Discharge on the day of birth, parental response and health and schooling outcomes☆

Hans Henrik Sievertsen*, Miriam Wüst

The Danish National Centre for Social Research, Herluf Trolles Gade 11, 1052 Copenhagen, Denmark

A R T I C L E   I N F O

A B S T R A C T

Exploiting the Danish roll-out of same-day discharge policies after uncomplicated births, we find that treated newborns have a higher probability of hospital readmission in the first month after birth. While these short-run effects may indicate substitution of hospital stays with readmissions, we also find that—in the longer run—a same-day discharge decreases children's 9th grade GPA. This effect is driven by children and mothers, who prior to the policy change would have been least likely to experience a same-day discharge. Using administrative and survey data to assess potential mechanisms, we show that a same-day discharge impacts those parents' health investments and their children's medium-run health. Our findings point to important negative effects of policies that expand same-day discharge policies to broad populations of mothers and children.

1. Introduction

Childbirth is expensive for health systems. Childbirth-related patients accounted for 23 percent of all discharged patients from US hospitals in 2005 (Sakala and Corry, 2008). To contain costs,

23 out of 26 OECD countries reduced the average length of post-partum hospital stays (i.e., hospital stay after birth) in the period 2000–2009 (see Appendix Fig. A1). However, a great degree of heterogeneity in the length of postpartum hospital stays—both across and within countries—remains. Factors explaining this variation include mothers' and children's underlying health, insurance status and variation in administrative procedures across hospitals or regions.

Postpartum hospital care for a general population of mothers and infants has two main objectives: First, health professionals monitor infant and mother well-being, and identify the potential need for medical treatment. Second, health professionals provide guidance to new parents to improve their skills and confidence in early child-parent contact. Thus shorter hospital stays at birth may have a number of short- and longer-run consequences: given shorter periods of monitoring, they may lead to mother and infant health problems remaining undiscovered. As a consequence, parents may after their discharge require additional hospital care or contacts with other health care professionals, such as gen-

eral practitioners.[1] Given less time for guidance, shorter hospital stays may impact parental knowledge and self-confidence, and ultimately, parental investments in children's health and development.

Important for policy, we still lack evidence that links the variation in the duration of postpartum hospital stays to differences in health and well-being across mothers and children. Moreover, we know little about the impact of care around birth on parental investments. For example, post-birth hospital stays and related medical services do not explain much of the variation in infant health outcomes between Austria, Finland and the US (Chen et al., 2016).

Studying data from the US, Almond and Doyle (2011) find that discharging mothers after two (or one) nights instead of three (or two) nights does not impact short-run health outcomes for an average population of mothers and infants. However, as they exploit exogenous variation in post-birth hospitalizations of at least one or two nights, their analyses may not be at the relevant margin—in terms of its impacts on child and mother outcomes. Evans and Garthwaite (2012) exploit variation in hospitalization length caused by legislative changes and identify heterogeneous effects of being discharged within 48 h. They find positive health effects of longer hospital stays for mothers and infants who experience complications. These findings, taken together, point to the importance of (i) the margin at which we evaluate the effect of a change in the length of postpartum hospital stay and (ii) the population of mothers and infants that we consider.

Denmark makes an excellent case for studying these two factors. First, five of 16 Danish counties, together accounting for 34 percent of all births, have introduced mandated discharge on the day of birth—a same-day discharge without formal maternity ward admission—for all uncomplicated births by multiparous mothers (i.e., non-first-time mothers) in the period 1990–2003. We exploit these policy changes in a difference-in-differences framework to evaluate the effects of the shortest possible hospital stay after birth on children and mothers. While not (yet) the norm in most OECD countries, our analysis of the effects of a same-day discharge is valuable in the light of a general debate about the optimal length of stay at hospitals after birth.

Second, the same-day discharge policies extended an (earlier) voluntary and infrequently used option to broad groups of the population: while around five percent of women and infants were discharged on the day of birth before the introduction of the same-day discharge policies (and these mothers consituted a highly selected sample), after the policy changes between 30 and 50 percent of multiparous mothers in treated countries experienced a same-day discharge. By analyzing effects on children of different types of mothers (as defined by their background characteristics and their resulting probability of experiencing a same-day discharge in the absence of a mandated policy), we are the first to study the potential heterogeneous effects of a population-wide mandated same-day discharge policy. Taken together, our results can inform policies in many countries about the potential costs of large-scale same-day discharge policies.

This paper contributes to the growing literature on the importance of early life health and health interventions for long-run health and economic outcomes (Almond and Currie, 2011; Almond et al., 2017; Black et al., 2007; Chay et al., 2009; Bharadwaj et al., 2013; Daysal et al., 2015; Breining et al., 2015).[2] Our study con-

tributes to the evidence on the impact of shortening postpartum hospital stay, a policy that is relevant in many developed countries. Given that previous studies on postpartum hospital stay have exclusively focused on short-run child outcomes, we still know very little about its longer-run effects. By using data on the universe of Danish births between 1985 and 2006, this paper considers impacts of postpartum hospitalization on first-year child and mother hospital readmission. Moreover, for the first time assessing longer-run consequences of postpartum hospitalizations, we study children's school achievement.

A final contribution of this paper is the focus on potential mechanisms for longer-run effects of a same-day discharge, among them the importance and nature of parental responses. To study mechanisms for the long-run effects of medical investments early in life, we use complementary survey data from the Danish National Birth Cohort and administrative data. Earlier work on parental responses to early-life health endowments is sparse (for an overview, see Almond and Mazumder, 2013). A small set of studies explicitly considers the impact of parental responses to early-life health improvements or shocks and highlight the need for further research on the topic: Aizer and Cunha (2012) find that parents invest more in higher endowed children. Adhvaryu and Nyshadham (2016) find that parents react to (and reinforce) in utero health shocks (measured as iodine exposure) by increasing post-birth investments in treated children (and their siblings). However, Bharadwaj et al. (2013) do not find that parental investments are mediating factors for the impact of post-birth treatment for very low birth-weight infants. Our research adds to this emerging line of research on the nature and importance of parental responses to child endowments and early life health interventions.

Our results show that rates of same-day discharge for multiparous mothers increased significantly in treated counties after the introduction of policies mandating same-day discharge. In treated counties, the share of mothers experiencing a same-day discharge increased by up to 300 percent. Exploiting the introduction of these policies as an instrument, we find that being discharged on the day of birth increases the probability of child hospital readmission in the first 28 days but not in the first year of life. At the mean of the dependent variable, first-month readmissions for marginal infants increase with 75 percent. We also find longer-run effects of a same-day discharge: being discharged on the day of birth leads to a significantly lower grade point average (GPA) in grade nine. We present an encompassing set of robustness tests that support our main results. Importantly, we show that there are no effects of the policies on same-day discharge rates and outcomes of first-time mothers and likely-untreated multiparous mothers (mothers with a complicated birth).

As a next step, we assess potential heterogeneous effects of the policy and the importance of parental responses. To do so, we group the population of mothers according to their probability of experiencing a voluntarily same-day discharge (i.e., we compute a propensity score for a same-day discharge in the pre-policy period based on mother characteristics). We then examine the effect of a same-day discharge in groups of mothers and children defined by their propensity score.

We find that, in the short run, children of the "highest-probability" mothers drive the effect on readmissions to hospital during the first 28 days. In the medium and long run, the picture looks different: while we find that a same-day discharge increases health care usage (measured as general practitioner contacts) for all children and mothers, we show that especially the

---

[1] This substitution effect may also be supply-side driven (i.e., by general practitioners and recommendations at the hospital).

[2] Particularly relevant for our study are papers demonstrating the impact of medical treatment early in life: Chay et al. (2009) demonstrate that improved access to medical care for black children narrowed the black-white achievement gap observed in the US. Bharadwaj et al. (2013) find that low birth-weight infants treated with intensive medical care at birth do better than their untreated counterparts in terms of educational achievement. Daysal et al. (2015) show that giving birth at a hospital

rather than at home reduced mortality among low-risk newborns. Breining et al. (2015) show that both the focal children and their siblings experience long-run educational benefits of treatment assigned to very low birth weight infants.

"lowest-probability" mothers (who would have been least likely to experience a same-day discharge in the absence of a policy) are less likely to breastfeed exclusively at four months of their child's life and are more likely to report poor health of their child at age seven. Also in the longer-run, we find that children of "lowest-probability" mothers drive the negative effect of a same-day discharge on schooling outcomes.

These findings taken together suggest that heterogeneous parental responses appear to be an important factor determining the long-run effects of a same-day discharge. Parents can offset the negative long-run effects of a same-day discharge for their children, potentially by demanding more contacts to health professionals or focusing on other investments.

Our results are in line with studies that show that lack of early parental investments can be directly linked to lack of adequate postnatal care (Kramer et al., 2008; Fitzsimons and Vera-Hernandez, 2014). Mothers may as a consequence lack knowledge, skills or confidence in parenting.[3] The lack of postnatal care may also matter for (on average) relatively experienced groups, such as multiparous mothers. Thus our results point to important costs resulting from the expansion of early discharge policies to broad groups of the average population of mothers and their children.

The remainder of the paper is organized as follows. Section 2 describes relevant features of the Danish health care system and the development of same-day discharge-policies over time. Section 3 presents our empirical strategy. Section 4 describes the data used in our analysis. Section 5 presents our main results and a set of robustness tests. We furthermore present an analysis of the heterogeneity of effects and an analysis of potential mechanisms. Section 6 concludes.

2. Background: births and postpartum care in Denmark

2.1. Relevant features of the Danish health care system

The Danish health care system consists of a municipal primary sector encompassing GPs, pharmacies, nursing homes and the home visiting nurses for infants and new mothers; and a secondary sector covering public hospitals under the responsibility of Danish counties.

Prenatal care consists of three GP examinations throughout pregnancy and four to seven examinations by a midwife, all of which are free. During the first trimester, GPs refer mothers to a public hospital, where midwife consultations and ultrasound examinations by trained nurses take place, and where the mother will give birth.[4] In Denmark only public hospitals provide birth assistance. Most births in Danish hospitals are assisted by trained midwives, with obstetricians and other doctors participating only in the case of complications. While mothers can in principle freely choose among all public hospitals in Denmark, the norm is that mothers are referred to the nearest hospital. The mothers' choice of hospital is further constrained by the hospitals' capacity, i.e. mothers can only choose a different hospital from the default hospital if the other hospital has free slots.

Postnatal care consists of a postpartum hospital stay and visits by a municipal home visiting nurse. The home visits start on average within 10 days after birth and end when the child is one to

Fig. 1. Share of multiparous mothers discharged on the day of birth. *Notes*: The vertical lines show the policy change years. The data cover all multiparous mothers who gave birth at a Danish hospital.

Table 1
Policy variation: introduction of same-day discharge policies in Danish counties.

County	Date	Parity	Motivation	Primary source
Aarhus	1.1.1990	>1	Cost con-tain-ment	(Aarhus Amtskommune, 1990)
Ringkøbing	1.1.1990	>1		(Kierkegaard, 1991)
Viborg	1.1.1993	>1		(Sundhedsplejerskegruppen, 1995)
Vejle	1.1.2002	>1		(Drevs, 2012)
Ribe	1.1.2003	>1		(Jensen, 2013)

two years old.[5] Moreover, both mothers and infants are entitled to scheduled GP examinations. The number of planned examinations within the children's first six years was reduced from eight to seven in 1995 (Sundhedsstyrelsen, 1995). Three of the scheduled examinations are in the first year after birth. However, also in 1995, the Danish National Board of Health suggested that children who were discharged on the day of their birth should be offered an additional GP visit. This latter change may impact the interpretation of our short-run health measure for GP contacts.

2.2. Postpartum hospital stay in Denmark 1985–2006

Fig. 1 shows yearly means for the share of multiparous mothers, who experienced a same-day discharge in the period 1985–2006. The figure shows—in line with existing small-scale studies—that voluntary same-day discharge in treated and never-treated counties accounted for less than five percent of all multiparous births in 1985 (Fabrin and Olsen, 1987; Fyns Amtskommune, 1987). As the vertical lines in Fig. 1 illustrate, the counties that introduced mandatory same-day discharge in the period we consider see jumps around the timing of introduction of these policies. These jumps departed from the overall trend towards more same-day discharge from the early 1990s.

