*** (0.009)	0.019 (0.013)
flu and pneumonia (J09-J18)	0.002 (0.003)	0.007** (0.003)	0.003 (0.004)
acute lower resp. infections (J20-22)	0.011*** (0.003)	0.012*** (0.003)	0.004 (0.004)
chronic lower resp. infections (J40-J47)	0.007 (0.005)	0.010* (0.006)	0.001 (0.009)
chronic upper resp. infections (J30-J39)	-0.004 (0.003)	-0.009* (0.005)	-0.001 (0.008)
non-intentional			
accidents	-0.007* (0.004)	-0.006 (0.004)	-0.008 (0.005)

Standard errors obtained from delta method; *** p<0.01, ** p<0.05, * p<0.1; Average marginal effects from a probit regression with individual random effects, linear/quadratic time trends, municipality fixed effects and standard errors clustered on the child level. Controls: Gender, annual household income, number of kids in household, number of older siblings, age of child, age of mother, child moved, log birth weight, twins, mother's age, parents unemployed, parents couple, unemployment rate and population density in municipality.

Finally, we split the detailed physical health diagnoses into transmissible and non-transmissible diseases and into diseases with and without vaccines during childhood. The results are displayed in Table 7. At age 2–3, children exposed to day care on average have a significantly higher likelihood of being diagnosed with transmissible diseases. At later ages, however this effect is comparatively small and mostly insignificant. For diseases for which vaccinations are available, we find a small but statistically significant impact of day care at age 2–3 but zero effects at later ages. We explain this findings by the high vaccination coverage rates in Sweden for typical childhood diseases.[24]

[24]For diphtheria, tetanus, pertussis, Hib, polio, measles, rubella and mumps the vaccination coverage

Table 7: Average marginal effects of cumulative day care exposure on children's transmissible diseases and vaccinated diseases

	age 2–3	age 4–5	age 6–7
transmissible childhood disease	0.050***	0.045***	-0.020
	(0.008)	(0.012)	(0.018)
diseases with vaccines	0.005***	0.001	0.004
	(0.002)	(0.002)	(0.003)
N	138,276	167,117	164,072

Standard errors obtained from delta method; *** p<0.01, ** p<0.05, * p<0.1; Average marginal effects from a probit regression with individual random effects, linear/quadratic time trends, municipality fixed effects and standard errors clustered on the child level. Controls: Gender, annual household income, number of kids in household, number of older siblings, age of child, age of mother, child moved, log birth weight, twins, mother's age, parents unemployed, parents couple, unemployment rate and population density in municipality.

4.3 Reduction in day care fees

As discussed in Section 2, there is a large variation in day care fees across municipalities before the implementation of the maximum fee rule reform. Based on the price function in Equation (3), we compute the change in day care fees per municipality induced by the maximum fee rule reform. We then classify municipalities by whether they experienced above or below median fee reductions, and interact the exposure dummy with this municipality group dummy. The empirical specification is outlined in Equation (4) in Section 3.3. This analysis may be informative on the importance of income transfer effects on health that are generated by the fee reduction.

Table 8 displays differences in predicted probabilities by day care exposure (e) and municipalities with high vs. low reduction of day care fees (h) at the sample average. Across all ages and on average, children from municipalities with large fee reductions ($h = 1$) shows higher probabilities of being diagnosed with mental health issues but lower probabilities of being diagnosed with physical health problems compared to children from municipalities with low changes in fees ($h = 0$). Being exposed to the reform from age 1 ($e = 1$) on average leads to significantly higher probabilities of being diagnosed with physical health conditions compared to not being exposed from age 1 ($e = 0$) at age 2-3, and this pattern persists at age 4-5. In contrast, predicted probabilities of being diagnosed with mental health conditions on average are significantly lower from age 4 for children exposed to maxtaxa from age 1. This confirms the findings in Table 4. For differences in predicted probabilities across municipality groups, we find consistently higher probabilities of mental health problems across all ages for children from municipalities with large reductions in day care fees.

rate is almost 100% (Anell, Glenngård, and Merkur (2012)).

Table 8: Differences in predicted probabilities of cumulative day care exposure and municipalities with large - small reductions in fees on children's physical and mental health

	mental health problems	infections	ear problems	respiratory diseases
N = 111,118	age 2–3			
$(\hat{Y}_{e=1} - \hat{Y}_{e=0})$	-0.002	0.029***	0.043***	0.067***
	(0.002)	(0.006)	(0.008)	(0.009)
$(\hat{Y}_{h=1} - \hat{Y}_{h=0})$	0.006***	0.017**	-0.006	-0.046***
	(0.002)	(0.007)	(0.009)	(0.011)
$(\hat{Y}_{e=1,h=1} - \hat{Y}_{e=0,h=1}) - (\hat{Y}_{e=1,h=0} - \hat{Y}_{e=0,h=0})$	-0.000	-0.021***	-0.038***	-0.050***
	(0.001)	(0.005)	(0.006)	(0.007)
N = 134,064	age 4–5			
$(\hat{Y}_{e=1} - \hat{Y}_{e=0})$	-0.021***	0.011	0.018*	0.057***
	(0.007)	(0.008)	(0.010)	(0.013)
$(\hat{Y}_{h=1} - \hat{Y}_{h=0})$	0.025***	-0.004	-0.038***	-0.048***
	(0.005)	(0.005)	(0.007)	(0.008)
$(\hat{Y}_{e=1,h=1} - \hat{Y}_{e=0,h=1}) - (\hat{Y}_{e=1,h=0} - \hat{Y}_{e=0,h=0})$	-0.012***	-0.018***	-0.028***	-0.061***
	(0.004)	(0.003)	(0.005)	(0.006)
N = 131,673	age 6–7			
$(\hat{Y}_{e=1} - \hat{Y}_{e=0})$	-0.012*	0.007	-0.016	0.021
	(0.007)	(0.010)	(0.012)	(0.018)
$(\hat{Y}_{h=1} - \hat{Y}_{h=0})$	0.010***	-0.016***	-0.059***	-0.078***
	(0.003)	(0.004)	(0.006)	(0.007)
$(\hat{Y}_{e=1,h=1} - \hat{Y}_{e=0,h=1}) - (\hat{Y}_{e=1,h=0} - \hat{Y}_{e=0,h=0})$	-0.003	-0.017***	-0.014	-0.048***
	(0.003)	(0.006)	(0.010)	(0.011)

Standard errors obtained from delta method; *** p<0.01, ** p<0.05, * p<0.1; Differences in predicted probabilities obtained from probit regression with individual random effects, linear/quadratic time trends, municipality fixed effects and standard errors clustered on the child level. Controls: Gender, annual household income, number kids, number older siblings, age kid, kid moved, log birth weight kid, kid twins, mother's age, parents unemployed, parents couple, unemployment rate and population density in municipality.

