Published in final edited form as:

Womens Health Issues. 2018 ; 28(3): 224–231. doi:10.1016/j.whi.2017.11.008.

Early elective delivery disparities between non-Hispanic black and white women following statewide policy implementation

Katy B. Kozhimannil, PhD, MPA,

Division of Health Policy and Management, University of Minnesota School of Public Health. 420 Delaware St. SE, MMC 729, Minneapolis, MN 55455, Phone: 612-626-3812

Ifeoma Muoto, PhD*,

Department of Obstetrics & Gynecology, Oregon Health & Science University, 3181 SW Sam Jackson Park Rd., Mail code: L-466, Portland, OR 97239, Phone: 860-455-6049

Blair G Darney, PhD, MPH,

Assistant Professor, Department of Obstetrics & Gynecology, Oregon Health & Science University, 3181 Sam Jackson Parkway Mail code: L-466 Portland, OR, 97239 Area Director, National Institute of Public Health, Cuernavaca, Mexico, Av. Universidad No 655, Cuernavaca, Mexico 62100, phone: 503-494-1190

Aaron B Caughey, MD, PhD, and

Department of Obstetrics & Gynecology, Oregon Health & Science University, 3181 SW Sam Jackson Park Rd., Mail code: L-466, Portland, Oregon 97239, Phone: 503-494-2999

Jonathan M. Snowden, PhD

Assistant Professor, Department of Obstetrics & Gynecology, Oregon Health & Science University, and School of Public Health, Oregon Health & Science University/Portland State University, 3181 SW Sam Jackson Park Rd., Mail code: L-466, Portland, Oregon 97239, Phone: 503-494-0904

Abstract

Background—In 2011, Oregon implemented a policy that reduced the state's rate of early (before 39 weeks' gestation) elective (without medical need) births.

Objective—This analysis measured differential policy effects by race, examining whether Oregon's policy was associated with changes in non-Hispanic black-white disparities in early elective cesarean and labor induction.

Methods—We used Oregon birth certificate data, defining pre-policy (2008–2010) and post-policy (2012–2014) periods, including non-Hispanic black and white women who gave birth

Corresponding Author Information: Katy B. Kozhimannil, Division of Health Policy and Management, University of Minnesota School of Public Health, 420 Delaware Street SE, MMC 729, Minneapolis, MN 55455. Telephone: 612-626-3812; Fax: 612-624-2196; kkb@umn.edu.

*Present affiliation: Kaiser Permanente Southern California, Los Angeles, California.

Publisher's Disclaimer: This is a PDF file of an unedited manuscript that has been accepted for publication. As a service to our customers we are providing this early version of the manuscript. The manuscript will undergo copyediting, typesetting, and review of the resulting proof before it is published in its final citable form. Please note that during the production process errors may be discovered which could affect the content, and all legal disclaimers that apply to the journal pertain.

during these periods (N=121,272). We used longitudinal spline models to assess policy impacts by race and probability models to measure policy-associated changes in black-white disparities.

Results—We found that the pre-policy black-white differences in early elective cesarean (6.1% vs 4.3%) were eliminated after policy implementation (2.8% vs 2.5%); adjusted models show declines in the odds of elective early cesarean among black women post-policy (adjusted odds ratio=0.47, 95% confidence interval=0.22–1.00; P=0.050) and among white women (adjusted odds ratio=0.79, 95% confidence interval=0.67–0.93; P=0.006). Adjusted probability models indicated that policy implementation resulted in a 1.75 percentage point narrowing (P=0.011) in the black-white disparity in early elective cesarean. Early elective induction also declined, from 4.9% and 4.7% for non-Hispanic black and non-Hispanic white women to 3.8% and 2.5%, respectively; the policy was not associated with a statistically significant change in disparities.

Conclusion—A statewide policy reduced racial disparities in early elective cesarean, but not early elective induction. Attention to differential policy effects by race may reveal changes in disparities, even when that is not the intended focus of the policy.

Introduction

Racial disparities in birth outcomes are stark and have remained largely unchanged for over a century (Lu & Halfon, 2003; Bryant, Worjolah, Caughey, & Washington, 2010; Grobman et al., 2015; Elder, Goddeeris, Haider, & Paneth, 2014). The largest, most consistent racial disparities occur when comparing non-Hispanic black and white women and their infants. Non-Hispanic black women have substantially higher rates of maternal mortality, morbidity, and preterm birth, compared with non-Hispanic white women (Callaghan, Creanga, & Kuklina, 2012; Howell, Egorova, Balbierz, Zeitlin, & Hebert, 2016), and their infants are at higher risk of complications and death (Elder, Goddeeris, Haider, & Paneth, 2014). There are also racial disparities in care during childbirth, including differences that do not appear to be driven by these noted differences in maternal morbidities. For example, non-Hispanic black women have higher rates of cesarean delivery than non-Hispanic white women (Bryant, Worjolah, Caughey, & Washington 2010), including cesarean without a medical indication (Huesch & Doctor, 2015), but potentially lower rates of induction of labor without medical indication (Kozhimannil, Macheras, & Lorch, 2014), compared with non-Hispanic white women. Differences in cesarean use or labor induction, including differences not driven by medical need, may contribute to racial disparities in neonatal and maternal outcomes. This potential association may be driven by timing of procedure use, overuse, underuse, or misuse.

