RESEARCH ARTICLE

The impact of voluntary and nonpayment policies in reducing early-term elective deliveries among privately insured and Medicaid enrollees

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Abstract

Objective: To assess the impact of a voluntary pledge policy and a mandatory nonpayment policy on reducing early-term elective deliveries among privately insured and Medicaid-enrolled individuals.

Data Sources/Study Setting: Birth certificate data from 2009 to 2015, from South Carolina and 16 control states.

Study Design: We use a difference-in-differences approach to test the impact of two different policy types. Outcomes include the probability of an early elective delivery, gestation time, and birthweight.

Principal Findings: The voluntary pledge and mandatory nonpayment policy reduced overall EED rates from 13.1 to 11.4 (−12.7 percent, [$P < .05$]), and 10.9 (−16.6 percent, [$P < .05$]), respectively. Compared to the privately insured, we found greater relative decreases in Medicaid EED rate, the proportion of Medicaid births occurring before 39 weeks, and the proportion of Medicaid babies born with low birthweight.

Conclusions: Both voluntary and mandatory nonpayment policies are effective in reducing the rate of EEDs, especially among Medicaid enrollees. Given the high costs and poor outcomes associated with EEDs, policy makers may consider using either tool as a way to improve care value.

KEYWORDS

elective deliveries, low birthweight, Medicaid, payment policies, private insurance

1 | INTRODUCTION

Early-term elective deliveries (EEDs)—that is, nonmedically justified labor inductions or Cesarean births occurring after 36 weeks' but before 39 weeks' gestation—are associated with poor health outcomes and increased costs.¹ In particular, EED babies are more likely to require C-section delivery, have costly stays in the NICU, and have poorer developmental and academic outcomes.^{2,3} Reducing EEDs has become a key health policy target for reducing costs and improving quality, earning support among organizations like the Centers for Medicare and Medicaid Services,⁴ the American College of Obstetricians and Gynecologists (ACOG),⁵ the National Quality

Forum,⁶ and the Joint Commission.⁷ Despite this policy emphasis, EED rates remain undesirably high, with rates in some states reaching 22 percent.⁸ Common reasons for mothers to request or doctors to perform EEDs include wanting to plan ahead for the delivery, accommodating travel needs to the hospital, ensuring provider availability, avoiding scheduling conflicts, having a history of poor pregnancy experiences, or misunderstanding the definition of a “full-term” pregnancy.⁹

States and other policy makers have implemented several approaches to reduce EEDs, including voluntary provider efforts and payment reform. To date, however, the small body of literature has focused on the Medicaid population, perhaps due to special concern

about infant outcomes in this generally less healthy population, or because Medicaid pays for almost half of US births.¹⁰ Thus far, no study has examined the impact of policies on EED rates among privately insured individuals. This gap is notable because, compared to Medicaid, private insurance accounts for an even larger percentage of all US births¹⁰ and is associated with higher rates of elective deliveries.^{10,11}

Further, no study has examined the impact of different types of EED reduction policies in the same population. Instead, empirical studies have tested the impact of *either* voluntary policies or nonpayment policies, often in single state settings. A voluntary educational outreach program conducted among 97 percent of eligible Ohio hospitals was associated with an EED rate reduction from 6.2 percent to 3.2 percent.¹² Yet, other education-based voluntary programs in 11 hospitals across several states resulted in no statistically significant change in EED rates.¹³

The literature on nonpayment policies—in which insurers refuse to pay for nonmedically justified EEDs—is similarly small and limited to Medicaid enrollees, but the findings are more consistent. Dahlen et al⁹ examined the impact of Medicaid nonpayment in Texas and found that EED rates declined by up to 14 percent. Buckles and Guld¹⁴ analyzed the impact of Medicaid policies in multiple states, finding that nonpayment policies decreased EED rates by 0.3 standard deviations, just under a 10 percent reduction. In this analysis, the authors only examined early-term inductions, rather than all EEDs, which would include Cesarean births. In a working paper, Byanova analyzed changes in EED rates in Texas, after the state passed a bill that required all hospitals and obstetric practitioners to implement practices to eliminate EEDs, and the state's Medicaid program (but not private payers) eliminated reimbursement for EEDs among its enrollees.¹⁵ Together, the two policies reduced EED rates by 18.5 percent and 5.9 percent in the Medicaid and non-Medicaid populations, respectively. Byanova attributes this discrepancy to the differential treatment of the two populations: Medicaid enrollees faced both the legislative and the reimbursement change, while the non-Medicaid population was subject only to the bill.