The differences in differences in predicted probabilities can be interpreted as average treatment effects on the treated. That is, among children in municipalities with large changes in day care fees, the probability of being diagnosed with physical health problems is significantly lower by between 2 and 5 percentage points at ages 2-3. These differences in exposure effects between children from municipalities with large vs small reductions in day care fees persists into later ages, and remains statistically significant for infections and respiratory diseases to the age of 6-7. This implies that children experiencing a large decrease in fees have the highest long run physical health returns from the maxtaxa rule.[25] We find significantly lower probabilities of being diagnosed with mental health problems for exposed children from municipalities with large changes in day care fees at age 4-5. This double difference in probabilities is still negative at age 6-7 but smaller and statistically not significant. Given the predicted probabilities by exposure at age 6-7, this suggests that the long-run exposure differences are moderately heterogeneous across municipalities.

Municipalities where the average drop in fees was high may be municipalities with relatively many low-SES households. If this is true then we expect that attendance rates increase more in municipalities with a larger reduction in day care fees and a high share of low-SES households. Our data do not allow us to examine this on the individual level. As will be seen in Section 5 we nevertheless will shed more light on this relationship using municipality-level data.

4.4 Additional findings

We also examine whether the results are heterogeneous with respect to a few individual characteristics. As mentioned before we do not observe children's day care attendance on the individual level. This makes a heterogeneity analysis difficult because differences between subgroups may not only be driven by differences in actual effects of day care on child health but also by e.g. group-specific take-up rates or by the quality of the counterfactual care mode. Thus, the following results should be interpreted with caution. To investigate whether the reform effects depend on the parental socioeconomic status (SES), we classify households as low income or high income (using the median household income as a cut-off), and calculate the double differences in predicted probabilities by exposure and household income group. Children exposed to the reform at age 1 exhibit significantly lower probabilities for being diagnosed with mental health impairments when living in low-income households. We thus conclude that our main results are driven by the low-SES group (see Table A.3 in the Appendix).[26] The fact that the estimated reform differences are larger for low-SES children may reflect the low quality of the informal care arrangements that these households make when not using public day care. However, this explanation also warrants a substantial change in attendance induced by the reform among low-SES children. After all, if most low-SES children already attended day care before the reform then one would not expect health effects of the reform among these children. Of course, the latter also applies to high-SES children, and indeed this may go some way in explaining why we find smaller probabilities for the high-income group.

[25]However, most separate coefficients for physical health are mostly not significantly different from zero. To some extent this may reflect the smallish sample sizes per "fee-change degree".

[26]We also analyze the instantaneous effect at age 4-5 separately by household income. Our results suggest that among high-SES children, entry into day care at age 4-5 is more beneficial than entry at age 2-3. The results on the instantaneous effects by household income are available upon request.

We also explore whether differences in exposure are heterogeneous with respect to regional disparities in the region of Skåne. The South-Western part of Skåne is highly urbanized, while the North-Eastern part is very rural with major industries in farming, foresting and fishing.[27] Across all age groups and for mental health impairments as well as for physical health, we find significantly lower diagnoses probabilities of for children exposed to the reform (see Appendix, Table A.4). This result suggests that children from urban areas are the main beneficiaries of the maxtaxa reform. The analysis of the overall day care attendance rates by region shows that children from urban areas start from higher attendance rates levels and exhibit a lower increase due to the reform. At the same time however, more children in urban areas are living in low-income households. Thus, the heterogeneity analysis by region can be seen as another supportive evidence that it is particularly the low-income children that benefit from the reform.

We analyze potential gender-specific heterogeneity in day care exposure by interacting exposure with gender. The results in Table A.5 suggest that boys have significantly lower probabilities of being diagnosed with mental health impairments when exposed to the reform. These significant mental health gains for boys from being exposed to day care start at age 4–5 and they persists into primary school age.[28] We do not find any considerable gender-specific differences in being diagnosed with physical health problems.

To examine the robustness of our findings, we perform some additional analyses. First, we address the hypothesis whether a higher number of siblings reduces per-child investments and therefore negatively affects child quality, including child health (Becker and Tomes (1976), Lundborg, Ralsmark, and Rooth (2013)). To this end, we re-estimate Equation (1) for two-children households as well as for households with only 1 child and calculate the corresponding AME. As outlined in Tables A.6 and A.7 in the Appendix, we do not find any remarkable differences in the estimated cumulative AME for health diagnoses of early day care exposure.

We further explore the robustness of our results by including birth order fixed effects into our main specification. While Black, Devereux, and Salvanes (2005) have shown that the children's birth order rather than family size plays a significant role for children's educational attainment, other studies have not found significant birth order effects on children's education or physical health (Garces, Duncan, and Currie (2002), Oreopoulos, Stabile, Wald, and Roos (2008)). As shown in Table A.8 in the Appendix, the calculated AME do not change with birth order fixed effects compared to our main results. Accordingly, the birth order of children does not confound the cumulative effect of day care exposure on children's physical and mental health.

[27]In the South-West, the Öresund bridge connects the city of Malmö, the capital of Skåne, in Sweden with the city of Copenhagen in Denmark and together they build a metropolitan area with a population of more than 3.8 million and a population density of 187/km^2.

[28]Evidence from the medical literature suggests that boys are more frail than girls in term of their physical health, and that they are three to four times more often diagnosed with developmental disorders, see Hill and Upchurch (1995), Kraemer (2000), and Wright, Stern, Kauffmann, and Martinez (2006).

Sibling fixed effects

We also investigate the sensitivity of our main results by estimating conditional logit models with sibling (or family household) fixed effects. Arguably, the results of the baseline analyses in the current Section 4 control for a substantial share of such fixed effects, given the large number of family-specific covariates used there. This is why we view the sibling fixed effects analyses as complementary sensitivity analyses. Note that the latter analyses do not use observations on single children or on households where all children are exposed to the same fee regime at the relevant ages.

The results are presented in Table A.9 in the Appendix. While most of the point estimates are qualitatively similar to those in the baseline analyses, the standard errors are considerably larger. The day care effects on infections are now considerably larger in absolute size. Note that both the individual-level analysis and the sibling fixed-effect analysis ignore health spillovers from the younger to the older sibling and vice versa. We return to the estimates below.

