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The Nurse is Here! Returns to a Nationwide School Health Program

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The Nurse is Here! Returns to a Nationwide School Health Program

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Abstract

This paper provides novel evidence that low-cost preventive health care services delivered in schools have positive and lasting impacts. Variation comes from a 1999-reform in Norway that increased the supply of health professionals at schools in municipalities with low pre-reform availability by 35%. The reform had substantial impacts on females: it reduced teenage childbirths and welfare dependency by age 30 while it increased on-time college completion and labor market earnings. The reform also increased planned use of primary and specialist health care services among both females and males in their 30s.

JEL Classification: H75, I10, I12, I28, I30, I38
Keywords: School Health Services, Teenage Pregnancy, Welfare Dependency, Use of Health Services, Health Status.

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1 Introduction

While there is an extensive literature on the long-term consequences of in-utero, neonatal and early childhood health programs (for a review, see Almond, Currie and Duque, 2018), much less is known about health interventions during the next phase of a child's life, the school age. Programs that expose children to safe, stable and nurturing environments have been proved effective in promoting long-lasting health and well-being (Muennig, 2015). Robust evidence on the effect of such interventions comes from small-scale randomized controlled trials (RCTs) targeting disadvantaged children in the US (e.g., Campbell et al., 2014; Conti, Heckman and Pinto, 2016), universal programs (e.g., Breivik, Del Bono and Riise, 2021; Cattan et al., 2021; Hong, Dragan and Glied, 2019; van den Berg and Siflinger, 2022) and large-scale programs targeting poor children, such as the Head Start in the US.[1] However, despite recent work showing that is possible to ameliorate early disadvantage by investing in non-cognitive skills at later stages of childhood it (Cunha, Heckman and Schennach, 2010; Heckman, 2006), there is still scarce evidence documenting the effectiveness of school-age interventions. This lack of evidence-based knowledge has prompted the Lancet Commission for Adolescents' Health and Wellbeing to call to close this gap (Patton et al., 2016). Our paper contributes to filling this knowledge gap by providing the first causal documentation of the potential of present-day universal school health services to affect individuals' lives long into adulthood.

Poor health in childhood has immediate costs, such as health related expenses and reduced quality of life, and it has been associated with reduced investments in human capital and education, with youth unemployment, poorer adult labor market outcomes, and criminal behavior (see e.g., Case, Fertig and Paxson, 2005; Cunha and Heckman, 2008; Currie et al., 2010; Delaney and Smith, 2012; Egan, Daly and Delaney, 2015; Smith, 2009).[2] Also mental health problems in childhood and adolescence are important predictors for long-term outcomes (see e.g. Currie et al., 2010; Egan, Daly and Delaney, 2015; Smith and Smith, 2010).

Adolescence is considered the healthiest period of life but is often disregarded by health-care providers. In developed countries, adolescence is the point of lowest mortality across the life course, between the peaks of early life mortality and chronic diseases later in adulthood. Thus, from the perspective of healthcare services, adolescents appear to have fewer needs than those in early childhood or later years. However, studies in the psychological and epidemiological

[1]The Head Start, a large-scale program targeting children in poor families, has been show to improve health in the short- and medium-run, labor market outcomes and individuals' behaviors (see e.g., Anders, Barr and Smith, 2023; Bailey, Sun and Timpe, 2021; Barr and Gibbs, 2022; Carneiro and Ginja, 2014; DHHS, 2010, 2012; Frisvold and Lumeng, 2011; Ludwig and Miller, 2007; Thompson, 2018).

[2]In turn, educational attainment has been associated with better physical and mental health, lower involvement in crime, and longer life expectancy (see e.g. Blanchflower and Oswald, 2004; Chevalier and Feinstein, 2006; Grossman, 2005; Lochner and Moretti, 2004; Stark and Noel, 2015).

literature have shown that preventive measures are often effective in promoting healthier behaviors and preventing the development of mental and physical health problems (Marmot and Wilkinson, 2005). This makes the adolescence a potentially important time to invest in early detection and prevention of future health problems. Adolescents spend a large part of their days at school and as such, schools constitute important platforms for detecting problems early and providing health-promoting services, such as essential health knowledge, sexual education and advice about healthy lifestyles. Hence, the scarcity of work studying the causal effect of school age interventions is surprising.

This paper constitutes the first evidence of how a universal current-day school health program affects the lives of adolescents in multiple dimensions. We focus on the Norwegian school health services, which are mainly delivered by school nurses, who provide accessible services at school conducting regular health check-ups, collaborating with teachers and other school personnel in preventive social work, and engaging with students. The services available in the Norwegian school system are similar to those available at schools in the UK,[3] Sweden (Fagerholt, 2009), US (Lovenheim, Reback and Wedenoja, 2016), and other developed countries.

The scarcity of evidence documenting causal effects of school health services can partially be attributed to the existence of confounding determinants that simultaneously influence parents' school and location choices and their children's education, health and health-related behaviors. To overcome these problems and identify the effects of school health services, we rely on a Norwegian reform that expanded the supply of health care professionals at schools - the 1999 Escalation Plan for Mental Health. This reform was gradually implemented between 1999 and 2008, and one of its most important features was the increased investment in preventive care through the school health sector, with the explicit goal of reducing inequalities in the availability of school nurses across municipalities. This reform allows us to estimate the effects of access to school nurses using a difference-in-differences framework that compares the outcomes for cohorts in school before and after the implementation of the 1999-reform (first difference) between municipalities with different degrees of increased school nurse coverage (second difference). In practice, individuals 19 years or older in 1998, the year before the reform, had graduated by the time the reform was implemented and were not affected by the expansion in the supply of school nurses, while for younger cohorts the exposure to the reform is a decreasing function of their age in 1999.

We combine several individual-level administrative datasets that cover the entire Norwegian population and include information about educational attainment, fertility, labor market outcomes, welfare dependence and use of health care services, and document the effects on a number of outcomes at ages 20-39. The reform increased the supply of school nurses in municipalities with

[3] See https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/303769/Service_specifications.pdf.

low baseline supply. In particular, one less school nurse per 1,000 6-19 years old in the pre-reform period was associated with additional 0.71 school nurses after the reform; this represents a 35% increase relative to the pre-reform mean of school nurses of two nurses per 1,000 6-19 year old. We show that the key identifying assumption for the validity of our strategy holds and that municipalities with different levels of pre-reform coverage of school nurses had similar trends in several other characteristics prior the reform and among cohorts unexposed to the reform. We present different pieces of evidence to support that is the case. Additionally, our estimates are robust to a number of alternative specifications.

Our paper has three main findings. First, the increased supply of school nurses had positive impacts on adult outcomes. It reduced teen childbirth and, for treated cohorts, one fewer school nurse per 1,000 school-age children at baseline reduced the likelihood of teen childbirth by 0.6 percentage points, which is equivalent to a 12.9% reduction from a baseline mean of 5%. For females, there is also an increased likelihood of obtaining a college degree on-time (ie, by age 23) by 2 percentage points (7.5% effect). For women, the reform furthermore increased labor market earnings at age 25 by 5.9% and reduced welfare use by age 30 by 4%. For both men and women at age 30-39, the reform increased their use of planned primary care visits (5% increase in the number of visits per year, relative to a baseline of 4 annual visits) and the likelihood of planned inpatient and outpatient visits in specialist care (both increasing by 4%).

Second, as some children were exposed to the reform from elementary school while others were exposed from high school, we can assess how impacts varied by the age of first exposure to the reform. The impacts on teen childbirth are similar for those first exposed to the reform during high school (at ages 16-18), since middle school (ages 13-15) and since primary school (ages 6-12), while the impacts on the use of health care, earnings and welfare dependence generally increase with exposure. This suggests two, not mutually exclusive, explanations. First, teen childbirth is more malleable to interventions at later stages of life and exposure prior to fertile age might be less relevant, while for labor market and health outcomes, investments in the early years and/or longer exposure are more important (Cunha, Heckman and Schennach, 2010). Second, our estimates may reflect that the services provided by the nurses at different ages vary, and some of the services provided at an early stage, as early detection of health problems and prevention, might be especially important for long term health and labor market, while others services targeting sexual behavior of adolescents are delivered during teen years, when they are most effective.

Finally, the detailed datasets used in this paper allow us to shed some light on the mechanisms behind our findings. The 1999-reform might affect individuals via three potential, nonexclusive, channels. First, it is possible that the reform may have changed individuals' health through the services provided. We provide suggestive evidence of short-run improvements on the health of exposed students, based on increased maternal earnings at the time of the reform. It is unlikely that the reform affected the health of individuals when they are in their prime age (30 to 39 years old), as we do not detect changes in the severity of health conditions of those who visited hospitals, or any changes in acute visits to primary or specialist healthcare services. Second, the reform could have raised the students' awareness for healthier behaviors, including the need for necessary health check-ups and the existence of services. This change in awareness and behaviors is a likely channel to explain the pattern of increased use of planned general practitioner (GP) and specialist care consultations. Finally, the 1999 reform might have had a direct and indirect effect on education through changes in fertility due to the school nurses' counseling role and improved sexual health education for girls.

This paper complements the literature on the impacts of preschool interventions on education, behaviors and mental health of adolescents and young adults (e.g., Carneiro and Ginja, 2014; Cattan et al., 2021; Conti, Heckman and Pinto, 2016; Garces, Thomas and Currie, 2002; Ludwig and Miller, 2007) by studying an intervention at a later age. While there is an abundance of work on the impacts of early childhood interventions, we still lack a comprehensive picture of the effectiveness of alternative policies at some point between early life and adulthood, which Almond, Currie and Duque (2018) calls the "missing middle". The evidence on impacts of health interventions at schools is mostly available for developing countries (e.g., Miguel and Kremer, 2004) or for early 20th century Europe from the provision of nutritious school meals in Norway in the 1920/30s and in 1960s Sweden (Bütikofer, Mølland and Salvanes, 2018; Lundborg, Rooth and Alex-Petersen, 2021). The existing evidence on recent school interventions in developed countries is limited to studies with samples of a few hundred observations and limited temporal coverage (Maughan, 2003).[4] We add to this literature by investigating the effects of a longstanding universal school health program on a wider set of outcomes measured during early adulthood, using rich panel data to probe the mechanisms behind our findings. The closest to our work is Lovenheim, Reback and Wedenoja (2016), who study the impacts of providing primary health care through school-based health centers in deprived school districts in the USA on fertility and high school dropout, and find a 5% reduction in teenage pregnancies, but no impacts on dropout rates.

[4]Recent health interventions have produced discouraging results among teenagers ages 13-17; see, e.g., Stice, Shaw and Marti (2006) for a meta-analysis on interventions to reduce obesity or Horowitz et al. (2007) for a meta-analysis of interventions to reduce depression.

2 Background and Expected Effects of School Health Services in Norway

2.1 School Health Services in Norway

In Norway, health services are publicly financed and universally accessible for all citizens. The services are organized into two levels: primary care and specialist care. Municipalities are responsible for delivering first-line health care services, including GPs, emergency rooms (ERs), infant and child health care centers, school health services, and elderly care. Specialist care, the second line care, is the responsibility of four health regions and includes somatic specialist care, psychiatric health services, and private referral specialists contracted by the health regions. Access to specialist care and hospital services can only be obtained through referrals from GPs or ER doctors in the primary care sector (except for emergencies).

All school-age children and youth are entitled to vaccinations, health education and guidance, as well as medical examinations and access to healthcare professionals when needed (Helse- og omsorgsdepartementet, 2003). These services are easily accessible; they are free of charge and to a large extent delegated to the school health services (at both private and public schools), which are available on school premises during school hours, and primarily provided by school nurses, who are certified nurses with an additional one- or two-years specialization in preventive and health-promoting work.[5] School nurses are employed by the municipalities, not by the schools, and may provide services to more than one school at the time. Furthermore, municipalities have some discretion to organize their activities; for example, some include physicians, psychologists and other health professionals as part of the school health services, either permanently or for shorter periods.[6] The school health services are generally preventive in their nature and for curative purposes the children should be referred to their GP, who can either treat the child or refer them to specialist care (Statens Helsetilsyn, 1998).

Services delivered Since the end of the 18th century, promotion of good health has been a central task for Norwegian school and health authorities. Originally the focus was on hygiene, (mal)nourishment, individual health examinations and the school environment, in addition to combating infectious diseases through the implementation of a vaccination program. However, as living conditions and medical treatments improved, the focus of these services shifted to also

[5]The length of the specialization varies between institutions across the country.

[6]In 1990, in total 1744 man-years were available in the health stations and school health services across Norway. Of these, 208 were physicians, 119 physiotherapists, and 1416 school nurses, midwives and other personnel. In 1998, the corresponding numbers were 2817 (total), 222 (physicians), 296 (physiotherapists) and 2354 (school nurses, midwives and other personnel (Statistics Norway, 2002).

detecting and preventing lifestyle-related health problems (Statens Helsetilsyn, 1998). In the beginning of the 1990s, the authorities passed a bill that described which health services should be prioritized at schools and child health stations. These included the *prevention* of psychosocial problems, accidents and injuries, asthma and allergies and the *promotion* of healthy behaviors related to nutrition and use of tobacco and drugs.

In 1998, the Norwegian Board of Health Supervision issued national guidelines for school health services for the first time (Statens Helsetilsyn, 1998). Many of these guidelines built on already well-established practices, and others were attempts to standardize practices across the different municipalities.[7] The main services to be delivered depend on the children's age and include:

1. The most comprehensive health examination is conducted when children start school, or ideally a few months before, when the child is 5 or 6 years old. Their height and weight are measured, and they are screened for any physical and developmental conditions that may need attention. The child's family situation and socioeconomic and emotional environments is also evaluated. During the assessment, parents receive general advice on conditions for their child's development and health (e.g. on nutrition/eating habits, sleep, screen time, setting limits, etc.).

2. School health services administrate vaccines for school-age children (usually at ages 8, 11, 12, 14, and 15).[8]

3. At ages 8, 12 or 13, and 16, the child's height is registered and health examinations are conducted according to the schools' assessments of individual risks and needs. Individual supervision and advice should be offered to parents and/or students based on their individual needs. These consultations aim to follow-up on the needs and challenges identified over time, and are not as comprehensive as the school-start examination.

4. During the whole schooling period, health information and guidance is provided in groups or classes at various stages. Information about general health-improving behavior, such as eating habits, the importance of physical activity, how to express feelings, and setting boundaries are recurring topics, while puberty, sexuality, contraception, and issues related to the use of tobacco, alcohol, and drugs are recommended to be introduced gradually.

[7] Schools and municipalities are not obliged to follow the guidelines. However, if they deviate from the guidelines, they are expected to justify their choices, and there is evidence that deviations from the guidelines are considered in cases where conflicts between parents/students and the municipalities are taken to court.

[8] The recommended ages have changed slightly over time. Vaccination rates are close to universal in Norway; e.g., 94% of children born in 1995 had completed the official vaccination program by the age of 16 (https://www.fhi.no/globalassets/dokumenterfiler/tema/vaksine/2011-fylker-16-aringer-1995.pdf).

5. Open office hours for general counseling. For adolescents, an important service typically delivered during these open office hours is the provision of free nonprescription contraceptives. Condoms and general advice have always been available. Since 2002, school nurses have also been allowed to prescribe birth control pills free of charge to women aged 16–19 years old.

Utilization of services There is no systematic registry of the use of school health services by students for the studied period; therefore, there is no exact information about their service uptake. According to a 2013 survey, 23.2% and 24.8% of the students in middle school and high school, respectively, reported at least one annual consultation with a school nurse.[9] However, there are substantial gender differences in the use of school health services. For example, 16.8% and 13.1% of boys in middle school and high school, respectively, consulted school nurses at least once a year.[10] For girls, these figures double: that is, 29.4% and 35.4% in middle and high school, respectively, had consulted the school nurse at least once a year.

The survey also reveals that the most common reasons for visiting the school nurse during middle school were physical problems, followed by well-being or friendship trouble and family problems. During high school, sexuality and contraceptives were reported to be the most important motive, followed by physical and psychological problems.

2.2 The 1999 Reform: the Escalation Plan for Mental Health

By the late 1990s, several areas of the Norwegian psychiatric sector had been strongly criticized for a long time, which resulted in a review of the sector and a parliamentary white paper that revealed generally deficient and inadequate levels of mental health-care services, with large discrepancies in the availability and quality of services across municipalities (Sosial- og helsedepartementet, 1996). Hence, with the aim of providing better preventive care, improving treatment for mentally ill patients, and equalizing the service levels across municipalities, in 1997, the Parliament passed the Escalation Plan for Mental Health (*Opptrappingsplanen for psykisk helse*) to be effective from 1999 (Helse- og omsorgsdepartementet, 1997). To support the Escalation Plan, subsidies were allocated to the municipalities based on objective criteria and, in exchange, municipalities must prepare concrete plans for its intended use of these subsidies and report on their actual use. The main focus areas were: 1) informing the population about mental health problems and disorders and

[9] Since 2010, the "Ungdata" surveys have been conducted with youth in most Norwegian municipalities. These surveys are regarded the most comprehensive source of information on adolescent health and well-being at the municipal and national levels and include questions about the use of school health services (Froyland, 2017). In this paper, we report information from the 2013 survey because it covers the largest number of schools and municipalities.

[10] We also note that 90% of school nurses are women (own calculations using Social Security records).

strengthening initiatives directed at users of mental health services; 2) reorganizing and strengthening health services for people with mental health problems, primarily through establishing new and supporting existing district psychiatric centers; 3) programs to support labor market participation among individuals with mental health problems; 4) strengthening the municipalities' preventive health services, especially those for children and youth; and 5) expanding psychiatric services for children and youth.

To identify the effects of increased access to school health services, we rely on one of the most important components of the reform directly addressing objective 4 above, namely the increased supply of school nurses. The Escalation Plan period was initially set for 1999 to 2006, but after an evaluation in 2002, this period was extended to 2008. In 2002, the Government prioritized child- and youth-related services with emphasis on early detection of mental problems, preventive work, and referral to the appropriate treatment (Helsedepartementet, 2002, 2003). In practice, this implied that at least 20% of the subsidies allocated under the Escalation Plan were earmarked to increase the resources targeting children and adolescents, with the goal of adding 800 man-years (a 50% increase) in the school and child health-care centers, which naturally increased the supply of school nurses. In 1998 (the year before the reform), the national average was 2.1 school nurses per 1,000 school-age children (i.e., 6–19-year-olds) by municipality, but this figure rose to 2.9 by the end of 2014. In accordance with the goal of the reform to equalize the supply of services across areas, municipalities with lower pre-reform coverage of school nurses, measured as the number of nurses per 1,000 children at age 6 to 19, experienced the strongest growth from the pre- to the post-reform period (see section 4). This is visible in Figure 1 which illustrates the relationship between pre-reform levels of school nurses and the growth from 1995–1997 (pre-reform period) to 1999-2008 (post-reform period). This pattern of higher growth in low pre-reform coverage municipalities is also confirmed by Figure 2, that shows how the municipality coverage evolved before and after 1998 for municipalities with high vs. low pre-reform coverage.[11]

2.3 Expected Effects of the Reform

Considering the variety of services offered by school health services, there are numerous channels through which the 1999 reform could have affected children and adolescents' outcomes.