Because these two policy types require different programmatic approaches and probably vary in their respective impacts—with nonpayment policies likely more effective than voluntary efforts—this omission is notable. To help fill this gap, we provide the first examination of both voluntary and nonpayment efforts on EED rates and related birthweight outcomes in both the Medicaid-enrolled and privately insured populations. We make use of a unique natural experiment in South Carolina (SC), in which all hospitals in the state voluntarily pledged to reduce EEDs. Later, both Medicaid and the state's largest private payer, Blue Cross Blue Shield (BCBS), ceased payment for EEDs. Though six states (SC, plus Georgia, Michigan, New Mexico, New York, and Texas) have adopted a nonpayment policy for Medicaid,⁹ SC is the only one to have also instituted nonpayment in the privately insured population.¹ Thus, we can examine the impact of both a voluntary and a nonvoluntary policy in the same state, across two different insurance groups.

1.1 | The South Carolina Birth Outcomes Initiative

The SC Birth Outcomes Initiative (SCBOI) began in July 2011 as a response to the state's 9.62 percent EED rate—the fourth highest in the country at the time. In addition to improving outcomes for infants, the state stood to save \$1 million a year in delivery costs and an additional \$7 million in reduced hospitalizations for babies, should EEDs be eliminated.¹ The first major policy intervention of the SCBOI was a voluntary effort among all SC birthing hospitals, which implemented strategies such as patient and provider education.¹⁶ Importantly, the state's Medicaid director at the time of the initiative declared that if rates were not suitably reduced with the voluntary program, he would institute a nonpayment policy for EEDs. This statement likely influenced hospital and provider behavior beyond what would have occurred in a truly voluntary situation. The nonpayment policy was implemented by both Medicaid and Blue Cross Blue Shield (BCBS, a private payer) in January 2013. If an EED was not medically justified, the hospital would attempt to “hard stop” the procedure from being scheduled; if a procedure was scheduled anyway, the insurers would not pay for it. Medicaid and BCBS jointly cover 85 percent of births in SC.¹

2 | STUDY DATA AND METHODS

We use a difference-in-differences identification framework to provide the first causal evidence of SCBOI's impact. This approach isolates the impact of a policy on a treatment group by comparing it to a control group that did not receive the policy, while accounting for pre-existing differences between both groups. At the same time, it allows us to identify the relative impacts of the separate voluntary and nonpayment policies.

Data for this study come from restricted-use National Vital Statistics data from the National Center for Health Statistics from 2009 to 2015¹⁷ and contain detailed information about the universe of births occurring in the United States. Birth records contain socio-demographic characteristics of the mother, father, and child, including sex, race/ethnicity, educational attainment, and smoking behaviors before and during the pregnancy. They also report whether a woman was induced into labor, whether a baby was delivered vaginally or by Cesarean birth, and the gestational length of the pregnancy. Finally, they provide birth weight of the baby, a proxy for health at birth. The restricted access dataset provides the county and state of birth. Our sample period starts in 2009 because that is the first year in which payment source for births was reported in National Vital Statistics data. We report results only for states using an updated birth certificate format that was first adopted by some states beginning in 2003, and which was fully adopted by all states in 2015. As a sensitivity analysis, we remove all states that were not using the updated birth certificate for the entire sample period and find similar results.

We compare EED rates and health outcomes in SC to the 16 states (Arizona, Colorado, Delaware, Idaho, Illinois, Indiana, Iowa, Kansas, Montana, Nebraska, Nevada, Pennsylvania, Utah,

Virginia, West Virginia, and Wyoming) that never implemented an EED reduction policy during our study period of 2009-2015. Our unit of analysis is the individual. Our first independent variable is *SC*, a dichotomous indicator equal to 1 if the birth occurred in SC (the treatment group), and 0 if it occurred in a different state (the control group). The second independent variable is *Voluntary*, a dichotomous indicator equal to 1 if the birth occurred during the period of time in which the voluntary pledge policy was in effect (September 2011 to December 2012). The third independent variable is *NonPay*, a dichotomous indicator equal to 1 if the birth occurred during the period of time in which the nonpayment policy was in effect (ie, January 2013 forward). Our key parameters of interest are the separate interaction terms between *SC* and *Voluntary*, and *SC* and *NonPay*, which allow us to estimate the independent effects of each policy.