Table 1 gives an overview of the policy changes in five out of 16 Danish counties that we use to identify the effect of a mandated same-day discharge on child and mother outcomes. All policies were introduced by elected county governments at a centralized level, were targeted at large parts of the population of mothers, were motivated by the aim of cost containment, and were imple-

---

[3] As our results show the importance of parental responses, we do not opt for a family fixed effect design as a further robustness test.

[4] Mothers in the 1980s and 1990s had no legal right to ultrasound examinations. This right was introduced in 2004. By that time, the majority of pregnant women already received two ultrasound examinations during pregnancy (Jørgensen, 2003). From 2004 onwards, all women have been entitled to two ultrasound examinations, around weeks 12 and 20 of the pregnancy.
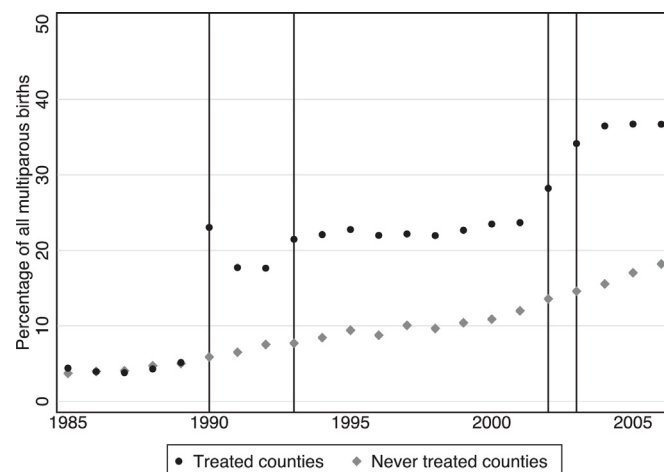
[5] The number of visits—and whether any visits after the first year of life are provided—depends on the municipal service level and has also changed considerably over time.
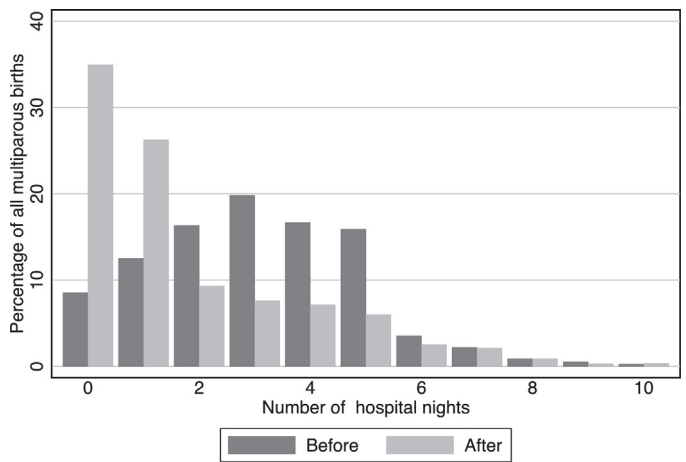
mented without additional changes in other services at the county level.[6] Reflecting a perceived greater need for post-partum care, none of the treatment counties introduced mandated same-day discharge policies for first-time mothers.

As Appendix Fig. A2 illustrates, two counties in central Jutland (Aarhus and Ringkøbing county) were the first to introduce mandated early discharge for multiparous mothers with uncomplicated births in 1990 (Kierkegaard, 1991; Kierkegaard et al., 1992; Lange, 1992; Kierkegaard and Monrad Hansen, 1993). Physicians and midwives/nurses made the descision on mothers' and children's discharge from hospital (both before and after the policy change). To assign a same-day discharge, they took a combination of maternal and child characteristics into account (Kierkegaard and Monrad Hansen, 1993). Mothers with complicated births (or Caesarean Sections) or children with health problems were exempted from the new same-day discharge policies. Apart from medical criteria (an uncomplicated at-term birth of a healthy child and no apparent health complications for the mother), also social criteria were explicitly to be taken into account. For example, mothers with social issues related to, e.g., their housing situation, their marital status, their (lack of) social network, immigrant status, psychological problems, or young age were typically excluded from the pool of potential early discharge mothers (see, for example, Aarhus Amtskommune, 1990). Thus the new policy left a significant amount of discretion to medical professionals at the hospitals.

Both counties left other services for new mothers and their children unchanged. However, midwives provided a home visit to early-discharged mothers after birth, and a few municipalities in the two counties provided additional home visits by home visiting nurses for early-discharged mothers (Kierkegaard et al., 1992). The county of Viborg introduced mandatory same-day discharge for multiparous mothers in 1993. Only one of 16 municipalities in Viborg county increased the resources for the home visiting program as a reaction to this policy change (Sundhedsplejerskegruppen, 1995).

In a second wave, the counties of Vejle and Ribe introduced mandatory same-day discharge policies in 2002 and 2003, respectively (Drevs, 2012; Jensen, 2013). While other counties also saw increases in same-day discharge rates, none introduced policies that led to sharp increases in the probability of experiencing a same-day discharge similar to that of the five treatment counties.

Finally, Fig. 2 shows the distribution of hospital stays for mothers who gave birth one year before and after the policy changes, respectively, in the treated counties. There is a clear shift in the distribution of hospital stays towards a larger share of mothers experiencing very short stays (from one to four nights to zero to one midnight). This change both reflects overall trends towards shorter hospital stays (which we flexibly account for in our analyses) and the introduction of same-day discharge policies.[7] At the same time, the tail of the distribution remains remarkably unchanged. This finding suggests that the treatment of mothers and children with more complicated births and other health needs—at least in terms of length of stay—remained unaffected by the policy changes. Together with the fact that counties implemented these policies to contain costs, this pattern indicates that no additional resources were used on mothers and children, who were not discharged on the day of birth.

---

[6] We have analyzed the impact of the policies on the number of midwife visits and we find no indication of an effect of the introduction of the same-day discharge policies on this main component of Danish prenatal care. Results (event graphs parallel to the ones presented for our outcomes in Fig. 3) are available on request.

[7] Given that we use calendar day data, as detailed in the data section, the increase of mothers with one night at the hospital is also driven by early discharges of mothers who give birth close to midnights. Thus in our analyses we underestimate the prevalence of a same-day discharge. For more details, see Section 4.

Fig. 2. Pre- and post-policy distribution of hospitalization length for multiparous mothers. *Notes*: The histogram includes data for births by multiparous mothers in a one-year window around the policy implementation in hospitals in treated counties.

3. Empirical methods

To estimate the effect of same-day discharge on the outcome y for individual i, born at time t in hospital h, we may compare outcomes across mothers and children who have or have not experienced the treatment. However, this comparison is likely biased as the duration of hospital stay is not randomly assigned at the individual level: obstetricians and midwives decide on the length of postpartum hospitalization based on not only observed child and mother characteristics such as gestational length, birth weight and mothers' characteristics (e.g. age, education, and income), but also characteristics unobserved by the researcher. As mothers and children with more favorable unobserved characteristics may on average have more favorable health outcomes and be more likely to experience a same-day discharge, a comparison of births across different lengths of hospital stay may lead to biased estimates of the effect of being discharged on the day of birth.

To overcome this problem, we exploit variation in administrative rules over time and across Danish hospitals in a difference-in-differences framework (DiD). While our setting has several attractive features that may encourage a regression discontinuity design (e.g. clear cut-offs in the forcing variable, administrative and daily data for a population of births), we lack power to locally exploit the policy changes.

The sudden increase in the share of same-day discharge in the hospitals of five counties gives rise to exogenous variation in the probability of being discharged from hospital on the day of childbirth. Thus we compare the differences in outcomes of multiparous mothers who give birth before and after the implementation of new administrative policies in treated hospitals to the differences in outcomes of multiparous mothers who give birth in the same years in non-implementing hospitals. Our reduced form relationship is:

$$y_{ith} = \gamma_0 + \gamma_1 Post_t \times Treated_h + \boldsymbol{\alpha}'_1 \boldsymbol{X}_{ith} + \boldsymbol{\alpha}'_2 \boldsymbol{\lambda}_h$$
$$+ \boldsymbol{\alpha}'_3 \boldsymbol{\theta}_t + \boldsymbol{\alpha}'_4 \boldsymbol{\omega}_h \times f(\text{year}) + \epsilon_{ith} \tag{1}$$

where $\boldsymbol{X}_{ith}$ is a vector of child and mother covariates and ϵ_{ith} is a random error. As hospitals vary systematically in their population of mothers, we include $\boldsymbol{\lambda}_h$, a set of hospital indicators accounting for time-invariant differences across hospitals. Hospitals are nested in counties, the level of the policy changes. $\boldsymbol{\theta}_t$ is a set of year indicators, accounting for macro shocks. As mothers' and children's outcomes may develop differentially across hospitals (e.g. due to the faster adoption of new technologies in some hospitals or differential

Table 2
The effect of the same-day discharge policies on child and mother observable characteristics.

Outcome	Estimate	Sample mean
Child birth weight	10.461	3571
	(11.707)	
Child bw <2500 g	0.000	0.030
	(0.002)	
Child gestational age	−0.031	39.73
	(0.042)	
C-section	−0.002	0.125
	(0.005)	
Mother taxable income	0.214	176.2
	(1.099)	
Mother has a higher education	−0.005	0.286
	(0.004)	
Mother age	0.048	30.85
	(0.057)	
Mother is married	0.003	0.629
	(0.006)	
Mother is unemployed	−0.001	0.131
	(0.004)	
Child born outside home county	−0.009	0.080
	(0.007)	
Included in DNBC	−0.001	0.127
	(0.018)	

Notes: Each cell presents estimates from separate regressions of child and mother observables (sample of multiparous mothers) on an indicator for a post-reform birth in a treated hospital (RF), year and hospital fixed effects, and hospital-specific quadratic trends. Clustered standard errors (at the hospital-level) in parenthesis. $^*p < 0.1$, $^{**}p < 0.05$, $^{***}p < 0.01$.

Table 3
The effect of same-day discharge on readmissions and school achievement, sample of primiparous mothers.

Outcome	Estimate	Sample mean
A. First stage		
Same-day discharge	−0.004	0.017
	(0.003)	
B. Reduced form		
Child readmitted ≤ 28 days	0.001	0.040
	(0.003)	
Child readmitted ≤ 365 days	−0.012***	0.189
	(0.004)	
Mother readmitted ≤ 28 days	−0.001	0.020
	(0.003)	
Mother readmitted ≤ 365 days	−0.006	0.077
	(0.006)	
Observations	591,459	
Child 9th grade GPA	0.009	0.120
	(0.017)	
Child 9th grade GPA, math	0.007	0.116
	(0.020)	
Child 9th grade GPA, Danish	0.004	0.119
	(0.016)	
Observations	270,944	

Notes: Each cell shows point estimates from a separate regression. All models include year and hospital fixed effects, and hospital-specific quadratic trends and all covariates (indicators for low birth weight, pre-term birth and a Caesarean section birth, mother's age at birth, employment status (indicators for being unemployed, self-employed, in education), taxable income and educational level). Missing values are set to zero, and indicator variables for missing values are included. Panel (A) provides the first stage coefficient. Panel (B) provides the reduced form regression coefficients. Clustered standard errors (at the hospital-level) in parenthesis.
$^*p < 0.1$.
$^{**}p < 0.05$.
*** $p < 0.01$.

changes in the population of mothers), we include $\omega_h \times f(year)$, to account for hospital-specific time trends. $Post_t \times Treated_h$ indicates a birth in a hospital in treated counties after the introduction of a same-day discharge policy and, consequently, γ_1 measures the reduced form impact of the policy change on child and mother outcomes.

To estimate the effect of a same-day discharge on the mothers who are discharged on the day of birth due to the policy change (a LATE for compliers of the policy), we exploit the administrative changes as an instrumental variable. Thus in a first stage regression we estimate:

$$SDD_{ith} = \beta_0 + \beta_1 Post_t \times Treated_h + \boldsymbol{\tau'_1 X_{ith}} + \boldsymbol{\tau'_2 \lambda_h}$$
$$+ \boldsymbol{\tau'_3 \theta_t} + \boldsymbol{\tau'_4 \omega_h} \times f(year) + \epsilon_{ith} \qquad (2)$$

β_1 measures the increased probability, due to the policy change, of being discharged on the day of birth.

3.1. Identifying assumptions

Given that we use across-county differences in administrative rules, we rely on the common trend assumption, i.e. that the differences in the outcomes of multiparous mothers and their infants (for example in Aarhus county and the remaining counties) would have remained constant over the period in the absence of the treatment. This assumption may be violated if the composition of the Aarhus county population changed differentially (and if the time trends that we specify fail to account for this change) or other policies were implemented in Aarhus.