[11] Figure 2 presents estimates for βs from the following model

$$Cov_{mt} = \sum_{k=1990}^{1997} \beta_k^B L_m \mathbf{1}\left[t - T_m = k\right] + \sum_{k=1999}^{2009} \beta_k^A L_m \mathbf{1}\left[t - T_m = k\right] + \mu_m + \pi_t + \varepsilon_{mt}$$

where Cov_{mt} is the log of school nurses per 1,000 children 6-19 years old in year t and municipality m, L_m is an indicator variable equal to 1 if the coverage between 1995 and 1997 is below the median coverage, and 0 otherwise. μ_m and π_t are municipality and year fixed effects, respectively.

Fertility and Teenage Childbirth Access to school nurses may reduce childbearing by teenagers in at least two ways. First, directly through education and guidance given in sexuality and contraception. In addition, school nurses provide free non-prescription contraceptives, and since 2002 they can prescribe hormonal contraceptives, which may reduce unwanted pregnancies and/or postpone fertility (Ananat and Hungerman, 2012; Bailey, 2006; Goldin and Katz, 2002; Guldi, 2008).[12] Second, the increased supply of school nurses may reduce school absences (see below) and thus dropout rates, which could indirectly affect teenage childbearing through the so-called lock-in effect.

Education The increased supply of health professionals at schools may improve educational achievement through their collaboration with the school's pedagogical staff to improve the children's learning environment, but also through the direct services provided to students. A common problem at high school is the high absence rate among some students, and school nurses typically assist these students trying to address the problems related to their absence.[13] Thus, the increased supply of nurses may have prevented and reduced school absences, which can have positive impacts on academic achievement and school graduation rates (Aucejo and Romano, 2016; Cattan et al., 2022; Goodman, 2014). In addition, if increased access to school nurses directly improves health (see discussion below), this may also affect the students' ability and willingness to learn, which in turn has positive effects on their future educational outcomes (Grossman, 2015).

There is substantial evidence that expanded access to contraception has important consequences for women's outcomes, mostly coming from studies that examine the effects of increasing legal access to the birth control pill in the 1960s and 1970s in the US. These studies found that access to birth control delayed marriage and increased educational attainment, employment, and earnings among young women (see e.g., Bailey, 2006; Bailey, Hershbein and Miller, 2012; Goldin and Katz, 2002; Steingrimsdottir, 2016), reduced crime (Pantano, 2007), and improved the outcomes of children (Ananat and Hungerman, 2012).[14] Also in the US, but more recently, access to school-

[12]Buckles and Hungerman (2018) find that exposure to condom distribution programs in schools increases teen fertility only if the distribution is not complemented with counseling. One of the roles of Norwegian school nurses is precisely to give this type of counseling.

[13]Students' absences may be due to a number of possible reasons besides health problems. For example, these can include substance abuse, problems at home, and relational problems. We note that 2000 is the first year that school absence data are available at the individual level. Thus, there are no data at the municipality or individual level, on school absences for the studied cohorts (born 1971–1993), unlike in Bütikofer, Mølland and Salvanes (2018) and Bütikofer and Salvanes (2020), who use municipality-level data on school absences for the cohorts born 1910–1932 and 1930–1945, respectively. We also note that school GPAs are only available from 2002 onward. Therefore, we are unable to directly test for effects on school absences.

[14]Recent work by Myers (2017) suggests that the legalization of abortion, rather than access to the pill, might drive the findings of the former studies. However, Bailey and Lindo (2018) review the literature and suggest that the mixed findings on the magnitude of the effects of the pill in the US might be partially due to the difficulty defining when state policies were enforced and differing interpretations across researchers.

based health centers in deprived areas reduced teenage childbearing (Lovenheim, Reback and Wedenoja, 2016). Finally, staying longer in school has furthermore been shown to affect fertility decisions (see e.g., Black, Devereux and Salvanes, 2008; Marcotte, 2013).

Labor Market Attachment and Welfare Dependency To the extent that increased supply of school nurses increases educational attainment, this may in turn impact a range of other outcomes. Dropping out of high school has been linked to a number of poor later life outcomes, such as criminal behavior (Bennett, 2018; Bjerk, 2012; Hjalmarsson, Holmlund and Lindquist, 2015; Lochner and Moretti, 2004; Sweeten, Bushway and Paternoster, 2009), poor physical and mental health, as well as generally lower well-being (Chevalier and Feinstein, 2006; Liem, Lustig and Dillon, 2010; Oreopoulos, 2007; Oreopoulos and Salvanes, 2011).[15] Weak attachment to the labor market may lead to unemployment and welfare dependency. If the reform reduces high school dropout, it may increase labor market attachment.[16] Additionally, dependence on welfare benefits may also be explained directly by poor health, and if increased supply of school nurses leads to health improvements (see below), it may reduce welfare dependency in the longer run.

Health The increased availability of school nurses can affect physical and mental health in various ways. First, children's and adolescents' health can improve through the school nurses' increased capacity to detect and prevent health problems at an early stage. Early detection is especially important in the treatment and prevention of mental health problems, which often start to develop before the age of 20 years (Marmot and Wilkinson, 2005). Detection of both physical and mental health problems can happen during the universal medical examinations when starting school or when the students consult the school nurse in later years. Thus, the increased supply of school nurses due to the 1999 reform increased their capacity to follow up on children and youth, which may improve their health outcomes both during school age and later in life.

Second, the improved availability of school nurses may also have indirect effects on health through provision of information, guidance, and promotion of healthy behaviors related to for example, diet, sufficient physical activity, and social relations.

Third, the national vaccination program is the responsibility of school nurses for school-age children. These services have always been the priority of the school health services; hence, we do not expect the 1999 reform to affect outcomes related to vaccination, such as infectious diseases.

Finally, our measures of health rely on administrative records of health care use (see section 3), thus the impact of increased supply of school nurses on the use of health services is *a priori* ambiguous. On the one hand, studies discussing what makes a youth-friendly primary health care

[15] See Grossman (2005) for a review of the effects of education on non-market outcomes.

[16] The link between education and income has been thoroughly assessed, see Campolieti, Fang and Gunderson (2010); Card (1999); Oreopoulos (2007).

service often highlight the importance of low barriers to use, including availability, accessibility, acceptability, confidentiality, and privacy (Ford et al., 1997; Shaw, 2009; Tylee et al., 2007). This description fits well with the school health services in Norway, and the reform made these services even more accessible. Therefore, we expect the reform to increase use of health services in the long run by raising awareness about the existing preventive healthcare services, importance of healthy behaviors such as regular health check-ups, and by reducing the stigma related to seeking medical treatment for substance dependency and mental health problems. On the other hand, increasing the supply of school nurses may improve health and reduce the use of health-care services. Below we estimate the effects of the reform on the use of services due to specific health conditions, with different severity, and on different types of contacts with the health services, in an attempt to disentangle changes in health-seeking behavior from changes in health.[17]

In sum, we expect that (1) the reform had a direct effect on fertility through counseling and availability of contraceptives, and indirectly on education due to fertility postponement; (2) that the reform may also have improved the health and well-being of individuals through the provided services, and, in turn, improved students' achievement in both school and the labor market; and that (3) the reform may have raised the students' awareness of healthier behaviors, including the need for necessary health check-ups and of the existence of relevant services, which may have lowered a barrier and increased their use of medical services.

3 Data

The data we use in this paper are compiled from several Norwegian administrative records, including the national educational registers, tax records, family registers, and health registers (see Table A1 for the individual administrative records used and the time period covered). Our main sample uses all individuals attending school around the time of the 1999-reform, more precisely, individuals born between 1970 and 1993.

3.1 Municipality-Level Data

Data from the Norwegian Social Science Data (NSD) provides annual information about the number of school nurse man-years in each municipality for the period 1990-2014. Information

[17]Our paper is not unique in using administrative data from the use of health-care services to study the impacts on health from policy changes. Cesarini et al. (2016); Ginja, Jans and Karimi (2020); Meghir, Palme and Simeonova (2018) rely on Swedish hospitalization records to study the effects of expanding compulsory education, wealth shocks and generosity of parental leave policies, while Borra, González and Sevilla (2019) uses Spanish hospitalization data to study the impact of scheduling birth on infant health. Relative to these studies, we add data on the use of primary health-care services. Survey data recording actual health cannot be used because no health survey covers the relevant cohorts.

on population and other municipality-level characteristics are provided by the NSD and Statistics Norway.

3.2 Demographic and Socioeconomic Information

Individual level information comes from several administrative registers provided by Statistics Norway. These registers cover the entire resident population in Norway between 1967 and 2020, and include demographic information such as date of birth, gender, immigration status and municipality of residency in each year, and socioeconomic data, such as education and earnings. All registers include unique individual identifiers that allow individuals to be matched across administrative registers and to match each individual to their parents and other relatives.

Fertility and Teenage Childbirth Information about maternal age at the time of births is constructed from the demographic registers. One of our main outcomes of interest, teenage childbearing, is defined as the probability of a girl giving birth before turning 20. We also estimate the probability of giving birth by different ages.

Educational Attainment Information on educational attainment comes from administrative registers from the Norwegian school authorities. These data sets include information about the completed level of education in each year since 1970. We construct indicators for on-time high school graduation (the year they turn 19) and on-time higher education completion (the year they turn 23).

Labor Market Attachment and Welfare Dependency We obtain information on labor market earnings from tax registers, which are available up to 2019. Information on welfare dependency comes from the social insurance database, which is used to construct an indicator for whether an individual received any welfare benefits each year. Welfare benefits include social assistance, unemployment benefits, work assessment allowance, and disability insurance. We measure labor income at age 25, which corresponds to the first completed year of work for individuals who complete college on-time, and cumulative use of welfare benefits by age 30.[18]

[18] We focus on the cumulative use of welfare benefits by age 30 to give individuals enough time to gain eligibility to some of the benefits available, such as unemployment benefits and work assessment allowance, that depend on a sufficiently long work history (see `https://www.nav.no/en/home/rules-and-regulations/membership-of-the-national-insurance-scheme`). Social assistance is a temporary income given as a last resort when an individual is considered unable to financially support himself/herself. Unemployment benefits are given to active job seekers. Individuals considered active job seekers must have earned at least 1.5G the previous year, or 3G over the previous three years. The work assessment allowance provides a partial income replacement in periods during which individuals are ill or injured and need assistance from the Norwegian Labor and Welfare Administration to return to work. The allowance is given for a maximum of 3 years. Finally, disability insurance is given when an

3.3 Health Data

We rely on administrative health records in this paper. On the one the hand, these data allow us to study objective measures for the whole population, in contrast to work relying on survey data, which strengthens the external validity of our results. On the other hand, these are measures of health service use, not health *per se*. Thus, while effects on the use of health services are important and of interest to policy-makers at various levels, the interpretation of our results on health are not straightforward (we discuss this issue in section 6).

Primary Care In Norway, GPs and local ERs constitute the foundation of primary care services. Most Norwegian citizens belong on the list of one specific GP, who is responsible for providing primary health-care services to the patients on his/her list. GPs diagnose their patients' health problems, certify sick leave, prescribe treatments, and refer their patients to specialist care when needed. They also follow up their patients after they have received care by specialists. In general, the GPs serve as gatekeepers to the specialist care system and to the health-related welfare benefits.

Information on visits to GPs and primary care ERs comes from the Control and Payment of Health Refunds database (acronym "*KUHR*" in Norwegian) and are available between 2006 and 2021. In order to be reimbursed for their services, GPs and ERs must report all services provided and actions taken during each consultation, including the main symptom or diagnosis, referrals and certification of sick leaves, to the national claims database. Specifically, the KUHR includes the list of symptoms and diagnoses assessed following the International Classification of Primary Care (ICPC-2).[19] Using these data, we study the reform's impacts on an individual's visits to GPs and ERs, visits due to specific medical conditions, and effects on annual reimbursements.

Specialist Care Specialist care, both somatic and psychiatric, is provided mainly through public hospitals and outpatient care clinics, but it can also be provided by contracted private specialists. Information on the use of all services, except contracted somatic specialists which report through the KUHR, is obtained from the Norwegian Patient Registry and is available between 2008 and 2020. This dataset allows us to study the impacts on hospitalizations (inpatient admissions) and consultations at outpatient clinics (outpatient admissions).[20] We also identify acute admissions and the medical conditions diagnosed at the admission, following the 10th revision of the International Statistical Classification of Diseases and Related Health Problems (ICD-10).

individual's earnings capacity is permanently reduced due to illness or injury. All monetary values are deflated to 2015 using the consumer price index (`https://www.ssb.no/en/statbank/list/kpi`).

[19] See `https://ehelse.no/kodeverk/icpc-2e--english-version`.

[20] An inpatient admission includes both overnight stays and day treatments, such as less invasive surgical procedures.

Construction of Variables As reported in Tables A1 and A2 in the Appendix, the data on primary care are available between 2006 and 2021, while the specialist care data covers the years between 2008 and 2020. Thus, to have a comparable sample across the different health outcomes and for cohorts exposed and not exposed to the reform, all health outcomes are measured as annual averages for individuals in their 30s. For each type of health service and each available year an individual is between 30 and 39 years old, we construct an indicator of whether the individual has used the service at all (i.e., extensive margin), and then take the average. For primary health care visits, we also construct two additional variables: the average number of visits/consultations per year (i.e., intensive margin), and the average annual reimbursement. Our measures thus reflect (1) the average likelihood of at least one visit per year for different types of care, (2) the average number of annual visits, and (3) the average annual reimbursements at the GP.

Maternal Health, Pregnancy Losses and Health of Newborns Data on births, pregnancy losses, infant health, and health behaviors of new mothers during pregnancy are obtained from the Medical Birth Registry of Norway, that covers all births with a minimum gestation period of 16 weeks since 1967. The records include information on date of birth, age of the mother and father, measures of infant health at birth and method of delivery. Specifically, we examine the baby's weight (in grams), length (in cm) and head circumference (in cm), an indicator of low birthweight (<2500g), APGAR[21] scores and gestational age (in weeks).

4 Empirical Strategy

To identify the impact of access to school nurses we rely on the 1999 Escalation Plan for Mental Health, which generated geographical and temporal variation in changes in the availability of school nurses across the country. This allows us to combine the differential increase in the school nurse ratio across municipalities with differential exposure to treatment across cohorts.[22]

Variation Across Municipalities Figure A1 shows a large variation in the pre-reform coverage of school nurses across Norwegian municipalities. In Table 1 we correlate pre-reform municipality

[21]The APGAR score is an index of a child's health at birth and take into account Activity (muscle tone), Pulse (heart rate), Grimace (reflex irritability), Appearance (skin coloration), and Respiration (breathing rate and effort). Each component is worth up to two points for a maximum of ten. This score is a quick way for doctors to evaluate the health of all newborns at 1 and 5 minutes after birth. Values of 7 or higher are considered normal range. Nevertheless, infants with APGAR scores of 7, 8, and 9 at 1, 5, and 10 minutes after birth have an associated higher risk of infections, breathing problems, brain injury as a result of oxygen deprivation, low blood sugar levels, and death compared with an APGAR score of 10 (Razaz, Cnattingius and Joseph, 2019).

[22]This strategy is similar to that used, for example, by Duflo (2001) to estimate the effect of school construction on education, by Løken, Lundberg and Riise (2017) to estimate the effects of formal elder care expansion, and by Goodman-Bacon (2018) to estimate the effects of introducing Medicaid on infant and child mortality.

characteristics with the growth in the school nurse coverage in the post-reform period, controlling for county fixed effects. The growth in coverage is measured as the change in the number of school nurses per 1,000 school-age children (ie, 6-19 years old) between 1999 and 2008, the first and last years of the Escalation Plan. Within each county, the pre-reform coverage is the strongest predictor of supply changes and one less school nurse per 1,000 6-19 years old in the pre-reform period (between 1995 and 1997; hereafter, the *pre-reform coverage*) is associated with an increase of 0.71 school nurses from the pre- to the post-reform period. Figure 1 confirms this negative correlation between the pre-reform coverage and the change from the pre- to the post-reform period. The pattern in Table 1 and Figure 1 is consistent with the goal of the Escalation Plan of reducing inequality in the supply of services across the country. The change in pre- to post-coverage represents an increase of 35% relative to the pre-reform mean of school nurses (two nurses per 1,000 6-19-year-olds). In practice this is comparable with increasing the supply with one extra nurse working 50% in high schools in the two largest Norwegian cities (Oslo and Bergen, with on average 540 students per high school). Table 1 also shows that within counties, municipalities with higher unrestricted income,[23] rural and less-populated had the largest expansions in coverage.[24]

Given that the 1999 Escalation Plan promoted an increase in the supply of school nurses, a natural question is to ask where these nurses came from. The increase in availability of school nurses was possible through the combination of reassigning nurses from areas with excess supply (Figure 1) and an increase in the supply of newly graduated specialized nurses (see Figure A2). Panel (a) in Figure A2 shows that about 400 new school nurses graduated in a regular year before the reform, but 756 and 574 school nurses graduated in 1997 and 1998, respectively. However, during the same period there was a stable growth in the supply of newly educated regular nurses (Panel (b) in Figure A2).

Variation Across Cohorts We also use cohort variation in exposure to the reform. Individuals aged 19 and older in 1998 were too old to be exposed directly to the reform (they had finished school by 1998).[25] For individuals 18 years old or younger in 1998, exposure to the reform is a decreasing

[23] Unrestricted municipality income are funds not earmarked to pre-specified expenses.

[24] In Table A3 in the Appendix we correlate municipality characteristics in 1997 and the pre-reform coverage. Municipalities with higher pre-reform coverage are less populated, more likely to be rural, have a smaller fraction of population in school-age (ie, 6 to 19 years old), higher unrestricted municipality income, and larger supply of health services (measured by the total employment in the health care sector per 1,000 inhabitants, GPs per 1,000 inhabitants and school doctors per 1,000 children in school age). There is a negative correlation between municipality per capita spending on education and the pre-reform school nurse coverage. Early life health as measured by the average birth weight and infant mortality rate is unrelated to the levels of pre-reform coverage. In our empirical analysis, we account for potential threats to internal validity driven by unobserved permanent differences in municipalities by including municipality fixed effects.

[25] In Norway, the on-time high school graduation age is 19; among those who start high school, about 70% graduate at age 19. Thus, we cannot entirely rule out that some individuals in the cohorts aged 19 and older in 1998 were in school during the reform period. If some of the individuals in the control group are partially exposed to the reform,

function of age, with younger cohorts being exposed to more school years in the post-reform period. Individuals aged 5 and younger in 1998 were fully exposed, that is, they spent their entire school period in the treatment period. This variation in exposure to the reform across cohorts is illustrated in Figure A3.[26]

As we note in section 2, the 1999 Escalation Plan for Mental Health was broader than dedicating funds to increase the availability of school nurses, and an increase in coverage could therefore be correlated with other simultaneous changes in the supply of health services provided by municipalities. As a consequence, we use as a measure of treatment the *pre-reform coverage* which is the best predictor of the growth in the school nurse coverage between 1999 and 2008, rather than the actual growth in coverage. In subsection 4.2, we investigate this and provide support for the absence of threats to the validity of our empirical approach (outlined below). We also show that the key identifying assumption of the absence of pre-reform differential trends in the outcomes in municipalities with different levels of pre-reform coverage is likely to hold.