Use of obstetric procedures during childbirth is increasingly common in the United States. In 2014, the percentage of cesarean births was 32.2% and the percentage of births that involved labor induction reached 22.8% (Martin, Hamilton, Osterman, 2015). Overuse of obstetric procedures is a growing concern, and the American College of Obstetrician-Gynecologists and Society for Maternal-Fetal Medicine have developed a consensus statement on safe reduction of cesarean use, focusing on cesarean births that are elective, or performed without clear medical need (Caughey, Cahill, Guise, & Rouse, 2014). The use of cesarean delivery may be “elective” (i.e., performed without medical indication), and/or the early-term timing of cesarean delivery may be elective (i.e., 37 or 38 weeks’ gestation but

with a medical indication, e.g., breech fetal presentation), but either may affect the chances of adverse neonatal outcomes. Infants born in the early-term period – via labor induction or cesarean – are at increased risk of mortality, respiratory distress syndrome, and admission to the neonatal intensive care unit (NICU) (Segupta, et al., 2013; Parikh, et al., 2014). Both the clinical management and the outcomes of early elective delivery differ by mode of initiation (labor induction or cesarean). In particular, early elective cesarean is associated with specific adverse outcomes for infants, doubling the risk for infant respiratory distress or need for ventilation (Tita, et al., 2009).

Black-white differences in early elective delivery have been recognized, with non-Hispanic black women having 30% higher odds of early elective cesarean, compared with non-Hispanic white women (Kozhimannil, Macheras, & Lorch, 2014). Differences in early elective delivery are much less clearly and consistently documented for other racial or ethnic groups (e.g. Hispanic, Asian, American Indian) compared with white women, which is why we focus on black-white differences in this analysis (Bryant, Worjolah, Caughey, & Washington, 2010).

The strong evidence of associated harms explains why efforts targeting early elective deliveries have become a clinical and policy priority. Recent initiatives by the Joint Commission, the National Quality Forum, the Leapfrog Group, March of Dimes, and the Centers for Medicare and Medicaid Services have focused on reducing or eliminating early elective births (Main, 2009; Fowler, Schiff, Applegate, Griffith, & Fairbrother, 2014). These broad, national initiatives have been bolstered by policy efforts at hospitals (Ehrenthal, Hoffman, Jiang, & Ostrum, 2011), within health systems (Oshiro, Henry, Wilson, & Branch, 2009), and at the state level (Donovan, et al., 2010; Snowden, et al. 2016). To date, racial disparities have not been a focus of these policy initiatives (Fowler, Schiff, Applegate, Griffith, & Fairbrother, 2014).

Oregon's 2011 statewide policy on early elective deliveries, described in detail elsewhere, effectively prohibited elective inductions and cesarean deliveries before 39 weeks' gestation, and resulted in a steep decline in their use (Snowden, et al., 2016). The policy was devised by the Oregon Perinatal Collaborative, implemented by hospitals across the state on a rolling basis throughout 2011, and designed as a "hard-stop" (i.e., an administrative prohibition rather than a "soft-stop," which leaves more discretion to providers) (Clark, Frye, & Meyers, 2010). It effectively prevented early elective deliveries by requiring review and administrative approval for any scheduled labor induction or cesarean delivery without a documented medical indication before 39 weeks' gestation. The policy was implemented at the hospital level and was expected to affect all women who were candidates for early elective delivery equally, regardless of individual factors such as insurance status and race/ethnicity. Although the Oregon hard-stop policy was not designed explicitly to target non-Hispanic black-white disparities, there is now strong evidence suggesting that policy implementation may affect population subgroups differentially, with implications for disparities (Lorenc, Petticrew, Welch, & Tugwell, 2013).

In the context of a broad, statewide policy, we aimed to understand whether racial disparities existed prior to policy implementation and if the policy's adoption affected outcomes

differently for non-Hispanic black and white women. In addition to their potential impact on overall population health, policies may affect disparities in health outcomes (Frohlich & Potvin, 2008). Public health interventions may be targeted at the general population, at vulnerable populations, or both simultaneously, and policies in any of these categories may act to increase or decrease disparities (Purnell, et al., 2016). It is therefore critical to understand how policies affect not just population health, but also racial subgroups and disparities between them, in order to design and implement policies that are both effective and equitable. This analysis measured differential effects of policy implementation by race, examining whether Oregon's policy was associated with changes in non-Hispanic black-white disparities in early elective cesarean and early elective induction of labor.