We perform two tests to assess the plausibility of the common trend assumption. First, to examine the impact of same-day discharge policies on the composition of multiparous mothers, we regress a wide range of mother and child characteristics on the reform indicator (in regressions defined by Eq. (2)). We should not see an effect of the policy changes on these observable characteristics. As Table 2 shows, the same-day discharge policies did not impact a variety of observable mother and child characteris-

tics (with precisely estimated zeros across outcomes). Thus we rule out that the policy changed the composition of mothers in treated counties. In the bottom of Table 2 we also show that the same-day discharge policies did not impact the share of mothers who (1) gave birth in a hospital located in another county than their county of residence[8] and (2) participated in the Danish National Birth Cohort (DNBC) in the period 1997–2003. We use this latter survey data set (described in detail in Section 4) in our analysis of potential mechanisms for the effects of a same-day discharge.

Second, we further exploit information on children's parity and birth mode. If other policies (such as new medical routines directed at newborns and their mothers) were implemented at the same time as the same-day discharge policies, we may also expect changes in the outcomes of first-time mothers and their children or children born by Caesarean section (who usually are considered a "complicated birth" and therefore de not experience a same-day discharge). First, we perform our DiD analysis on the sample of first-time mothers. As shown in Table 3, there is no first stage for first-time mothers, i.e. we are certain that the policy did not impact them. The reduced form estimates are very small and mostly imprecise for first-time mothers and their children. As we further discuss in Section 5.1, while we lose precision, triple difference estimates—that compare differences in outcomes for primi- and multiparous mothers before and after the policy change in treated counties to the same differences in differences in untreated counties—are in line with our main results based on multiparous mothers and their children.

Second, we perform similar placebo regressions using a sample of multiparous mothers, who should not be treated by the same-day discharge policies: mothers who give birth by Caesarean

---

[8] The vast majority of mothers (over 90%) give birth in a hospital in their county of residence.

section (CS). As Appendix Table A2 shows, in line with what we would expect, we do not find any first stage for these mothers and the reduced form estimates are mostly small and imprecise. While these results constitute an informal placebo test, they support that we do not confuse the impact of the same-day discharge policies with the effect of other policies implemented at the same time.

3.2. Inference

In our main analyses, we cluster standard errors at the hospital-level. Thus we allow for arbitrary correlation within around 60 hospital-cells. As stated above, hospitals are nested in counties. As hospitals have a catchment area and selected hospitals serve women with special needs (such as twin mothers), the population of patients differs across hospitals with respect to their background and health. Thus hospitals make a natural level for accounting for correlations in the outcomes of mothers or children. As we exploit county-level policy changes a natural alternative to our level of clustering would be county-level clusters. However, given the small number of counties (N_{county} = 16), we cannot cluster standard errors at this level. While wild cluster bootstrap standard errors are usually advocated in few-cluster situations like ours, McKinnon and Webb (2016) show that they perform poorly in cases with few treated clusters.

Thus to test the robustness of our hospital-level inference, we apply a permutation test inspired by McKinnon and Webb (2016).[9] In this test, we assign the treatment initiation date (the same-day discharge policy) 10,000 times to random year × county-cells. For each assignment, we compute the t-values from the reduced form regression of the outcomes on the reform indicator, birth year, county fixed effects and county trends. The p-value for our permutation test is defined by the fraction of placebo t-values that are more extreme than the one from our main analysis. We chose the "randomization inference" based on t-values rather than beta-estimates (for the treatment indicator, as applied e.g. in Chetty et al., 2009) because McKinnon and Webb (2016) show that this method performs better in the case of few treated clusters. Given the non-parametric nature of this test, we expect the resulting p-values to be somewhat larger than those in our main analysis. As further detailed in Section 5.1, the permutation test indicates that our inference in the main analysis, based on hospital cells, is reasonable.

4. Data and summary statistics

4.1. Data sources and sample construction

To construct our main sample we use information on all registered live births in Denmark from 1985 to 2006. In our main analyses we restrict these data to the 733,373 multiparous births of that time period.[10] Thus we do not exclude mothers or children with health problems from our sample but rather compare estimates with and without controls for, among other variables, health at birth.[11] As mothers and children with observed health problems never experience a same-day discharge, in accordance with our expectations, including controls for mother and child observables increases precision of our estimates but does not impact our main conclusions.

While we have data on hospital admissions for the period 1985–2006, other data sources are available only for subsets of this period (see also Appendix Table A1): our GPA sample comprises children who completed 9th grade in the period 2002–2012 (roughly the cohorts 1987–1997). To further assess potential mechanisms for long-run effects of a same-day discharge, we additionally use survey data from the Danish National Birth Cohort (DNBC) (for details on this survey see, e.g. Olsen et al., 2001). This survey is linked to the administrative data and contains initially a sample of around 100,000 births from the period 1997–2003. For the DNBC data collection, pregnant women were invited to participate in two pre-birth and up to four post-birth surveys (at 6 and 18 months, 7 years and 11 years). The survey waves collected a broad set of health-related measures, among them information on maternal health behaviors, maternal investments in children's health and development, and mother-reported child health. We use data from the 18 month and seven-year interviews for all mothers and their children. Although the DNBC suffers from some attrition between waves and thus is not a representative sample of Danish mothers and children, at the last interview (currently at age 7) around 60 percent of mothers still participated (Jacobsen et al., 2010).

4.2. Variable definitions

We use hospital records from the Danish Inpatient Register to compute the length of hospital stay at birth. As we have daily (not hourly) information on hospital admissions and discharges, we define a same-day discharge as a hospital discharge of the mother and child on the calendar day of birth. As a result—and as we always define discharges that are on another calendar day (e.g. during the same night but after midnight) as a full hospital night—we underestimate the prevalence of same-day discharge. In all treated counties, mothers who gave birth during the evening and night (i.e. close to midnight) were (as a default) also discharged a few hours later (but most likely on the next calendar day). To account for children's direct admission to another hospital ward after birth, we define all same-day admissions to another ward as one single hospital spell, not as a readmission (moving children from the maternity ward to other wards in case of health issues is common).

To measure maternal and child health outcomes, we use the Inpatient Register data to construct measures for mother and child hospital readmissions within the first 28 days and within the first 365 days after birth.[12] To measure child school achievement, we use data on the children's 9th grade GPA—when children are approximately 15 years old—from the Danish Ministry of Education. We create an unweighted and standardized (by school year) GPA based on all grades given in 9th grade in mathematics and Danish. The grade point average is the average over final exams, oral and written, and teacher evaluations.

As existing studies have found very small effects of length of postpartum hospital stay on readmissions (Almond and Doyle, 2011; Evans and Garthwaite, 2012), and as we are interested in potential mechanisms for longer-run effects of a same-day discharge, we also evaluate less severe health outcomes. We examine the number of mother and child GP contacts within the first month and the first three years of the child's life. Our GP analyses are constraint by data structure and availability: First, we only have data on GP contacts from 1997 onwards. Second, our GP records include one observation per GP "contact", each of which may contain sev-

---

[9] We have also computed standard errors using a wild cluster bootstrap as suggested in Cameron and Miller (2015). Our main conclusions are unchanged. Results are available on request.

[10] We exclude multiple births (three percent of the gross sample) and observations with missing hospital information (home births or births outside Denmark, 1.7 percent of the gross sample).

[11] We do not restrict our main analysis sample as we do not have a fixed set of criteria used at the treatment hospitals.

[12] We do not consider neonatal or infant mortality, because both are extremely low in Denmark (The Danish National Board of Health, 2004). Thus we lack power to examine these outcomes. Given a data break in the Inpatient Registry in 1994 we can only study readmissions and not outpatient contacts for the entire period that we consider.

Table 4
Summary statistics, means and standard deviations.

	Mean	SD	N	Yearly means		
				1985	1998	2006
Child characteristics						
Male child	0.51	0.50	736,247	0.51	0.51	0.51
Child birth weight	3571.27	559.16	734,022	3479.49	3606.30	3611.80
Child bw <2500 g	0.03	0.17	734,022	0.04	0.03	0.02
Child preterm birth	0.04	0.19	731,694	0.04	0.04	0.04
APGAR < 7	0.00	0.07	345,009		0.00	0.00
Child born outside home county	0.08	0.27	718,918	0.06	0.09	0.14
Child hospital nights at birth	3.46	6.15	736,247	5.29	3.11	2.26
Same-day discharge	0.14	0.35	736,247	0.04	0.14	0.24
Child readmitted ≤ 28 days	0.04	0.20	736,247	0.03	0.04	0.06
Child readmitted ≤ 365 days	0.21	0.40	736,247	0.18	0.20	0.24
Mother characteristics						
Mother age	30.85	4.46	727,218	29.57	31.13	32.15
Mother age < 18 years	0.00	0.01	727,218	0.00	0.00	0.00
Caesarean section	0.13	0.33	736,247	0.11	0.11	0.18
Mother is married	0.63	0.48	727,218	0.66	0.64	0.64
Mother has a higher education	0.29	0.45	709,891	0.24	0.28	0.41
Mother taxable income	176.16	85.07	695,576	166.02	175.95	192.19
Mother is unemployed	0.13	0.34	727,218	0.16	0.13	0.11
Mother is in education	0.02	0.14	727,218	0.02	0.01	0.03
Mother readmitted ≤ 28 days	0.02	0.14	733,373	0.01	0.04	0.03
Mother readmitted ≤ 365 days	0.10	0.29	733,373	0.10	0.10	0.08

Notes: The data covers all multiparous births in Danish hospitals in the period 1985–2006.

eral services, and (as the data are on GP reimbursements) we lack a precise measure of the timing of the contacts. Thus, to measure the timing of the GP contact, we use information on the week the GP requested a reimbursement within the public payment system. We assume that this week is shortly after service provision.

Using survey data from the DNBC we add additional measures for parental investments and mother-reported measures for child health to the analysis. From the six-months DNBC survey wave, we create an indicator for maternal (exclusive) breastfeeding of the child for at least four months. As another proxy for parental health investments, we create an indicator for the child's having received all scheduled vaccines at age 18 months. Furthermore, from the seven-year interview we add a mother-reported measures of child health to the analysis: an indicator for the child's being in poorer health than average for children of the same age.

To assess the importance of differences in observable characteristics between mothers and children, we estimate our main regressions both with and without a rich set of mother and child controls. We use administrative data on maternal background characteristics including employment status (indicator variables for whether the mother is in education or unemployed), gross income, education (an indicator variable for whether the mother has completed an educational level higher than high school), marital status, and age at childbirth. We measure all socio-economic background characteristics with a two-year lag for births in the first six months of the year and with a one-year lag for births in the last six months. For example for births in December 1989 or January 1990 the background characteristics are measured in 1988. This shift ensures comparability in background characteristics around the timing of the policy change. We also control for mother's age at birth and civil status. For the child, we control for indicators for low birth weight, prematurity (gestational age at birth <37 weeks), and an indicator for a Caesarean section (as a proxy for complications at birth). For missing values, we impute a zero and include a set of indicator variables that take the value of one for observations with a missing value for the respective covariate.

Table 4 provides summary statistics for selected outcome and control variables in our main sample of multiparous children and their mothers, and sample means for selected years in the period considered (only administrative data). The table indicates that

child readmission rates increased over the period, while the average number of postpartum hospital nights decreased. Similarly, changes in other variable means, such as the share of Caesarean-section births (as a proxy for the share of uncomplicated births and/or changes in medical technologies applied), indicate the importance of controlling for trends in our analyses.

5. Results

5.1. Graphical evidence: first stage and reduced form

Fig. 1 graphically presents the variation we use to identify the effect of a same-day discharge. It shows the yearly share of same-day discharge births for multiparous mothers before and after the introduction of the same-day discharge policies in hospitals in treated and never-treated counties (the between-county variation used in the DiD estimation). Appendix Fig. A3 shows the figure "disaggregated" for the individual treated counties. It illustrates (i) clear jumps in early discharge rates around the introduction of the policies in all treated counties and (ii) flat and parallel pre-treatment trends across treatment and (never-treated) control counties.[13]

In a further examination of the impact of the same-day discharge policies, Table A3 presents the results of a complier analysis. We split our sample along a set of dimensions (likely to be observed by health professionals) and estimate our first stage relationship in these subsamples. The table also presents the share of mothers and children in the respective groups who experienced a same-day discharge in untreated year-cells (i.e., in the treated counties in the years prior to the policy change and in untreated counties).