4.1 Main Specification

We estimate the effects of access to school nurses in a difference-in-differences framework that compares the outcomes for cohorts in school before and after the implementation of the 1999 reform (first difference) between municipalities with higher and lower pre-reform coverage (second difference). Our main specification is the model below:

$$Y_{imt} = \alpha + \left(I_m \times Post_i\right)\gamma + \mathbf{X}_i'\delta + \mu_m + \theta_t + \epsilon_{imt} \tag{1}$$

where Y_{imt} is the outcome of interest for individual i residing in municipality m at age 5 and born in year t. I_m measures the intensity of treatment in municipality m. We define I_m as the negative of the *pre-reform* number of school nurses per 1,000 children aged 6-19. $Post_i$ indicates whether the individual is exposed to the reform for at least one year. $\mathbf{X}_i$ is a vector of individual controls, including the child's gender, mother's age at birth, and education when the child is 5 years old, indicator variables for whether the mother and child are born in Norway, the number of siblings when the child was 5 years old, the child's birth order and whether information about the father is available. μ_m are fixed effects for the municipality of residence at age 5 to account for systematic differences in time-invariant area characteristics that are correlated with the baseline coverage and Y_{imt}. θ_t are cohort fixed effects that account for common cohort characteristics. Finally, ϵ_{imt} are

then our estimates are downward biased.

[26] Individuals born in 1991 or after were exposed to a national reform that reduced the school starting age from 7 to 6 years in 1997. These children spend 13 years in school and not 12 as for cohorts starting school before 1997. The 1997 reform does not affect our findings because we rely on the differential exposure to treatment across both municipalities and cohorts, and any effects of the 1997 reform will be absorbed by the cohort fixed effects.

idiosyncratic shocks. As the outcomes might be correlated within municipalities across cohorts, the standard errors are clustered at the level of the municipality of residence at age 5 (Bertrand, Duflo and Mullainathan, 2004).

The parameter γ captures the average effect of the reform on individuals from exposed cohorts living in treated municipalities at age 5, where the supply increased by 0.71 school nurses in the post-reform period (or a 35% increase), regardless of actual visits to school nurses. Thus, γ is interpreted as an intention-to-treat (ITT). In section 5, we discuss possible ways to translate the ITT estimates into average treatment effects on the treated.

Alternatively, we use a specification where we split the sample at the median and classify municipalities into high or low baseline coverage rates:

$$Y_{imt} = \alpha + \left(L_m \times Post_i\right)\kappa + \mathbf{X}_i'\delta + \mu_m + \theta_t + \epsilon_{imt}. \tag{2}$$

The variable L_m takes value one if individual i at age 5 lived in a municipality with a low coverage rate (hence with a large expansion from the pre- to post-reform period), and zero otherwise. Here, κ measures the differences in outcome Y_{imt} across individuals residing in municipalities with low versus high coverage.

Importantly, cohorts not exposed to the reform provide a pre-trend test and allow us to estimate an event-study model capturing the time path of the effects of exposure to the reform. To do so, we estimate the following model that allows for different impacts of exposure depending on the students' age in 1998 (the year just before the reform):

$$Y_{imt} = \alpha + \sum_{a=20}^{28} \beta_B^a I_m[Age98_i = a] + \sum_{a=6}^{18} \beta_A^a I_m[Age98_i = a] + \mathbf{X}_i'\delta_1 + \mu_m + \theta_t + \epsilon_{imt}. \tag{3}$$

In the model above, age 19 in 1998 is the excluded category, which corresponds to the cohort just too old to be exposed to the 1999 reform. Individuals between 20 and 28 years old in 1998 were too old to be exposed to the reform, hence, we expect the coefficients β_B^as to be indistinguishable from zero.

In the main specification, we exclude municipalities with fewer than 1,500 inhabitants in 1997, restricting our main analyses to 374 of the 428 municipalities. This is because municipalities with few inhabitants are located in remote areas and services are often provided through inter-municipal cooperation.[27]

Finally, we study the impacts on a large number of outcomes simultaneously, therefore we

[27]The regulations related to municipal promotion of healthy behavior and preventive work in child well centers and school health services allow for these types of inter-municipal cooperation activities, see`https://lovdata.no/dokument/SFO/forskrift/2003-04-03-450`.

correct inference for multiple hypothesis testing. For each outcome in the main tables we include the p-value obtained using the stepwise procedure described in algorithms 4.1 and 4.2 of Romano and Wolf (2005). In the tables, variables measuring conceptually similar outcomes are grouped together and inference is adjusted using all the outcomes presented in each table.

4.2 Potential Threats to Identification

Pre-Reform Trends in Municipality Characteristics The validity of our empirical strategy relies on the assumption that municipalities with different levels of pre-reform coverage have similar underlying trends in health, education and labor market outcomes as well as in other relevant municipality-level characteristics. To investigate this, we divide municipalities into two groups according to whether they fall above or below the median pre-reform coverage. For each group of municipalities, we plot the yearly level averages for different characteristics measured around the time of the reform. In each graph in Figures A4 and A5, the vertical line in the figure marks the *year* the reform was implemented. In the bottom left corner of each figure, we include the estimates for the coefficient δ_2 in the following model estimated in the pre-reform years (1990 to 1997):

$$y_m = \delta_1 + \delta_2 I_m \times t + \delta_3 t + \mu_m + \theta_t + \varepsilon_m \tag{4}$$

where I_m is the (negative of the) pre-reform coverage between 1995 and 1997 and t is a linear annual trend, and μ_m and θ_t represent municipality and year effects, respectively.

We investigate the pre-reform trends for municipality characteristics related to school resources (Figure A4), and municipality indicators of health and provision of health services (Figure A5). The figures show the trends for 10 different municipality characteristics and reveal parallel trends for municipalities with high and low coverage in the pre-reform period. The estimates on the bottom left corner of each graph show that there is no correlation between the pre-reform coverage and pre-reform trends in these characteristics. In sum, this evidence suggests no pre-existing trends in education, health services or health for municipalities with different levels of pre-reform coverage.

Other Changes Predicted by Pre-Reform Coverage The package of laws approved in 1998 (and enacted from 1999 onward) targeted mental health in general, but it was composed of several elements.[28] We only use the aspect of the reform that specifically targeted the school health services and increased the number of school nurses. While there were no other school reforms taking place during the studied period that could have affected the cohorts and municipalities exposed to the

[28]This is not unusual when legislation is approved (e.g., the Head Start in the USA was enacted under the 1964 Economic Opportunity Act studied in Bailey, Sun and Timpe (2021), but this Act included also the Job Corps and several other programs).

reform, it is still possible that the broad nature of the Escalation Plan might have implied that the pre-reform coverage of school nurses also predicted changes over time in other municipality characteristics, which could in turn be related to changes in the studied outcomes. If this was the case, our estimates would be partially driven by other aspects of the reform and not by the increase in the coverage of school nurses. We assess this potential threat in Figures A6 and A7 in the Appendix. In these figures, we plot the relationship between the change from the pre- to the post-reform period for each variable and the baseline number of school nurses per 1,000 children aged 6-19. Figure A6 shows a larger increase in the number of school doctors and psychologists in municipalities with lower pre-reform coverage. These doctors and psychologists are also part of the school health services, but the coefficients in the bottom of the graphs show that this increase was much smaller than the increase in school nurses. In addition, the provision of school doctors and psychologists in 1997 - just before the reform - was very small (on average, there were 0.299 school doctors and 0.004 psychologists per 1,000 6–19-years-olds). We also observe a larger increase in the number of students in compulsory education in municipalities with high pre-reform coverage, but not in the number of high school students (Figure A6). We note that this increase in the number of students in compulsory education likely indicates higher demand for services in control areas, which could create an upward bias in our estimates. This suggests that we should be more cautious in interpreting the effects driven by changes in supply during compulsory education, but not during high school years. Finally, Figure A7 shows no relationship between pre-reform coverage and changes in the provision of early life health services, health indicators or elderly mortality. The number of GPs per 1,000 inhabitants increased more in control areas, which if anything may have improved health in control areas and bias downwards our estimates.

All in all, these results provide reassurance that the effect we estimate is not confounded by other correlated shocks or changes in policies.

5 Results

5.1 Main Results

We now turn to the main results estimated using model (1). Our baseline specification includes individual controls, in addition to municipality and cohort fixed effects. All estimates are interpreted as the effect of living in a municipality that had one fewer nurse per 1,000 school-aged children before the reform, which implied an increase of 0.71 school nurses, or a 35% increase in nurse availability from the pre- to the post-reform period.

5.1.1 Teenage Childbirth, Educational Attainment, Labor Market and Welfare Dependency

Column (1) of Table 2 reports the effect on childbirth before age 20 for girls. The estimates show that one fewer school nurse per 1,000 school-age children at baseline reduces the likelihood of teen childbirth by 0.6 percentage points, which represents an effect of 12.9% relative to the pre-reform mean of 5%. In the Appendix, we estimate the impacts of the reform on the probability of the first child being born by ages 18 to 38. Figure A8 shows that being exposed to the reform in the treatment municipalities significantly reduces the probability of having the first child before turning 28 years old.[29] There is also a drop in fertility measured by the total number of children, for women up to the age of 35 (Appendix Table A4).

Column (2) of Table 2 shows that for the exposed cohorts in the treated municipalities there were no effects on on-time high school graduation (by age 19), while column (3) shows an increase of 6% in the probability of on-time college graduation (completing a higher education degree by age 23).

Columns (4) and (5) of Table 2 present the impact of the reform on labor earnings and take-up of welfare services. Column (4) shows an increase in earnings at labor-market entry (ie, at age 25) of 4.7% and column (5) shows a reduction in the probability of ever having received welfare benefits of 1.7 percentage points by age 30 (3% of the control mean).

The p-values obtained using the procedure in Romano and Wolf (2005) to correct for multiple hypothesis testing in Table 2 show that the impacts on teen childbirth and on college degree are still significant at 10% level.

5.1.2 Health Outcomes

We now assess the impacts on the use of primary and specialist health care services when individuals are in their 30s. In columns (1) to (4) of Table 3, we focus on the use of primary health-care services. For exposed cohorts in a municipality with one less school nurse per 1,000 school-age children in the baseline period, the likelihood of at least one GP consultation increased by 1.3 percentage points (a 1.8% increase from a mean of 0.69; column (1)), and the mean annual number of visits increased by 0.22 (a 5% increase relative to a mean of 4.37 annual visits; column (2)). The increased use of primary care is driven by planned visits, and we find no impact on the use of primary care ERs (column (3)). Despite the increase in the likelihood of annual visits and number of visits, there are no changes in the average annual reimbursement costs the GPs receive per patient (column (4)). This suggests that the individuals are not undertaking more

[29] We note that some of the cohorts in our sample have not aged enough to allow the study of the impacts on completed fertility. By 2020 (the last year in our population data), all women in the sample had turned at least 27 years old, as the youngest woman in the sample was born in 1993. The sample size to estimate Figure A8 ranges between 611,789 (between first births at 27 years old or younger) and 315,950 (by age 38).

expensive medical check-ups and/or procedures during the visits, if anything rather the opposite. The estimates in columns (1) and (2) survive adjustment for multiple hypothesis testing.

A similar pattern occurs when we turn to the use of specialist care in columns (5) to (7) of Table 3. Due to the infrequent use of these services in the age group we study, we only focus on the extensive margin: that is, the likelihood of at least one consultation at the hospital or with a contracted specialist per year. Columns (5) and (6) show an increase in both in- and outpatient visits (both are in their nature planned visits) in response to the reform, and these estimates survive adjustment for multiple hypothesis testing. As for the impacts on primary care, there are no impacts on acute admissions to specialist care (column 7).

Summing up, the reform increased the planned use of both primary and specialist care services, but this did not translate into any increases in costs. Whether the increase in the use of services refers to changes in health status and/or individuals' health-related behavior is still an open question. In section 6, we examine some of the possible mechanisms behind these findings. In section 6, we examine some of the possible mechanisms behind these findings.

5.1.3 Event Study Estimates

In Figure 3, we present estimates for model (3), where we use the cohorts not exposed to the reform to provide a pre-trend test. We estimate an event-study model that allows us to estimate the time path of the effects of exposure to the reform. The four panels in the figure show that the β_Bs in model (3) are indistinguishable from zero. The figure also shows the time path of the effects: the impact on teen childbirth in Panel (a) is negative for all exposed cohorts, and is not dependent on the age at exposure. The impacts on use of primary health care (Panel b) and income (Panel c) increase with time exposed to the reform, while the impacts on welfare use are larger for those exposed to the reform between ages 10 and 17.[30]

The immediate impacts on teen childbirth suggest that the availability of school nurses and their services around the time students become sexually active (age 16–18) is especially important in preventing teen childbirth, while the impacts on health care use, labor income and use of welfare typically appear after longer exposure to the reform, and become stronger the longer the students are exposed. As we describe in section 2, the services provided by school nurses vary across ages, and some of the services provided at an early stage, including early detection and prevention of health issues, as well as the continuous job of creating a good "working environment" for the students, could be especially important for long-term labor market outcomes.

Furthermore, Panel (a) of Figure 3 shows that there were similar effects on teen childbirth for

[30] Length of treatment is perfectly collinear with age at the start of the treatment, as in many other settings; therefore, we cannot separate between the effect of age and length of exposure in this context where the reform was introduced in 1999.

women who were first exposed to the reform at ages 13–15 and 16–18. This finding suggests that the 2002 reform, which allowed nurses to prescribe the pill, did not result in a larger effect than the 1999 reform, which increased the supply of nurses.

5.2 Sensitivity Analyses

We now subject our findings to a battery of robustness checks. First, estimates based on cohorts far away from the reform are more likely to be influenced by cohort trends, thus to probe that our main estimates are not driven cohort trends we restrict our sample to children aged 14 to 22 in 1998 (born between 1976 and 1984, instead of 1970–1993 as in the main analysis). We present the results of this exercise in Table A5. The estimates are similar to those in Tables 2 and 3.

Second, the treatment variable is continuous in our main analysis. In Table A6 in the Appendix we show that the estimates are also unchanged using a discrete treatment indicator as in model (2), which divides municipalities into high (control) vs. low (treatment) baseline coverage of school nurses.

Third, in Table A7 in the Appendix we assess the sensitivity of our estimates to different specifications. Column (1) shows our baseline specification for comparison. In Column (2), we re-estimate model (1) clustering the standard errors by cohort and municipality of residence at age 5. In Column (3), we drop those residing in the five largest Norwegian cities (i.e., Oslo, Bergen, Trondheim, Stavanger and Kristiansand) at age 5. In Column (4), we also include the smallest municipalities that we dropped in our main analysis. In Column (5), we control for omitted trends in outcomes that might be correlated with the expansion of school nurse coverage. We do this by including municipality-level pre-reform linear trends based on outcomes for cohorts unexposed to the reform.[31] In Column (6), we expand equation (1) by including linear trends in municipalities' baseline characteristics. More specifically, we include trends for the following characteristics measured in 1997: (log of) population and individuals aged 6–19 years old, unrestricted municipality budget, school expenditure per pupil, and number of doctors per 1,000 inhabitants. In Column (7), we include nonparametric trends in the same baseline characteristics as in Column (6). The estimates are in general unchanged from the main results across the various columns of Table A7, which provides reassuring evidence that our findings are driven by the exposure to increased availability of school nurses and not by contemporaneous local shocks or secular trends.

[31] We estimate municipality-specific time trends for each outcome using data for the unexposed cohorts, and obtain the slope estimate λ_{ms} for each municipality. We then extrapolate the pre-expansion time trends to the post-reform period and estimate the following version of model (1) (see also Bhuller et al. (2013)):

$$Y_{imy} = \alpha + (I_m \times R_i)\gamma + \mathbf{X}_i'\delta + \mu_m + \theta_y + \delta\widehat{\lambda_m}t + \epsilon_{imy}.$$

Fourth, in our main analyses we assign the municipality based on residence before starting school, at age 5. For some cohorts, this is many years before the reform year, which can create measurement errors and bias our estimates. In Table A8, we show that the estimates remain unchanged when we use the municipality of residence in 1998 (the year before the reform) instead of at age 5 to assign the coverage of school nurses. The estimates in Table A8 are similar to our main results, which suggests that selective migration due to the program is unlikely to be a problem in our analysis.

Finally, to present even further conclusive evidence that causality drives our estimates and not random noise, we conduct a randomization inference test for the significant estimates in the spirit of a placebo test. To do so, we randomly assign the baseline coverage for each municipality using 1,000 permutations (Duflo, Glennerster and Kremer, 2006). In accordance with MacKinnon and Webb (2019), we present randomization inference results based on t-statistics, as this is superior to inference based on coefficients. Figure A9 in the Appendix plots the distributions of the placebo treatment effect: the actual t-statistics for γ in equation (1) are represented by the solid vertical lines, while the dashed lines represent the 5th and 95th percentiles of the distribution of the placebo treatment effects. The distributions of the placebo treatment effects look smooth and the solid lines are always outside of the confidence interval, allowing us to reject the null hypothesis that any combination of coverage would generate the same magnitude of treatment effects that are displayed in tables 2 and 3.

5.3 From Intention-To-Treat Effects to Average Treatment Effects on the Treated

The ITT estimates represent the average effect of school nurses over all individuals aged 6-19 that are exposed to the reform, regardless of whether they actually use the services or not. Given the lack of data on take-up of the services, we cannot directly estimate the average treatment effect on the "treated" (ATET), i.e., the effect on those who, as a consequence of increased of supply of school nurses, received services they would not have obtained otherwise. Instead we use two ways to approximate the ATETs.

First, we rely on the survey conducted in 2013 that covered youth living in most Norwegian municipalities. According to this survey, about 23% and 25% of the students in middle and high school, respectively, had visited a school nurse at least once during 2012 (the year prior to the survey; see section 2). Among high school girls, the same survey reports a usage rate of 35%. Using these figures as an approximation for the uptake rate of the services, our estimates suggest an ATET of 1.7% for teenage childbirth.[32]

[32] $\frac{0.006}{0.35}$.

Second, we use the same survey but accounting by our estimate from Table 1; namely, that one fewer nurse per 1,000 children/youth before the reform is associated with an increase of 0.71 school nurses. Combining this with the usage rates from the 2013 youth survey yields an ATET for teenage childbirth of 2.4%.[33] In practice, we can think of these two sets of estimates as lower (1.7%) and upper (2.4%) bounds for the ATET.