5 Municipality-level take-up rates in day care

We now shed some light on the potential mechanisms that are responsible for our findings. As mentioned in previous sections, we do not observe children's day care attendance on the individual level. However, we can make use of municipality-level data to understand whether the day care reform increased attendance rates in public day care for more disadvantaged children, crowding out other types of childcare. These contain day care attendance rates over the period of interest and also comprise a number of socioeconomic, structural, and financial measures, for each municipality.[29] We use information on the fraction of poor children, the fraction of low education people and the average taxable income in each year and municipality and regress the day care attendance rates on interactions between these measures and a reform dummy which takes the value 1 after the reform has been implemented.

$$\text{Crate}_{mt} = \alpha_m + \beta_1 \mathbb{1}(\text{SES low})_m + \beta_2 \mathbb{1}(\text{after})_t + \beta_3 \mathbb{1}((\text{SES low}) \times \text{after})_{mt} + \boldsymbol{x}_{mt}\gamma + \epsilon_{mt}, \tag{5}$$

where $Crate_{mt}$ is the day care attendance rate in municipality m and year t. $\mathbb{1}(\text{SES low})_m$ a dummy variable for SES taking the value 1 if we observe a municipality with a high fraction of poor children, low education people, or low income in the year before the maxtaxa refom. The reform dummy is defined by $\mathbb{1}(\text{after})_t$ and takes the value 1 in the years after the maxtaxa reform has taken effect, and is zero otherwise. $\mathbb{1}((\text{SES low}) \times$

[29] The municipality-level data are provided by Statistics Sweden and by the Swedish National Agency for Education and are publicly accessible on their websites (Statistics Sweden: www.scb.se; Swedish National Agency for Education: www.skolverket.se. These data have been used before by Hanes, Holmlund, and Wikström (2009) in the empirical analysis of the maxtaxa reform.

after)$_{mt}$ is the interaction term of the SES dummy and the reform dummy, and $\boldsymbol{x}_{mt}$ is a vector containing various demographic, socioeconomic, and financial measures for municipalities. We cluster the standard errors on the municipality level.[30]

Table 9 displays the results from an OLS regression with municipality fixed effects α_m based on Equation (5). As shown in the upper panel of Table 9, day care attendance rates are between 1.241 and 12.44 percent higher after the introduction of the maxtaxa reform. We moreover find that attendance rates after the maxtaxa reform are significantly higher in municipalities with a high fraction of poor children, low educated people, and where taxable income is low. Thus, the reform-induced increase in day care attendance was relatively largely driven by low-SES children, and this may at least partly explain why the effects for the high-income group are smaller.

In the lower panel of Table 9, we replace the SES measures with measures on the change in day care fees caused by the maximum fee rule reform but keep the fixed effects specification otherwise. Municipalities are classified into three groups according to the amount of reduction in day care fees in response to the reform, with municipalities with small fee changes being the reference category. Among municipalities with small fee reductions, the introduction of the maximum fee rule increased the day care attendance rate by about 7.3 percent. In comparison, municipalities that experienced a large reduction in day care fees show a significantly stronger increase in attendance rates. Municipalities experiencing a medium fee change also show an increase in day care attendance rates but the coefficient is statistically not different from zero.

Taking all the evidence together, this confirms that the reform led to a relatively strong increase in day care attendance rates among children from disadvantaged backgrounds. In contrast, the evidence for an income transfer effect on child health is weak at best (see Section 4.4). This in turn confirms the view that the effect of the reform on child health runs through a substitution from informal care arrangements to public day care.[31] Notice also that a shift in infection-related diagnoses from the first years of primary school towards the first years of day care is difficult to explain by a positive household income transfer.[32] It seems obvious that this finding is driven by the enrollment into day care.

[30]We alternatively interacted each year with our SES measure. The results qualitatively remain the same and are available upon request.

[31]This is confirmed by the sibling fixed effects analyses, as their results appear to be very close to our baseline results.

[32]Similarly, this shift, as well as the fact that physicians and pediatricians visit schools at a frequency that is at least weekly and the fact that parental labor supply was not affected by the reform, suggests that our results are not driven by changes in parental costs of making daytime visits to health care centers.

Table 9: Impact of maxtaxa reform on day care attendance by socioeconomic status, municipality level analysis

	day care attendance, %			
N = 327	(1)	(2)	(3)	(4)
after	12.44**	8.896	1.241	
	(5.875)	(6.789)	(3.191)	
after$\times\mathbb{1}$(%low educ > 50%)	3.159***			
	(0.996)			
after$\times\mathbb{1}$(%poor children > 50%)		1.816*		
		(0.923)		
after$\times\mathbb{1}$(income < 50%)			2.636**	
			(0.991)	
N = 257				
after				7.335
				(4.968)
after$\times\mathbb{1}$(muni: med change in fees)				0.728
				(0.931)
after$\times\mathbb{1}$(muni: large change in fees)				3.316**
				(1.405)

Standard errors clustered on the municipality level; *** p<0.01, ** p<0.05, * p<0.1; Municipality fixed effects OLS regression of day care attendance on interaction between reform dummy and socioeconomic/fee change measure and time fixed effects. Controls municipality level: Urban area, unemployment rate for age 18-64, fraction population aged 1-5/6-15/16-19/20-64 year, population density, fraction foreign population, local tax rate, municipality per-capita expenditures for day care, teacher-child ratio, day care costs per child.

6 Health care utilization and costs

To investigate if the reduction in diagnosed diseases and disorders goes along with a lower extent of health care utilization, we estimate Equation (1) with the total number of annual diagnoses and the number of annual medical visits, preventive visits and acute visits, as outcomes.