Appendix Table A3 confirms that the large-scale same-day discharge policies—in line with the aim of the policies—primarily affected mothers with children in good health at birth (measured here as birth weight and gestational age). At the same time, as illustrated by the F-statistics, there is a strong and sizeable first stage for mothers with different backgrounds. As confirmed by

---

[13] Figures for the yearly early discharge rates for first-time mothers in treated and untreated counties do not show any jumps for the treated counties (figures available on request).
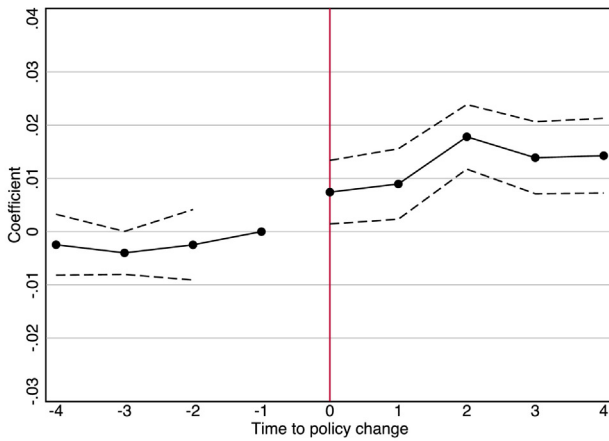
(a) Child readmitted ≤ 28 days
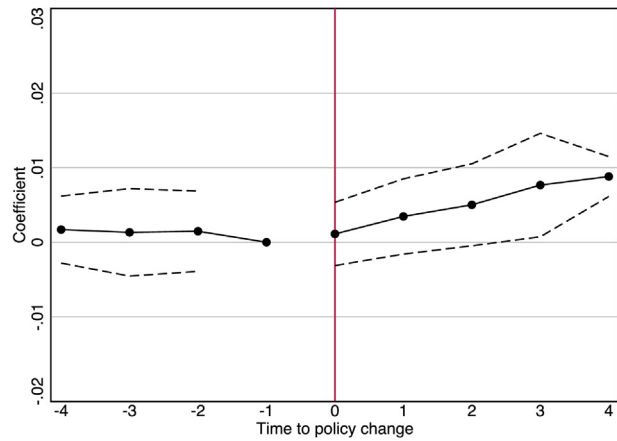
(b) Mother readmitted ≤ 28 days
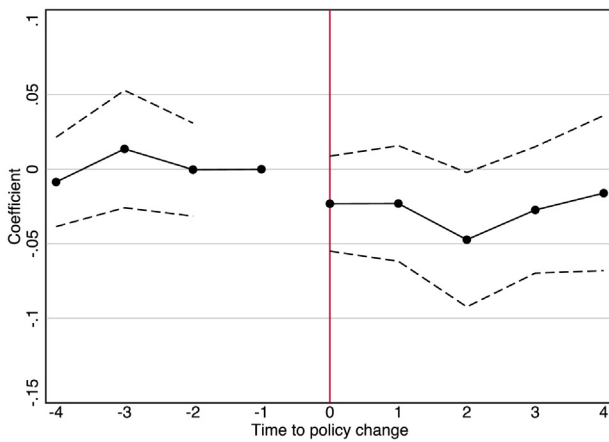
(c) Ninth grade GPA, Danish
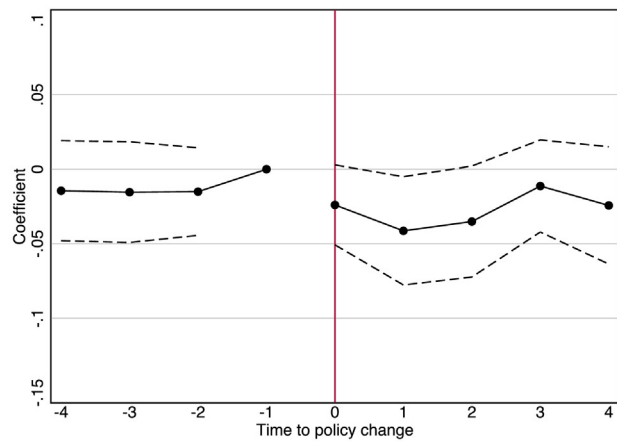
(d) Ninth grade GPA, maths

Fig. 3. Event graphs for child and mother outcomes. *Notes*: The graphs are based on a regression (for the treated counties and multiparous mothers only) of the outcome on a set of year-to-intervention indicators and a full set of controls. Each graph shows point estimates and 95% confidence intervals for the year-to-intervention indicators. The reference category is the year before the intervention ($t = -1$).

anecdotal evidence, the complier analysis suggests that health care professionals did not assess mothers according to single observable characteristics when deciding on allocating a mandated same-day discharge. Rather than that, for healthy women and their children same-day discharge decisions were based on the assessment of a set of risk factors (mothers' age, civil status, education, employment), which in combination may be predictive of parental need for a post-birth hospital stay (Kierkegaard and Monrad Hansen, 1993). We return to the heterogeneity of the impact of a same-day discharge and its impact on parental response in Sections 5.3 and 5.4.

For central short- and longer-run outcomes of our analyses, Fig. 3a–d shows event graphs for multiparous mothers and their children in treated counties (the reduced form). The figures plot estimates and confidence intervals from a regression of outcomes on indicators of time to treatment. We expect the event graphs to show an impact of the introduction of the new policies only after time $t = 0$. In line with this expectation, the graphs indicate flat pre-trends and changes in child first-month readmission rates in the first year after the introduction of the policies. Moreover, for our long-run outcomes—9th grade GPA in Danish and maths—we observe the same pattern. For mothers' readmissions, we do not see a clear jump around the introduction of the same-day discharge

policies, but potentially a trend towards higher readmission rates in the years after the policy changes.

5.2. Main results and robustness

Given the graphical evidence, Table 5 presents our main results for the effect of a same-day discharge on mother and child health outcomes. Panel (A) shows our first stage estimates (FS). Panel (B) presents reduced form estimates (RF) for regressions of our outcome measures on an indicator for a post-treatment birth. Panel (C) presents two-stage least squares estimates (2SLS).

Each cell presents point-estimates and standard errors from a separate regression. All specifications account for hospital and year fixed effects, as well as hospital-specific quadratic trends in birth year. Standard errors are clustered at the hospital level. In column (2) we also include mother and child controls. For all outcomes considered, the inclusion of mother and child control variables does not impact our point estimates. Finally, column (3) presents the relevant sample means.

In line with Appendix Fig. A3, Table 5 shows a large jump of 25 percentage points in the probability of same-day discharge for multiparous mothers after the introduction of the policies. The first stage F-statistic is 84 and thus confirms a strong first

Table 5
The effect of same-day discharge on readmissions, sample of multiparous mothers.

Outcome	(1)	(2)	Sample mean
A. First stage			
Same-day discharge	0.248***	0.247***	0.139
	(0.027)	(0.027)	
B. Reduced form			
Child readmitted ≤ 28 days	0.008***	0.008***	0.043
	(0.003)	(0.003)	
Child readmitted ≤ 365 days	−0.005	−0.005	0.206
	(0.007)	(0.007)	
Mother readmitted ≤ 28 days	0.005	0.005	0.021
	(0.005)	(0.005)	
Mother readmitted ≤ 365 days	−0.006	−0.006	0.095
	(0.009)	(0.009)	
C. IV			
Child readmitted ≤ 28 days	0.031***	0.031***	0.043
	(0.011)	(0.011)	
Child readmitted ≤ 365 days	−0.020	−0.020	0.206
	(0.027)	(0.027)	
Mother readmitted ≤ 28 days	0.022	0.022	0.021
	(0.018)	(0.018)	
Mother readmitted ≤ 365 days	−0.025	−0.025	0.095
	(0.037)	(0.038)	
Observations	733,373	733,373	
Controls	No	Yes	

Notes: Each cell shows point estimates from a separate regression. All models include year and hospital fixed effects, and hospital-specific quadratic trends. Panel (A) provides the first stage coefficient. Panel (B) provides the reduced form regression coefficients. Panel (C) provides 2SLS results. Column (1) and (2) are without and with covariates, respectively. The included covariates are indicators for low birth weight, pre-term birth and a Caesarean section birth, mother's age at birth, employment status (indicators for being unemployed, self-employed, in education), taxable income and educational level. Missing values are set to zero, and indicator variables for missing values are included. Clustered standard errors (at the hospital level) in parenthesis.

* $p < 0.1$.
** $p < 0.05$.
*** $p < 0.01$.

Table 6
The effect of same-day discharge on school achievement, sample of multiparous mothers.

Outcome	(1)	(2)	Sample mean
A. First stage			
Same-day discharge	0.272***	0.271***	0.103
	(0.032)	(0.032)	
B. Reduced form			
Child 9th grade GPA	−0.019	−0.021*	−0.054
	(0.012)	(0.011)	
Child 9th grade GPA, math	−0.005	−0.010	−0.048
	(0.013)	(0.012)	
Child 9th grade GPA, Danish	−0.025*	−0.028**	−0.043
	(0.014)	(0.013)	
C. IV			
Child 9th grade GPA	−0.068	−0.079**	−0.054
	(0.045)	(0.040)	
Child 9th grade GPA, math	−0.020	−0.036	−0.048
	(0.048)	(0.045)	
Child 9th grade GPA, Danish	−0.090*	−0.105**	−0.043
	(0.050)	(0.046)	
Observations	319,104	319,104	
Controls	No	Yes	

Notes: Each cell shows point estimates from a separate regression. All models include year and hospital fixed effects, and hospital-specific quadratic trends. Panel (A) provides the first stage coefficient. Panel (B) provides the reduced form regression coefficients. Panel (C) provides 2SLS results. Column (1) and (2) are without and with covariates, respectively. The included covariates are indicators for low birth weight, pre-term birth and a Caesarean section birth, mother's age at birth, employment status (indicators for being unemployed, self-employed, in education), taxable income and educational level. Missing values are set to zero, and indicator variables for missing values are included. Clustered standard errors (at the hospital level) in parenthesis.

* $p < 0.1$.
** $p < 0.05$.
*** $p < 0.01$.

stage. For hospital readmissions, both reduced form and 2SLS estimates show that a same-day discharge increases the probability of infant readmission within the first 28 days after birth. Panel (C) shows that early discharged children (compliers) experience a three percentage point increase in early readmission rates. At a sample mean of around four percent this LATE implies a 75 percent increase in infant hospital readmissions for marginal children.[14] The increase in early readmission may indicate that parents (or hospitals) replace postpartum hospital stays with readmissions to hospitals. Turning to our measure for hospitalizations in the first year of the child's life, we do not find a persistent effect of a same-day discharge.[15] Furthermore, we find no persistent effect of a same-day discharge on child hospital admissions in the second and third year of the child's life.[16] For mothers, the estimate for readmission in the first 28 days is only close to significant at the 10 percent level. Also for mother readmissions in the first year of the child's life we do not detect any strong effect of a same-day discharge.

Taking the results for child readmissions as a point of departure, Table 6 examines the impact of same-day discharge on school

achievement in grade nine. We find negative and large effects of a same-day discharge on 9th grade GPA, driven by a negative effect for Danish (interpretable as changes in standard deviations). Same-day discharge also leads to a decrease in 9th grade maths GPA, but this result is estimated with less precision. For complying children, we find that a same-day discharge reduces their overall 9th grade GPA with 0.08 of a standard deviation.

Table 7 assesses the robustness of our main results. Each cell in this table presents estimates from a separate regression. Columns (1)–(5) present IV estimates and examine the robustness of our findings to changes in the sample of children and mothers that we consider and the functional form chosen: To test whether the policy changes in the first or second wave have a differential impact on child and mother outcomes and to estimate regressions for all outcomes on the same sample, we perform our analysis on data only around the early and late wave of introduction of early discharge policies (columns (1) and (2)). We test the impact of different polynomials in birth year on our conclusions (column 3). A strategy for making the sample more homogeneous is to consider only second-born children (instead of all non-first-born children as in our main analysis). Column (4) shows estimates based on this restricted sample. In column (5) we show regression results from a specification where the treatment is the number of postpartum hospital nights (instead of a binary indicator for zero nights as in all other specifications). Finally, we add an additional control group, namely first-time mothers (column (6) of Table 7). For this triple difference analysis we show the reduced form results.[17]

---

[14] Our results for infant diagnoses are imprecise and available on request. Only around 2–4 percent of readmitted infants are registered in the Inpatient Register with these diagnoses in the period we consider. Given that the registration of diagnoses at hospitals is changing over time, this finding suggests that the respective ICD codes were not routinely used. It may or may not reflect that the conditions were present.