Methods

Data and study population

This analysis utilized birth certificate records from the state of Oregon between 2008 and 2014 (N = 325,823). The Oregon Center for Health Statistics compiles vital records and provided the data files used for this study. In order to focus on disparities between non-Hispanic black and white women in early elective delivery, we excluded preterm births (<37 weeks' gestation (n = 25,198)), women from other racial and ethnic groups (Hispanic, Asian, American Indian/Alaska Native, or other races (n = 88,590)), and out of-hospital births (n = 6,411). Although there are also important disparities in obstetric procedures and morbidities as relates to other racial and ethnic groups (Grobman et al., 2015), this analysis focused on disparities between non-Hispanic black and white women, as these are the most consistently observed. In keeping with prior literature (Kozhimannil, Macheras, & Lorch, 2014), we used the Joint Commission specifications to define a population of women "at risk" for elective cesarean or labor induction by: (1) excluding women with contraindications to vaginal delivery (n = 10,123), and (2) excluding women with medical conditions potentially justifying early delivery (n = 54,429) (The Joint Commission, 2013). As such, all births included in the analysis were singleton births without any pregnancy-related risk factors or diagnoses that would require a cesarean, or delivery before 39 weeks' gestation. We also excluded deliveries in 2011 as this was considered a transitional period for the implementation of the hard-stop policy (n = 19,710). The final study population included 121,272 non-Hispanic black and white women who gave birth in Oregon in 2008–2010, or 2012–2014. A diagram of the study population is included as a Supplemental Appendix.

Variables

This analysis focused on "early elective cesarean delivery," performed without labor, and "early elective labor induction." Based on the Joint Commission's specifications manual (The Joint Commission, 2013), we used the following conditions to determine the presence of labor: fetal intolerance of labor, prolonged labor, attempted forceps or vacuum delivery, uterine rupture, induction of labor, augmentation of labor, uterine bleeding, and precipitous labor. The main outcome variables were thus measured as obstetric procedures (cesarean or labor induction) occurring at 37 or 38 weeks' gestation without a documented medical or obstetric indication on the birth certificate. This analysis did not include cesareans

performed early, but with documentation of a medical indication (elective as to timing, but not indication).

The key exposures of interests were the period before (2008–2010) or after (2012–2014) the implementation of Oregon’s hard-stop policy, and maternal race/ethnicity (non-Hispanic white, non-Hispanic black), which is reliably self-reported in birth certificate data (Baumeister, Marchi, Pearl, Williams, & Braveman, 2000).

Given the many changes in obstetric procedure utilization nationally over the study period, this analysis adjusted for maternal characteristics that may be associated with obstetric procedure use. This keeps potential temporal changes in these variables over time from driving estimated associations between policy implementation and procedure use. Maternal characteristics were determined based on prior literature on obstetric procedure use, and were derived from birth certificate data. Covariates included maternal age (35 years or more versus less than 35), maternal education (more than 12 years versus 12 or less), prenatal care visits (5 or more versus fewer than 5 visits), parity (nulliparous or multiparous), and insurance type (private or public/no insurance).

Analysis

We conducted three main types of analyses: descriptive, longitudinal, and probability models. First, we used chi square analysis to describe maternal characteristics and temporal trends in early elective cesarean and early elective labor induction (before versus after policy), overall and for non-Hispanic white and black women separately. Second, recognizing the possibility that pre- and post-policy time trends may be present and may affect estimation of the policy effect, we employed a longitudinal modeling approach, spline regression. Specifically, we used a single knot for the policy period (i.e., 2011), and modelled time using 6-month intervals with separate segmented regressions in the pre- and post-policy periods. Although data were available on month of delivery, the size of the population, number of covariates in the models, and the event rate precluded analysis using more fine-grained temporal intervals than 6 months. We controlled for the variables described above. Third, we specified multivariable probability models to estimate, for each outcome, the change in the disparity between white and black women from the period before the policy to the period after the policy. In the probability model, we included interaction terms between time and race; the coefficient of these interaction terms represented the change in disparities from the pre-policy to the post-policy period (i.e., whether disparities widened, narrowed, or stayed the same). This multivariable probability model describes results (both disparities and changes in disparities) in terms of percentage points.

Women without medical indication for early delivery and who gave birth any time after 37 weeks’ gestation are “at risk” for early elective delivery, not just women who gave birth at 37 or 38 weeks (Caughey, Nicholson, Cheng, Lyell, & Washington, 2006). Therefore, the denominator for these analyses was women who gave birth at 37 weeks or later and had no medical indication for delivery prior to 39 weeks’ gestation.

All models were estimated with robust standard errors and all analyses were conducted using Stata 14. This analysis was approved by the Institutional Review Board at Oregon Health and Science University.

Results

Results are described below for each of the three main types of analyses: descriptive (Table 1), longitudinal (Table 2; Figure 1), and probability models (Table 3).

Pre- and post-policy maternal characteristics for non-Hispanic black and white women are shown in Table 1. Nearly 97% of the women in the analysis were white, and 3% were black. The percentage of mothers with more than 12 years of education was higher for white women compared with black women and increased between the pre- and post-policy periods to 70.4% for white women and 54.5% for black women. The percentage of women with Medicaid insurance at the time of childbirth increased slightly from 38.3% before 2011 to 39.8% after 2011, with a higher percentage of black women (63.5%) compared with white women (39.0%) having Medicaid coverage in the post-policy period. Having five or more prenatal care visits was near universal across the study population.

Overall rates of early elective cesarean declined from 6.1% and 4.3% among non-Hispanic black and white women, respectively, to 2.8% and 2.5% respectively, following implementation of Oregon's statewide policy. Rates of early elective induction of labor also declined, from 4.9% and 4.7% for black and white women to 3.8% and 2.5%, respectively. All other pre-post comparisons shown in the table are statistically significant ($p < 0.05$), except for the pre-post decline in early elective induction among black women ($P = 0.081$).