The results presented in Table 10 indicate a reduction in the number of medical diagnoses and the number of medical contacts at age 6–7. Day care exposure at age 1 leads to a significant reduction in the number of diagnoses by 0.31 or 15% per year.[33] This finding is in line with our analysis on children's mental and physical health. In addition, the sign and magnitude of the point estimates point to an increase in the annual number of preventive visits and a decrease in the number of acute visits at ages 2–5. This suggests a substitution pattern between preventive and acute visits during the period children go

[33]The number of medical visits is reduced by 0.24 or 7% annually.

to day care. One reason for this behavior is that parents whose children are in day care cannot spontaneously see the doctor but have to plan visits according to the day care schedule. Moreover, day care centers may be more careful with children's health and nudge parents for health prevention of their children. Along these lines, it makes sense that the observed relationship between preventive and acute visits has disappeared at primary school age.[34]

Table 10: Effects of cumulative day care exposure on children's health care utilization

	number of diagnoses/a	medical visits/a	preventive visits/a	acute visits/a
N = 138,278		age 2–3		
exposed from age 1	-0.114	-0.028	0.140	-0.142*
	(0.163)	(0.113)	(0.156)	(0.086)
N = 167,117		age 4–5		
exposed from age 1	-0.100	-0.036	0.128	-0.124**
	(0.155)	(0.125)	(0.118)	(0.062)
N = 99,105		age 6–7		
exposed from age 1	-0.308*	-0.244	-0.078	0.006
	(0.181)	(0.225)	(0.064)	(0.047)

Standard errors clustered on the municipality level; *** p<0.01, ** p<0.05, * p<0.1; OLS regression with individual random effects, linear/quadratic time trends and municipality fixed effects. Controls: Gender, annual household income, number kids, number older siblings, age kid, kid moved, log birth weight kid, kid twins, mother's age, parents unemployed, parents couple, unemployment rate and population density in municipality.

Next, we investigate if the reduction in health diagnoses and medical visits translates into a decrease in children's health care costs. First, we again run Equation (1) for each age group 2–3, 4–5, and 6–7 in order to estimate the impact of day care on children's total annual health care costs. Table A.10 in the Appendix reports a positive but small and insignificant effect at age 2–3. While the total annual health care costs are not significantly reduced at age 4–5, we find a significant reduction for in this age group for the costs associated with diagnoses on infectious diseases. At age 6–7, the total health care are about 2,740 SEK ($\approx$ 384 USD in 2010) lower for children exposed to day care at age 1. While we find a decrease in the costs associated with all conditions (mental

[34]An alternative line of argument to explain the lower number of diagnoses and acute visits is that day care providers take over the role of health care providers. In this case parents who are worried about their children's health then would refer to day care workers with their concerns, reducing the number of health care contacts of children. While we cannot rule out such a mechanism, we may expect the most anxious parents to be highly educated and employed, in which case the significant reduction in mental health diagnoses should be driven by higher SES children. If anything, our effects are coming from children with disadvantaged backgrounds.

health, infections, ear, respiratory), the respective impact is statistically significant at the 10% level for mental health impairments only.

Finally, we plot the percent change in the annual health care costs for children aged 1–7 years against the observation period. We estimate Equation (1) with our main specification and plot the predicted mean health care costs against years [35].

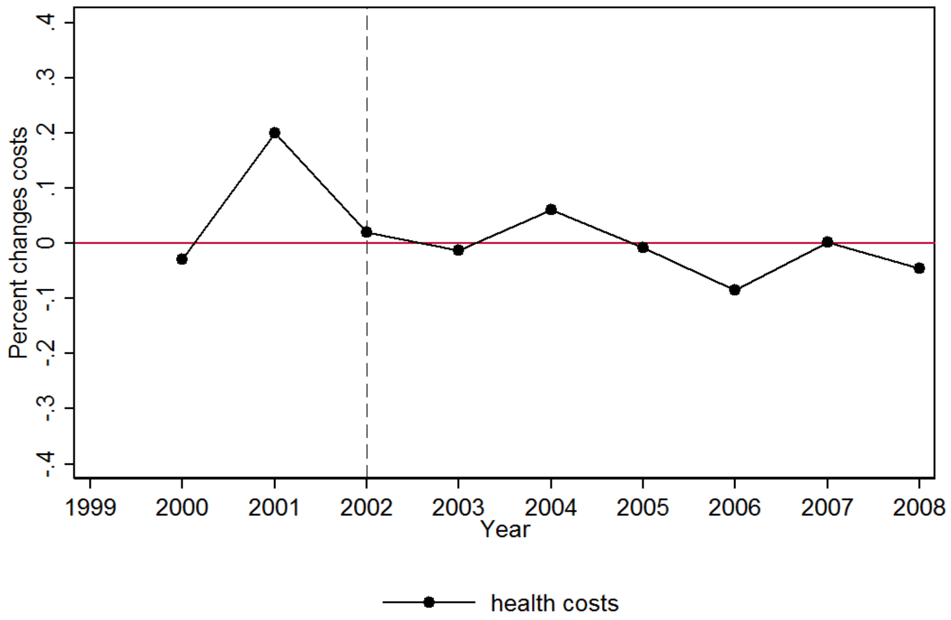


Figure 3: Development mean health care costs in the region of Skåne

The trend in health care costs is illustrated in Figure 3. Starting in 2001 we find a moderate decrease in the accumulation of health care costs. From 2005, the percent change in costs is negative. This provides suggestive evidence that child health care costs decrease after the implementation of the maximum fee rule which is consistent with our main findings. Due to data limitations, a full-blown cost-benefit analysis is beyond the scope of this paper.

7 Conclusion

We document several important effects of day care on children's health. First, there is a beneficial effect of day care on reducing the prevalence of behavioral and social disorders and on improving mental health and non-cognitive abilities in general. As the individual ages up to age 7, the beneficial effect of cumulative exposure to day care becomes larger and larger. In the first school-going ages, children previously exposed to day care have less behavioral and social disorders and other mental problems than those not exposed.

[35] The predicted annual health care costs are obtained from estimating Equation (1) with our main specification for children 1–7 years old.

These problems are already reduced instantaneously if the child enters day care at ages 4-5. The effects are of considerable size.

A second important effect concerns physical health. Compared to not going to day care until primary school, an intertemporal substitution of infectious disease spells takes place from the first years of primary school towards the first years of day care, whether this is at ages 2-3 or at ages 4-5. This is in accordance to the fact that the experience of contagious diseases increases once the child becomes intensively exposed to many other children and subsequently leads to immunity. The findings are also in accordance with the hygiene hypothesis.

Mental health gains are most pronounced among children living in municipalities where the reduction in day care fees was among the highest. Moreover, these effects on mental health are concentrated among low-SES families. In both cases, mental health gains from cumulative day care exposure as of age 4-5 are large and significant, and the size of these effects increases in absolute terms with increasing age. The analysis of municipality-level data adds evidence to the conjecture that low-SES children may benefit most from a reduction in day care fees: Those municipalities with the highest share of low-SES inhabitants and with the highest reduction in day care fees exhibit the starkest increase in day care attendance rates in response to the maxtaxa reform. Taking all evidence together, we thus conclude that an increase in day care attendance seems to be the key mechanism behind the documented health benefits while income transfers play a minor role. We view these as key results of our paper, as they mean that (state-run) day care does a better job than (parentally organized) informal care arrangements, in preventing behavioral and social disorders among children from disadvantaged backgrounds.