[15] Examining different child readmissions for different periods–throughout the first year of life—we find that the early readmission effect is short-lived.

[16] Results are available on request.

---

[17] As there is no first stage for first-time mothers, we only present reduced form versions of the triple difference specification.

Table 7
Robustness: the effect of same-day discharge on health and schooling outcomes using alternative specifications.

Outcome	(1)	(2)	(3)	(4)	(5)	(6)
Child readmitted ≤ 28 days	0.041**	0.042***	0.036***	0.035***	−0.005***	0.007**
	(0.019)	(0.014)	(0.006)	(0.012)	(0.002)	(0.003)
Child readmitted ≤ 365 days	0.024	−0.031	−0.028	−0.026	0.003	0.007
	(0.031)	(0.022)	(0.028)	(0.029)	(0.004)	(0.006)
Mother readmitted ≤ 28 days	0.032***	−0.029***	0.006	0.024	−0.004	0.006*
	(0.010)	(0.011)	(0.008)	(0.020)	(0.003)	(0.003)
Mother readmitted ≤ 365 days	0.057*	−0.107***	−0.051	−0.025	0.004	0.000
	(0.031)	(0.042)	(0.038)	(0.039)	(0.006)	(0.006)
Child 9th grade GPA, math	−0.022		−0.008	−0.066	0.006	−0.014
	(0.045)		(0.047)	(0.061)	(0.007)	(0.023)
Child 9th grade GPA, Danish	−0.099**		−0.069*	−0.130***	0.016**	−0.029
	(0.044)		(0.039)	(0.038)	(0.007)	(0.020)
Child 9th grade GPA	−0.098**		−0.037	−0.101**	0.012**	−0.028
	(0.040)		(0.045)	(0.046)	(0.006)	(0.021)
Model	DiD IV	DiD IV	DiD IV	DiD IV	DiD IV	DiDiD RF
Sample	89–93	01–03	Full	Full	Full	Full
Trends	None	None	Lin	Quad	Quad	Quad
Parity	>1	>1	>1	=2	>1	All
Treatment	SDD	SDD	SDD	SDD	Nights	SDD

Notes: Each cell presents the estimates from a separate regression. Consult Section 5 for details on model specifications. Standard errors clustered at the hospital level in parenthesis.
* $p < 0.1$
** $p < 0.05$
*** $p < 0.01$.

In general we find rather similar estimates for the impact of mandated same-day discharge on early child readmission and child school achievement. Estimates for child readmissions are remarkably stable across specification and samples. For child GPA and especially the GPA in Danish, estimates without trends or with linear trends (columns (1) and (3) of Table 7) confirm the size (and direction) of the effects we find in our main analysis. Also constraining our sample second-born only, does not alter our conclusions. Finally, applying a triple-difference approach with first-time mothers as additional controls impacts the precision of our results but indicates negative effects of a same-day discharge for children's GPA. Our results for mothers' probability of readmissions are somewhat less stable across different specifications. Part of this may be explained by stark (downward) trends for hospitalizations in Denmark in general over the 1985–2006 period. As we, for example, only use subsets of data in columns (1) and (2) of Table 7 and do not account for trends in outcomes, we may not be able to properly capture those overall developments. Thus we interpret the results for maternal hospital admissions with caution.

A final important concern of our main analysis is the level of clustering of our standard errors. To assess the robustness of our inference based on hospitals, Appendix Table A4 presents the p-values from the permutation test described in Section 3. The p-value is the fraction of t-values (from placebo regressions) that is more extreme than our "true" t-value. The permutation test suggests that our inference based on hospital-clusters is reasonable: although the p-values in Appendix Table A4 are larger than the ones in our main analysis, they suggest a significant effect of a same-day discharge on early child readmissions and child GPA.

In sum we present robust evidence for a same-day discharge affecting health care usage of children in the time directly after birth, measured as child hospital readmissions in the first month of life. Furthermore, we find that a same-day discharge impacts children's longer-run school achievement negatively.

5.2.1. Magnitudes of the GPA effects

To assess the magnitude of our GPA estimates, we compare our findings to two related studies that have examined the effect of early-life medical care in similar contexts. These studies examine highly specialized care for at-risk infants. Examining data from Norway and Chile, Bharadwaj et al. (2013) find that very low birth-weight (VLBW) infants who receive specialized treatment have higher test scores. For Norway, their preferred estimate suggests a large test-score gain of 0.228 of a standard deviation in the tenth grade national exam. Breining et al. (2015) examine the same VLBW cut-off in Denmark and find large effects of specialized care on the test scores for focal children (with VLBW) and their siblings. They find that extra treatment results in 0.38 of a standard deviation higher GPA in math for VLBW children.[18]

In the light of these studies, our estimates for the effect of a same-day discharge for uncomplicated births on 9th grade GPA of 0.08–0.1 of a standard deviation do not appear unreasonable. Furthermore, cautiously relating our estimated effects for improvement in test scores to monetary benefits, we consider the results in Blau and Kahn (2005). They estimate that, in Denmark, a one standard deviation increase in test scores relates to a seven percent increase in (hourly) wages. This figure suggests that our estimates for test score gains are economically meaningful.

5.3. Heterogeneity

As the complier analysis in Appendix Table A3 shows, the same-day discharge policies were rolled out to impact broad groups of mothers with uncomplicated births. In the following we examine whether the policies had heterogeneous effects for (healthy) children of mothers of different backgrounds. We base all of the following analyses on a subsample of uncomplicated births, i.e. our sample omits children who are not born at term, are low birth weight or small for gestational age, are born with a Caesarean section or to mothers below age 15.[19]

In the following, we examine the impact of a same-day discharge in groups of mothers and children with a priori rather different probabilities of choosing a same-day discharge. We follow an approach inspired by Evans and Garthwaite (2012) and

---

[18] They find effects of similar size for GPA in math and language for treated children's siblings suggesting large spill-over effects for early-life medical treatments.
[19] We constrain our sample here to make sure that we capture heterogeneity according to mothers' background rather than heterogeneity according to children's initial health status.

divide mothers into (equally sized) groups based on their probability of treatment in the pre-policy period. Like Evans and Garthwaite (2012), we proceed in two steps: first, we estimate the propensity score for the likelihood of experiencing a same-day discharge for all mothers who give birth in treated counties based on the pre-policy period.[20]

$$Prob(SDD_{itc} = 1) = P_{itc} = \Phi(\alpha + \eta \boldsymbol{X}_{itc})$$

where X_{itch} contains indicator variables for whether the mother was married, unemployed, employed, in education, has a higher education, and mother's age.

We then assign all mothers in the post-treatment period a propensity score for experiencing a same-day discharge.

Second, we estimate our main specification on three subsamples defined by mothers' propensity of being discharged on the day of birth. On one extreme, the first group contains the observations with the 33 percent lowest propensity score for each year and county. This group has the lowest likelihood of experiencing a same-day discharge based on pre-implementation data. On the other extreme, the third group contains those mothers with the 33 percent largest propensity scores, i.e. mothers who have the highest likelihood of experiencing a same-day discharge.

To present the composition of the groups of mothers, Appendix Table A5 shows covariate means for mother and child characteristics in the three subsamples: in the lowest-propensity score group mothers are (on average) much younger and much less educated than the mothers in the other two groups. At the same time mothers in the lowest propensity score group are less likely to be unemployed. This difference is most likely due to the younger age of the lowest-propensity score group. In line with anecdotal evidence the table confirms that rather than single maternal characteristics (such as education), health professionals considered a combination of potential risk all three groups of mothers are treated with a same-day discharge at relatively comparable levels after the reforms. Thus we can assess the impact of the policy for mothers who in the absence of the policy would have been treated with considerably longer hospital stays (the low probability group).

Table 8 presents our first stage and 2SLS results for the three subsamples defined by their propensity score.[21] Illustrating the large-scale nature of the discharge policies, the first stage is strong for all propensity score groups. For child (and mother) readmissions, Table 8 shows that children and mothers in the highest-propensity score group drive our main result. This result may indicate that these parents substitute hospital admissions with readmissions. Furthermore, also mothers in the highest-propensity score group are more likely to be readmitted in the first month of their child's life.

The negative effects on school attainment in grade nine are largest and all negative for children in the lowest-propensity-score group. While our results are based on considerably smaller samples and thus less precise, the estimates suggest that children in the lowest-propensity-score group drive our main result for GPA in grade nine.

In sum, our findings of heterogeneity in the effects of same-day discharge on both early hospital readmissions and on schooling outcomes support different explanations: on the one hand, increased early hospital readmission rates may purely reflect substitution of hospital admissions with readmissions rather than

Table 8
Heterogeneity of the effect of same-day discharge on readmission and school achievement results.

Propensity score sample Percentiles of the propensity score	(1) 0–33	(2) 34–66	(3) 67–100
Same-day discharge	0.313***	0.288***	0.274***
	(0.034)	(0.036)	(0.032)
Child readmitted ≤ 28 days	0.001	0.019	0.056***
	(0.015)	(0.018)	(0.015)
	[0.044]	[0.041]	[0.038]
Child readmitted ≤ 365 days	−0.019	−0.024	0.023
	(0.029)	(0.049)	(0.029)
	[0.217]	[0.187]	[0.168]
Mother readmitted ≤ 28 days	0.015	0.018	0.034*
	(0.018)	(0.019)	(0.018)
	[0.021]	[0.021]	[0.021]
Mother readmitted ≤ 365 days	−0.011	−0.035	0.007
	(0.037)	(0.041)	(0.033)
	[0.106]	[0.096]	[0.089]
Observations	187,096	186,949	186,853
Child 9th grade GPA, math	−0.080	0.025	0.036
	(0.082)	(0.067)	(0.061)
	[−0.239]	[−0.060]	[0.247]
Child 9th grade GPA, Danish	−0.105	−0.086	−0.020
	(0.071)	(0.073)	(0.076)
	[−0.278]	[−0.071]	[0.279]
Child 9th grade GPA	−0.114*	−0.020	0.021
	(0.063)	(0.072)	(0.070)
	[−0.303]	[−0.083]	[0.296]
Observations	81,268	83,814	85,728

Notes: Each cell shows point estimates from separate regressions (FS and 2SLS). All models include year and hospital fixed effects, and hospital-specific quadratic trends and all covariates (indicators for low birth weight, pre-term birth and a Caesarean section birth, mother's age at birth, employment status, taxable income and educational level). Missing values are set to zero, and indicator variables for missing values are included. Clustered standard errors (at the hospital level) are in parenthesis. Subsample means are in square brackets.
* p<0.1.
** p < 0.05.
*** p<0.01.

underlying health problems.[22] Short-run heterogeneity for this outcome may indicate that only some types of parents demand extra services in the absence of default care. On the other hand, if there are underlying health problems for children who are discharged on the day of birth and readmission rates only increase for some groups, not all children in need may receive the necessary care. In support of this possibility, longer-run schooling effects are concentrated in the lowest-propensity-score group (who do not experience higher initial child readmission rates). This finding may suggest that these children actually had an unmet need for more care, guidance and supervision. The next section turns to the question of the ways in which parental behaviors may contribute to longer-run health and educational effects of same-day discharge.

5.4. Mechanisms

While hospital admissions are less treatment-intensive for uncomplicated births than for complicated births, a same-day discharge for uncomplicated births—all other things being equal—implies a reduced level (or lack) of hospital care, health monitoring and guidance for parents. As such, the observed effect of a same-day discharge on schooling outcomes may therefore partly manifest itself through lasting health problems during childhood or reduced parental investments. Health interventions such as hospital care may be instrumental for shaping parental investment

---

[20] Specifically, we estimate the following probit model on all births in the treated counties *prior to* the introduction of mandatory same-day discharge:
[21] To illustrate that our findings are not driven by our group construction, Appendix Table A6 shows results using quartiles of the propensity score. All results are very similar to our preferred specification.

[22] This potential substitution may either be demand-driven or encouraged by health care professionals.

behaviors: for example, earlier studies have shown that breast-feeding decisions are highly susceptible to policies, and that they relate to children's longer-run academic achievement (Fitzsimons and Vera-Hernandez, 2014; Del Bono and Rabe, 2012; Kramer et al., 2008).