6 Heterogeneity and Mechanisms

6.1 Heterogeneity of Impacts by Gender

The setting in this paper provides an example of a universal program where school health services are free of charge and available to all students in the school. Groups may differ in the way they are affected by such services, and by the changes in supply resulting from the reform. While an analysis by groups is useful to learn about the mechanisms behind our results, we must exercise caution. Given that data on the actual use of school health services around the reform time is not available, we are not directly able to separate program effects from uptake effects, which means that we do not know whether the estimated heterogeneous impacts are due to differences in use across groups or whether they reflect heterogeneous impacts from the increased supply.

To get a picture of the take-up in different groups we can use the survey from 2013 used in subsection 2.1 and examine the correlation between school nurse coverage and the use of the school health services. In Table A9 we correlate the number of nurses per 1000 school aged children in a municipality (based on the average coverage for the years 2012-2014) with the likelihood of using school health services in year prior to the survey. The table shows that one extra nurse per 1000 school aged children in a municipality is associated with a 7.9% higher likelihood (an increase of 1.8 percentage points from a mean of 22.7 percent) of having used the school health services during the last 12 months (column 1). The association is stronger for girls and weaker and statistically insignificant for boys (column 3). There is no statistically significant association between nurse coverage and the probability of using school health services more than 2 times (column 2), but for girls there is a positive association also here (column 4). These estimates suggest that girls have been more exposed to the increased supply of nurses due to the reform, and that the effects we find in the following heterogeneity analysis reflect a combination of take-up and impacts of the reform.

As the impact on teen childbirth is detected among females, we study differential effects by gender estimating model (1) separately for boys and girls. Table 4 presents the impacts of the reform by gender on teenage childbirth, education, labor market and welfare dependency. In Panel A we also include the impact on fertility for boys. The comparison of estimates in Panels A and B

33 $\frac{\frac{0.006}{0.35}}{0.71}$.

show that impacts identified in Table 2 are driven by females. Also, the impacts on teen fertility, college degree, earnings and welfare use are statistically significant only for females after adjusting inference for multiple hypothesis testing. These estimates suggest that improvements in educational achievement, earnings and welfare dependency for girls might be related to the reduction in teen childbirth (see also e.g., Ananat and Hungerman, 2012; Bailey, 2006; Goldin and Katz, 2002; Guldi, 2008; Pantano, 2007).

Table 5 presents the heterogeneity of the impacts on the use of health services. Unlike the pattern emerging in Table 4, where impacts are driven by females, the impacts on the use of health care services are similar and statistically significant for both females and males, even after adjusting inference for multiple hypothesis testing. This suggests that the mechanisms behind the impacts on use of health care services are different from those affecting the impact on educational attainment and labor market outcomes.

6.2 Mechanisms

From the analyses presented so far, we conclude that the increased availability of school nurses led to a reduction in the prevalence of teen childbirth, increased educational attainment, increased earnings and reduced welfare use for females. Furthermore, we find an increase in planned visits to primary and specialist health-care services between ages 30 and 39 for both females and males, but no changes in the use of acute services.

In subsection 2.3, we discussed how we would expect the increased supply of school nurses to induce changes in outcomes. Here, we combine this discussion with our main findings, and put forward three possible mechanisms behind the effects found. First, the impacts on fertility can be driven directly by better education in sexuality, contraceptive advice and access to contraception, and indirectly via improved education. Second, the observed improvement in adult outcomes can be driven by a change in health due to increased access to preventive services. The impacts on the health of individuals exposed to the reform can be immediate and/or take time to materialize. These improvements can in turn affect educational and labor market outcomes. Finally, exposure to the reform can decrease the barriers to use health services and raise awareness of both the availability of health services and when it is appropriate to go for medical check-ups. The role of nurses in both information and group activities on the one hand, and experiences from personal consultations with the school nurse on the other hand, can be important components in the development of health-related behaviors. Thus, the contacts with the health care system, through the school nurse, can make youth more accustomed to use health services. We also note that the observed impacts can be driven by a combination of these mechanisms.

6.2.1 Planned fertility

In Figure A8, we show that the reform significantly reduced the probability of having the first child before turning 28, and in Figure 3 we show that there were immediate effects of the expansion, that is, that even those only exposed at ages 16–18 were affected. This reduction can be driven by a change in contraception use, but it could also come from more terminations of unwanted pregnancies.

First, to understand to which extent the impact of the reform is related to changes in the exposure to contraceptive advice and preventive check-ups related to pregnancies, we draw from a combination of survey and administrative data. First, in Table A10 we use data from the 2013 survey, and correlate the number of nurses per 1,000 school aged children in a municipality (based on the average coverage for the years 2012-2014) with the likelihood of using school health services for problems related to sex/sexuality. The table shows that one extra nurse per 1,000 school aged children in a municipality is associated with a 10.9% higher likelihood (an increase of 0.8 percentage points from a mean of 7.33 percent) of having used the school health services for purposes related to sex/sexuality during the last 12 months (column 1). The association is stronger for girls and weaker and statistically insignificant for boys (column 3). In columns 2 and 4 we look at the probability of using school health services related to sex/sexuality conditional on reported use of school health services during the year prior to the survey. When we allow for variation by gender, there is a strong and positive association for girls (column 4). These estimates suggest that girls exposed to higher supply of school nurses might be better prepared in terms of contraceptive use and planning of pregnancies.

This interpretation is further supported by the detailed administrative data on GP visits at ages 30 to 39. Table A12 shows an increase in the use of GPs related to pregnancy and fertility issues. The increase in columns (1) and (2) is not driven by visits related to contraceptives (columns 3 and 4), but rather by visits related to pregnancies (both normal and high-risk pregnancies) and to other fertility and family planning-related issues, such as questions about pregnancy, infertility, postpartum bleeding, postpartum symptom/complaint, breast/lactation symptom/complaint, and concerns related to body image in pregnancy (columns 7 and 8). The increase in planned pre- and postnatal maternal services for women aged 30–39 might of course be explained by the delayed fertility: the reform is associated with more expecting mothers in this age group, which increases the risk of pregnancies and childbirth complications and, hence, may have increase the need for check-ups and advice. However, behavioral changes can also be a direct effect of school nurses' influence, and/or positive experiences with seeking advice and help from health personnel during school years.

To investigate whether the reform had any impact on miscarriages and abortions, we use information from the birth register, which includes information on pregnancy losses from 1999 onwards. Columns (1) to (4) of Table A11 do not show any relation between the reform and miscarriages or other fetal losses. Thus, our result suggest that the effect on fertility is driven by increased preventive behavior and planning of pregnancies, rather than terminations of unwanted pregnancies.

Finally, the increase in use of planned medical services related to prenatal care seems to have improved the health of newborn babies: we observe an increase in the probability that newborns have a 1- and 5-minutes APGAR score of 10 (Columns 7 and 8 of Table A13), but no effects on birth weight or length or gestational age. These results should be interpreted with caution given the changes in the compositions of births due to the reduction in fertility shown in Table A4.

6.2.2 Changes in health

Contemporaneous Effects of the Reform on Child and Adolescent Health To understand the extent to which the increase in the use of primary and specialist health care services is driven by changes in the individuals' underlying health status, we start by studying whether it is possible to detect an immediate effect of the reform on the children's health. The availability of health data limits this analysis, since the data on use of primary and specialist health care services are only available from 2006 onward (thus, after the reform). In addition, there are no data on school absence available for the studied cohorts, at neither municipality nor individual levels (unlike for earlier cohorts; see Bütikofer and Salvanes (2020); Bütikofer, Mølland and Salvanes (2018)). However, we provide suggestive evidence for changes in the health of children and adolescents during school, presenting the impacts on maternal income in Table A14. These estimates show an increase in income for mothers of children in exposed cohorts in the years their children were at school, suggesting a increased capacity to work due to improvements in the health of their children.

Effects on Adult Health We then turn to understand the effects on the health of exposed cohorts as young adults between 30 and 39 years old. Table A15 in the Appendix shows that the reform did not affect overall mortality by age 35 (column 1), nor the severity of conditions related to individuals' use of specialist care at ages 30-39. The severity is measured by the Charlson Comorbidity Index.[34] Furthermore, we have shown in Table 3, that despite the increase in the likelihood of annual visits and number of visits to primary healthcare services, there was no change in the average annual reimbursement cost associated with the visits. Thus, all these results combined suggest no effects on the severity of conditions that lead individuals to use health services, at any levels, in their 30s.

[34]The Charlson Comorbidity Index is a method of categorizing comorbidities of patients based on the International Classification of Diseases (ICD) diagnosis codes found in administrative data, such as hospital data. Each comorbidity category has an associated weight (from 1 to 6), based on the adjusted risk of mortality or resource use, and the sum of all the weights results in a single comorbidity score for a patient. A score of zero indicates that no comorbidities were found. The higher the score, the more likely the predicted outcome will result in mortality or higher resource use.

6.2.3 Changes in health-related behaviors

We then turn to assess whether the effects on the use of health services are driven by improved health-related behaviors, such as timely health check-ups, and better knowledge of the availability of different services. Ultimately, these types of channels are difficult to probe without access to survey data, but the pattern of increases in the number of planned visits to both primary and specialist care shown in Table 3 suggests changes in health related-behavior due to the reform. This is supported by the estimates in tables A16 and A17.

Table A16 includes estimates for γ in model (1) for the main categories of health conditions and treatments that are associated with GP visits following the ICPC-2 list. After adjusting inference for multiple hypothesis testing, the impact on GP visits is driven by conditions associated with (i) general/unspecified conditions (column 1), which include conditions such as chills, fever, felling ill, weakness or general tiredness, no disease and simple maintenance visits; (ii) respiratory conditions (column 10) such as breathing problems, cough, influenza or pneumonia; and (iii) conditions related to pregnancy, childbearing, and family planning (column 14, also discussed above).

Furthermore, the estimates in Table A17 show that the increase in visits to specialist care is driven by obstetric-related admissions (column 12) and by conditions that relate to medical examinations and screenings (ICD-10 codes R or Z) (column 15), which suggests that the increase in the use of specialist services is driven by preventive follow-ups and services.

In sum, while we detected some suggestive evidence of short-term health improvements, it is unlikely that these health impacts persist into early adulthood. Nevertheless, it is possible that better health related-behavior and more preventive contacts with the health services before the age of 39 can translate into improved health as the affected cohorts age. Lastly, we note that the 1999 reform's focus was on improving mental health (see section 2), however the estimate in column (9) of Table A16 shows no impacts on GP visits associated with psychological symptoms or diagnoses, which are defined by codes starting with letter P in the ICPC-2 list. Thus, despite the reform's aim to tackle mental health problems, most of the impacts from increased supply of school nurses are not related to mental health problems but rather to general well-being (as measured by educational attainment, labor earnings and reduced welfare dependency) and preventive health care use.

7 Discussion and Conclusion

While there is a large literature on the effectiveness of early interventions, much less is known about the interventions in the next phase of a child's life, namely their school age. Hence, governments considering low-cost interventions taking place at school have very little information about whether they can expect any long-lasting impacts on the children. In this paper, we answer this question by taking advantage of a reform that increased the supply of school nurses in the Norwegian school health program. In particular, exogenous variation in the access to school health care comes from a reform that expanded and improved services for mental health illnesses. This reform was implemented between 1999 and 2008, and it increased the availability of school nurses by 35%. We use a difference-in-differences approach to estimate the effects of this increased access, comparing the outcomes at age 20 to 39 for the children who went to school before and after the reform in municipalities where the expansion in the availability of nurses was large relative to municipalities where there were small or no changes in the availability of nurses.

We find a substantial decrease in the likelihood of teenage childbearing. Given that fertility did not increase at later ages, this suggests a reduction in total fertility. The increased supply of school nurses also had positive effects on girls' educational attainment, on their labor earnings at the beginning of their career, and reduced welfare dependency before age 30. The reform led to increased planned use of primary and specialist health services when the individuals were in their 30s, but no changes in admissions to the primary care ERs or the emergency wards at hospitals, nor the annual costs induced by primary health care visits. We interpret these effects as driven by changes in health-promoting behaviors, rather than associated to changes in health status in young adulthood.

To our knowledge, this is the first study identifying causal effects of universal access to school nurses in childhood and adolescence on later life outcomes. Thus, it is not straightforward to discuss our results in the light of the available literature. Nevertheless, it is interesting to compare our results to previous studies that assess the effects of other policy interventions on similar outcomes, especially considering the low costs related to increasing the availability of school nurses. Therefore, we compare our findings to those from a number of policies targeting the first years of life, of which there have been numerous studies in the Scandinavian context. Qualitatively, the improvements in education and earnings are similar to those found for the provision of nutritious meals, introduction of paid maternity leave, expansion of childcare, and of increasing compulsory education in Norway. Bütikofer, Mølland and Salvanes (2018) and Lundborg, Rooth and Alex-Petersen (2021) study the impacts of the introduction of nutritious school meals in Norway (during the 1930s) and Sweden (during the 1960s) on life time income, defined as the mean of yearly incomes below age 65. Both papers have similar findings, and similar also to ours. Lundborg, Rooth and Alex-Petersen (2021) find that one additional year of school lunches increases adult income by 0.35%, thus being exposed during their entire compulsory school period (9 years) has an effect of about 3%. Bütikofer, Mølland and Salvanes (2018) find that exposure to a year of free school breakfast[35] increases the average earnings by 2–3%. Our effects are in line with such estimates, although given that the reform

[35]The intervention studied by Bütikofer, Mølland and Salvanes (2018) provides children with nutritious food and replaces a hot school meal at the end of the day with similar caloric value but fewer micro-nutrients.

was implemented in 1999, we cannot estimate the impacts on lifetime earnings. Also, for some of the cohorts used in this paper, Carneiro, Løken and Salvanes (2015) find that the introduction of paid maternity leave in 1977[36] increased wages at age 30 by 5%, while further expansions of the paid maternity leave period between 1987 and 1992 had no impacts on children's academic achievement or on high school graduation (Dahl et al., 2016). Mogstad and Havnes (2011) study a large-scale expansion of subsidized child care during the 1970s and find that it improved educational attainment and labor market participation and reduced welfare dependency. Finally, expanding the mandatory years of schooling during the 1960s in Norway has improved educational achievement (Hægeland, Raaum and Salvanes, 2012) and reduced the probability of becoming a teen mother by about 3.5% (Black, Devereux and Salvanes, 2008). There are less studies on the impacts of these interventions on health, nevertheless, relying on survey data, Bütikofer, Riise and Skira (2021) find that the introduction of paid maternity leave in Norway in 1977 improved health-promoting behaviors among women around age 40, such as exercise and not smoking. Ginja, Jans and Karimi (2020) find that access to higher parental leave benefit levels in Sweden does not affect the birth outcomes of the new child or on the incidence of hospital visits for either the existing or the new child.[37] Finally, Breivik, Del Bono and Riise (2021) find that the expansion of publicly provided childcare during the 1970s (see also Mogstad and Havnes (2011)) only increased the use of primary and specialist health care among women ages 30 to 47 years; as in our paper, the increase was also driven by preventive health checks-ups.

A simple cost-benefit analysis shows that the financial benefits from the increased earnings offset the provision cost of the program (see Appendix B). Our calculations for the program benefits should be interpreted as a lower bound estimate, as they disregard impacts on other outcomes such as welfare use, health and health service use. It is also worth noting that school health services represent a small investment compared to, for instance, the average yearly expenditures per child attending compulsory schooling, which amounts to 112,200 NOK (Utdanningsdirektoratet, 2018).

Our findings have implications for the discussion of policies that target children and youth. We show that universal health services delivered in the school context, which make them easily accessible to children and adolescents, can have significant lasting impacts on educational attainment, family formation, employment, and on the use of health services later in life. This suggests that also in developed countries there is scope for governments to use the school as a ground to deliver effective low-cost, preventive health-services.

[36] Going from 12 weeks of unpaid leave to 4 months of paid leave *plus* 12 months of unpaid leave.

[37] Ginja, Jans and Karimi (2020) exploit variation from the eligibility to the speed premium in the Swedish leave system, that grants mothers higher benefits for a subsequent child without reestablishing eligibility through market work if two births occur within a pre-specified interval.

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8 Tables and Figures

Table 1: Post-reform growth in school nurse coverage

	(1)
School nurse coverage	-0.708***
(school nurse per 1,000 6-19 year old)	(0.099)
Population ages 6-19 years old	-3.642
	(2.283)
Disposable municipality budget in 1997	0.291**
	(0.132)
Total Population	-0.000004**
	(0.000002)
Rural municipality	0.326**
	(0.101)
Observations	373

Note: The dependent variable is the change in school nurse coverage from the pre- to the post-reform period. The pre-reform period is defined as 1995-1997, while the post-reform period is defined as 1999-2008. The regression includes county fixed effects (there were 19 counties in Norway during the period studied). Municipalities with less than 1,500 inhabitants in 1997 are excluded. Robust standard errors in parentheses. * p<0.1, ** p<0.05, *** p<0.01.

Table 2: Teenage Childbirth, Education, Earnings and Welfare Use.

	(1) Teen Childbirth	(2) High School at 19	(3) College Degree at 23	(4) Earnings at 25	(5) Ever in Welfare by 30
ITT	-0.006***	-0.010	0.015***	9789.665*	-0.017*
	(0.002)	(0.012)	(0.005)	(5463.869)	(0.009)
Control Mean	.050	.485	.24	207242	.583
Effect	-.129	-.020	.064	.047	-.030
R&W p-value	0.008	0.409	0.004	0.156	0.146
N	641915	1306199	1306199	1280300	1100010

NOTE: The table shows estimates of γ for model (1) for fertility, educational attainment and labor market outcomes. Teen Childbirth is defined as having a child before age 20. The effect on teenage childbearing is estimated for only girls, while the other effects are estimated for the whole sample. High school includes both vocational and academic training, and is measured at standard completion age (age 19). College degree is defined as completing either a university or university college degree, and is also measured at standard completion age (age 23). Controls included in the regressions, but excluded from the table, are: child's gender, mother's age at birth and education at child age 5, dummies indicating whether mother and child are born in Norway, the number of siblings at child age 5, child's birth order, and whether there is information on the father. All regressions include municipality of residence at age 5 and year of birth fixed effects. The means of the outcomes are measured for children that were 19 or older in 1998. Municipalities with less than 1,500 inhabitants in 1997 are excluded. Robust standard errors, clustered at the level of municipality of residence at age 5, in parentheses. * p<0.1, ** p<0.05, *** p<0.01.