It is clear that these insights can only be obtained by virtue of access to the outpatient register data. After all, most diagnoses do not go along with a night's stay in hospital, so that they are not visible in inpatient registers. It would be interesting to exploit additional registers that are informative on health, notably the prescription registers. First, this would widen the range of informative outcome variables even further. Secondly, some medication and vaccinations may have adverse long-run side-effects. One of our findings is that day care involves a shift in sickness spells towards early ages. The latter may lead to an increased exposure to antibiotics at young ages, and this in turn is thought to have adverse effects on the microbiome, the immune system, obesity, and thus on later health in general. It is therefore an interesting topic for further research to combine our setting with data on prescribed medications.

Another consequence of the shift in sickness spells from school-going ages to earlier ages is that sickness absence at primary school may be reduced. This would constitute a long-run advantage, since lower sickness absence would lead to an improved cognitive development at school. This brings us to a second avenue for future research. Non-cognitive abilities and skills may support the development of cognitive skills, and according to the theory of health production, positive health returns may yield as cross-fertilizer for cognitive and non-cognitive child development. Indeed, the improved mental and physical health of children may explain the commonly found positive effects of day care on cognition in primary school and at later ages. Our data do not contain cognitive outcome variables. However, at the aggregate level, the 2002 reform seems to be positively associated with cognition at age 15. The PISA study (Skolverket, 2016) shows that average test scores for reading comprehension, mathematics and natural sciences in Sweden at age 15 had deteriorated monotonically from 2006 until 2012 and had fallen much below the mean across the other PISA countries. However, in 2015, which is the first year with PISA data after 2012, and hence which is the first year that the 15-year old in PISA mostly consisted of cohorts exposed to the day care reform, the test scores showed a remarkable improvement back to the cross-country mean. In general, our analysis calls for a simultaneous framework for the development of physical health, non-cognitive skills and cognitive skills in childhood. Data including cognitive outcomes would enable the estimation of a dynamic structural model, extending Cunha and Heckman (2008). This could include dynamic effects between physical and mental health as well.

References

Aalto, A., E. Mörk, and H. Svaleryd (2019): "Does Childcare Improve the Health of Children with Unemployed Parents? Evidence from Swedish Childcare Access Reform," *Working paper, IFAU Uppsala.*

Anell, A., A. Glenngård, and S. Merkur (2012): "Sweden-Health System Review," *Health Systems in Transition*, 14.

Baker, M., J. Gruber, and K. Milligan (2008): "Universal Child Care, Maternal Labor Supply, and Family Well-being," *Journal of Political Economy*, 116, 709–745.

——— (2015): "Non-cognitive Deficits and Young Adult Outcomes: The Long-run Impacts of a Universal Child Care Program," *NBER working paper*, 21571.

Becker, G., and N. Tomes (1976): "Child Endowments and the Quantity and Quality of Children," *Journal of Political Economy*, 84, 143–162.

Björnberg, U., and L. Dahlgren (2005): "Labor Supply – The Case of Sweden," *National Policy Report*, 26, 33–65.

Black, S., P. Devereux, and K. Salvanes (2005): "The More the Merrier? The Effects of Family Size and Birth Order on Children's Education," *Quarterly Journal of Economics*, 120, 669–700.

Blau, D., and J. Currie (2006): "Pre-School, Day Care, and After-School Care: Who's Minding the Kids?," in *Handbook of the Economics of Education*, ed. by E. Hanushek, pp. 1163–1278. Elsevier.

Bradley, R., and D. Vandell (2007): "Child Care and the Well-being of Ghildren," *JAMA Pediatrics*, 161, 669–676.

Bremberg, S. (2009): "A perfect 10: Why Sweden Comes Out on Top in Early Child Development Programming," *Paediatric Child Health*, 14, 677–680.

Brink, A., K. Nordblom, and R. Wahlberg (2007): "Maximum Fee versus Child Benefit: A Welfare Analysis of Swedish Child-care Fee Reform," *International Tax and Public Finance*, 14, 457–480.

Campbell, F., G. Conti, J. Heckman, S. Moon, R. Pinto, E. Pungello, and Y. Pan (2014): "Early Childhood Investments Substantially Boost Adult Health," *Science*, 343, 1478–1485.

Carneiro, P., and R. Ginja (2014): "Long-Term Impacts of Compensatory Preschool on Health and Behavior: Evidence from Head Start," *American Economic Journal: Economic Policy*, 6, 135–173.

Conti, G., J. Heckman, and R. Pinto (2016): "The Effects of Two Influential Interventions on Health and Healthy Behaviour," *Economic Journal*, 126, F28–F65.

Cornelissen, T., C. Dustmann, A. Raute, and U. Schönberg (2018): "Who Benefits from Universal Child Care? Estimating Marginal Returns to Early Child Care Attendance," *Journal of Political Economy, forthcoming.*

Côté, S., A. Petitclerc, M. Raynault, Q. Xu, B. Falissard, M. Boivin, and R. Tremblay (2010): "Short- and Long-term Risk of Infections as a Function of Group Child Care Attendance," *JAMA Pediatrics*, 164, 1132–1137.

Cunha, F., and J. Heckman (2008): "Formulating, Identifying and Estimating the Technology of Cognitive and Non-cognitive Skill Formation," *Journal of Human Resources*, 43, 738–782.

Datta Gupta, N., and M. Simonsen (2010): "Non-cognitive Child Outcomes and Universal High-quality Child Care," *Journal of Public Economics*, 94, 30–43.

Dietrichson, J., I. Lykke Kristiansen, and B. Nielsen (2018): "Universal Preschool Programs and Long-Term Child Outcomes: A Systematic Review," *Working paper, IFAU Uppsala.*

Enserink, R., A. Lugnér, A. Suijkerbuijk, P. Bruijning-Verhagen, H. Smit, and W. van Pelt (2014): "Gastrointestinal and Respiratory Illness in Children That Do and Do Not Attend Child Day Care Centers: A Cost-of-Illness Study," *PLoS ONE*, 9(8), e104940, 1–10.

Enserink, R., R. Ypma, G. Donker, H. Smit, and W. van Pelt (2013): "Infectious Disease Burden Related to Child Day Care in the Netherlands," *Pediatric Infectious Disease Journal*, 32, 334–340.

Felfe, C., and R. Lalive (2018): "Does Early Child Care Help or Hinder Children's Development?," *Journal of Public Economics*, 159, 33–35.