In line with this finding, prior evidence from small-scale studies of the Danish early discharge policies from the early 1990s show that women who experienced mandated same-day discharge perceived the breastfeeding support as inadequate to a higher degree than hospitalized mothers (Kierkegaard et al., 1992; Kierkegaard, 1993; Brinkmann, 2011). While these studies do not find differences in median breastfeeding duration, one study shows that early-discharged mothers were significantly less likely to breastfeed at four weeks after birth (Kierkegaard, 1993). Moreover, early-discharged mothers appeared to have more telephone contacts and personal contacts with other health professionals than their controls. Even though all these previous studies use small sample sizes and only use control mothers from inside the same county, they indicate that parental self-confidence and parental early investments even of experienced mothers may have been impacted by mandated same-day discharge.

This section further explores mechanisms for the longer-run effects of a same-day discharge on child educational outcomes.[23] We analyze intermediate health outcomes and parental behaviors as potential channels for longer-run impacts of a same-day discharge. We continue to study three groups of mothers and children (with different predicted probabilities of a same day discharge) to shed light on potential heterogeneity in parental responses.[24]

For the following analyses we use complementary administrative and survey data that can shed light on some intermediate outcomes. If same-day discharge leads to lasting health problems for mothers or children, we should not only consider readmissions, but also expect mothers and children to demand more contacts with other health professionals. As GPs constitute the primary access to the Danish health care system, we examine the number of GP contacts for children and mothers. Same-day discharge infants from 1995 onwards were scheduled for an additional GP visit in the first month of life (Sundhedsstyrelsen, 1995).[25] Thus our result for short-run GP contacts should be interpreted with caution.

To obtain more information on medium-run health outcomes and parental inputs, we use survey measures from the DNBC. As the DNBC questionnaires focus on maternal and child health and health behaviors, unfortunately we lack measures of broader human capital investments of parents.[26] However, with respect to the guidance and support mothers can expect at hospitals after birth, we have some relevant measures of maternal inputs: we study the probability of exclusive breastfeeding at age four month, the probability

Table 9
Heterogeneity of the effect of same-day discharge on parental investments.

| Propensity score sample | (1) | (2) | (3) |
Percentiles of the propensity score	0–33	34–66	67–100
Same-day discharge	0.332***	0.170***	0.280***
	(0.047)	(0.037)	(0.061)
At least four months exclusive breastfeeding	−0.311**	−0.213	−0.015
	(0.139)	(0.146)	(0.244)
	[0.639]	[0.733]	[0.815]
Received all scheduled 7 vaccines, 18 months	−0.062	−0.006	0.126
	(0.117)	(0.130)	(0.136)
	[0.863]	[0.861]	[0.840]
Mother reported poor health, age 7	0.069**	0.083	−0.040
	(0.028)	(0.091)	(0.047)
	[0.028]	[0.022]	[0.022]
Observations	5482	7633	9432
Same-day discharge	0.303***	0.288***	0.261***
	(0.029)	(0.033)	(0.027)
Child GP contacts, month 1	0.209**	0.203*	0.217**
	(0.105)	(0.107)	(0.100)
	[0.201]	[0.177]	[0.161]
Child GP contacts, y1–y3	−0.291	−0.260	−1.706
	(3.404)	(4.545)	(1.562)
	[25.045]	[22.902]	[20.616]
Mother GP contacts, month 1	0.752**	0.888***	1.207***
	(0.322)	(0.151)	(0.244)
	[1.116]	[1.069]	[1.036]
Mother GP contacts, y1–y3	4.168***	0.938	4.267**
	(1.377)	(4.358)	(2.098)
	[27.194]	[23.368]	[21.063]
Observations	87,039	86,972	86,927

Notes: Each cell shows point estimates from separate regressions (FS and 2SLS). All models include year and hospital fixed effects, and hospital-specific quadratic trends and all covariates (indicators for low birth weight, pre-term birth and a Caesarean section birth, mother's age at birth, employment status, taxable income and educational level). Missing values are set to zero, and indicator variables for missing values are included. Clustered standard errors (at the hospital level) are in parenthesis. Subsample means are in square brackets. *$p < 0.1$, **$p < 0.05$, ***$p < 0.01$.

of having received all scheduled vaccines by age 18 month, and mother reported health at age seven (relative to peers' health).

Table 9 shows our results for the parental investment variables, health care usage and mother-reported child health at age seven. For both children and mothers and across propensity score groups, our analysis shows increases in the number of GP visits in the first month of the child's life. More important, also mothers experience longer-run increases in GP contact rates. This finding may indicate maternal health problems after a same-day discharge, which are treated by GPs and may be one channel for longer-run effects of a same-day discharge on children: while we cannot study in detail factors such as post-natal maternal depression, post-birth maternal health problems may impact mothers' investments in children.[27]

In line with mothers' report of lack of breastfeeding support in earlier studies, we find that mothers in the lowest propensity score-group are less likely to breastfeed exclusively for at least four months if they are discharged on the day of birth.[28] At the mean of the dependent variable for this group, a same-day discharge decreases marginal mothers' probability of breastfeeding exclu-

---

[23] A natural starting point for this analysis is the consideration of potential fertility responses of treated mothers. If treated mothers react in terms of the number of children they have or in terms of child spacing, this behavior may impact child outcomes through various channels, among them the time and resources families can allocate to each child. However, as Appendix Table A7 shows, we do not find any indication that exposure to the same-day discharge policies impacted multiparous' mothers probability of having any additional children. Given this finding, we also examine the timing of their fertility decisions in the bottom of Appendix Table A7. We find no indication for an impact of a same-day discharge on the timing of mothers' fertility choices.

[24] Appendix Table A8 presents estimates for the average effects based on our full sample of mothers and children.

[25] Additionally, we cannot distinguish well-baby visits from other visits related to health issues. So by analyzing the total number of GP contacts we cannot examine the relative importance of scheduled well-baby visits and increased number of contacts due to health issues of the child.

[26] Given the timing of the survey, we can only use the 2002 and 2003 policy changes for these analyzes. Furthermore, earlier analyzes indicate that the survey represents a somewhat positively selected sample of mothers (increasingly so for the post-birth survey waves) (Jacobsen et al., 2010).

[27] There are no scheduled GP consultations for mothers beyond the first month after birth. For mothers we cannot rule out the possibility that some of the persistent effect on GP contacts may be driven by some mothers' subsequent fertility and related pregnancy checks by GPs.

[28] We chose this margin because the official recommendations in Denmark suggest a four-month period of exclusive breastfeeding. From around four months, Danish visiting nurses encourage mothers to introduce solid food.

sively until month four by almost 50 percent. While this finding suggests that those mothers reinforce the effect of lower investments in health at birth, mothers from the highest-propensity score group who experienced a same-day discharge are not less likely to breastfeed for four months. Furthermore, children in the two low propensity score groups appear to be less likely to having received all scheduled vaccines by age 18 months, but this result is not precisely estimated. Finally, mothers in the lowest-propensity-score group are significantly more likely to report poor health for their child at age seven.[29]

While constrained by data availability, our results cautiously indicate that parents respond differentially to early health shocks and that child health is impacted by a same-day discharge and these parental responses. In the low-propensity-score group, breastfeeding duration appears to decrease as a response to a same-day discharge, but the same is not true for (especially) the highest-propensity-score group. Moreover, we find suggestive evidence for lasting (modest) health effects for mothers, who appear to consult their GP more often. This impact on maternal well-being may additionally impact parental investments in children.

6. Conclusion

In this paper we exploit the introduction of the shortest possible postpartum hospital stay—mandatory discharge on the day of birth—for multiparous mothers in five Danish counties to estimate its causal effect on mother and child health and well-being. We find significant effects of same-day discharge on child hospital readmission in the first 28 days. Moreover, we find lasting negative effects on school performance at age 15 (in 9th grade).

We also consider potential mechanisms: a same-day discharge may make it less likely that health problems are discovered and treated promptly. Furthermore, parents may react to a same-day discharge and adjust their health investments. Examining these channels, we show that poorer health status during childhood (reported by mothers) and parental responses appear to drive our longer-run effects. Thus our findings are in line with recent research showing effects of early life health interventions on longer-run educational outcomes (e.g., Bharadwaj et al., 2013), but we also document the importance of parental responses. Those appear to matter as mechanisms for these effects.

Finally, our results point to heterogeneity in parental responses to a same-day discharge: The policies impacted parental health investments (such as breastfeeding) and long-run child outcomes most among those mothers and children, who in the absence of a mandated policy would have been least likely to choose this option. Thus mandated same-day discharge policies for large parts of the population may come at significant costs for some groups of mothers and their children. When evaluating the cost effectiveness of postpartum care, researchers and policy makers should consider these longer-run consequences. Early life health interventions have the potential to significantly impact parental investments, such as breastfeeding. Whether this impact is due to the effect of these health interventions on parental knowledge, parenting skills or self-confidence gives rise to different policy implications. Thus future research should consider in greater detail the impact of postpartum care on parents' behaviors.

Appendix A.

See Fig. A4.
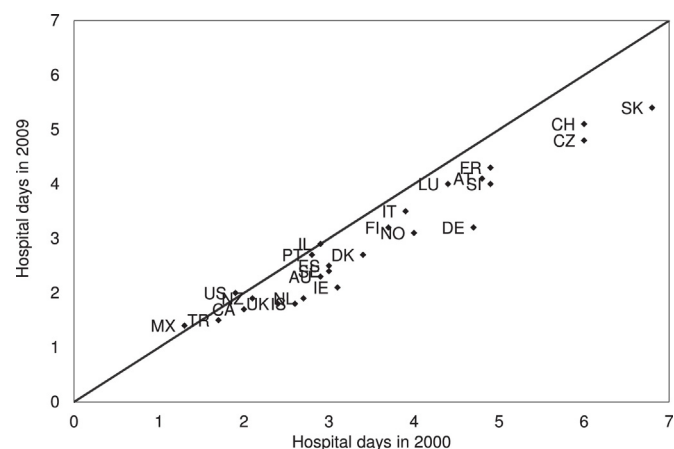
Fig. A1. Average number of hospital days at childbirth in 2000 and 2009. *Notes*: The data covers all mothers with a spontaneous delivery.
Source: OECD (2012).

---

[29] Lacking other widely recognized measures of child health in the survey, we have also considered less standard measures of child health, such as the probability of reporting frequent colds for the child at age 18 months. These analyses support our finding of poorer mother-reported child health of same-day discharge children already at earlier interviews. However, given the non-standard measures we do not want to overemphasize these results. They are available on request.

Fig. A2. The introduction of same-day discharge policies across Danish counties.
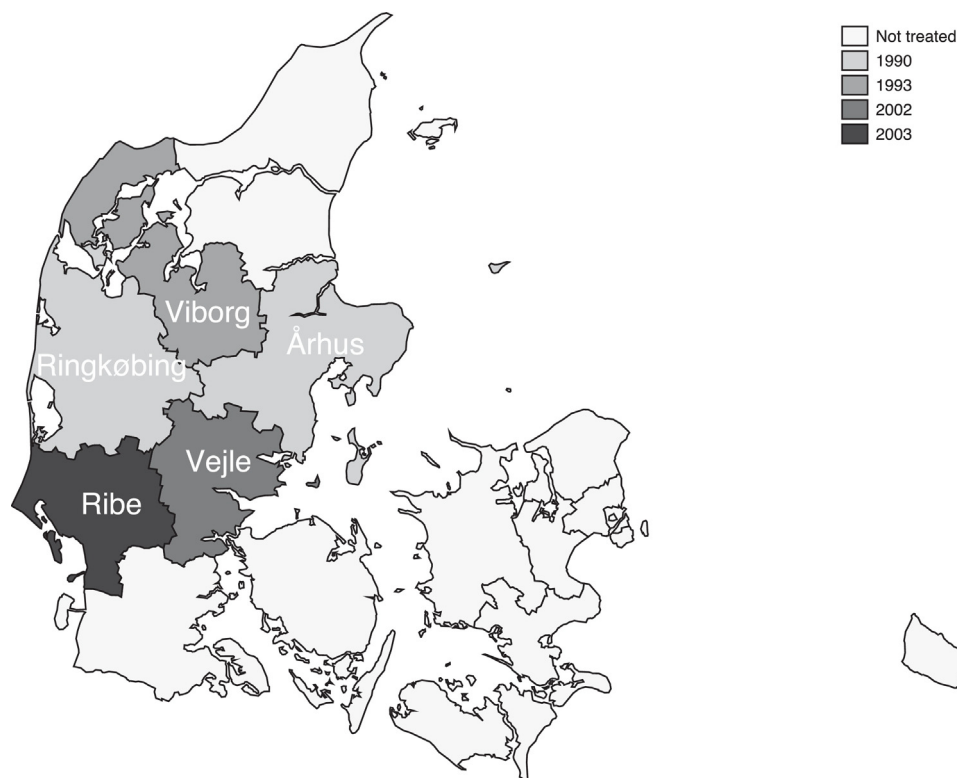
Table A1
Analysis samples, outcomes and data sources.