For both non-Hispanic black and white women, and overall, measured changes in the odds of early elective cesarean or early elective induction following policy implementation are shown in Table 2. After adjustment for age, education, payer, parity, and prenatal care utilization, the odds of early elective cesarean dropped 22% between the pre- and post-policy periods (AOR=0.78, 95% Confidence Interval (CI)=0.66–0.91, $P = 0.002$), led by a dramatic drop (53%) among black women, compared with a 21% decline in the odds of early elective cesarean among white women (black AOR=0.47, 95% CI=0.22–1.00; $P = 0.050$; white AOR=0.79, 95% CI=0.67–0.93, $P = 0.006$).

For early elective induction of labor, Oregon's policy was associated with a 26% decline in the odds of this outcome (AOR=0.74, 95% CI=0.64–0.87, $P < 0.001$). The decreased odds of this outcome were concentrated in white women, (AOR=0.73, 95% CI=0.62–0.85, $P < 0.001$); for black women, a significant change was not detected (AOR=1.34, 95% CI=0.59–3.05, $P = 0.489$).

After measuring policy-associated changes in odds of early elective delivery for non-Hispanic black and white women, we used linear probability models to directly measure the black-white disparity in early elective cesarean and early elective induction in terms of percentage points (Table 3). We present both pre- and post-policy differences, and then measure the change in the black-white disparity following Oregon's policy. Prior to policy implementation, there was a 1.95 percentage point difference in the rate of early elective

cesareans between black and white women, with higher rates among black women ($P<0.001$). After the policy, the 0.10 percentage point difference was negligible ($P=0.809$), indicating that the policy resulted in a 1.75 percentage point narrowing ($P=0.011$) in the black-white disparity in early elective cesarean, effectively eliminating that disparity. The pre-policy black-white difference in early elective induction rates was 0.12 and not statistically significant ($P=0.813$), but in the post-policy period, there was a 1.01 percentage point disparity, such that white women had lower rates of the outcome ($P=0.027$). Yet, the widening in the disparity (0.89 percentage points) in early elective induction rates that emerged with the pre-post change was not statistically significant ($P=0.194$).

Figure 1 shows trends in the rates of early elective cesarean (panel A) and early elective induction of labor (panel B) during the study period. It compares pre-policy (2008–2010) and post-policy (2012–2014) trends in study outcomes for non-Hispanic black and white women, and shows linear trends as well as intercept differences for black and white women that occur at the time of policy implementation. Panel A highlights the racial disparity in early elective cesarean that existed prior to 2011 and was eliminated after the policy was implemented. It also shows the absence of any black-white disparity in early elective labor induction prior to policy implementation, and the (non-significant) difference that emerged following the policy.

Discussion

While the main intent of the Oregon's 201 statewide early elective delivery policy was not focused on reducing racial disparities, this analysis showed that the pre-policy disparity between non-Hispanic black and white women in early elective cesarean (6.1% vs 4.3%) was eliminated after policy implementation (2.8% vs 2.5%), owing to a particularly marked decline in the odds of early elective cesarean among black women after the policy was in place. The odds of early elective cesarean decreased among white women after 2011 as well, but the rate of early elective cesarean among black women was higher initially, and this subgroup of women experienced a correspondingly greater decline in this outcome.

One potential mechanism through which such a policy may have differential policy effects by race could occur via hospital compliance with evidence-based practice. Prior research shows that the quality of maternity care in the delivery hospital may contribute to black-white disparities in birth outcomes (Howell, Egorova, Balbierz, Zeitlin, & Hebert, 2016), so hospital-based quality improvement in maternity care may have greater effects on black mothers if the hospitals where they receive care consistently perform comparatively poorly in the absence of a policy designed to ensure consistency within and across hospitals. The finding of a reduced black-white disparity following Oregon's policy is encouraging because of the known adverse effects of early elective cesarean (Kozhimannil, Macheras, & Lorch, 2014; Sengupta, et al., 2013), and the potentially life-long health and cost consequences (Tita, et al., 2009). In considering mechanisms explaining changes in procedure use, it must also be considered that changes in clinical practice and policy climate may predate official policy implementation, e.g., through increased provider awareness of emerging clinical evidence prior to the policy's adoption (as suggested by the decreases in procedure use seen in the pre-policy period in the spline models for both outcomes). This pre-policy uptake has

been observed in other policy areas and practice guidelines, including in obstetrics (Kozhimannil, Karaca-Mandic, Blauer-Peterson, Shah, & Snowden, 2017), and suggests that some providers change practice in response to evidence, but prior to adoption of official policies.

Interestingly, this analysis revealed different policy effects not only by race but also by the specific procedure (e.g., cesarean delivery versus induction of labor), which may reflect differences in clinical practice and decision-making around both of these procedures. Before 2011, non-Hispanic white women and black women had similar rates of early elective induction in Oregon (4.7% vs 4.9%). Significant policy-related declines in the odds of early elective induction were observed among white women, but this drop was smaller in magnitude and not statistically significant among black women, suggesting that the policy may have had the potential to widened disparity (although the measured change did not meet the threshold of statistical significance at the $P < 0.05$ level).