Folkhälsomyndigheten (2014): "Folkhälsan i Sverige," *Folkhälsomyndigheten Årsrapport.*

Garces, E., T. Duncan, and J. Currie (2002): "Longer-term effects of Head Start," *American Economic Review*, 92, 999–1012.

Gunnarsson, L., B. Korpi, and U. Nordenstam (1999): "Early Childhood Education and Care Policy in Sweden," *Background Report, Ministry of Education and Science.*

Hagerhed-Engman, L., C. Bornehag, J. Sundell, and N. Åberg (2006): "Day-care Attendance and Increased Risk for Respiratory and Allergic Symptoms in Preschool Age," *Allergy*, 61, 447–453.

Hanes, N., L. Holmlund, and M. Wikström (2009): "Assessing the Effects of the Child-care Fee Reform on Public Expenditures and Taxation," *Umeå Economic Studies*, 780.

Hedin, K., M. Andre, A. Håkansson, S. Mölstad, N. Rodhe, and C. Petersson (2007): "Physician Consultation and Antibiotic Prescription in Swedish Infants: Population-based Comparison of Group Daycare and Home Care," *Acta Paediatrica*, 96, 1059–1063.

Hill, K., and D. Upchurch (1995): "Gender Differences in Child Health: Evidence from theDemographic and Health Surveys," *Population and Development Review*, 21, 127–151.

Hong, K., K. Dragan, and S. Glied (2017): "Seeing and Hearing: The impacts of New York City's Universal Prekindergarten Program on the Health of Low-income Children," *NBER working paper*, 23297.

Japel, C., R. Tremblay, and S. Côté (2005): "Quality counts," *Institute for Research on Public Policy Choices*, 12, 1–42.

Kottenlenberg, M., and S. Lehrer (2014a): "Do the Perils of Universal Childcare Depend on the Child's Age?," *CESifo Economic Studies*, 60, 338–365.

——— (2014b): "The Gender Effects of Universal Child Care in Canada: Much ado about Boys?," *Unpublished Manuscript, Queen's University.*

Kraemer, S. (2000): "The Fragile Male," *British Medical Journal*, 321, 1609–1612.

Kristensson, J., I. Hallberg, and U. Jakobsson (2007): "Healthcare Consumption in Men and Women Aged 65 and Above in the Two Years Preceding Decision About Long-Term Municipal Care," *Health & Social Care in the Community*, 15, 474–485.

Lundborg, P., H. Ralsmark, and D. Rooth (2013): "When a Little Dirt Doesn't Hurt - The Effect of Family Size on Child Health Outcomes," *Unpublished Manuscript, Linnéuniversitetet.*

Lundin, D., E. Mörk, and B. Öckert (2008): "How Far can Reduced Childcare Prices Push Female Labour Supply?," *Labor Economics*, 15, 647–659.

Meghir, C., and M. Palme (2005): "Educational Reform, Ability and Parental Background," *American Economic Review*, 95, 414–424.

Mörk, E., A. Sjögren, and H. Svaleryd (2013): "Child Care Costs and the Demand for Children– Evidence from a Nationwide Reform," *Journal of Population Economics*, 26, 33–65.

Nores, M., and W. Barnett (2009): "Benefits of Early Childhood Interventions across the World: (Under) Investing in the Very Young," *Economics of Education Review*, 29, 271–282.

OECD (1999): "Early Childhood Education and Care Policy in Sweden," *Background Report for the OECD Thematic Review of Early Childhood Education and Care Policy*, U99.032, 1–84.

——— (2010): "Enrolment in Day-care and Pre-schools," http://www.oecd.org/social/family/database.htm, Last access: 2016-10-25.

Oreopoulos, P., M. Stabile, R. Wald, and L. Roos (2008): "Short, Medium, and Long Term Consequences of Poor Infant Health: An Analysis using Siblings and Twins," *Journal of Human Resources*, 43, 88–138.

Pingault, J., R. Tremblay, F. Vitaro, C. Japel, M. Boivin, and S. Côté (2015): "Early Nonparental Care and Social Behavior in Elementary School: Support for a Social Group Adaptation Hypothesis," *Child Development*, 86, 1469–1488.

Rasmussen, F., and C. Sundelin (1990): "Influence of Day Care Attendance on the Use of Systemic Antibiotics in 0- to 2-Year-Old Children," *Acta Paediatrica Scandinavia*, 79, 838–846.

Romano, J., and M. Wolf (2005): "Stepwise Multiple Testing as Formalized data Snooping," *Econometrica*, 73, 1237–1282.

Skolverket (2002): "Statistics for Child Care, School and Adult Education 2002:2, Children, Staff, Pupils and Teachers," *Skolverket Rapport*, 214.

——— (2003): "Uppföljning av reformen maxtaxa, allmän förskola m.m. 2003," *Skolverket Rapport*, 231.

——— (2016): "PISA 2015, 15-åringars kunskaper i naturvetenskap, läsförståelse och matematik," *Skolverket Rapport*, 450.

Strachan, D. (1989): "Hay Fever, Hygiene, and Household Size," *British Medical Journal*, 299, 1259–1260.

Tertilt, M., and G. van den Berg (2015): "The Association between Own Unemployment and Violence Victimization among Female Youths," *The Journal of Economics and Statistics*, 235, 499–513.

Thrane, N., C. Olesen, J. Mortensen, C. Søndergaard, H. Schønheyder, and H. Toft Sørensen (2001): "Influence of Day Care Attendance on the Use of Systemic Antibiotics in 0- to 2-Year-Old Children," *Pediatrics*, 107, e76, 1–6.

Vikman, U. (2010): "Does Providing Childcare to Unemployed Affect Unemployment Duration?," *Working paper, IFAU Uppsala.*

Wettergren, B., M. Blennow, A. Hjern, O. Söder, and J. Ludvigsson (2016): "Child Health Systems in Sweden," *The Journal of Pediatrics*, 177, S187–S202.

Wright, A., D. Stern, F. Kauffmann, and F. Martinez (2006): "Factors influencing Gender Differences in the Diagnosis and Treatment of Asthma in Childhood: The Tucson Children's Respiratory Study," *Pediatric Pulmonology*, 41, 318–325.