Policy change counties covered	Outcome data period (approx.)	Outcomes	Data source
Aarhus (1990), Ringkøbing (1990), Viborg (1993)	1985–2006	Hospital readmission, 9th grade GPA	Admin.
Vejle (2002), Ribe (2003)	1997–2006	Hospital readmission, GP contacts	Admin.
Vejle (2002), Ribe (2003)	1997–2003	Breastfeeding duration, vaccine participation, mother-reported health at age 7	Survey

Notes: Note that we have data on births in all Danish counties. Column (1) only illustrates which policy-changes are covered in the different data sources (given that the years of data availability vary).

Table A2
Placebo: The effect of same-day discharge on school achievement, sample of multiparous CS mothers.

Outcome	Estimate	Sample mean
A. First stage		
Same-day discharge	−0.005	0.009
	(0.004)	
B. Reduced form		
Child readmitted ≤ 28 days	−0.002	0.048
	(0.005)	
Child readmitted ≤ 365 days	−0.033**	0.257
	(0.013)	
Mother readmitted ≤ 28 days	−0.001	0.019
	(0.005)	
Mother readmitted ≤ 365 days	−0.018	0.063
	(0.011)	
Observations	92,196	
Child 9th grade GPA	−0.013	−0.079
	(0.061)	
Child 9th grade GPA, math	−0.066	−0.096
	(0.063)	
Child 9th grade GPA, Danish	0.014	−0.068
	(0.065)	
Observations	32,760	

Notes: Each cell shows point estimates from a separate regression. All models include year and hospital fixed effects, and hospital-specific quadratic trends and all covariates (indicators for low birth weight, pre-term birth, mother's age at birth, employment status (indicators for being unemployed, self-employed, in education), taxable income and educational level). Missing values are set to zero, and indicator variables for missing values are included. Panel (A) provides the first stage coefficient. Panel (B) provides the reduced form regression coefficients. Clustered standard errors (at the hospital-level) in parenthesis.

* $p < 0.1$.

** $p < 0.05$.

*** $p < 0.01$.

(a) Aarhus county 1990

(b) Ringkøbing county 1990

(c) Viborg county 1993
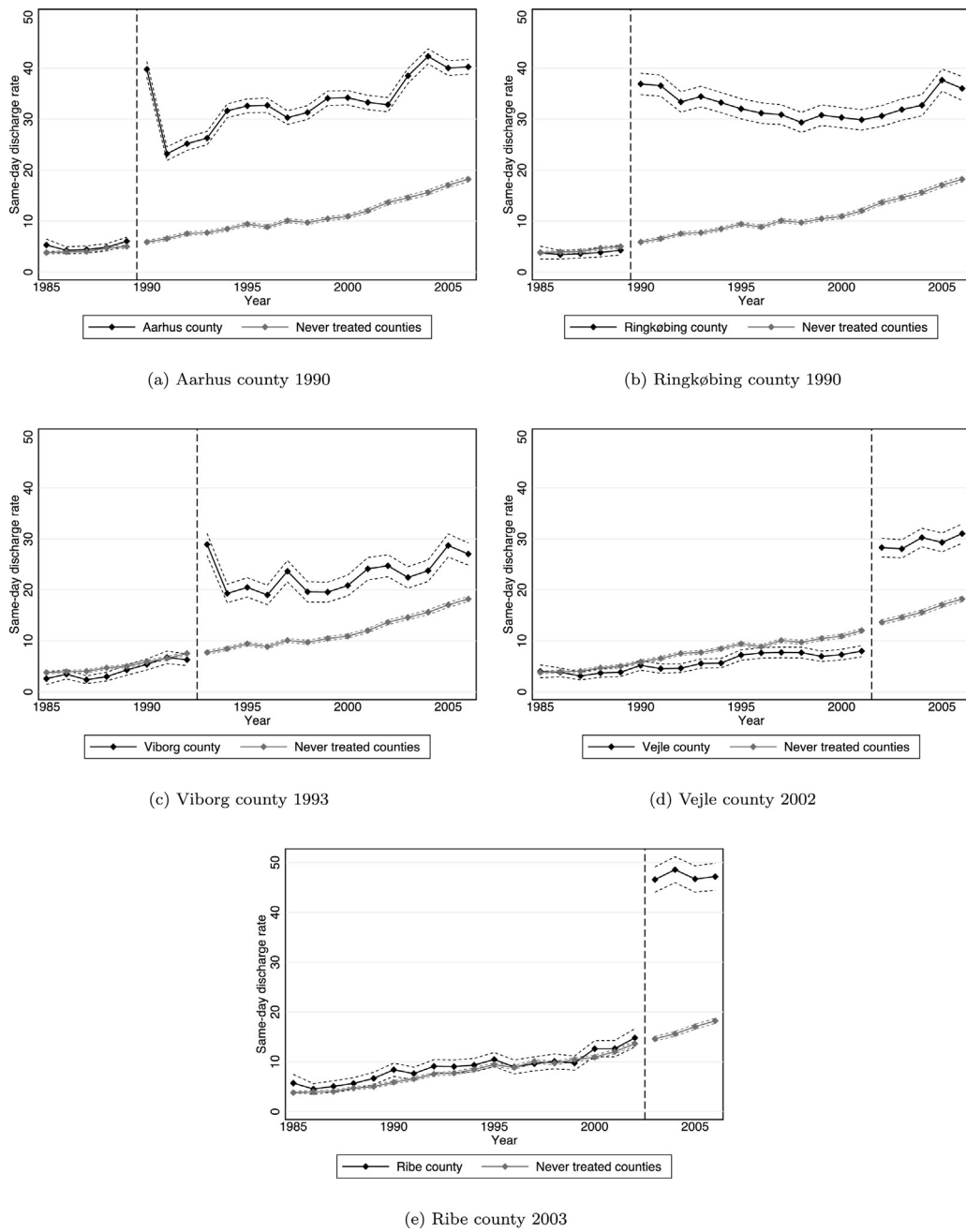
(d) Vejle county 2002

(e) Ribe county 2003

Fig. A3. Early discharge rates for multiparous mothers in treated and never-treated counties, yearly means and 95% confidence intervals.

Table A3
Complier analysis: first stage estimates in subgroups of the population.

	Mother higher education		Mother's inc. > median		Mother unemployed		Pre-term birth (<37 weeks)		Low birth weight (<2500 g)	
	No	Yes	No	Yes	No	Yes	Yes	No	Yes	No
Post × treated	0.245***	0.253***	0.248***	0.251***	0.247***	0.250***	0.033*	0.256***	0.010	0.255***
	(0.027)	(0.029)	(0.027)	(0.029)	(0.028)	(0.023)	(0.018)	(0.028)	(0.017)	(0.028)
Untreated mean	0.085	0.107	0.098	0.082	0.090	0.095	0.024	0.094	0.019	0.094
F-stat	84.027	74.537	82.152	75.372	77.539	115.833	3.460	84.745	0.401	83.718
Obs.	506,521	203,370	347,793	347,783	631,807	95,411	28,641	703,053	21,801	712,221

Notes: Each cell presents the first stage estimate from a different regression. Clustered standard errors (at the hospital level) in parentheses. The bottom row presents same-day discharge rates in non-treated years and counties. *p < 0.1, **p < 0.05, ***p < 0.01.
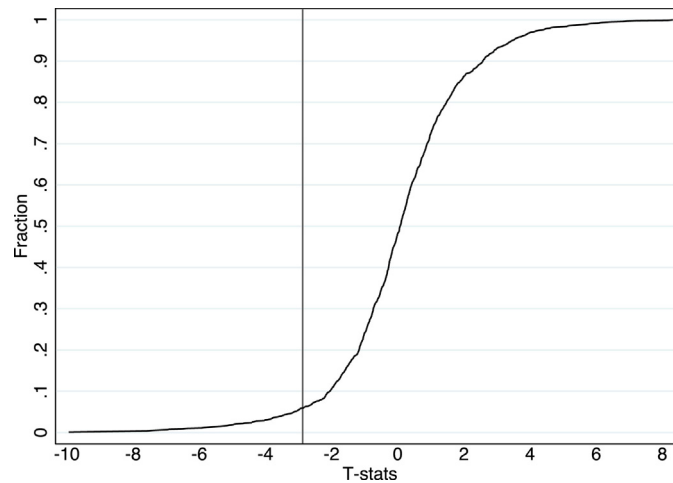
Fig. A4. Distribution of Placebo *t*-values: 9th grade GPA. *Notes*: This figure presents the empirical CDF for *t*-values from 10,000 regression of the outcome (GPA) on placebo reform indicators. The vertical line marks the *t*-value of the true estimate. For further details, consult Section 3.

Table A4
p-Values based on a permutation test.

Same-day discharge	0.00
Child readmitted ≤ 28 days	0.07
Child readmitted ≤ 365 days	0.26
Mother readmitted ≤ 28 days	0.20
Mother readmitted ≤ 365 days	0.38
Child 9th grade GPA	0.06
Child 9th grade GPA, math	0.25
Child 9th grade GPA, Danish	0.11

Notes: Each cell presents a *p*-value from our permutation test as described in Section 3 for our main outcomes.

Table A5
The same-day discharge rate and covariate means for propensity score samples (tertiles) predicting the pre-reform probability of same-day discharge.

Percentiles of the propensity score	(1) 0–33	(2) 34–66	(3) 67–100
Same-day discharge	0.158	0.156	0.174
Child birth weight	3667.598	3699.645	3728.037
Mother age	26.748	31.048	34.360
Mother is married	0.578	0.652	0.671
Mother has a higher education	0.005	0.206	0.657
Mother is unemployed	0.062	0.163	0.159
Mother taxable income	147.304	170.656	189.898

Notes: The table presents variable means for three samples of mothers, defined by the propensity score for experiencing a same-day discharge. Group (1) is the group of mothers, who—given their characteristics—would have had the lowest propensity of pre-policy change same-day discharge. Group (2) is the group of mothers, who—given their characteristics—would have had a middle propensity of pre-policy change same-day discharge. Group (3) is the group of mothers, who—given their characteristics—would have had the highest propensity of pre-policy change same-day discharge. For further details consult Section 5.3.

Table A6
Heterogeneity of the effect of same-day discharge on readmission and school achievement results (quartiles of the propensity score).

Propensity score sample Percentiles of the propensity score	(1) 0–25	(2) 26–50	(3) 51–75	(4) 76–100
Same-day discharge	0.313***	0.303***	0.278***	0.271***
	(0.034)	(0.040)	(0.035)	(0.030)
Child readmitted ≤ 28 days	0.001	−0.014	0.068***	0.049***
	(0.021)	(0.019)	(0.019)	(0.015)
	[0.045]	[0.041]	[0.040]	[0.038]
Child readmitted ≤ 365 days	−0.041	−0.028	0.057	−0.008
	(0.032)	(0.041)	(0.050)	(0.026)
	[0.223]	[0.193]	[0.181]	[0.166]
Mother readmitted ≤ 28 days	0.017	0.014	0.030	0.028
	(0.018)	(0.019)	(0.021)	(0.019)
	[0.021]	[0.021]	[0.021]	[0.021]
Mother readmitted ≤ 365 days	−0.013	−0.012	−0.020	−0.006
	(0.041)	(0.035)	(0.041)	(0.037)
	[0.109]	[0.098]	[0.093]	[0.088]
Observations	140,384	140,172	140,255	140,087
Child 9th grade GPA, math	−0.177**	0.105	−0.015	0.060
	(0.087)	(0.094)	(0.093)	(0.076)
	[−0.274]	[−0.128]	[0.052]	[0.279]
Child 9th grade GPA, Danish	−0.164*	−0.004	−0.119	−0.017
	(0.087)	(0.076)	(0.148)	(0.078)
	[−0.317]	[−0.148]	[0.051]	[0.319]
Child 9th grade GPA	−0.194**	0.038	−0.051	0.041
	(0.078)	(0.077)	(0.131)	(0.078)
	[−0.344]	[−0.166]	[0.049]	[0.338]
Observations	60,487	62,509	63,355	64,459

Notes: Each cell shows point estimates from a separate 2SLS regression. All models include year and hospital fixed effects, and hospital-specific quadratic trends and all covariates (indicators for low birth weight, pre-term birth and a Caesarean section birth, mother's age at birth, employment status, taxable income and educational level). Missing values are set to zero, and indicator variables for missing values are included. Clustered standard errors (at the hospital level) are in parenthesis. Subsample means are in square brackets.
* *p* < 0.1.
** *p* < 0.05.
*** *p* < 0.01.