Taken together, these findings highlight the complexity of designing and evaluating healthcare policies, which may affect multiple outcomes in different manners and magnitudes, calling for thoughtful weighing of benefits against risks. Without clear attention to the potential impact of policy effects on disparities, an unintended effect may be the creation of disparities that may go unnoticed if data are not disaggregated by race, especially in a context like Oregon, where the vast white majority among those who give birth dominate the average statistics.

Implications for Policy and Practice

Briefly, there are important limitations of this analysis, which are described in greater detail below, but include data constraints and sample size considerations. In spite of the limitations described, the findings have implications for the clinical practice of obstetric care and for broader maternity care policies.

Racial disparities are generated and perpetuated at multiple levels: societal context, the institutional/hospital level, and the interpersonal level (e.g., clinician-patient interactions) (Smedley & Stith, 2003). Interpersonally, patient-centered care and attention to overcoming implicit bias in clinical interactions may improve individual encounters (Hardeman, Medina, & Kozhimannil, 2016). At the institutional level, evidence suggests that a large proportion (nearly half, in one study) of racial disparities in maternal outcomes can be attributed to black women giving birth at minority-serving hospitals with lower quality of care and worse outcomes (Howell, Egorova, Balbierz, Zeitlin, & Hebert, 2016; Creanga, et al., 2014). Emerging research has begun to explore how women's experiences of provider and systems-level discrimination shape their birthing experiences and outcomes (Attanasio & Kozhimannil, 2015). As policies directed at improving maternity care procedure use proliferate as part of quality improvement initiatives, attention to the complex interplay between a patient's preferences, medical needs, provider recommendations, and hospital policies is needed in both policy research and implementation (Jou, Kozhimannil, Johnson, & Sakala, 2015).

Beyond the potential effects of interpersonal and institutional racism in the clinical context, Oregon's early elective delivery policy and all policies are designed and implemented against the backdrop of broader societal factors, one of which is structural racism (Nazroo, 2003). This deeply embedded social force affects maternal-child health (and other dimensions of life in the US) in complex ways that resist simple classification, but they are nonetheless essential to identify and rigorously study (Eichelberger, Doll, Ekpo, Zerden, 2016). The findings from this study highlight the importance of disaggregating policy impacts by race in evaluation and research.

Collectively, taking this study's findings into a broader policy context highlights the need for systems redesign toward patient-centered healthcare and shared decision-making, which must consider women's racial group, cultural heritage, and other social identities as one dimension of their patient experience, to ensure that (1) current racial disparities in access and outcomes can be addressed and mitigated through clinical care and policy, and (2) future policy changes do not create new disparities or worsen existing ones.

Limitations

Birth certificate data contain information on all recorded births in the state and are available over time, making them well-suited for this analysis, but there are known limitations of these data. For example, key variables are not recorded (e.g., the presence of labor, whether procedures are scheduled or not). We used rigorous algorithms to identify early elective deliveries as comprehensively as is possible from vital records data. Additionally, some variables such as complications of labor, and medical indications for labor induction may be under-recorded (Lain, et al., 2012; Martin, et al., 2013), but it is unlikely that changes in measurement of these conditions would coincide with the implementation of Oregon's policy. That is, while detected prevalence may be lower than true prevalence, the policy-associated change in prevalence is likely minimally affected. Also, detection of cesarean delivery is quite accurate (Lain, et al., 2012), lending credence to these findings. Nonetheless, the potential for unmeasured confounding exists, especially in the absence of an unexposed comparison group (e.g., black and white women in a state without such a policy). There is also the possibility that some concurrent factor other than the hard-stop policy may partly explain changes in practice and changes in disparities observed in this analysis (e.g., the Affordable Care Act, Oregon's Coordinated Care Organizations (Abdus, Mistry, & Selden, 2015; Muoto, Luck, Yoon, Bernell, & Snowden, 2016)).

Oregon is a state with a small proportion of non-Hispanic black births; they accounted for 3% of births, compared to 16% nationwide. This demographic constraint on the sample size and comparatively rare outcome also limit the potential for use of stronger longitudinal study design, such as a monthly interrupted time series analysis, which could allow for more precision in estimates of policy impact. Additionally, black women in Oregon are disproportionately represented in urban (vs. rural) areas, so we are not able to assess potential differential policy effects by geography. Although we focused on the non-Hispanic black-white racial disparity in elective early delivery, future research should also explore disparities and policy-related changes in other racial/ethnic groups of women (e.g., Hispanic women) and disparities of different types (e.g., insurance-type disparities). Hispanic women

constitute a large and growing share of the US childbearing population, and patterns of their birth outcomes in comparison to other racial/ethnic groups are complex, highlighting the need for an in-depth analysis of outcomes within this population and disparities between others. Because we analyzed data from only one state with a comparatively racially homogenous population, generalizability may be limited in other state contexts, especially states with greater racial diversity. The focus on early elective delivery also resulted in the exclusion of women with chronic pre-pregnancy conditions, which also exhibit black-white disparities, affecting generalizability of study findings to the entire childbearing population. Also, it is not clear whether the findings from this study, which relate to maternity services, would generalize to other areas of clinical care.