Our model takes the form:

$$Y_{ist} = \alpha_0 + \beta_1 SC_s + \beta_2 Voluntary_t + NonPay_t + \beta_4 (SC_s * Voluntary_t) + \beta_5 (SC_s * NonPay_t) + X_{ist} \phi' + \lambda_s + \gamma_t + \varepsilon_{ist}$$

where i indexes the individual, s indexes the state of birth, and t indexes the year of birth. We include a vector X_{ist} of demographic characteristics, including sex of the child, and a number of maternal characteristics, including maternal age fixed effects, race/ethnicity, marital status, educational attainment, whether the mother was born in the United States, whether the mother smoked at any of four separate points during the pregnancy (prepregnancy and in each trimester). We also include county/state and year fixed effects, represented by λ_s and γ_t , respectively; ε_{ist} represents the random error term, which we adjust for serial correlation within the state of birth. We perform inference by calculating wild bootstrapped P -values for our main analysis.¹⁸ All models were estimated using OLS.

Our primary outcome variable was whether an individual birth was an EED, which we measured using the approach created by Fowler¹⁹ and followed by Dahlen et al.⁹ We defined an EED as any birth in which a woman was induced into labor or had a Cesarean birth between 37 and 39 weeks of pregnancy without medical justification. The medically justified list includes conditions present throughout the pregnancy such as diabetes, hypertension, eclampsia, breech, and other pregnancy abnormalities, as well as medical conditions present at the time of delivery like premature rupture of membranes, prolonged labor and fetal distress listed in Table S1. As a test for whether physicians “game” the system, we also ran a model in which our outcome is medically justified early deliveries. If physicians simply create justification by improperly indicating medical necessity of an early delivery, we would expect a sudden increase in the rate of *nonelective* early deliveries. Because we measure both categories with error, we also include a variable for women who were either induced or received a Cesarean section between 37 and 39 weeks regardless of whether it was medically justified.

An additional outcome of interest is gestation weeks, a predictor of health outcomes, which we measured in two ways. First, we simply measured weeks of gestation, as defined by last menses. This

measure has been validated by the CDC as an accurate measure of gestational age; as a robustness check, we also use obstetrician estimate of gestational age, another CDC-validated measure.^{20,21} Our results are robust to this change in measurement instrument. We then created separate binary variables for whether a birth occurred before 39 weeks, in the 39th week, or after 39 weeks.⁹ Our last outcome variable was birthweight, which we measured in grams. Because of the poor health outcomes associated with categorically low birthweight, we also created a binary variable equal to one if the baby weighed <2500 g at the time of birth.

A major advantage of examining the SCBOI is that the program implemented nonpayment across both the Medicaid and the private-pay populations. To determine the impact of the policies on each group, we stratified our analyses by insurance status. Since coefficients from stratified analyses cannot be directly compared, we report results in terms of coefficients and relative changes from baseline, which offer a better basis for comparison.

We tested the robustness of our results in several ways. We limited our sample to only those states that consistently used the 2003 updated birth certificate in all sample years. We allow each state to trend differently by including state-specific linear time trends. We included only state fixed effects, rather than county fixed effects, which controlled for time invariant characteristics of the area, such as proclivity for providers to prefer inducing births early.¹⁴ We limit the sample to that used in by Byanova and use binary response models including logit and probit.¹⁵ We do not use wild bootstrap methods for these analyses as it requires substantial computing power to perform. Our results are quite robust to these additional specifications (see Tables S4-S6).

We also conduct a supplementary analysis in which we break out our main analysis by procedure type (C-section vs inductions). Because unsuccessful early inductions can necessitate a C-section, we avoid double-counting C-sections by treating inductions as the absorbing state (ie, if a patient is listed as having an induction and C-section for the same birth, they are coded as having only an induction, which assumes that induction occurred first and the C-section that followed was necessitated by an unsuccessful induction).

3 | RESULTS

From 2009 to 2015, there were 27 935 288 births in the United States. We limited our main analysis to include only SC and states that never implemented an EED policy during our study period, reducing our sample to 6 791 845. We further eliminated any state-year before which the state implemented the 2003 birth certificate, bringing our sample to 5 730 180. We included only births that gestated for at least 37 weeks and eliminated deliveries paid for by other sources besides Medicaid (1 921 639) and private insurance (2 671 813), yielding a final analytic sample of 4 593 452.