Table A7
The effect of a same-day discharge on the probability of having additional children within six years and the timing of future fertility, sample of second-time mothers.

Outcome	(1)	(2)	Sample mean
A. First stage			
Same-day discharge	0.255***	0.255***	0.118
	(0.029)	(0.029)	
B. Reduced form			
Third child within 6y	0.007	0.008	0.272
	(0.007)	(0.007)	
C. IV			
Third child within 6y	0.026	0.030	0.272
	(0.026)	(0.026)	
Observations	492,003	492,003	
D. IV—timing of fertility			
Years to third child	−0.178	−0.173	3.321
	(0.120)	(0.119)	
Observations	133,949	133,949	
Controls	No	Yes	

Notes: Each cell shows point estimates from a separate regression. All models include year and hospital fixed effects, and hospital-specific quadratic trends. Panel (A) provides the first stage coefficient. Panel (B) provides the reduced form regression coefficients. Panels (C) and (D) provide 2SLS results. Column (1) and (2) are without and with covariates, respectively. The included covariates are indicators for low birth weight, pre-term birth and a Caesarean section birth, mother's age at birth, employment status (indicators for being unemployed, self-employed, in education), taxable income and educational level. Missing values are set to zero, and indicator variables for missing values are included. Clustered standard errors (at the hospital level) in parenthesis.
*$p < 0.1$.
**$p < 0.05$.
*** $p<0.01$.

Table A8
Mechanisms: the effect of same-day discharge on health outcomes and parental investments.

	(1)	(2)	Sample mean
A. First stage			
GP sample	0.246***	0.245***	0.139
	(0.024)	(0.024)	
DNBC Sample	0.237***	0.234***	0.163
	(0.030)	(0.030)	
B. Reduced form			
Child GP contacts, month 1	0.048**	0.047**	0.179
	(0.024)	(0.024)	
Child GP contacts, y1–y3	−0.022	−0.138	23.40
	(0.549)	(0.534)	
Mother GP contacts, month 1	0.237***	0.228***	1.146
	(0.044)	(0.047)	
Mother GP contacts, y1–y3	1.244**	1.109**	24.68
	(0.496)	(0.485)	
At least four months exclusive breastfeeding	−0.035	−0.036	0.725
	(0.027)	(0.025)	
Received all scheduled 7 vaccines, 18 months	−0.003	−0.003	0.850
	(0.011)	(0.012)	
Mother reported poor health, age 7	0.018	0.017	0.026
	(0.011)	(0.011)	
C. IV			
Child GP contacts, month 1	0.194*	0.193*	0.179
	(0.106)	(0.106)	
Child GP contacts, y1–y3	−0.095	−0.579	23.40
	(2.314)	(2.229)	
Mother GP contacts, month 1	1.007***	0.957***	1.146
	(0.224)	(0.227)	
Mother GP contacts, y1–y3	5.299***	4.650***	24.68
	(1.867)	(1.727)	
At least four months exclusive breastfeeding	−0.148	−0.152	0.725
	(0.111)	(0.102)	

Table A8 (*Continued*)

	(1)	(2)	Sample mean
Received all scheduled 7 vaccines, 18 months	−0.012	−0.015	0.850
	(0.047)	(0.049)	
Mother reported poor health, age 7	0.077*	0.071*	0.026
	(0.043)	(0.042)	
Controls	No	Yes	

Notes: Each cell shows point estimates from a separate regression. All models include year and hospital fixed effects, and hospital-specific linear (survey data) or quadratic (admin. data) trends. Panel (A) provides the first stage coefficients (for the survey and admin. data samples). Panel (B) provides the reduced form regression coefficients. Panel (C) provide 2SLS results. Column (1) and (2) are without and with covariates, respectively. The included covariates are indicators for low birth weight, pre-term birth and a Caesarean section birth, mother's age at birth, employment status (indicators for being unemployed, self-employed, in education), taxable income and educational level. Missing values are set to zero, and indicator variables for missing values are included. Clustered standard errors (at the hospital level) in parenthesis.
*$p < 0.1$.
**$p < 0.05$.
*** $p < 0.01$.

References

Aarhus Amtskommune, 1990. Statusnotat vedrørende 1. halvårs erfaringer med barselshvilebesparelsen [Report on experiences with budget cuts in the area of postpartum hospital care], Tech. Rep.

Adhvaryu, A., Nyshadham, A., 2016. Endowments at birth and parents' investments in children. Econ. J., http://dx.doi.org/10.1111/ecoj.12186.

Aizer, A., Cunha, F., 2012, September. The production of human capital: endowments, investments and fertility. Working Paper 18429, National Bureau of Economic Research. http://www.nber.org/papers/w18429.

Almond, D., Currie, J., 2011. Human capital development before age five. Handb. Lab. Econ. 4, 1315–1486.

Almond, D., Currie, J., Duque, V., 2017, January. Childhood circumstances and adult outcomes: act II. Working Paper 23017, National Bureau of Economic Research. http://www.nber.org/papers/w23017.

Almond, D., Doyle, J.J., 2011. After midnight: a regression discontinuity design in length of postpartum hospital stays. Am. Econ. J.: Econ. Policy 3 (3), 1–34.

Almond, D., Mazumder, B., 2013. Fetal origins and parental responses. Ann. Rev. Econ. 5 (1), 37–56.

Bharadwaj, P., Løken, K.V., Neilson, C., 2013. Early life health interventions and academic achievement. Am. Econ. Rev. 103 (5), 1862–1891.

Black, S.E., Devereux, P.J., Salvanes, K.G., 2007. From the cradle to the labor market? The effect of birth weight on adult outcomes. Q. J. Econ. 122 (1), 409–439, 02.

Blau, F.D., Kahn, L.M., February 2005. Do cognitive test scores explain higher U.S. wage inequality? Rev. Econ. Stat. 87 (1), 184–193 https://ideas.repec.org/a/tpr/restat/v87y2005i1p184-193.html.

Breining, S., Daysal, N.M., Simonsen, M., Trandafir, M., 2015. Spillover effects of early-life medical interventions. Iza discussion paper.

Brinkmann, L., 2011. 3 perspektiver på tidlig hjemsendelse af flergangsfødende [Report: Three perspectives on the introduction of same-day discharge policies for multiparous mothers]. Tech. Rep.

Cameron, C.A., Miller, D.L., 2015. A practitioner's guide to cluster–robust inference. J. Hum. Resour. 50 (2), 317–372 http://jhr.uwpress.org/content/50/2/317.abstract.

Chay, K.Y., Guryan, J., Mazumder, B., 2009. Birth cohort and the black–white achievement gap: the roles of access and health soon after birth. In: FRB of Chicago Working Paper No. 2008-20.

Chen, A., Oster, E., Williams, H., 2016. Why is infant mortality higher in the United States than in Europe? Am. Econ. J.: Econ. Policy 8 (2), 89–124.

Chetty, R., Looney, A., Kroft, K., 2009. Salience and taxation: theory and evidence. Am. Econ. Rev. 99 (4), 1145–1177.

Daysal, N.M., Trandafir, M., van Ewijk, R., 2015. Saving lives at birth: the impact of home births on infant outcomes. Am. Econ. J.: Appl. Econ. 7 (July (3)), 28–50, http://dx.doi.org/10.1257/app.20120359.

Del Bono, E., Rabe, B., 2012, December. Breastfeeding and child cognitive outcomes: evidence from a hospital-based breastfeeding support policy. In: ISER Working Paper Series 2012-29, Institute for Social and Economic Research. https://ideas.repec.org/p/ese/iserwp/2012-29.html.

Drevs, L., 2012. Personal Correspondence. Head Midwife, Regionshospitalet Horsens.

Evans, W.N., Garthwaite, C., 2012. Estimating heterogeneity in the benefits of medical treatment intensity. Rev. Econ. Stat. 94 (3), 635–649.

Fabrin, B., Olsen, J., 1987. Ambulante fødsler i storstrøms amt 1984 og 1985 [Outpatient births in the county storstrøm in 1984 and 1985]. J. Dan. Med. Assoc. (11).

Fitzsimons, E., Vera-Hernandez, M., 2014. Food for thought: breastfeeding and child development. In: DoQSS Working Papers 14-04, Department of

Quantitative Social Science – UCL Institute of Education. University College London.

Fyns Amtskommune, 1987. Rapport om pilotprojekt vedrørende ambulante fødsler [Report on a pilot project on same-day discharge]. Tech. Rep.

Jacobsen, T.N., Nohr, E.A., Frydenberg, M., 2010. Selection by socioeconomic factors into the Danish national birth cohort. Eur. J. Epidemiol. 25 (5), 349–355.

Jensen, A.-M., 2013. Personal Correspondence. Head Midwife, Regionshospitalet Esbjerg.

Jørgensen, F.S., 2003. Organisation af obstetrisk ultralyd i danmark 2000. med beskrivelse af udviklingen siden 1990 [The organisation of obstetric ultrasound examinations in Denmark in 2000. a description of the development since 1990]. J. Dan. Med. Assoc. 165 (46), 4404–4409.

Kierkegaard, O., 1991. Morbiditet hos mødre og børn efter ambulant fødsel [Morbidity among mother and infants after a same-day discharge]. J. Dan. Med. Assoc. 153 (31), 2170–2172.

Kierkegaard, O., 1993. Ammeperiodens varighed efter tvungen ambulant fødsel. J. Dan. Med. Assoc. 34.

Kierkegaard, O., Engstrøm, H., Næsted, H., Briand, A., 1992. Barselsperiodens forløb efter tvungen ambulant fødsel [The postpartum period after mandated same-day discharge]. J. Dan. Med. Assoc. 154 (3), 119–123.

Kierkegaard, O., Monrad Hansen, R., 1993. Ambulante fødsler — erfaringer fra de første to år [Same-day discharge – experiences from the first two years]. J. Dan. Med. Assoc. (34).

Kramer, M.S., Aboud, F., Mironova, E., Vanilovich, I., Platt, R.W., Matush, L., Igumnov, S., Fombonne, E., Bogdanovich, N., Ducruet, T., et al., 2008. Breastfeeding and child cognitive development: new evidence from a large randomized trial. Arch. Gen. Psychiatry 65 (5), 578–584.

Lange, A.P., 1992. Tvungne ambulante fødsler [Mandated same-day discharge]. J. Dan. Med. Assoc. (3).

McKinnon, J.G., Webb, M.D., 2016. Difference-in-differences inference with few treated clusters. In: Working Paper 1355, Queen's Economics Department.

OECD, 2012. Average Length of Stay by Diagnostic Categories, Single Spontaneous Delivery, Days. http://stats.oecd.org/Index.aspx?DataSetCode=HEALTH_PROC.

Olsen, J., Melbye, M., Olsen, S.F., Sørensen, T.I., Aaby, P., Nybo Andersen, A.-M., Taxbøl, D., Hansen, K.D., Juhl, M., Schow, T.B., Sørensen, H.T., Andresen, J., Mortensen, E.L., Wind Olesen, A., Søndergaard, C., 2001. The Danish national birth cohort – its background, structure and aim. Scand. J. Public Health 29 (4), 300–307 http://sjp.sagepub.com/content/29/4/300.abstract.

Sakala, C., Corry, M.P., 2008. Evidence-based maternity care: what it is and what it can achieve. Tech. Rep. Milbank Memorial Fund, New York.

Sundhedsplejerskegruppen, 1995. Ambulante fødslers betydning for prioriteringer i sundhedsplejen [The impact of same-day discharge on the home visiting program]. Tech. Rep.

Sundhedsstyrelsen, 1995. Forebyggende sundhedsordninger for børn og unge – retningslinier [Primary public health services for children and young people – guidelines]. Tech. Rep.

The Danish National Board of Health, 2004. Fødselsregisteret 2003 [The fertility register 2003]. Report.