Conclusions

The steep decline in early elective deliveries following the 2011 Oregon policy affected non-Hispanic black and white women in the state differently, ultimately eliminating the pre-policy black-white disparity in early elective cesarean rates. These findings provide empirical evidence that state policies can mitigate racial disparities in maternity care and birth outcomes, through differential policy impacts, but they may also widen disparities. Disaggregating policy impacts by race may reveal important insights regarding persistent disparities and efforts to improve health equity in maternity care and beyond.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

Acknowledgments

The authors gratefully acknowledge input and assistance from Frances Biel, MPH, MS, with data analysis and presentation.

Funding: This research was supported by funding from the *Eunice Kennedy Shriver* National Institute of Child Health and Human Development (grant number R00 HD079658-03), the Health Resources and Services Administration (HRSA) of the U.S. Department of Health and Human Services (HHS) under grant number R40 MC26809-01-00, and a Jr. Investigator Award from the Society of Family Planning (SFPRF9-JI2). The funding organizations had no role in design or conduct of the study; collection, management, analysis, or interpretation of the data; and preparation, review, or approval of the manuscript.

References

- Abdus S, Mistry KB, Selden TM. Racial and Ethnic Disparities in Services and the Patient Protection and Affordable Care Act. *Am J Public Health*. 2015; 105(Suppl 5):S668–75. [PubMed: 26447920]
- Attanasio L, Kozhimannil KB. Patient-reported communication quality and perceived discrimination in maternity care. *Med Care*. 2015; 53(10):863–871. [PubMed: 26340663]
- Baumeister L, Marchi K, Pearl M, Williams R, Braveman P. The validity of information on “race” and “Hispanic ethnicity” in California birth certificate data. *Health Serv Res*. 2000; 35(4):869–883. [PubMed: 11055453]
- Bryant AS, Worjloh A, Caughey AB, Washington AE. Racial/ethnic disparities in obstetric outcomes and care: prevalence and determinants. *Am J Obstet Gynecol*. 2010; 202(4):335–343. [PubMed: 20060513]
- Callaghan WM, Creanga A, Kuklina EV. Severe maternal morbidity among delivery and postpartum hospitalizations in the United States. *Obstet Gynecol*. 2012; 120(5):1. [PubMed: 22914383]

- Caughey AB, Cahill AG, Guise JM, Rouse DJ. Consensus statement: safe prevention of the primary cesarean delivery. *Obstet Gynecol.* 2014; 123(3):693–711. [PubMed: 24553167]
- Caughey AB, Nicholson JM, Cheng YW, Lyell DJ, Washington AE. Induction of labor and cesarean delivery by gestational age. *Am J Obstet Gynecol.* 2006; 195(3):700–705. [PubMed: 16949399]
- Clark SL, Frye DR, Meyers JA. Reduction in elective delivery at < 39 weeks of gestation: comparative effectiveness of 3 different approaches to change and the impact on newborn intensive care admissions and stillbirths. *Am J Obstet Gynecol.* 2010; 203(5):449e1–449e6. [PubMed: 20619388]
- Creanga AA, Bateman BT, Mhyre JM, Kuklina E, Shilkret A, Callaghan WM. Performance of racial and ethnic minority-serving hospitals on delivery-related indicators. *Am J Obstet Gynecol.* 2014; 211(6):647.e1–647.e16. [PubMed: 24909341]
- Donovan EF, Lannon C, Bailit J, Rose B, Iams JD, Byczkowski T. A statewide initiative to reduce inappropriate scheduled births at 36 (0/7)-38 (6/7) weeks' gestation. *Am J Obstet Gynecol.* 2010; 202(3):243.e1–243.e8. [PubMed: 20207241]
- Ehrenthal DB, Hoffman MK, Jiang X, Ostrum G. Neonatal outcomes after implementation of guidelines limiting elective delivery before 39 weeks of gestation. *Obstet Gynecol.* 2011; 118(5):1047–1055. [PubMed: 22015872]
- Eichelberger KY, Doll K, Ekpo GE, Zerden ML. Black lives matter: claiming a space for evidence-based outrage in obstetrics and gynecology. *Am J Public Health.* 2016; 106(10):1771–1772. [PubMed: 27626348]
- Elder TE, Goddeeris JH, Haider SJ, Paneth N. The changing character of the black-white infant mortality gap, 1983–2004. *Am J Public Health.* 2014; 104(Suppl. 1):S105–S111. [PubMed: 24354831]
- Fowler TT, Schiff J, Applegate MS, Griffith K, Fairbrother GL. Early elective deliveries accounted for nearly 9 percent of births paid for by Medicaid. *Health Aff.* 2014; 33(12):2170–2178.
- Frohlich KL, Potvin L. Transcending the known in public health practice: the inequality paradox: the population approach and vulnerable populations. *Am J Public Health.* 2008; 98(2):216–221. [PubMed: 18172133]
- Grobman WA, Bailit JL, Rice MM, Wapner RJ, Reddy UM, Thorp JM Jr, Eunice Kennedy Shriver National Institute of Child Health and Human Development NICHD) Maternal- Fetal Medicine Units (MFMU) Netork. Racial and ethnic disparities in maternal morbidity and obstetric care. *Obstet Gynecol.* 2015; 125(6):1460–1467. [PubMed: 26000518]
- Hardeman RR, Medina EM, Kozhimannil KB. Structural Racism and Supporting Black Lives - The Role of Health Professionals. *N Engl J Med.* 2016; 375(22):2113–2115. [PubMed: 27732126]
- Huesch M, Doctor JN. Factors associated with increased cesarean risk among African American women: evidence from California, 2010. *Am J Public Health.* 2015; 105(5):956–62. [PubMed: 25790391]
- Howell E, Egorova N, Balbierz A, Zeitlin J, Hebert PL. Black-white differences in severe maternal morbidity and site of care. *Am J Obstet Gynecol.* 2016a; 214(1):122e1–7. [PubMed: 26283457]
- Howell EA, Egorova NN, Balbierz A, Zeitlin J, Hebert PL. Site of delivery contribution to black-white severe maternal morbidity disparity. *Am J Obstet Gynecol.* 2016b; 215(2):143–152. [PubMed: 27179441]
- Jou J, Kozhimannil KB, Johnson PJ, Sakala C. Patient-perceived pressure from clinicians for labor induction and cesarean delivery: a population-based survey of U.S. women. *Health Serv Res.* 2015; 50(4):961–981. [PubMed: 25250981]
- Kozhimannil KB, Karaca-Mandic P, Blauer-Peterson C, Shah N, Snowden JM. Uptake and utilization of practice guidelines in US hospitals: the case of routine episiotomy. *Jt Comm J Qual Patient Saf.* 2017; 43(1):41–48. [PubMed: 28334585]
- Kozhimannil KB, Macheras M, Lorch S. Trends in childbirth before 39 weeks' gestation without medical indication. *Med Care.* 2014; 52(7):649–657. [PubMed: 24926713]
- Lain SJ, Hadfield RM, Raynes-Greenow CH, Ford JB, Mealing NM, Algert CS, Roberts CL. Quality of data in perinatal population health databases: a systematic review. *Med Care.* 2012; 50(4):e7–e20. [PubMed: 21617569]