Table 3: Utilization of Primary and Specialist Health Care Services

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	Primary Health Care				Specialist Health Care		
	GP	#GP	ER	Reimbursements	Inpatient	Outpatient	Acute
ITT	0.013**	0.224***	0.003	11.571	0.003***	0.010***	0.002*
	(0.005)	(0.043)	(0.003)	(11.106)	(0.001)	(0.002)	(0.001)
Control Mean	.691	4.37	.189	760	.067	.239	.092
Effect	.018	.051	.017	.015	.040	.040	.023
R&W p-value	0.036	0.000	0.477	0.477	0.020	0.000	0.158
N	1015272	1015272	1015272	1015272	1015272	1015272	1015272

NOTE: The table shows estimates of γ for model (1) using as outcome variables different measures of utilization of health care services between ages 30 and 39. Columns 1-4 display effects on the use of primary health care services. Column (1) includes the average annual likelihood of a GP consultation, column (2) includes the average annual number of GP consultations, column (3) includes the likelihood of at least one visit to the primary care emergency room, and column (4) includes the average annual reimbursements associated to the primary care visits. Columns 5-7 display the effects on specialist health care utilization. Column (5) considers the average annual likelihood of at least one inpatient visit, column (6) includes the average annual likelihood of at least one outpatient visit, and column (7) has the average annual likelihood of an acute visit to the specialist care emergency room. Controls included in the regressions, but excluded from the table, are: child's gender, mother's age at birth and education at child age 5, dummies indicating whether mother and child are born in Norway, the number of siblings at child age 5, child's birth order, and whether there is information on the father. All regressions include municipality of residence at age 5 and year of birth fixed effects. The means of the outcomes are measured for children that were 19 or older in 1998. Municipalities with less than 1,500 inhabitants in 1997 are excluded. Robust standard errors, clustered at the level of municipality of residence at age 5, in parentheses. * $p<0.1$, ** $p<0.05$, *** $p<0.01$.

Table 4: Heterogeneity: Teenage Childbirth, Education and Labor Market Attachment

	(1) Teen Childbirth	(2) High School at 19	(3) College Degree at 23	(4) Earnings at 25	(5) Ever in Welfare by 30
			Panel A: Male		
ITT	0.000	-0.021	0.010**	9175.741	-0.012
	(0.001)	(0.014)	(0.004)	(6972.302)	(0.009)
Control Mean	.010	.439	.196	240360	.635
Effect	.007	-.049	.051	.038	-.019
R&W p-value	0.948	0.501	0.112	0.541	0.541
N	674250	668982	668982	656818	562747
			Panel B: Female		
ITT	-0.006***	0.003	0.021***	10194.335**	-0.023***
	(0.002)	(0.009)	(0.006)	(3986.051)	(0.009)
Control Mean	.050	.533	.286	172610	.529
Effect	-.129	.005	.075	.059	-.043
R&W p-value	0.040	0.948	0.002	0.070	0.070
N	641915	637217	637217	623482	537263

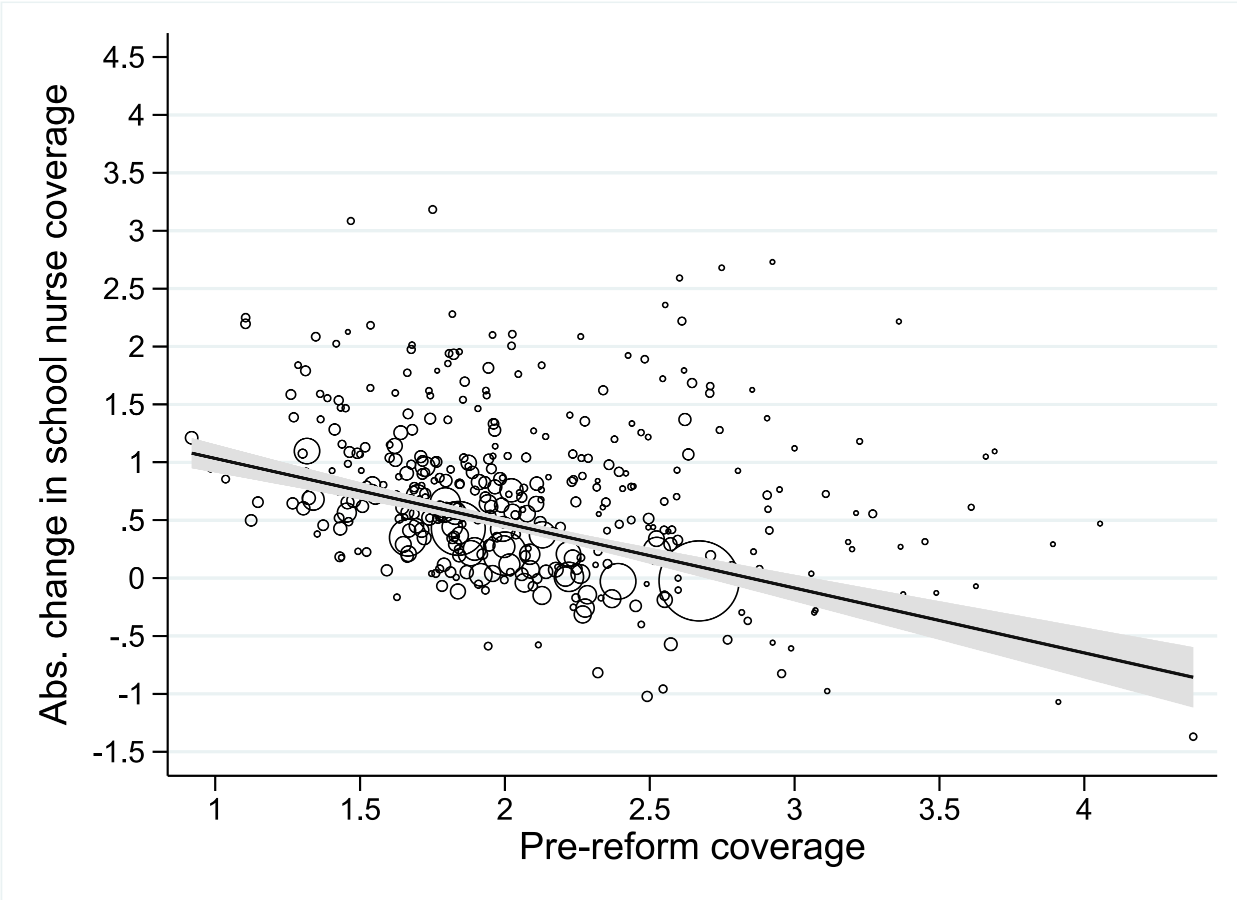
NOTE: The table shows estimates of γ for model (1 estimated for boys and girls separately; all outcomes are defined as in Table 2. Panel A displays the results for boys, while Panel B displays the results for girls. Controls included in the regressions, but excluded from the table, are: child's gender, mother's age at birth and education at child age 5, dummies indicating whether mother and child are born in Norway, the number of siblings at child age 5, child's birth order, and whether there is information on the father. All regressions include municipality of residence at age 5 and year of birth fixed effects. The means of the outcomes are measured for children that were 19 or older in 1998. Municipalities with less than 1,500 inhabitants in 1997 are excluded. Robust standard errors, clustered at the level of municipality of residence at age 5, in parentheses. * p<0.1, ** p<0.05, *** p<0.01.

Table 5: Heterogeneity: Utilization of Primary and Specialist Health Care Services

	(1)	(2)	(3)	(4)	(5)
	Primary Health Care		Specialist Health Care		
	GP	#GP	Inpatient	Outpatient	Acute
			Panel A: Male		
ITT	0.012**	0.107***	0.002***	0.004*	0.001
	(0.005)	(0.036)	(0.001)	(0.002)	(0.001)
Control Mean	.587	2.990	.042	0.169	0.094
Effect	.020	.036	.048	.024	.015
R&W p-value	0.180	0.028	0.006	0.295	0.595
N	519762	519762	519762	519762	519762
			Panel B: Female		
ITT	0.014***	0.343***	0.003*	0.015***	0.003**
	(0.005)	(0.067)	(0.002)	(0.003)	(0.001)
Control Mean	.799	5.820	.094	.313	.090
Effect	.017	.059	.034	.049	.032
R&W p-value	0.070	0.000	0.295	0.000	0.200
N	495510	495510	495510	495510	495510

NOTE: The table shows estimates of γ for model (1 estimated for boys and girls separately; all outcomes are defined as in Table 3. Panel A displays the results for boys, while Panel B displays the results for girls. Controls included in the regressions, but excluded from the table, are: child's gender, mother's age at birth and education at child age 5, dummies indicating whether mother and child are born in Norway, the number of siblings at child age 5, child's birth order, and whether there is information on the father. All regressions include municipality of residence at age 5 and year of birth fixed effects. The means of the outcomes are measured for children that were 19 or older in 1998. Municipalities with less than 1,500 inhabitants in 1997 are excluded. Robust standard errors, clustered at the level of municipality of residence at age 5, in parentheses. * p<0.1, ** p<0.05, *** p<0.01.

Figure 1: Growth in School Nurse Coverage



NOTE: The figure shows the relationship between pre-reform coverage levels of school nurses and the growth in school nurse coverage from the pre- to the post-reform period (ie, between 1999 and 2008). School nurse coverage is defined as the number of school nurses per 1,000 6-19 year old in the municipality. The pre-reform period is defined as 1995-1997. Municipalities with less than 1,500 inhabitants in 1997 are excluded. The solid line in this figures shows the fitted values with a 95% CI.

Figure 2: Growth in School Nurse Coverage

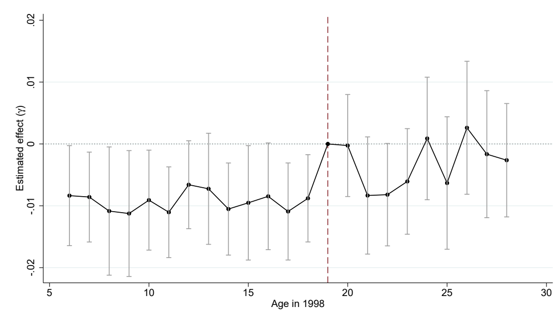
Note: This figure presents estimates for βs from the following model

$$Cov_{mt} = \sum_{k=1990}^{1997} \beta_k^B L_m \mathbf{1}\left[t - T_m = k\right] + \sum_{k=1999}^{2009} \beta_k^A L_m \mathbf{1}\left[t - T_m = k\right] + \mu_m + \pi_t + \varepsilon_{mt} \quad (5)$$

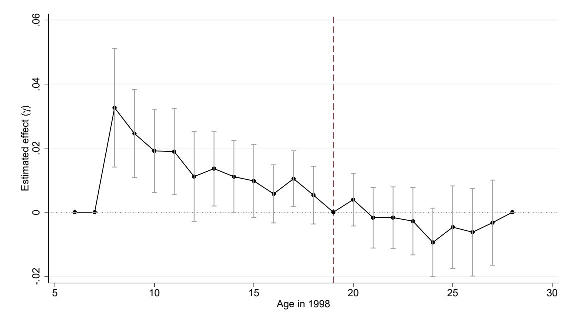
where Cov_{mt} is the log of school nurses per 1,000 children 6-19 years old in year t and municipality m, L_m is an indicator variable equal to 1 if the coverage between 1995-1997 is below the median coverage, and 0 otherwise. μ_m and π_t are municipality and year fixed effects, respectively. The dashed lines are 95% confidence intervals.

Figure 3: Time to Event Specification

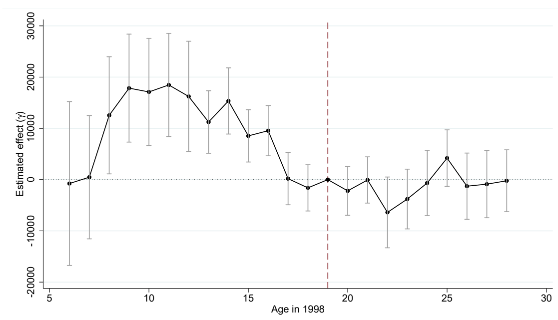
(a) Teen Childbirth



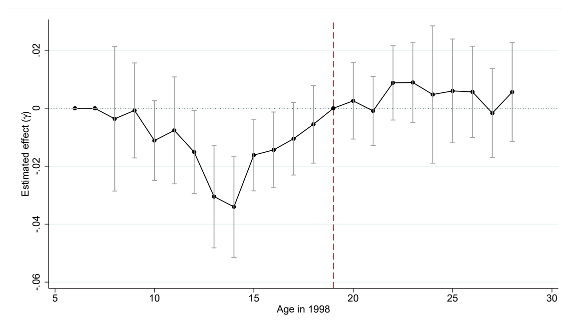
(b) Primary Health Care



(c) Earnings at 25



(d) Ever in Welfare by age 30



NOTE: The plots include estimates for the γs and 95% confidence intervals from the following model

$$Y_{imt} = \alpha + \sum_{a=20}^{28} \beta_B^a I_m[Age98_i = a] + \sum_{a=6}^{18} \beta_A^a I_m[Age98_i = a] + \mathbf{X}_i' \delta_1 + \mu_m + \theta_t + \epsilon_{imt}.$$

In the model above, age is measured in 1998, the year before the reform was implemented. Age 19 is the excluded category, which represents the cohort just too old to be exposed to the reform. Individuals to the left of the vertical dashed line were between 6 and 18 years old in 1998, and represent the cohorts that were exposed to the reform. Individuals to the right of the vertical dashed line were between 20 and 28 years old in 1998, and were too old to be exposed to the reform.

A Additional Tables and Figures

Table A1: Data Sources

Data source	Main description	Data used in analysis	Years available
Control and Payment of Health Reimbursement (KUHR) Database	Individual primary care visits (to GPs or emergency rooms)	Dates (year) of visits, with related diagnoses and symptoms (ICPC2), reimbursements and procedures	2006-2021
Norwegian Patient Registry (NPR)	Individual inpatient and outpatient visits in specialist care.	Entry & discharge dates (year), diagnoses (ICD10), planned and urgent admissions	2008-2020
Medical Birth Registry of Norway	Information on births, pregnancy losses, health and health behavior during pregnancy	Mother's behaviors during pregnancy and babys weight (in grams), an indicator of low (<2500g) birthweight, APGAR scores and duration of gestation (in weeks).	1967-2020
Mortality Records	Individual death event	Date (year) & cause of death (ICD10)	up to 2020
Education Records	Individual highest achieved education	High School Completion, College Enrolment and Completion	1970-2019
Tax Authority Records	Annual information for eligible individuals (those formally employed).	Labor earnings and income from other sources	1993-2020
Social Security Records	Annual information for eligible individuals	Welfare Use (ie, sick Leave, disability income, unemployment benefits, and other social insurance benefits)	1989-2019
Population Records	Annual demographic information about all individuals	Marital status, municipality of residence, gender, age, nationality	1967-2020

NOTE: This table presents the time frame of covered by the administrative records used in the analysis.

Table A2: Outcome Data Availability

Cohort	Reform	Number of school years in reform period	KUHR data 2006-2021 measured at age 30-39	NPR data 2008-2020 measured at age 30-39	Other outcomes measured at age: 19	23	30
1970	Pre	0			X	X	X
1971	Pre	0	X	X	X	X	X
1972	Pre	0	X	X	X	X	X
1973	Pre	0	X	X	X	X	X
1974	Pre	0	X	X	X	X	X
1975	Pre	0	X	X	X	X	X
1976	Pre	0	X	X	X	X	X
1977	Pre	0	X	X	X	X	X
1978	Pre	0	X	X	X	X	X
1979	Pre	0	X	X	X	X	X
1980	Post	0.5	X	X	X	X	X
1981	Post	1.5	X	X	X	X	X
1982	Post	2.5	X	X	X	X	X
1983	Post	3.5	X	X	X	X	X
1984	Post	4.5	X	X	X	X	X
1985	Post	5.5	X	X	X	X	X
1986	Post	6.5	X	X	X	X	X
1987	Post	7.5	X	X	X	X	X
1988	Post	8.5	X	X	X	X	X
1989	Post	9.5	X	X	X	X	X
1990	Post	10.5			X	X	X
1991	Post	11.5			X	X	
1992	Post	12.5			X	X	
1993	Post	13			X	X	

NOTE: The KUHR data is available for 2006-2021 and includes data on primary health care services (ER visits and GP consultations and related information). The NPR data is available for 2008-2020 and includes data on specialist health care of various types: somatic care, psychiatric care, interdisciplinary drug/addiction treatment and psychologists.

Table A3: Pre-reform Differences for Municipalities with different Levels of Baseline Coverage

	(1) Mean	(2) Coefficient	(3) S.E.
Pre-Reform Coverage (nurses per 1,000 6-19 year old) :			
Mean	2.074		
S.D.	0.559		
Demography			
Total Population	11588	-2482.073*	(1343.225)
Share of pop. aged 6-19	0.185	-0.011***	(0.002)
Share of 16+ with compulsory schooling	0.409	-0.003	(0.009)
Share of 16+ with high school	0.451	0.001	(0.006)
Share of 16+ with university degree	0.126	-0.006	(0.004)
Private income (100,000 NOK)	16558	-2000.548	(2306.661)
Unemployment rate (%)	3.87	0.011	(0.166)
Unrestricted budget (10,000 NOK per capita)	1.26	0.253***	(0.064)
Labor Party has majority of votes	0.548	-0.056	(0.054)
Geography			
Land area (km^2)	740	12.296	(167.087)
Rural	0.607	0.183***	(0.061)
Health Services			
Empl. in munic. health care sector /1,000 inh.	10.5	2.013**	(0.714)
School doctors per 1,000 6-19 year old	0.299	0.124***	(0.021)
School psychologists per 1,000 6-19 year old	0.004	0.004	(0.003)
GPs in munic. health care sector /1,000 inh.	0.936	0.199***	(0.024)
Man-yrs in child welfare services per 1,000 6-19 year old	2.46	0.121	(0.149)
Education			
Munic. spending on compulsory schooling (10,000 NOK)	3202	463.263***	(72.455)
Share of schools private	0.012	0.005	(0.005)
Share of pop. in 1st-10th grade	0.133	-0.008***	(0.001)
Share of pop. in high school	0.031	-0.004	(0.004)
Early Health			
Birth weight (grams)	3494	20.381	(38.781)
Infant Mortality Rate	10.3	1.320	(1.108)

NOTE: Column (2) shows estimates for the coefficient δ in the following model

$$y_m = \alpha + \delta I_m + \pi_c + \nu_m$$

where y_m is a municipality characteristic measured in 1997, I_m is the pre-reform school-nurse coverage between 1995 and 1997 and π_c is a county fixed effect. Municipalities with less than 1,500 inhabitants in 1997 are excluded. Robust standard errors in column (3). * p<0.1, ** p<0.05, *** p<0.01.

Table A4: Number of Children

	(1) Number of Children at 30	(2) Number of Children at 35
ITT	-0.041***	-0.027***
	(0.008)	(0.009)
Control Mean	1.27	1.94
Effect	-.032	-.0137
N	426560	350488

NOTE: The table shows estimates of γ for model (1) and it uses the sample of women only. Controls included in the regressions, but excluded from the table, are: child's gender, mother's age at birth and education at child age 5, dummies indicating whether mother and child are born in Norway, the number of siblings at child age 5, child's birth order, and whether there is information on the father. All regressions include municipality of residence at age 5 and year of birth fixed effects. The means of the outcomes are measured for children that were 19 or older in 1998. Municipalities with less than 1,500 inhabitants in 1997 are excluded. Robust standard errors, clustered at the level of municipality of residence at age 5, in parentheses. * p<0.1, ** p<0.05, *** p<0.01.