In Table 1, we provide summary statistics for our sample. This table provides means of each outcome variable and independent

	South Carolina		Control states	
	Medicaid	Private insurance	Medicaid	Private insurance
All early delivery	18.9 (39.2)	20.9 (40.6)	13.8 (34.5)	15.1 (35.8)
Early elective delivery	12.7 (33.4)	13.4 (34.1)	8.8 (28.3)	9.4 (29.2)
Early elective C-sections	6.1 (24.0)	7.0 (25.5)	4.7 (21.2)	5.4 (22.5)
Early elective inductions	6.6 (24.9)	6.4 (24.5)	4.1 (19.8)	4.1 (19.8)
Medically justified early delivery	6.2 (24.1)	7.4 (26.2)	5.0 (21.9)	5.6 (23.0)
Gestational age (wk)	39.2 (1.6)	39.1 (1.4)	39.3 (1.6)	39.2 (1.4)
Born before 39th week	34.1 (47.4)	33.6 (47.2)	29.9 (45.8)	29.1 (45.4)
Born in 39th week	31.3 (46.4)	35.3 (47.8)	31.2 (46.3)	34.7 (47.6)
Born after 39th week	34.6 (47.6)	31.2 (46.3)	38.9 (48.8)	36.2 (48.0)
Birthweight (g)	3250.4 (473.1)	3386.8 (464.7)	3308.0 (468.7)	3413.6 (462.5)
Low birthweight	5.1 (22.0)	2.8 (16.5)	4.0 (19.5)	2.4 (15.4)
Mother's age	24.3 (5.4)	29.3 (5.4)	24.9 (5.6)	29.6 (5.2)
White	46.2 (49.9)	75.0 (43.3)	53.9 (49.9)	82.7 (37.8)
Black	44.1 (49.7)	18.3 (38.7)	16.8 (37.4)	4.7 (21.2)
Other race	1.2 (11.1)	2.9 (16.7)	3.6 (18.6)	5.0 (21.8)
Hispanic	8.1 (27.2)	3.3 (17.8)	25.2 (43.4)	7.2 (25.9)
Married	28.7 (45.2)	79.3 (40.5)	34.8 (47.6)	85.1 (35.6)
Less than High School	30.7 (46.1)	5.4 (22.6)	30.1 (45.9)	3.9 (19.4)
High School Graduate	33.9 (47.3)	14.1 (34.8)	35.6 (47.9)	14.3 (35.0)
Some College	30.1 (45.9)	33.3 (47.1)	27.9 (44.9)	31.1 (46.3)
College Plus	5.0 (21.7)	47.0 (49.9)	5.5 (22.7)	50.2 (50.0)
Male Child	50.5 (50.0)	50.5 (50.0)	50.9 (50.0)	50.9 (50.0)
Born in United States	91.9 (27.4)	92.7 (26.0)	79.9 (40.1)	88.7 (31.7)
Smoked Prepregnancy	21.2 (40.9)	9.1 (28.8)	25.9 (43.8)	8.5 (27.8)
Smoked 1st Trimester	16.9 (37.5)	5.8 (23.4)	21.2 (40.9)	5.3 (22.5)
Smoked 2nd Trimester	14.5 (35.2)	4.4 (20.5)	18.7 (39.0)	4.3 (20.2)
Smoked 3rd Trimester	13.9 (34.6)	4.2 (20.0)	18.1 (38.5)	4.1 (19.8)
Observations	64 655	51 292	557 129	792 766

Note: Means presented with standard deviations in parentheses. Inductions are treated as the absorbing state (ie, if a patient is listed as having an induction and C-section for the same birth, they are coded as having only an induction, which assumes that induction occurred first and the C-section that followed was necessitated by an unsuccessful induction).

variable included in our main specification. (In Table S2, we present descriptive statistics in the same format as Table 1, but expand the sample to include births after the voluntary pledge was

TABLE 1 Summary statistics for South Carolina and Control states for the period before September 2011, by insurance status

enacted in September 2011.) The rates of EEDs in South Carolina during the study period were substantially higher for both the Medicaid and privately insurance groups. The rate of Medicaid

FIGURE 1 Medicaid [Color figure can be viewed at wileyonlinelibrary.com]

EEDs in SC was 16 percent, compared to 12 percent in the control group. Across both the treatment and control groups, EED rates were slightly lower among the privately insured compared to Medicaid enrollees. Rates of medically justified early deliveries were lower in control states. Medicaid coverage rates were particularly high in South Carolina, accounting for more than 57 percent of our sample, compared to 42 percent for the control sample. This number was calculated by comparing the number of observations in Medicaid in SC divided by the total number of observations in the Medicaid and private insurance columns. South Carolina has a larger black population and a smaller Hispanic population compared to the control states.