Appendix

Table A.1: Overview over most commonly diagnosed childhood diseases

main categories	detailed diagnoses
mental health problems	
developmental impairments	language, scholastic, motor, combined language & motor
behavioral impairments	hyperkinetic, social, emotional-social, social functioning, ADHD
mental retardation	impairment of skills during developmental period contributing to overall level of intelligence
infectious diseases	
intestines	salmonellis, campylobacter, rota virus, viral diarhhoea
viral infections skin & membrane lesions	measles, rubella, chicken pox, herpes-viral, warts, mc virus, sixth disease, fifth disease, hand-foot-mouth disease
other viral infections	mononucleosis, mumps, pink eye, entero virus, adeno virus
bacterial infections	pertussis, scarlet fever, erysipelas
mycosis	tinea, candidosis
ear diseases	
middle ear diseases	non-suppurative, suppurative, Eustachian salpingitis/obstruction, mastoiditis, cholesteatoma, perforation tympanic membrane
respiratory diseases	
acute upper respiratory infections	sinusitis, pharyngitis, tonsillitis, laryngitis & tracheitis, croup, common cold
acute lower respiratory infections	bronchitis, bronchiolitis rs-viral, bronchiolitis other viruses
influenza & pneumonia influenza	viral pneumonia, streptococcus pneumonia, Haemophilus influenzae pneumonia, pneumonia other bacteria
chronic upper respiratory infections	chronic sinusitis, chronic rhinitis, allergic rhinitis
chronic lower respiratory infections	chronic bronchitis, asthma

Table A.2: Correction for multiple hypothesis testing: effects of cumulative day care exposure children's physical and mental health

	coeff.	stepdown p-value
age 2–3		
intestines	-0.009	0.033
viral infect, skin/mucous membrane lesion	0.008	0.000
other viral infections	0.028	0.000
middle ear diseases	0.034	0.000
acute upper resp. infect	0.053	0.000
acute lower resp. infect	0.011	0.000
bacterial infect	0.004	0.033
age 4–5		
developmental disorders	-0.027	0.066
bacterial infect	-0.004	0.000
acute upper resp. infect	0.048	0.000
chronic lower. resp. infect	0.010	0.066
age 6–7		
viral infect, skin/mucous membrane lesion	-0.010	0.000
other viral infections	0.011	0.000
middle ear diseases	-0.020	0.000
acute upper resp. infections	0.019	0.000
acute lower resp. infections	0.004	0.000
behavioral disorders	-0.011	0.066
mental retardation	-0.003	0.066

Multiple hypothesis test on probit coefficients. Nominal level $\alpha = 0.05$, bootstrap sample $R = 30$, number of tested hypotheses per age group $k = 15$, standard errors clustered on individual level.

Table A.3: Differences in Differences in predicted probabilities of cumulative day care exposure and low-high parental income for children's physical and mental health

	mental health problems	infections	ear problems	respiratory diseases
N=93,837		age 2–3		
$(\hat{Y}_{e=1,l=1} - \hat{Y}_{e=0,l=1}) - (\hat{Y}_{e=1,l=0} - \hat{Y}_{e=0,l=0})$	-0.000	0.000	0.008	0.008
	(0.001)	(0.005)	(0.006)	(0.007)
N=126,491		age 4–5		
$(\hat{Y}_{e=1,l=1} - \hat{Y}_{e=0,l=1}) - (\hat{Y}_{e=1,l=0} - \hat{Y}_{e=0,l=0})$	-0.006*	-0.000	-0.004	0.010
	(0.003)	(0.003)	(0.005)	(0.006)
N=133,259		age 6–7		
$(\hat{Y}_{e=1,l=1} - \hat{Y}_{e=0,l=1}) - (\hat{Y}_{e=1,l=0} - \hat{Y}_{e=0,l=0})$	-0.006**	-0.002	0.007	0.018**
	(0.003)	(0.004)	(0.005)	(0.008)

Standard errors obtained from delta method; *** p<0.01, ** p<0.05, * p<0.1; Double differences in predicted probabilities of day care exposure (e=1) and child is from low income household (l=1) obtained from probit regression with individual random effects, linear/quadratic time trends, municipality fixed effects and standard errors clustered on the child level. Controls: Gender, annual household income, number kids, number older siblings, age kid, kid moved, log birth weight kid, kid twins, mother's age, parents unemployed, parents couple, unemployment rate and population density in municipality.

Table A.4: Differences in Differences in predicted probabilities of cumulative day care exposure and urban-rural area for children's physical and mental health

	mental health problems	infections	ear problems	respiratory diseases
N = 138,276		age 2–3		
$(\hat{Y}_{e=1,u=1} - \hat{Y}_{e=0,u=1}) - (\hat{Y}_{e=1,u=0} - \hat{Y}_{e=0,u=0})$	-0.003**	-0.009**	-0.020***	-0.053***
	(0.001)	(0.005)	(0.006)	(0.007)
N = 167,117		age 4–5		
	-0.017***	-0.013***	-0.031***	-0.050***
$(\hat{Y}_{e=1,u=1} - \hat{Y}_{e=0,u=1}) - (\hat{Y}_{e=1,u=0} - \hat{Y}_{e=0,u=0})$	(0.004)	(0.004)	(0.006)	(0.006)
N = 164,072		age 6–7		
	-0.005**	-0.010*	-0.014*	-0.044***
$(\hat{Y}_{e=1,u=1} - \hat{Y}_{e=0,u=1}) - (\hat{Y}_{e=1,u=0} - \hat{Y}_{e=0,u=0})$	(0.002)	(0.005)	(0.008)	(0.008)

Standard errors obtained from delta method; *** p<0.01, ** p<0.05, * p<0.1; Double differences in predicted probabilities obtained of day care exposure (e=1) and child lives in urban area (u=1) from probit regression with individual random effects, linear/quadratic time trends, municipality fixed effects and and standard errors clustered on the child level. Controls: Gender, annual household income, number kids, number older siblings, age kid, kid moved, log birth weight kid, kid twins, mother's age, parents unemployed, parents couple, unemployment rate and population density in municipality. The following municipalities characterize the urban area: Hoeganaes, Helsingborg, Bjuv, Hoerby, Esloev, Landskrona, Kaevlinge, Staffanstorp, Sjoebo, Malmö, Svedala, Trelleborg, Skurup, and Ystad.