Table A5: Alternative Sample: Individuals born between 1976 and 1984 (14 to 22 years old in 1998)

	(1)	(2)	(3)	(4)	(5)
			Panel A		
	Teen Childbirth	High School at 19	College Degree at 23	Earnings at 25	Ever in Welfare by 30
ITT	-0.005**	-0.021*	0.006*	8826.584***	-0.019***
	(0.002)	(0.011)	(0.003)	(1998.954)	(0.005)
R&W p-value	0.075	0.106	0.106	0.000	0.004
N	218986	447205	447205	437041	434773
			Panel B		
	Primary Health Care		Specialist Health Care		
	GP	#GP	Inpatient	Outpatient	Acute
ITT	0.008***	0.153***	0.002***	0.006***	0.002**
	(0.003)	(0.041)	(0.001)	(0.002)	(0.001)
R&W p-value	0.030	0.020	0.030	0.000	0.100
N	449247	449247	449247	449247	449247

NOTE: The table shows estimates of γ for model (1). Controls included in the regressions, but excluded from the table, are: child's gender, mother's age at birth and education at child age 5, dummies indicating whether mother and child are born in Norway, the number of siblings at child age 5, child's birth order, and whether there is information on the father. All regressions include municipality of residence at age 5 and year of birth fixed effects. The means of the outcomes are measured for children that were 19 or older in 1998. Municipalities with less than 1,500 inhabitants in 1997 are excluded. Robust standard errors, clustered at the level of municipality of residence at age 5, in parentheses. * p<0.1, ** p<0.05, *** p<0.01.

Table A6: Alternative Treatment Definition: Discrete treatment variable

	(1)	(2)	(3)	(4)	(5)
			Panel A		
	Teen Childbirth	High School at 19	College Degree at 23	Earnings at 25	Ever in Welfare by 30
Post×Low Coverage	-0.006***	-0.010	0.006	7440.447	-0.019**
	(0.002)	(0.009)	(0.006)	(4605.116)	(0.007)
N	641915	1306199	1306199	1280300	1100010
			Panel B		
	Primary Health Care		Specialist Health Care		
	GP	#GP	Inpatient	Outpatient	Acute
Post×Low Coverage	0.015***	0.261***	0.002*	0.009***	0.002
	(0.004)	(0.039)	(0.001)	(0.002)	(0.001)
N	1015272	1015272	1015272	1015272	1015272

NOTE: The table shows estimates for κ in model (2), where the treatment variable is discrete. Controls included in the regressions, but excluded from the table, are: child's gender, mother's age at birth and education at child age 5, dummies indicating whether mother and child are born in Norway, the number of siblings at child age 5, child's birth order, and whether there is information on the father. All regressions include municipality of residence at age 5 and year of birth fixed effects. The means of the outcomes are measured for children that were 19 or older in 1998. Municipalities with less than 1,500 inhabitants in 1997 are excluded. Robust standard errors, clustered at the level of municipality of residence at age 5, in parentheses. * p<0.1, ** p<0.05, *** p<0.01.

Table A7: Alternative Specifications

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
						Trend versions	
	Baseline	Cluster at munic Xcohort	Exclude large cities	All munic.	Linear estimated pre-trend	Trend baseline charact.	Non-parametric trend
Panel A: Teenage Childbirth							
ITT	-0.006***	-0.006***	-0.005*	-0.003***	-0.006***	-0.007***	-0.007**
	(0.002)	(0.001)	(0.003)	(0.001)	(0.002)	(0.002)	(0.003)
N	641915	641915	504616	651665	641915	639483	639483
Panel B: College Degree at 23							
ITT	0.015***	0.015***	0.020***	0.010***	0.007	0.021***	0.020***
	(0.005)	(0.004)	(0.005)	(0.003)	(0.005)	(0.004)	(0.006)
N	1306199	1306199	1029131	1326071	1306199	1301356	1301356
Panel C: Earnings at 25							
ITT	9789.665*	9789.665***	3220.971	5349.480***	8328.134**	9373.439***	4516.348
	(5463.869)	(1645.097)	(2394.812)	(1340.290)	(3790.435)	(2270.651)	(2891.529)
N	1280300	1280300	1010219	1299874	1280300	1275596	1275596
Panel D: Ever in welfare by 30							
ITT	-0.017*	-0.017***	-0.006	-0.009***	-0.017**	-0.024***	-0.023***
	(0.009)	(0.003)	(0.006)	(0.003)	(0.009)	(0.006)	(0.008)
N	1100010	1100010	871492	1117289	1100010	1096028	1096028
Panel E: Probability of at least one GP visit per year							
ITT	0.013**	0.013***	0.016***	0.013***	0.008**	0.006*	0.007
	(0.005)	(0.002)	(0.004)	(0.002)	(0.004)	(0.004)	(0.005)
N	1015272	1015272	802872	1031158	1015272	1011558	1011558
Panel F: Average Annual Number of GP visits							
ITT	0.224***	0.224***	0.217***	0.208***	0.172***	0.116***	0.095*
	(0.043)	(0.028)	(0.052)	(0.023)	(0.041)	(0.044)	(0.054)
N	1015272	1015272	802872	1031158	1015272	1011558	1011558
Panel G: Probability of at least one specialist inpatient visit per year							
ITT	0.003***	0.003***	0.003***	0.002***	0.003***	0.002**	0.002
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.002)
N	1015272	1015272	802872	1031158	1015272	1011558	1011558
Panel H: Probability of at least one specialist outpatient visit per year							
ITT	0.010***	0.010***	0.008***	0.007***	0.007***	0.007***	0.006**
	(0.002)	(0.001)	(0.002)	(0.001)	(0.001)	(0.002)	(0.003)
N	1015272	1015272	802872	1031158	1015272	1011558	1011558
Panel I: Probability of at least one acute specialist visit per year							
ITT	0.002*	0.002***	0.002**	0.002***	0.002**	0.001	0.002
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.002)
N	1015272	1015272	802872	1031158	1015272	1011558	1011558

NOTE: Column (1) includes the baseline specification. In column (2) the standard errors are clustered by cohort-municipality of residence at age 5. Column (3) excludes the five largest cities. Column (4) includes the smallest municipalities. Column (5) expands equation (1) to control for municipality-level pre-reform linear trends in the outcome; column (6) includes linear municipality trends in characteristics measured in 1997; and column (7) includes non-parametric municipality trends in characteristics measured in 1997. * p<0.1, ** p<0.05, *** p<0.01.

Table A8: Alternative Treatment Definition: Coverage measured in 1998

	(1)	(2)	(3)	(4)	(5)
			Panel A		
	Teen Childbirth	High School at 19	College Degree at 23	Earnings at 25	Ever in Welfare by 30
ITT	-0.007***	-0.009	0.014***	9732.783**	-0.019**
	(0.002)	(0.011)	(0.004)	(4546.413)	(0.010)
N	635056	1294056	1294056	1268885	1088601
			Panel B		
	Primary Health Care		Specialist Health Care		
	GP	#GP	Inpatient	Outpatient	Acute
ITT	0.012**	0.205***	0.002**	0.009***	0.001
	(0.005)	(0.045)	(0.001)	(0.002)	(0.001)
N	1002724	1002724	1002724	1002724	1002724

NOTE: The table shows estimates for γ for model (1), our main specification, but where the school nurse coverage in the municipality is measured in 1998 instead of 1995-1997. Controls included in the regressions, but excluded from the table, are: child's gender, mother's age at birth and education at child age 5, dummies indicating whether mother and child are born in Norway, the number of siblings at child age 5, child's birth order, and whether there is information on the father. All regressions include municipality of residence in 1998 and year of birth fixed effects. The means of the outcomes are measured for children that were 19 or older in 1998. Municipalities with less than 1,500 inhabitants in 1997 are excluded. Robust standard errors, clustered at the level of municipality of residence in 1998, in parentheses. * p<0.1, ** p<0.05, *** p<0.01.

Table A9: Correlation Between School Nurse Coverage and Use of School Health Services

	(1) Prob. of visit	(2) Prob. >2 visits	(3) Prob. of visit	(4) Prob. >2 visits
Nurses/1,000 children aged 6-19	0.018***	0.003	0.006	-0.002
	(0.004)	(0.003)	(0.006)	(0.003)
Nurses/1,000 children aged 6-19 × Girl			0.024***	0.011***
			(0.007)	(0.004)
Mean	.227	.060	.227	.060
N	27766	27766	27766	27766

NOTE: This table uses survey data from 2013. It shows the correlation between the number of nurses per 1,000 children aged 6-19 in a municipality (based on the average coverage for the years 2012-2014) and the use of school health services. Columns (1) and (3) show the likelihood of visiting the school nurse at least once in the year prior to the survey, while columns (2) and (4) show the likelihood of visiting the nurse more than two times. Controls included in the model, but excluded from the table are gender and fixed effects for the school level and county. * p<0.1, ** p<0.05, *** p<0.01.

Table A10: Correlation Between School Nurse Coverage and Use of School Health Services Related to Sex/Sexuality

	(1) Prob. of visit	(2) Conditional on visit	(3) Prob. of visit	(4) Conditional on visit
Nurses/1,000 children aged 6-19	0.008***	0.006	-0.000	-0.025*
	(0.003)	(0.009)	(0.004)	(0.015)
Nurses/1,000 children aged 6-19× Girl			0.016***	0.046***
			(0.004)	(0.016)
Mean	.073	.272	.073	.272
N	27766	5946	27766	5946

NOTE: This table uses survey data from 2013. It shows the correlation between the number of nurses per 1,000 children aged 6-19 in a municipality (based on the average coverage for the years 2012-2014) and the use of school health services for problems related to sex/sexuality. Columns (1) and (3) show the likelihood of visiting the school nurse at least once in the year prior to the survey, while columns (2) and (4) show the likelihood of visiting the nurse more than two times. Controls included in the model, but excluded from the table are gender and fixed effects for the school level and county. * p<0.1, ** p<0.05, *** p<0.01.

Table A11: Miscarriages and Fetal Losses

	(1)	(2)	(3)	(4)
		Miscarriage		Other Fetal
	≤ 24 Weeks	<12 Weeks	13-23 Weeks	Loss
ITT	-0.001	-0.002	-0.000	-0.002
	(0.004)	(0.005)	(0.002)	(0.001)
Control Mean	.234	.215	.042	.016
Effect	-.006	-.011	-.011	-.094
N	404792	407476	405287	442769

NOTE: The table includes estimates of γ for model (1), our main specification. Controls included in the regressions, but excluded from the table, are: child's gender, mother's age at birth and education at child age 5, dummies indicating whether mother and child are born in Norway, the number of siblings at child age 5, child's birth order, and whether there is information on the father. All regressions include municipality of residence at age 5 and year of birth fixed effects. The means of the outcomes are measured for children that were 19 or older in 1998. Municipalities with less than 1,500 inhabitants in 1997 are excluded. Robust standard errors, clustered at the level of municipality of residence at age 5, in parentheses. * p<0.1, ** p<0.05, *** p<0.01.

Table A12: Pregnancy and fertility related GP-visits

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	All Preg/Fert.		Contraceptive		Pregnancy		Other Fertility	
	ICPC-02 W		ICPC-02 W10-14		ICPC-02 W78-99		Remaining ICPC-02 W	
	Prob.	# cons.	Prob.	# cons.	Prob.	# cons.	Prob.	# cons.
ITT	0.007***	0.051***	-0.003*	-0.006**	0.010***	0.046***	0.005***	0.011
	(0.002)	(0.016)	(0.002)	(0.003)	(0.002)	(0.010)	(0.002)	(0.010)
Control Mean	.263	1.04	.133	.201	.133	.612	.078	.233
Effect	.025	.049	-.026	-.032	.077	.076	.059	.047
N	495510	495510	495510	495510	495510	495510	495510	495510

NOTE: The table includes estimates of γ from model (1) for females. Controls included in the regressions, but excluded from the table, are: child's gender, mother's age at birth and education at child age 5, dummies indicating whether mother and child are born in Norway, the number of siblings at child age 5, child's birth order, and whether there is information on the father. All regressions include municipality of residence at age 5 and year of birth fixed effects. The means of the outcomes are measured for children that were 19 or older in 1998. Municipalities with less than 1,500 inhabitants in 1997 are excluded. Robust standard errors, clustered at the level of municipality of residence at age 5, in parentheses. * p<0.1, ** p<0.05, *** p<0.01.

Table A13: Birth Related Outcomes

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	Head	Length	Birth	Low Birth	Gestational	APGAR	
	Circumference		Weight	Weight	Age	1min 10	5min 10
ITT	0.009	0.008	-3.114	-0.001	-0.002	0.026***	0.031***
	(0.017)	(0.022)	(3.864)	(0.002)	(0.016)	(0.004)	(0.009)
Control Mean	35.1	50	3516	.094	39.3	.078	.498
Effect	.0003	.0002	-.001	-.007	-.0001	.334	.062
N	440244	435980	442437	442769	440743	442326	442287

NOTE: The table includes estimates of γ from model (1) for the newborns of females. Controls included in the regressions, but excluded from the table, are: child's gender, mother's age at birth and education at child age 5, dummies indicating whether mother and child are born in Norway, the number of siblings at child age 5, child's birth order, and whether there is information on the father. All regressions include municipality of residence at age 5 and year of birth fixed effects. The means of the outcomes are measured for children that were 19 or older in 1998. Municipalities with less than 1,500 inhabitants in 1997 are excluded. Robust standard errors, clustered at the level of municipality of residence at age 5, in parentheses. * p<0.1, ** p<0.05, *** p<0.01.

Table A14: Mother's labor income during the child's school-age.

	(1)	(2)	(3)
	When the child is:		
	10-12	13-15	16-18
ITT	4762.666*	7538.155***	7915.424***
	(2868.996)	(2815.871)	(2279.542)
Control Mean	125779	158294	183883
Effect	.038	.048	.043
N	1288538	1288538	1288538

NOTE: The table includes estimates of γ for model (1), our main specification. Controls included in the regressions, but excluded from the table, are: child's gender, mother's age at birth and education at child age 5, dummies indicating whether mother and child are born in Norway, the number of siblings at child age 5, child's birth order, and whether there is information on the father. All regressions include municipality of residence at age 5 and year of birth fixed effects. The means of the outcomes are measured for children that were 19 or older in 1998. Municipalities with less than 1,500 inhabitants in 1997 are excluded. Robust standard errors, clustered at the level of municipality of residence at age 5, in parentheses. * p<0.1, ** p<0.05, *** p<0.01.

Table A15: Mortality and Severity of Health Conditions

	(1) Any Cause Mortality by Age 35	(2) Hospitalizations Charlson Index (30 to 39 years old)
ITT	0.00048	0.00115
	(0.00063)	(0.00136)
Control Mean	.010	.036
Effect	.046	.032
N	1316165	1015272

NOTE: The table includes estimates of γ for model (1), our main specification. The dependent variable in column (1) is an indicator that takes value if the individual died by age 35. The dependent variable in column (2) is the mean Charlson Comorbidity Index for specialist care admissions between 30 and 39 years old. Controls included in the regressions, but excluded from the table, are: child's gender, mother's age at birth and education at child age 5, dummies indicating whether mother and child are born in Norway, the number of siblings at child age 5, child's birth order, and whether there is information on the father. All regressions include municipality of residence at age 5 and year of birth fixed effects. The means of the outcomes are measured for children that were 19 or older in 1998. Municipalities with less than 1,500 inhabitants in 1997 are excluded. Robust standard errors, clustered at the level of municipality of residence at age 5, in parentheses. * p<0.1, ** p<0.05, *** p<0.01.

Table A16: Utilization of Primary Health Care Services – Specific Conditions

	(1) General/Unsp. ICPC-02 A	(2) Blood/Immune System ICPC-02 B	(3) Digestive ICPC-02 D	(4) Eye ICPC-02 F	(5) Ear ICPC-02 H	(6) Cardiovascular ICPC-02 K	(7) Musculoskeletal ICPC-02 L	(8) Neurological ICPC-02 N
ITT	0.016***	0.000	0.000	-0.000	-0.000	-0.001**	0.001	0.000
	(0.005)	(0.001)	(0.001)	(0.001)	(0.000)	(0.001)	(0.002)	(0.001)
Control Mean	.297	.018	.116	.055	.035	.053	.273	.079
Effect	.056	.007	.003	-.004	-.009	-.022	.005	.004
R&W p-value	0.006	0.996	0.996	0.996	0.529	0.397	0.996	0.996
N	1015272	1015272	1015272	1015272	1015272	1015272	1015272	1015272

	(9) Psychol/Social ICPC-02 PZ	(10) Respiratory ICPC-02 R	(11) Skin ICPC-02 S	(12) Endocrine ICPC-02 T	(13) Urological ICPC-02 U	(14) Pregnancy ICPC-02 W	(15) Female/Male Genital ICPC-02 XY
ITT	0.000	0.006***	-0.000	0.003*	0.000	0.007***	-0.002**
	(0.002)	(0.002)	(0.002)	(0.001)	(0.001)	(0.002)	(0.001)
Control Mean	.169	.265	.151	.069	.051	.263	.088
Effect	.001	.024	-.003	.037	.001	.025	-.023
R&W p-value	0.996	0.052	0.996	0.529	0.996	0.024	0.397
N	1015272	1015272	1015272	1015272	1015272	495510	1015272

NOTE: The table includes estimates of γ for model (1). All outcomes are measured as the average yearly likelihood of utilization in the age interval 30-39 years. Controls included in the regressions, but excluded from the table, are: child's gender, mother's age at birth and education at child age 5, dummies indicating whether mother and child are born in Norway, the number of siblings at child age 5, child's birth order, and whether there is information on the father. All regressions include municipality of residence at age 5 and year of birth fixed effects. The means of the outcomes are measured for children that were 19 or older in 1998. Municipalities with less than 1,500 inhabitants in 1997 are excluded. Robust standard errors, clustered at the level of municipality of residence at age 5, in parentheses. * p<0.1, ** p<0.05, *** p<0.01.