Figures 1 and 2 provide graphical evidence that SC and control groups were trending similarly in the period before SC enacted the voluntary policy to reduce EEDs. The difference-in-differences framework rests on the untestable assumption that treatment areas would have continued to trend in a similar fashion to the control group had the policy never been implemented. The fact that the two areas were trending similarly in the preperiod lends credibility to our identification strategy Figures S1 and S2.

In Table 2, we present results from our primary models, which examined the respective impacts of the voluntary pledge and mandatory nonpayment policies on the likelihood of having an EED. The adjusted EED rates were higher in the privately insured group (13.4 percent) than in the Medicaid sample (12.7 percent). Across the total sample, the voluntary pledge reduced the probability of receiving an

EED by 12.7 percent ($P < .05$). Compared to the preperiod before SC had implemented any EED policy, the mandatory nonpayment policy reduced the likelihood of receiving an EED by 16.6 percent ($P < .05$). While this effect size is larger than that for the voluntary policy, these results are not directly comparable. This can be seen more clearly in Figure 1. The decrease in EED began almost immediately following the voluntary policy implementation. By the time the mandatory policy was implemented, rates of EEDs were substantially lower than they had been before the voluntary policy. Therefore, we are unable to make claims about the effect of the mandatory policy on our outcomes of interest, over and above the voluntary policy.

The payer-stratified results are consistent with this overall trend. For the voluntary policy, we found similar relative changes from baseline (13.6 percent [$P < .05$]) among Medicaid-enrolled individuals, compared to the privately insured (13.4 percent [$P < .05$]). We find the greatest relative reduction in EEDs among Medicaid enrollees in response to the mandatory nonpayment policy (18.9 percent [$P < .05$]). This is a larger relative impact than we found in the privately insured group, in which there was a 16.6 percent ($P < .05$) reduction.

In Table S3, we provide results from our supplementary analysis, in which we break out our main analysis by procedure type (C-section vs induction). We find much larger relative reductions in induction rates. As above, we find larger effects for the mandatory nonpayment policy, and among the Medicaid population.

Panel B of Table 2 shows results from our second model, which tests whether physicians “game” the system by using medically

FIGURE 2 Private insurance [Color figure can be viewed at wileyonlinelibrary.com]

TABLE 2 Effect of South Carolina policy on early elective deliveries, differentiated by medically justified

	Full sample		Medicaid		Private insurance	
	Coefficient	% Change from baseline	Coefficient	% Change from baseline	Coefficient	% Change from baseline
Panel A. Early elective deliveries						
Voluntary pledge	-1.668* (0.154) [.01]	-12.7	-1.726* (0.127) [.01]	-13.6	-1.787* (0.236) [.01]	-13.4
Mandatory nonpayment	-2.173* (0.214) [.01]	-16.6	-2.396* (0.181) [.01]	-18.9	-2.219* (0.281) [.01]	-16.6
Observations	4 589 520		1 919 631		2 669 889	
Mean	13.053		12.748		13.437	
Panel B. Early medically justified (nonelective) deliveries						
Voluntary pledge	-0.668* (0.0605) [.01]	-9.9	-0.748* (0.0638) [.01]	-12.1	-0.519* (0.0700) [.01]	-7.0
Mandatory nonpayment	-0.547* (0.124) [.01]	-8.1	-0.423* (0.124) [.01]	-6.8	-0.648* (0.147) [.01]	-8.7
Observations	4 589 520		1 919 631		2 669 889	
Mean	6.749		6.199		7.442	
Panel C. All early deliveries						
Voluntary pledge	-2.336* (0.151) [.01]	-11.8	-2.474* (0.113) [.01]	-13.1	-2.306* (0.240) [.01]	-11.0
Mandatory nonpayment	-2.720* (0.255) [.01]	-13.7	-2.819* (0.231) [.01]	-14.9	-2.868* (0.328) [.01]	-13.7
Observations	4 589 520		1 919 631		2 669 889	
Mean	19.801		18.947		20.879	