- Lorenc T, Petticrew M, Welch V, Tugwell P. What types of interventions generate inequalities? Evidence from systematic reviews. *J Epidemiol Community Health*. 2013; 67(2):190–193. [PubMed: 22875078]
- Lu MC, Halfon N. Racial and ethnic disparities in birth outcomes: a life-course perspective. *Matern Child Health J*. 2003; 7(1):13–30. [PubMed: 12710797]
- Main EK. New perinatal quality measures from the National Quality Forum, the Joint Commission and the Leapfrog Group. *Curr Opin Obstet Gynecol*. 2009; 21(6):532–540. [PubMed: 19797948]
- Martin, JA., Hamilton, BE., Osterman, MJK., Births in the United States, 2014. NCHS Data Brief. 2015. p. 1-8. Available: <https://www.ncbi.nlm.nih.gov/pubmed/26460599>. Accessed October 11, 2016.
- Martin JA, Wilson EC, Osterman MJK, Saadi EW, Sutton SR, Hamilton BE. Assessing the quality of medical and health data from the 2003 birth certificate revision: results from two states. *Natl Vital Stat Rep*. 2013; 62(2):1–19.
- Muoto I, Luck J, Yoon J, Bernell S, Snowden JM. Oregon's Coordinated Care Organizations Increased Timely Prenatal Care Initiation And Decreased Disparities. *Health Aff (Millwood)*. 2016; 35(9): 1625–32. [PubMed: 27605642]
- Nazroo JY. The structuring of ethnic inequalities in health: economic position, racial discrimination, and racism. *Am J Public Health*. 2003; 93(2):277–284. [PubMed: 12554585]
- Oshiro BT, Henry E, Wilson J, Branch D, Varner MW. Decreasing elective deliveries before 39 weeks of gestation in an integrated health care system. *Obstet Gynecol*. 2009; 113(4):804–811. [PubMed: 19305323]
- Parikh LI, Reddy UM, Männistö T, Mendola P, Sjaarda L, Hinkle S, Chen Z, Lu Z, Laughon SK. Neonatal outcomes in early term birth. *Am J Obstet Gynecol*. 2014; 211(3):265e1–e265.e11. [PubMed: 24631438]
- Purnell TS, Calhoun EA, Golden SH, Halladay JR, Krok-Schoen JL, Appelhans BM, Cooper LA. Achieving health equity: closing the gaps in health care disparities, interventions, and research. *Health Aff (Millwood)*. 2016; 35(8):1410–1415. [PubMed: 27503965]
- Sengupta S, Carrion V, Shelton J, Wynn RJ, Ryan RM, Singhal K, Lakshminrusimha S. Adverse neonatal outcomes associated with early-term birth. *JAMA Pediatr*. 2013; 167(11):1053–1059. [PubMed: 24080985]
- Stedley, BD, Stith, AY., Nelson, AR., editors. *Unequal treatment: confronting racial and ethnic disparities in health care*. Washington, DC: National Academies Press; 2003.
- Snowden JM, Muoto I, Darney BG, Quigley B, Tomlinson MW, Neilson D, Friedman SA, Rogovoy J, Caughey AB. Oregon's hard-stop policy limiting elective early-term deliveries: association with obstetric procedure use and health outcomes. *Obstet Gynecol*. 2016; 128(6):1389–1396. [PubMed: 27824748]
- The Joint Commission. Specifications Manual for Joint Commission National Quality Measures. 2013. https://www.jointcommission.org/specifications_manual_joint_commission_national_quality_core_measures.aspx Accessed: April 6, 2017
- Tita AT, Landon MB, Spong CY, Lai Y, Leveno KJ, Varner MW, Unice Kennedy Shriver NICHD Maternal-Fetal Medicine Units Network. Timing of elective repeat cesarean delivery at term and neonatal outcomes. *N Engl J Med*. 2009; 360(2):111–120. [PubMed: 19129525]