Table A.5: Differences in Differences in predicted probabilities of cumulative day care exposure and child sex for children's physical and mental health

	mental health problems	infections	ear problems	respiratory diseases
N = 138,276		age 2–3		
$(\hat{Y}_{e=1,b=1} - \hat{Y}_{e=0,b=1}) - (\hat{Y}_{e=1,b=0} - \hat{Y}_{e=0,b=0})$	-0.002	-0.006	-0.002	-0.006
	(0.002)	(0.004)	(0.004)	(0.005)
N = 167,117		age 4–5		
$(\hat{Y}_{e=1,b=1} - \hat{Y}_{e=0,b=1}) - (\hat{Y}_{e=1,b=0} - \hat{Y}_{e=0,b=0})$	-0.011***	0.001	-0.011***	0.002
	(0.004)	(0.003)	(0.004)	(0.005)
N = 164,072		age 6–7		
$(\hat{Y}_{e=1,b=1} - \hat{Y}_{e=0,b=1}) - (\hat{Y}_{e=1,b=0} - \hat{Y}_{e=0,b=0})$	-0.009**	0.000	-0.001	0.000
	(0.004)	(0.003)	(0.004)	(0.005)

Standard errors obtained from delta method; *** p<0.01, ** p<0.05, * p<0.1; Double differences in predicted probabilities obtained of day care exposure (e=1) and child is a boy (b=1) from probit regression with individual random effects, linear/quadratic time trends, municipality fixed effects and standard errors clustered on the child level. Controls: Gender, annual household income, number kids, number older siblings, age kid, kid moved, log birth weight kid, kid twins, mother's age, parents unemployed, parents couple, unemployment rate and population density in municipality.

Table A.6: Average marginal effects of cumulative day care exposure on children's physical and mental health, two children households

	mental health problems	infections	ear problems	respiratory diseases
N = 116,406		age 2–3		
exposed: age 1	-0.002	0.028***	0.040***	0.054***
	(0.003)	(0.007)	(0.008)	(0.009)
N = 141,010		age 4–5		
exposed: age 1	-0.029***	0.014*	0.013	0.054***
	(0.008)	(0.008)	(0.011)	(0.012)
N = 138,945		age 6–7		
exposed: age 1	-0.016	0.003	-0.024*	0.010
	(0.011)	(0.010)	(0.015)	(0.017)

Standard errors obtained from delta method; *** p<0.01, ** p<0.05, * p<0.1; Average marginal effects from a probit regression with individual random effects, linear/quadratic time trends, municipality fixed effects and standard errors clustered on the child level. Controls: Gender, log annual household income, age kid, kid moved, log birth weight kid, kid twins, mother's age, parents unemployed, parents couple, unemployment rate and population density in municipality.

Table A.7: Average marginal effects of cumulative day care exposure on children's physical and mental health, single child households

	mental health problems	infections	ear problems	respiratory diseases
N = 35,284		age 2–3		
exposed from age 1	0.002	0.048***	0.058***	0.057***
	(0.005)	(0.012)	(0.014)	(0.016)
N = 45,576		age 4–5		
exposed from age 1	-0.038***	0.015	0.026	0.080***
	(0.014)	(0.014)	(0.018)	(0.020)
N = 48,851		age 6–7		
exposed from age 1	-0.029*	0.003	-0.033	-0.007
	(0.018)	(0.016)	(0.023)	(0.026)

Standard errors obtained from delta method; *** p<0.01, ** p<0.05, * p<0.1; Average marginal effects from a probit regression with individual random effects, linear/quadratic time trends, municipality fixed effects and standard errors clustered on the child level. Controls: Gender, log annual household income, age kid, kid moved, log birth weight kid, kid twins, mother's age, parents unemployed, parents couple, unemployment rate and population density in municipality.

Table A.8: Average marginal effects of cumulative day care exposure on children's physical and mental health, with birth order fixed effects

	mental health problems	infections	ear problems	respiratory diseases
		age 2–3		
exposed from age 1	-0.004	0.025***	0.036***	0.050***
	(0.003)	(0.006)	(0.007)	(0.008)
		age 4–5		
exposed from age 1	-0.028***	0.012*	0.017*	0.058***
	(0.008)	(0.007)	(0.010)	(0.011)
		age 6–7		
exposed from age 1	-0.020**	0.001	-0.017	0.014
	(0.010)	(0.010)	(0.013)	(0.016)

Standard errors obtained from delta method; *** p<0.01, ** p<0.05, * p<0.1; Average marginal effects from a probit regression with individual random effects, linear/quadratic time trends, municipality fixed effects and standard errors clustered on the child level. Controls: Gender, log annual household income, age kid, kid moved, log birth weight kid, kid twins, mother's age, parents unemployed, parents couple, unemployment rate and population density in municipality.

Table A.9: Average marginal effects of cumulative day care exposure on children's physical and mental health, with sibling FE

	mental health problems	infections	ear problems	respiratory diseases
N = 74,805		age 2–3		
exposed from age 1	-0.792***	0.211**	0.165**	0.227***
	(0.272)	(0.083)	(0.076)	(0.059)
N = 97,680		age 4–5		
exposed from age 1	-0.139	0.222	0.061	0.179*
	(0.219)	(0.159)	(0.130)	(0.105)
N = 93,965		age 6–7		
exposed from age 1	-0.283	-0.485	-0.178	0.185
	(0.438)	(0.363)	(0.288)	(0.223)

Standard errors clustered on family level; *** p<0.01, ** p<0.05, * p<0.1; Average marginal effects from a conditional (fixed effects) logit regression, linear/quadratic time trends, municipality fixed effects and standard errors clustered on the child level. Controls: Gender, log annual household income, age kid, kid moved, log birth weight kid, kid twins, mother's age, parents unemployed, parents couple, unemployment rate and population density in municipality. Note: number of observations varies due to missing variation in the outcome within families.

Table A.10: Effects of cumulative day care exposure on children's annual health care costs

	coefficient: day care exposure at age 1		
	age 2–3	age 4–5	age 6–7
annual health costs, SEK	255.748	-1,242.32	-2,741.46*
	(558.84)	(818.89)	(1505.66)
costs single diagnoses, SEK			
mental health problems	-6.08	-165.15	-383.64*
	(47.13)	(116.00)	(230.81)
infections	-19.53	-335.55**	-529.56
	(104.20)	(137.34)	(520.70)
ear problems	-92.31	-243.35	-184.71
	(172.68)	(151.14)	(140.65)
respiratory diseases	169.52	-165.34	-491.41
	(203.94)	(301.64)	(564.53)
N	138,257	167,104	164,054

Standard errors clustered on municipality level; *** p<0.01, ** p<0.05, * p<0.1; OLS regression with individual random effects, linear/quadratic time trends and municipality fixed effects. Controls: Gender, log annual household income, number kids, number older siblings, age kid, kid moved, log birth weight kid, kid twins, mother's age, parents unemployed, parents couple, unemployment rate and population density in municipality. All costs are presented in Swedish Crones (SEK) and in 2010 prices.