Note: Baseline means measured using South Carolina mothers from 2009 to September 2011. Standard errors are in parentheses. All standard errors are clustered at the state level. Wild bootstrap *P*-values are in brackets, and all asterisks are based on these *P*-values unless otherwise denoted:

****P* < .001, ***P* < .01, **P* < .05.

justified (nonelective) early-term deliveries as its outcome. If physicians were attempting to circumvent the new rules to continue to receive higher reimbursement rates, we would expect to see an increase in these rates, suggesting that providers were fabricating medical codes that indicate a procedure is medically justified when it is not. Instead, we see declines in these rates, suggesting a certain level of caution by physicians and hospitals. This may be due to fear of not being reimbursed for a procedure or a shift toward enacting a higher standard to perform an EED to ensure that hospitals and physicians comply with state expectations of lower EED rates.

We present results for any early delivery, which is a combination of early elective and medically justified early-term deliveries, in Panel C of Table 2. Unsurprisingly, given the individual results for each, early deliveries decrease by between 11 percent and 13 percent during the voluntary policy and 14 percent and 15 percent during the mandatory policy.

In Table 3, we present gestation results. Panel A reveals that the number of weeks that babies spent in utero increased significantly across both insurance populations. The magnitude of these results is very small, because our sample is limited to those who gave birth in or after their 37th week; after this point in a pregnancy, large magnitude changes in gestation are unlikely. Nonetheless, Panel B provides evidence that the shift in gestation time helped reduce the proportion of births that took place before 39 weeks. Medicaid babies were 5.5 percent (*P* < .05) less likely to be born before the 39th week after the voluntary pledge, compared to no policy change. Again, the nonpayment policy had a larger effect size, reducing the likelihood of

an EED by 7.4 percent (*P* < .05). Among the privately insured group, both policies yielded about a 7 percent reduction (*P* < .01).

Panel C shows the impact of the policies on birthweight outcomes, a proxy for health at birth.²² Adjusted mean birthweight was higher in the privately insured group compared to the Medicaid group and increased by 0.3 percent (*P* < .01) and 0.4 percent (*P* < .01) after the implementation of the voluntary pledge and the nonpayment policy, respectively. Results by insurance status produced very similar effects for both voluntary pledge and nonpayment policy.

Panel D of the table shows whether these birthweight changes increased the proportion of births that were low birthweight. The only group in which we find a sizable and statistically significant change in this rate is for Medicaid enrollees who received the mandatory nonpayment intervention, with a reduction of 5.1 percent (*P* < .01).

4 | DISCUSSION

This paper provides the first formal examination of EED reduction policies in SC. Notably, it is the first study to test the impacts of these policies in the privately insured population, as well as in the Medicaid population. Further, this natural experiment offers a unique opportunity to examine both a voluntary and a mandatory nonpayment policy within the same state population.

Results from this study should be placed in the context of its limitations. First, and most importantly, the voluntary EED reduction policy was accompanied by the Medicaid director's warning that if EED rates

TABLE 3 Effect of South Carolina policy on gestation weeks

	Full sample		Medicaid		Private insurance	
	Coefficient	% Change from baseline	Coefficient	% Change from baseline	Coefficient	% Change from baseline
Panel A. Gestation (in wk)						
Voluntary pledge	0.035*** (0.005) [.00]	0.1	0.040*** (0.009) [.00]	0.1	0.041*** (0.006) [.00]	0.1
Mandatory nonpayment	0.058*** (0.010) [.00]	0.1	0.074*** (0.016) [.00]	0.2	0.060*** (0.007) [.00]	0.2
Observations	4 589 520		1 919 631		2 669 889	
Mean	39.144		39.198		39.075	
Panel B. Before 39 wk (percent of births)						
Voluntary pledge	-1.949* (0.176) [.01]	-5.7	-1.866* (0.159) [.01]	-5.5	-2.295* (0.278) [.01]	-6.8
Mandatory nonpayment	-2.152* (0.277) [.01]	-6.3	-2.515* (0.275) [.01]	-7.4	-2.235* (0.361) [.01]	-6.7
Observations	4 589 520		1 919 631		2 669 889	
Mean	33.887		34.140		33.569	
Panel C. Birthweight (in g)						
Voluntary pledge	8.801*** (0.855) [.00]	0.3	8.122*** (1.161)	0.2	11.070*** (0.773) [.00]	0.3
Mandatory nonpayment	13.579*** (1.659) [.00]	0.4	15.477*** (1.336)	0.5	14.419*** (2.099) [.00]	0.4
Observations	4 587 085		1 918 702		2 668 383	
Mean	3310.708		3250.386		3386.771	
Panel D. Low birthweight (percent of births)						
Voluntary pledge	0.001 (0.032) [.61]	0.0	-0.038 (0.048)	-0.7	0.029 (0.030) [.27]	1.0
Mandatory nonpayment	-0.081 (0.035) [.16]	-2.1	-0.263*** (0.044)	-5.1	0.080 (0.036) [.24]	2.8
Observations	4 587 085		1 918 702		2 668 383	
Mean	4.098		5.115		2.816	