Table A17: Utilization of Specialist Health Care Services – Specific Conditions

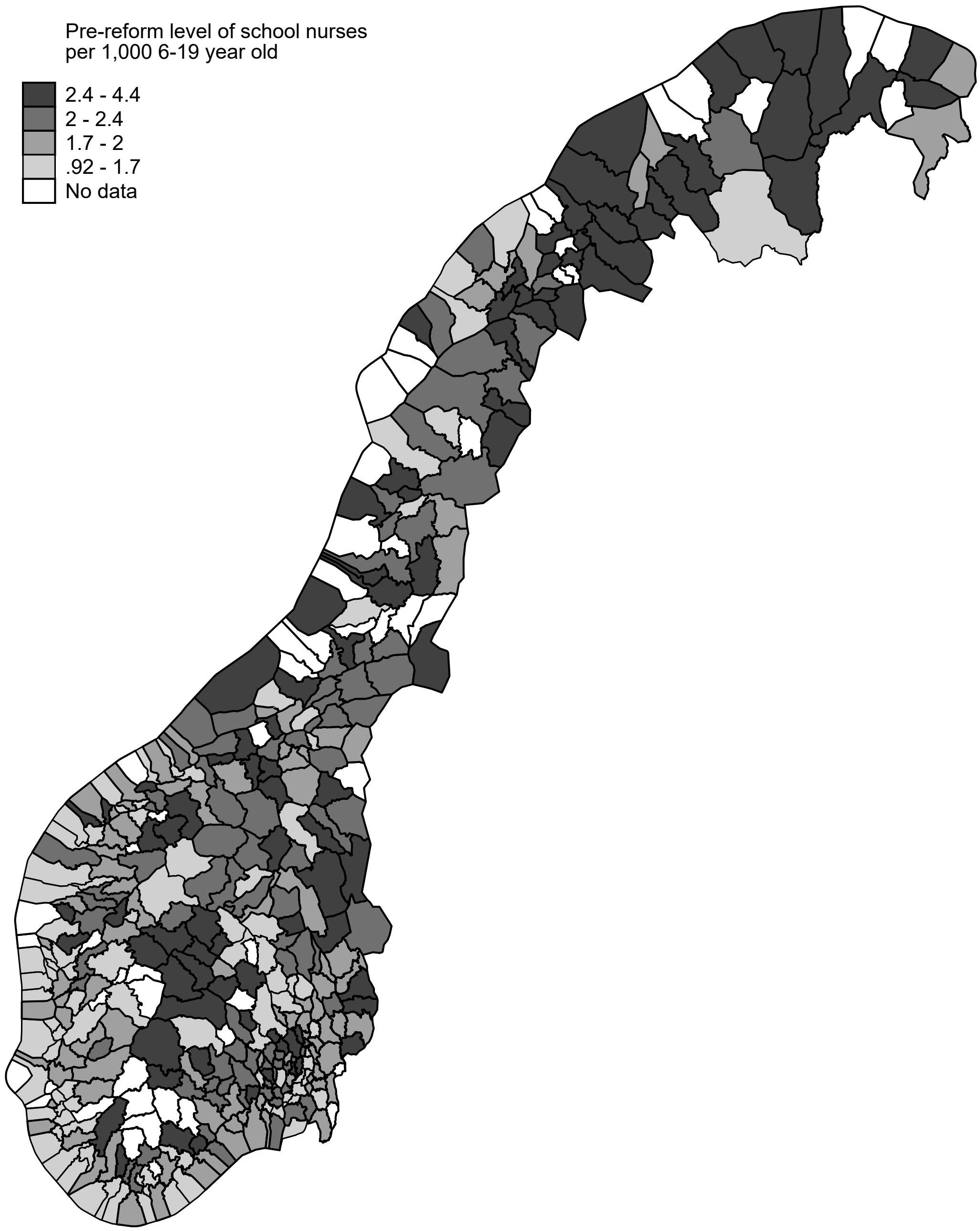
	(1) Infections Diseases ICD10 A/B	(2) Cancer ICD10 C/D	(3) Endocrine Diseases ICD10 E	(4) Nervous System ICD10 G	(5) Ear and Eye Diseases ICD10 H
ITT	0.000	0.000	0.001*	0.000	0.000
	(0.000)	(0.000)	(0.001)	(0.001)	(0.000)
Control Mean	.006	.020	.019	.020	.013
Effect	.036	.013	.071	.006	.005
R&W p-value	0.906	0.934	0.479	0.974	0.974
N	1015272	1015272	1015272	1015272	1015272

	(6) Cardiovascular System ICD10 I	(7) Respiratory System ICD10 J	(8) Digestive System ICD10 K	(9) Skin ICD10 L	(10) Musculoskeletal System ICD10 M
ITT	0.000	0.001**	0.000	0.001**	0.001
	(0.000)	(0.000)	(0.000)	(0.000)	(0.001)
Control Mean	.015	.014	.028	.014	.047
Effect	.023	.056	.015	.054	.017
R&W p-value	0.918	0.407	0.934	0.333	0.934
N	1015272	1015272	1015272	1015272	1015272

	(11) Genitourinary System ICD10 N	(12) Obstetric ICD10 O*	(13) Congenital ICD10 Q	(14) Accidents ICD10 S/T/W/Y	(15) Other ICD10 R/Z
ITT	0.002**	0.010***	0.000	-0.000	0.008***
	(0.001)	(0.002)	(0.000)	(0.000)	(0.002)
Control Mean	.035	.108	.003	.00002	.133
Effect	.063	.090	.043	-.351	.061
R&W p-value	0.349	0.000	0.934	0.918	0.000
N	1015272	495510	1015272	1015272	1015272

NOTE: The table includes estimates of γ for model (1). All outcomes are measured as the average yearly likelihood of an admission in the age interval 30-39 years. Controls included in the regressions, but excluded from the table, are: child's gender, mother's age at birth and education at child age 5, dummies indicating whether mother and child are born in Norway, the number of siblings at child age 5, child's birth order, and whether there is information on the father. All regressions include municipality of residence at age 5 and year of birth fixed effects. The means of the outcomes are measured for children that were 19 or older in 1998. Municipalities with less than 1,500 inhabitants in 1997 are excluded. Robust standard errors, clustered at the level of municipality of residence at age 5, in parentheses. * p<0.1, ** p<0.05, *** p<0.01.

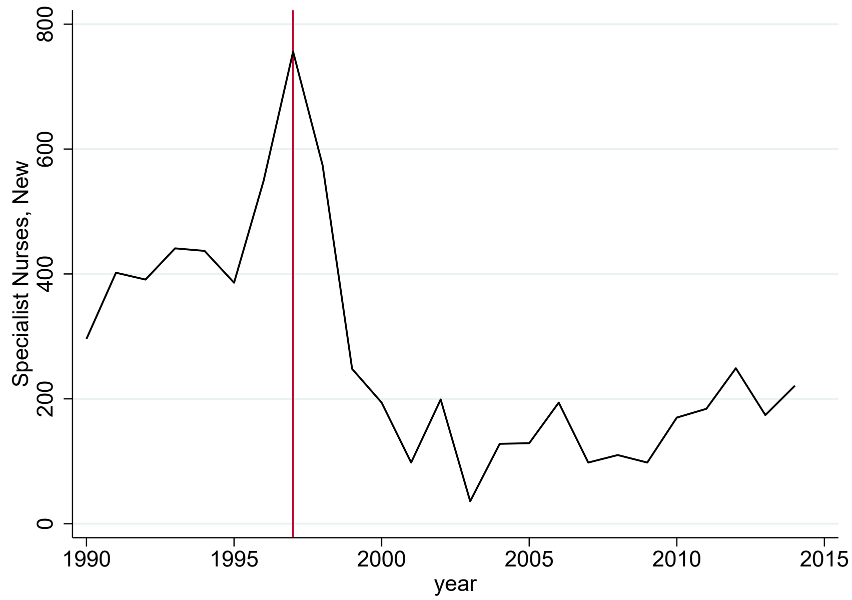
Figure A1: Regional Variation in Treatment Intensity



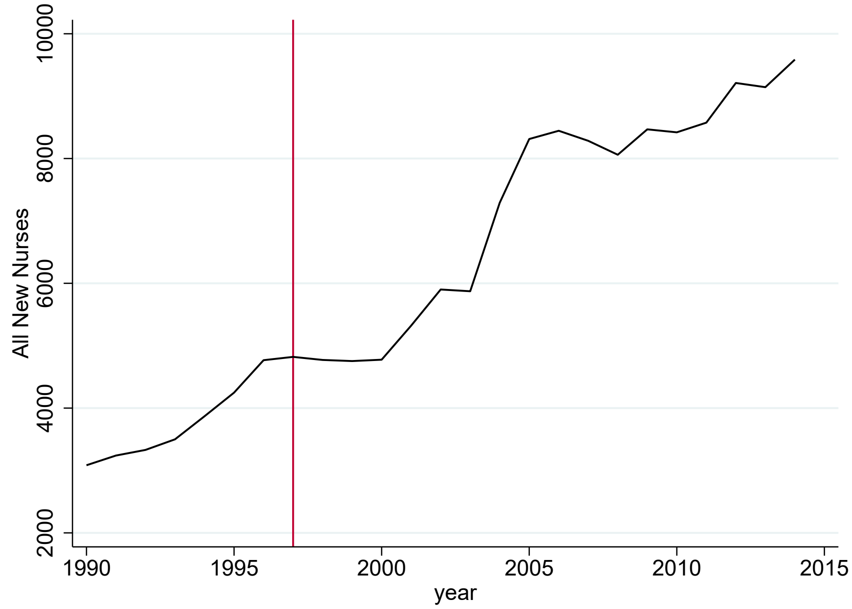
Note: The map shows variation in pre-reform levels of school nurse coverage, defined as school nurses per 1,000 children aged 6-19 in 1995-1997. Municipalities with less than 1,500 inhabitants in 1997 are excluded because they are not included in our main sample. The darker shades indicate a higher school nurse coverage.

Figure A2: Number of Newly Graduated Nurses in Norway

(a) All newly specialized nurses in the relevant fields

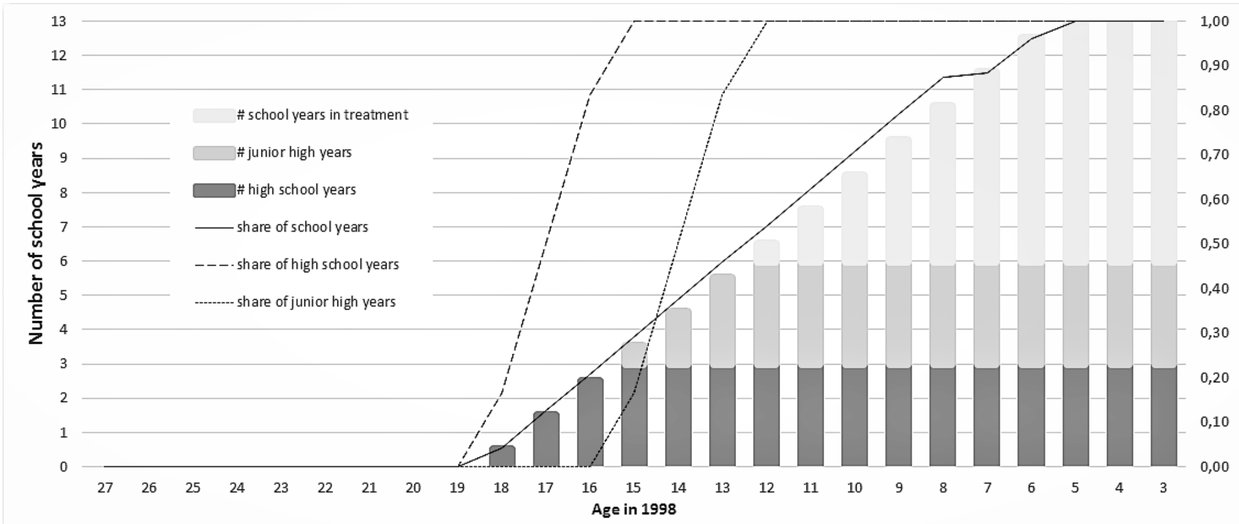


(b) All new graduates in nursing or caring (all fields)



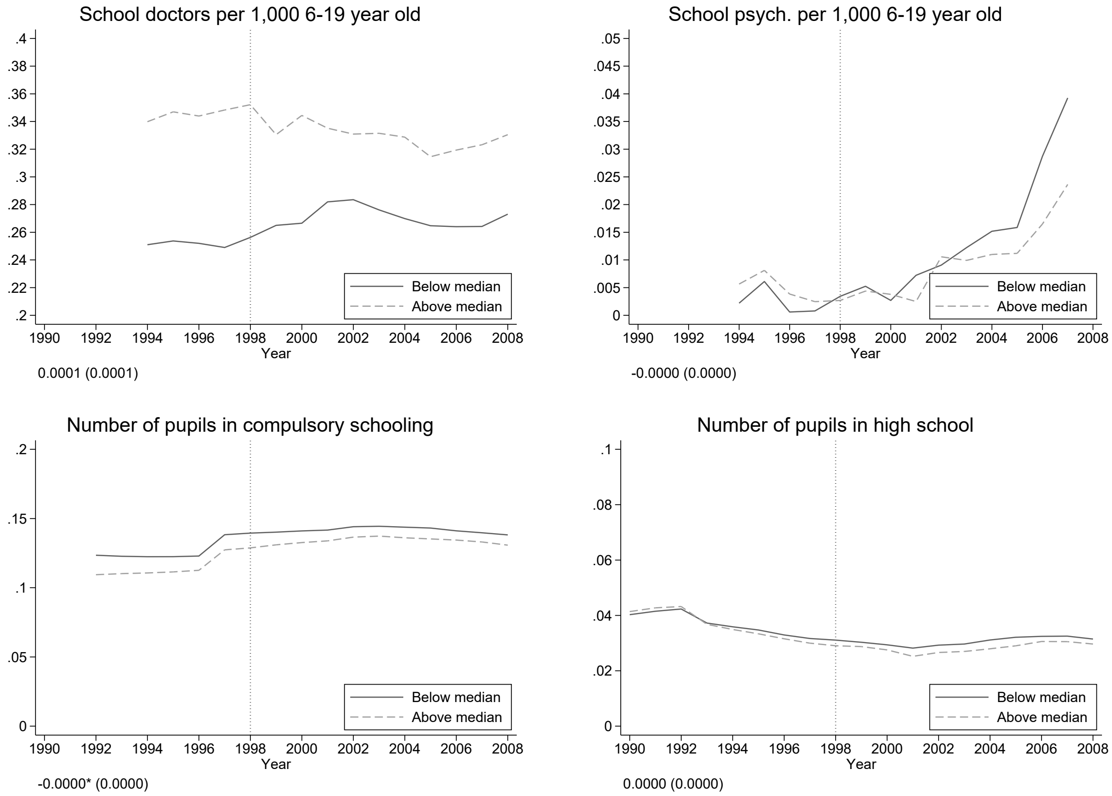
Note: Panel (a) shows the number of specialized nurses graduating in relevant fields for a position as a school nurse. These include the following degrees: public health nursing undergraduate degree (NUS2000 code 661101), two-year master degree (NUS2000 code 761115), and those graduating with a supplementary education in psychiatric nursing (NUS2000 code 661117). Panel (b) shows the total number of nurses graduating, i.e. all those graduating with degrees with codes starting with 661.

Figure A3: Treatment Exposure by Age



NOTE: The graph shows the number of school years (left hand side y-axis) and the share of the total school years (right hand side y-axis) exposed to the reform, by the age of the child in 1998 (the year before the reform). The kink in the share of school years appears because of the 1997 reform that changed school starting age from age 7 to age 6.

Figure A4: Municipality Characteristics: School Resources

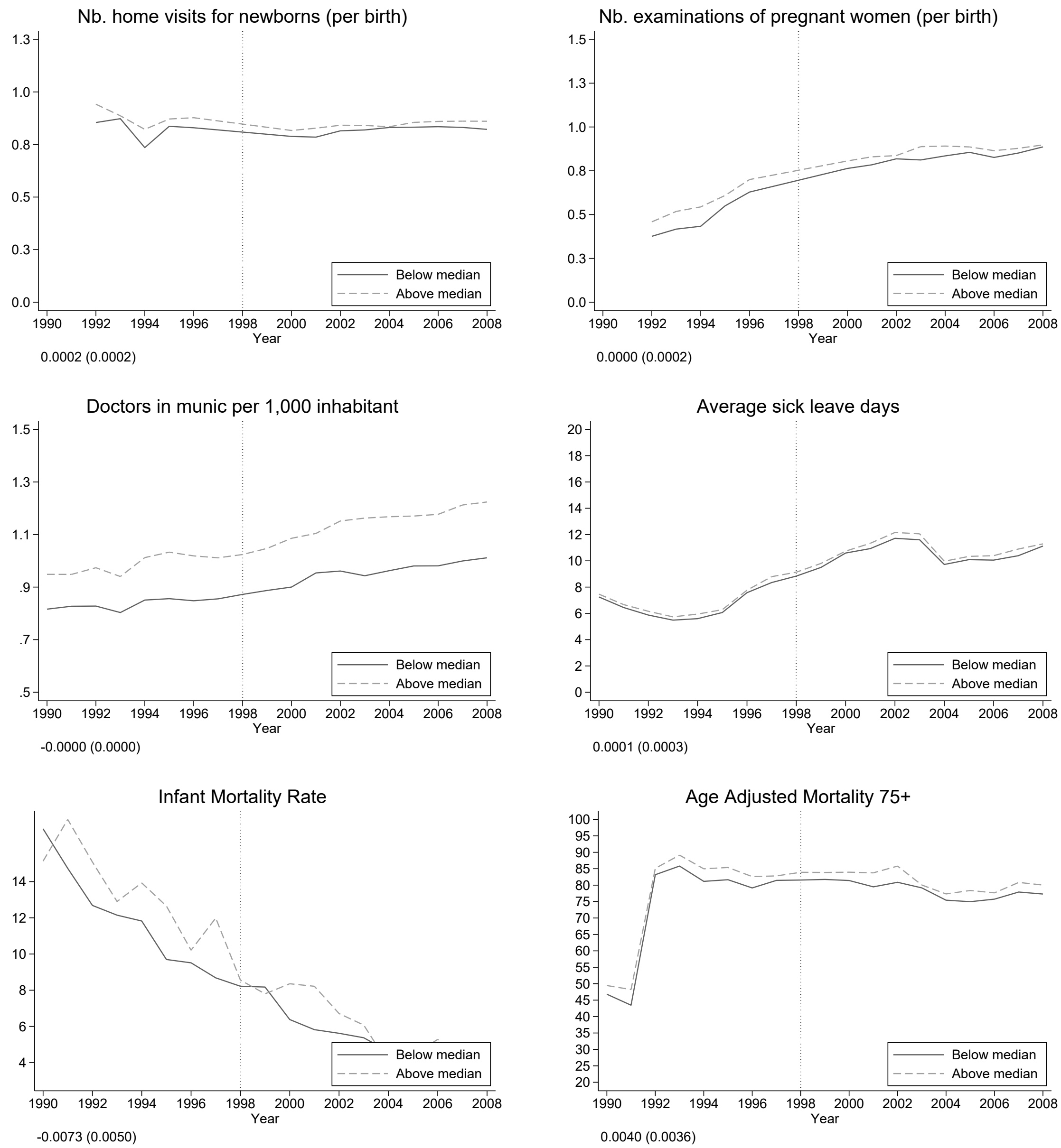


Note: Municipalities are split according to whether they fall below (solid line) or below (dashed line) the median of the distribution of the pre-reform level of school nurses per 1,000 children ages 6 to 19 years old. Municipalities with population below 1,500 inhabitants are excluded. In the bottom left corner of each figure, we include the estimates of coefficient δ_2 from the following model estimated for the pre-reform years when data is available:

$$y_m = \delta_1 + \delta_2 I_m \times t + \delta_3 t + \mu_m + \theta_t + \varepsilon_m \tag{6}$$

where I_m is the pre-reform coverage between 1995 and 1997 and t is a linear year trend, μ_m represents municipality fixed effects and θ_t are the year effects.