Figure 1.

Panel A: Early elective cesarean rates among non-Hispanic black and white women in Oregon, before and after a 2011 statewide policy

Panel B: Early elective induction rates among non-Hispanic black and white women in Oregon, before and after a 2011 statewide policy

Table 1

Maternal characteristics, overall, and for non-Hispanic white and black women who gave birth in Oregon, 2008–2010 (pre-policy) and 2012–2014 (post-policy)

	Overall N=121,272		Non-Hispanic white N=117,499		Non-Hispanic black N= 3,773	
	Pre-policy	Post-policy	Pre-policy	Post-policy	Pre-policy	Post-policy
Age >35 years (%)	13.2	14.5	13.3	14.6	9.8	12.2
Non-Hispanic white (%)	97.0	96.8	–	–	–	–
Non-Hispanic black (%)	3.0	3.2	–	–	–	–
Education>12 years (%)	64.9	69.9	65.5	70.4	45.9	54.5
Medicaid (%)	38.3	39.8	37.4	39.0	65.9	63.5
5 prenatal care visits (%)	97.8	98.0	97.9	98.1	95.0	95.1
Nulliparous (%)	39.3	37.7	39.4	37.8	36.4	34.6
Early elective cesarean	4.4	2.5	4.3	2.5	6.1	2.8
Early elective induction of labor	4.7	2.6	4.7	2.5	4.9	3.8

Bold indicates values significant at $P<.05$

Pre-policy: 2008–2010; Post-policy: 2012–2014

Note: Chi square analyses used to compare pre-policy to post-policy prevalence for each category (overall, non-Hispanic white, and non-Hispanic black)

Table 2

Analysis of the odds of early elective cesarean and early elective induction of labor in the post-policy period (2012–2014), compared with the pre-policy period (2008–2010), overall and for non-Hispanic white and black women using spline regression.

	Overall aOR (CI)	Non-Hispanic white women aOR (CI)	Non-Hispanic black women aOR (CI)
Early elective cesarean			
Policy effect	0.78 (0.66 – 0.91)	0.79 (0.67 – 0.93)	0.47 (0.22 – 1.00)
Pre-policy time trend	0.95 (0.93 – 0.98)	0.95 (0.93 – 0.98)	0.98 (0.88 – 1.09)
Post-policy time trend	0.95 (0.92 – 0.99)	0.95 (0.92 – 0.99)	0.97 (0.80 – 1.18)
Early elective induction of labor			
Policy effect	0.74 (0.64 – 0.87)	0.73 (0.62 – 0.85)	1.34 (0.59 – 3.05)
Pre-policy time trend	0.95 (0.93 – 0.97)	0.95 (0.93 – 0.97)	0.88 (0.78 – 0.99)
Post-policy time trend	0.98 (0.95 – 1.01)	0.98 (0.94 – 1.01)	1.06 (0.89 – 1.25)

Bold indicates values significant at $P < .05$

aOR, adjusted odds ratio

Models controlled for pre-policy time and for post policy time (6-month intervals), maternal age (≥ 35 versus <35), education (>12 versus ≤ 12 years), Insurance type (Private versus Medicaid or none), race (for the overall results), parity (nulliparous versus multiparous) and prenatal care utilization (<5 versus ≥ 5 visits).

Table 3

Results of linear probability models estimating non-Hispanic black-white disparities in early elective cesarean and early elective labor induction in the pre- and post-policy periods, as well as change in disparities.

	Pre-policy (2008–2010)		Post-policy (2012–2014)		Pre-post disparity	
	Non-Hispanic black-white difference % points	P value	Non-Hispanic black-white difference % points	P value	Non-Hispanic black-white difference % points	P value
Early elective cesarean	1.95	<0.001	0.10	0.809	−1.75	0.011
Early elective induction of labor	0.12	0.813	1.01	0.027	0.89	0.194

Bold indicates values significant at $P < .05$

Models controlled for maternal age (35 versus <35), education (>12 versus 12 years), Insurance type (Private versus Medicaid or none), race (for the overall results), parity (nulliparous versus multiparous) and PNC utilization (<5 versus 5 visits).

Notes: Findings are expressed in percentage points in all three columns. In the first two columns, positive values represent a higher rate of the outcome among non-Hispanic blacks compared to non-Hispanic whites. In the third column, positive values represent an increase in disparities and negative values represent a reduction in disparities.