Note: Baseline means measured using South Carolina mothers from 2009 to September 2011. Standard errors are in parentheses. All standard errors are clustered at the state level. Wild bootstrap *P*-values are in brackets, and all asterisks are based on these *P*-values unless otherwise denoted:

****P* < .001, ***P* < .01, **P* < .05. For Medicaid analyses of birthweight and low birthweight, we were unable to calculate wild bootstrap *P*-values. For these results, *P*-values are based on OLS clustered standard errors.

were not satisfactorily reduced, a nonpayment policy would be implemented. To some degree, this undermines the “voluntary” nature of the policy, and it is likely that voluntary policies without the underlying threat of nonpayment will be less effective. Therefore, though this natural experiment informs our understanding about voluntary policy effectiveness, our results may be specific to a voluntary policy that carries a penalty if ignored. However, hospitals could not have known whether the state would actually implement the threat of nonpayment, and we note that they implemented the nonpayment policy despite the fact that the original voluntary policy appeared to be working.

The way we structured our interaction terms in our model (ie, using only two two-way interaction terms, without a three-way interaction term between Voluntary, NonPay, and SC) means that the coefficient on each term can be viewed as each policy’s impact relative to the preperiod. This allows for a clean comparison of the impact of a nonpayment policy compared to no policy at all and should not be interpreted as evidence of the effect of the nonpayment policy compared to the initial voluntary policy.

A second limitation is that the SCBOI took place in a state with extremely high preperiod EED rates and involved intensive collaboration from multiple stakeholders within the state. Therefore, results

may not be generalizable to less highly motivated hospitals or states with lower EED rates to begin with.

Finally, birth certificate data are self-reported and may be prone to recall bias or measurement error. To the extent that differential measurement error exists by socioeconomic status, the stratification of our sample by insurance status should alleviate this concern. The strengths of these data, including the near universal nature of the data, and the fact these data have been used in a large majority of previous studies investigating EEDs far outweigh minor concerns about the self-reported nature of the data.^{9,14}

We find that the voluntary pledge reduced EEDs across both privately insured and Medicaid-enrolled individuals, which is consistent with previous literature that examined similar policies in other states.^{12,13} As predicted, we also find that the mandatory nonpayment policy reduced EED rates, especially in the Medicaid group. Taken together, the largest impacts of the EED policies occurred among Medicaid enrollees. We posit that there are two mechanisms through which this differential effect might have occurred. First, in the case of the voluntary pledge to reduce EEDs, it is possible that providers more consistently targeted Medicaid patients, due to the known poorer health outcomes in this population. Second, the privately insured

patients may have more resources available to appeal an insurer's decision. Therefore, reducing EED rates to desired levels among the privately insured might require more education for patients on the health-related (ie, nonmonetary) benefits of delaying birth.

Like Dahlen et al,⁹ we find no concomitant increase in medically justified (nonelective) deliveries over our study period, which we take as evidence the providers are not merely reducing their EED rates by changing their coding practices to make their deliveries appear more medically justified.

We find that both types of EED policies were effective in reducing the proportion of births that were born prior to 39 weeks. As expected, and consistent with prior literature, longer gestation times yielded higher birthweights.⁹ However, only in the Medicaid group did the mandatory nonpayment policy meaningfully decrease the proportion of categorically low birthweight babies. Considering that this population generally has higher rate of low birthweight and poorer health outcomes, the 8.3 percent decrease in this measure is notable; it suggests EED nonpayment policies are viable mechanisms for improving population health among Medicaid enrollees.

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SUPPORTING INFORMATION

Additional supporting information may be found online in the Supporting Information section.

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