Figure A5: Municipality characteristics: Health Indicators and Supply of Health Services

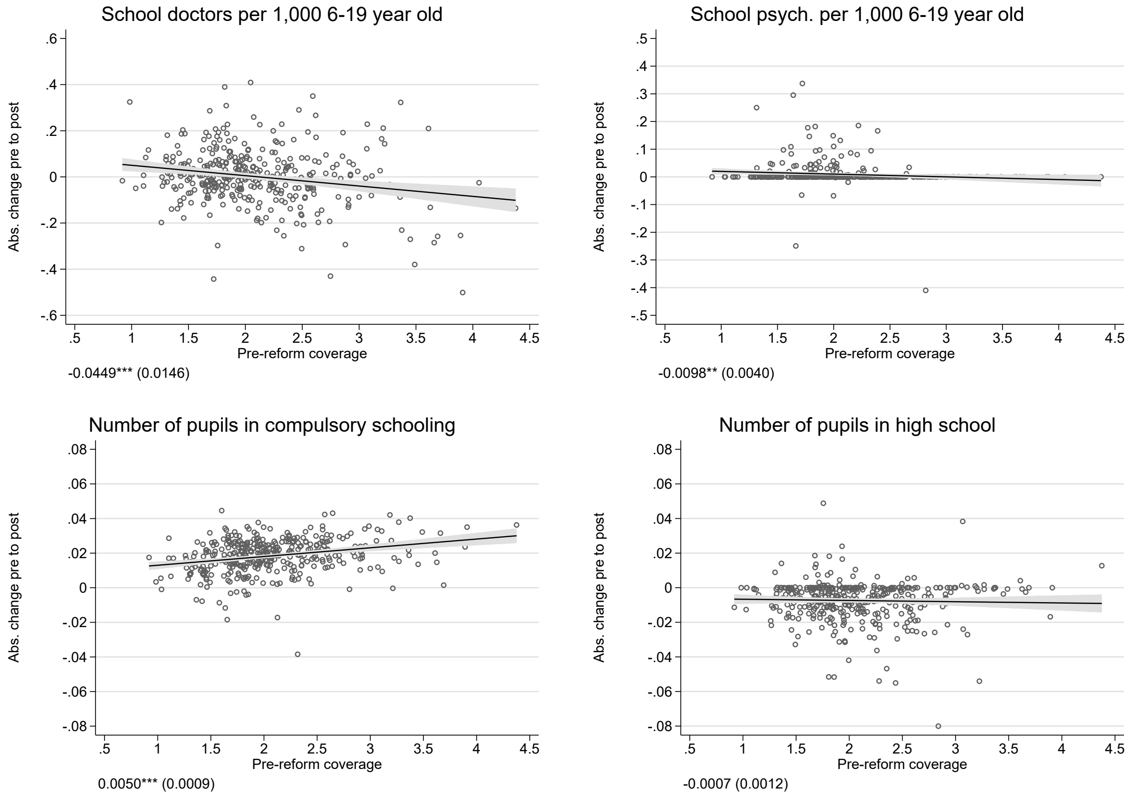


NOTE:Municipalities are split according to whether they fall below (solid line) or below (dashed line) the median of the distribution of the pre-reform level of school nurses per 1,000 children ages 6 to 19 years old. Municipalities with population below 1,500 inhabitants are excluded. In the bottom left corner of each figure, we include the estimates of coefficient δ_2 from the following model estimated for the pre-reform years when data is available:

$$y_m = \delta_1 + \delta_2 I_m \times t + \delta_3 t + \mu_m + \theta_t + \varepsilon_m \tag{7}$$

where I_m is the pre-reform coverage between 1995 and 1997 and t is a linear year trend, μ_m represents municipality fixed effects and θ_t are the year effects.

Figure A6: Municipality Characteristics: School Resources

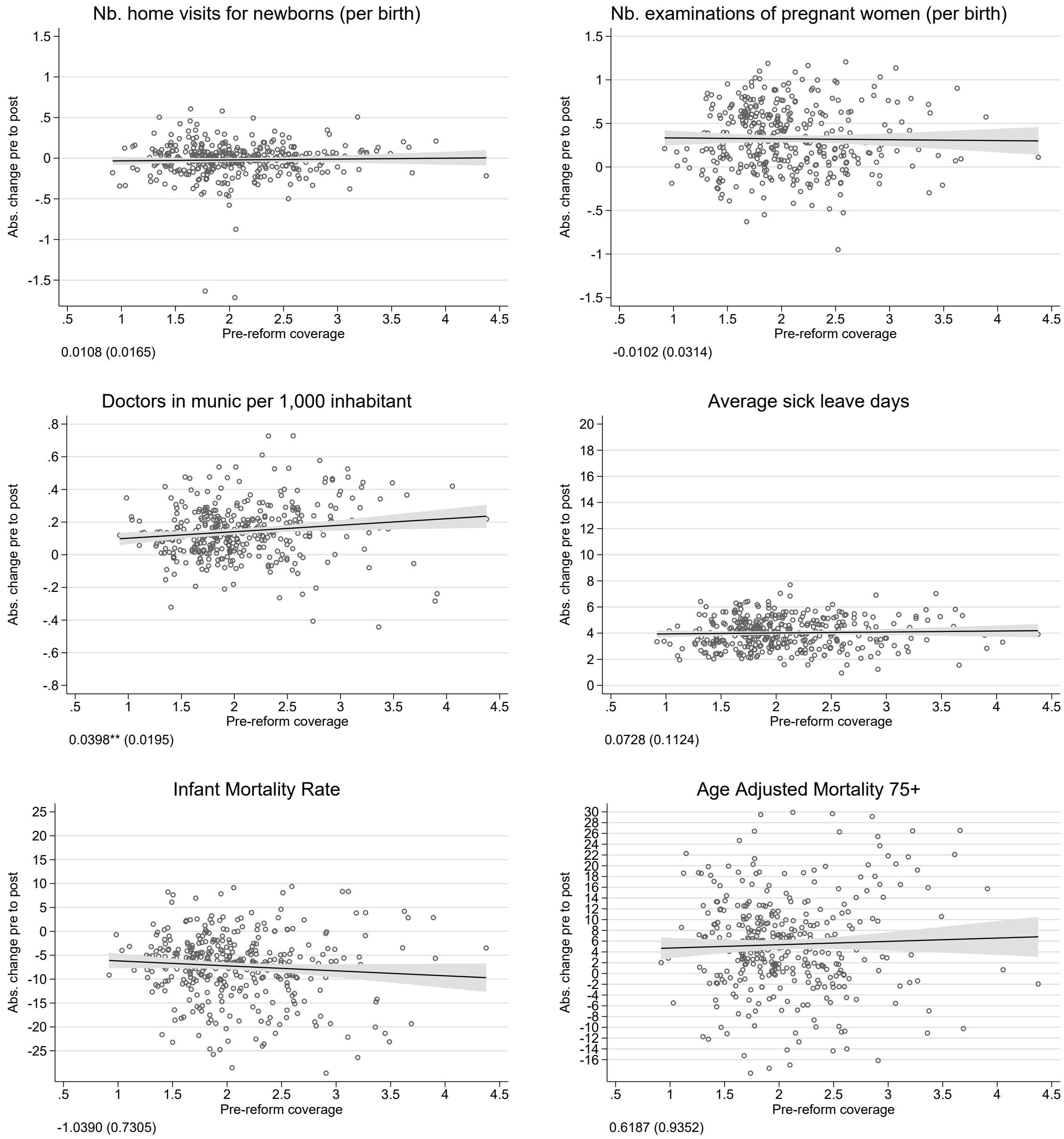


Note: In the graphs, the pre-reform level of school nurses per 1,000 children aged 6-19 is graphed against the change in each outcome from the pre-reform period to the post-reform period. The solid line shows the fitted values with a 95% CI. In the bottom left corner include for $\hat{\alpha_1}$ of the following model

$$\Delta Cov = \alpha_0 + \alpha_1 I_m + \varepsilon$$

where ΔCov is the change in coverage between the baseline (ie, average between 1995 and 1997) and 2008 and I_m is the negative of the pre-reform coverage between 1995 and 1997. Municipalities with less than 1,500 inhabitants are excluded.

Figure A7: Municipality Characteristics: Health Indicators and Supply of Health Services

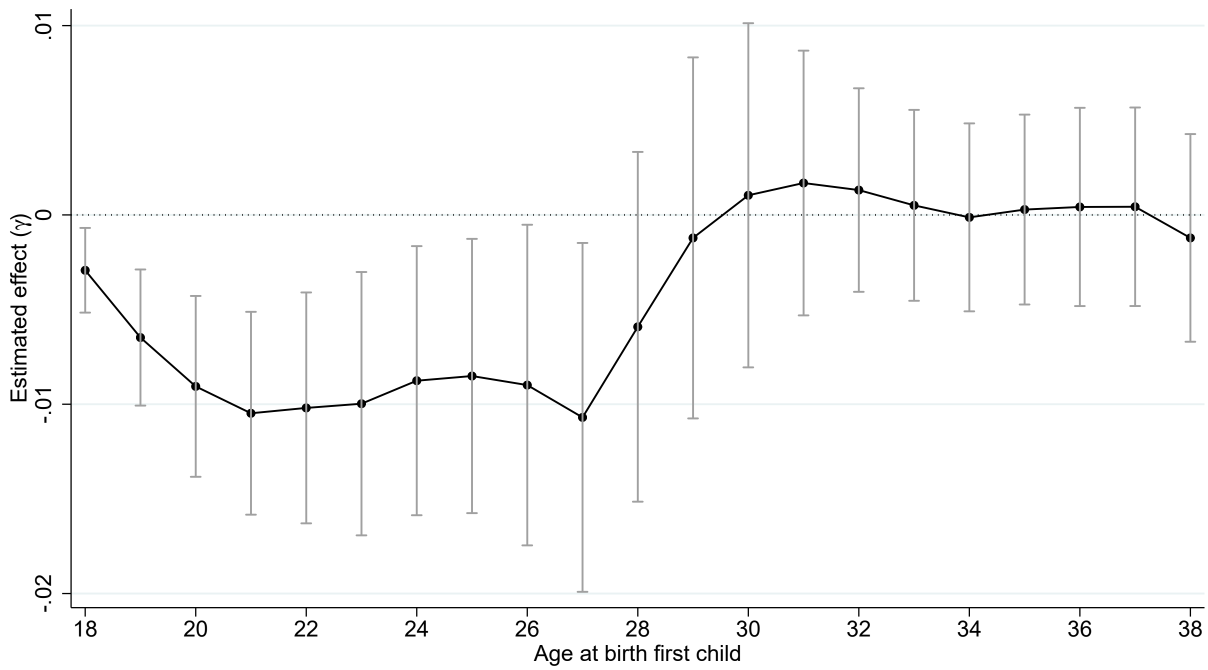


Note: In the graphs, the pre-reform level of school nurses per 1,000 children aged 6-19 is graphed against the change in each outcome from the pre-reform period to the post-reform period. The solid line shows the fitted values with a 95% CI. In the bottom left corner include for $\hat{\alpha_1}$ of the following model

$$\Delta Cov = \alpha_0 + \alpha_1 I_m + \varepsilon$$

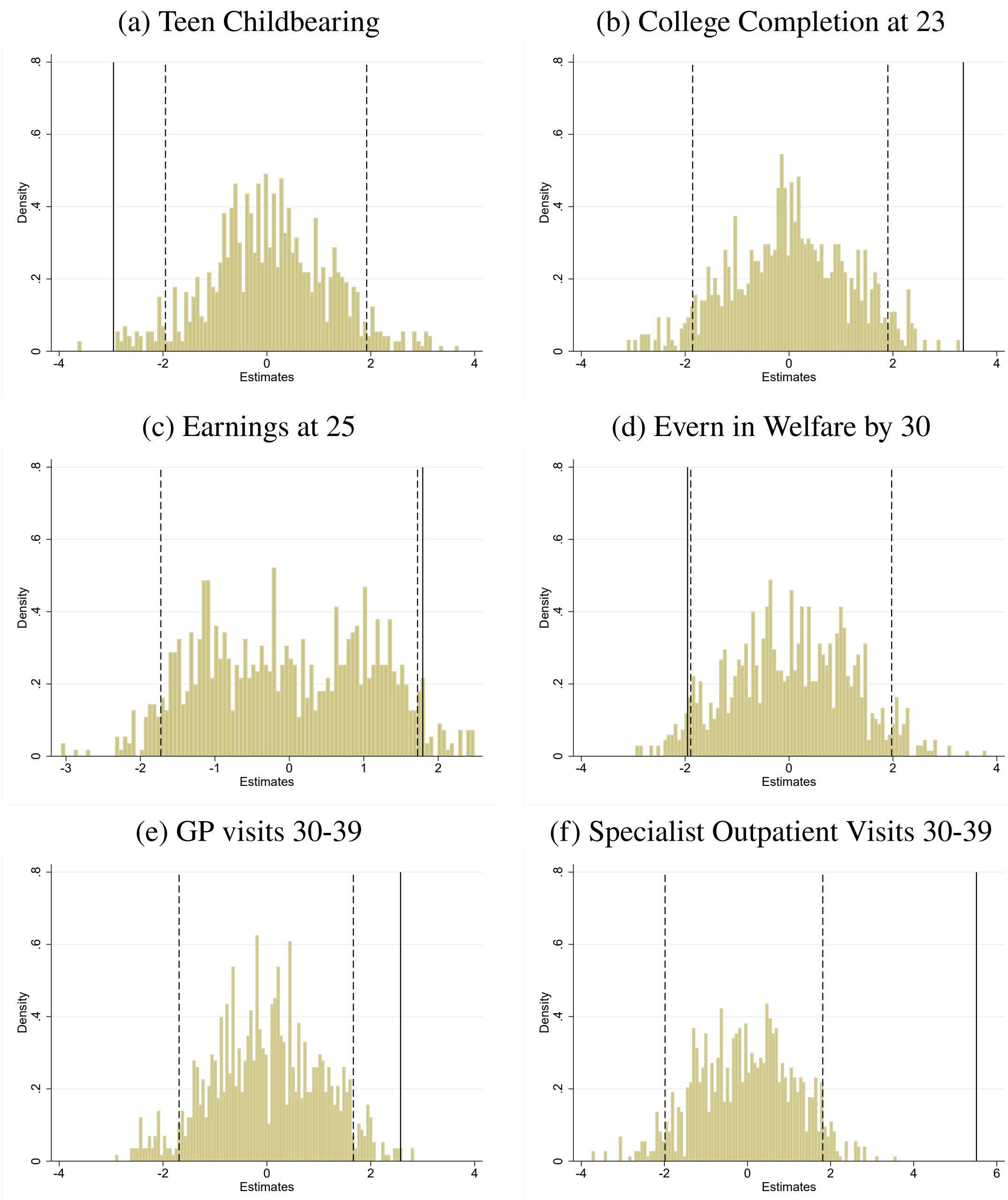
where ΔCov is the change in coverage between the baseline (ie, average between 1995 and 1997) and 2008 and I_m is the negative of the pre-reform coverage between 1995 and 1997. Municipalities with less than 1,500 inhabitants are excluded.

Figure A8: Probability of having first child at a given age



Note: The dots in the graph represent estimates for γ from model (1) along with the 95% confidence intervals. One regression is estimated for the probability of giving birth to the first child at ages between 18 and 38. Controls included in the regressions are: child's gender, mother's age at birth and education when child is 5 years old, dummies indicating whether mother and child are born in Norway, the number of siblings when child was 5, child's birth order, and whether there is information on the father. All regressions include fixed effects for the municipality of residence at age 5 and year of birth. Municipalities with less than 1,500 inhabitants in 1997 are excluded from all specifications. The 95% confidence interval is based on robust standard errors, clustered at the level of municipality of residence when child was 5 years old. * p<0.1, ** p<0.05, *** p<0.01.

Figure A9: Randomized Inference Analysis



NOTE: The figure presents the distribution of estimates of γ for model (1). The vertical solid lines are the t-statistics for the actual estimate for γ; the dashed lines are the 5th and 95th percentiles of the distributions of placebo treatment effects.

B Cost-Benefit Analysis

In this article, we present evidence that increasing the supply of modern school health services in municipalities with scarce services reduces teenage fertility, increases labor market attachment, and reduces welfare use among young adults. In addition, it increases the use of planned primary health services and in- and outpatient specialist care visits. To understand the economic magnitude of our results, we study whether the benefits outweigh the costs of the program using a simple cost–benefit analysis comparing the costs of hiring more school nurses to the early career effects on labor earnings.

The cost of hiring a full-time equivalent of a school nurse in 2014 was about 560,000 NOK per year (57,000 Euros/60,200 USD) (Sykepleien, 2014). When adding Social Security contributions (14.1% in Norway) and updating to 2015 NOK values, one extra school nurse costs 652,666 NOK per year. The present value of these costs over a typical school period of 13 years is given by $\sum_{t=6}^{19} \frac{652,665}{(1+r)^t}$ where r is the discount rate of 3%, which is the mean yield for 10-years government bonds [38] This translates into a present value of 6,359,637 NOK for 13 years of schooling (see Table A18). In an urban high school with on average 500 students, the present value of costs per student is then 12,719 NOK.

On the benefit side, we account for the effects on labor earnings. We assume that the reform affects only the first years of active work life, i.e. the annual earnings between age 25 and 30. Furthermore, selection into the labor market is unlikely to be an issue in our setting given the high participation rate of about 97%. Unlike in the settings of Bailey, Sun and Timpe (2021); Deming (2009); Neal and Johnson (1996) wage effects are likely not driven by selection in this study, and we therefore use actual earnings rather than potential earnings in our calculations. The present value of the benefits in terms of increased earnings is given by $\sum_{t=25}^{30} \frac{9,789}{(1+r)^t}$; which results in a present value of benefits of 26,087 NOK per individual (see Table A18).

In this analysis we have not taken into account the costs or benefits of increased use of health services. These costs should of course not be ignored, but as we have discussed earlier, we interpret these effects mainly as changes in health behavior, and the individuals we study are likely too young for us to be able to pick up on any positive effects on health due to preventive check ups.

We conclude that expanding the supply of school nurses passes a cost-benefit analysis in this context, even without accounting for the benefits from reduced welfare use, potential positive health effects of the individuals exposed to the reform, or effects on the next generation.

[38] See https://www.norges-bank.no/en/topics/Statistics/norwegian-government-securities/generiske-statsrenter/.

Table A18: Cost-Benefit Analysis

Program Costs	
Gross Salary of School Nurse (2014)	560,000
Gross Salary including Social Security Contributions (2014)	652,666
Present Value of Costs (during school duration) - ages 6 to 19	6,359,637
Cost per student (high school with 500 students)	12,719
Benefits	
Effect on earnings at 25	9,789
Present Value of benefits for one individual between ages 25 and 30	26,087

NOTE: We use a discount rate of 3%, reflecting the mean yield for 10 years government bonds (see `https://www.norges-bank.no/en/topics/Statistics/norwegian-government-securities/generiske-statsrenter/`).