Unequal Motherhood: Racial-Ethnic and Socioeconomic Disparities in Cesarean Sections in the United States

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Disparities in cesarean rates in the United States represent an important social problem because cesareans are related to maternal deaths and to the high cost of American health care. There are pervasive racial-ethnic and socioeconomic disparities in maternity care as in health care more generally, yet there has been little scrutiny of how overuse of cesarean deliveries might be linked to these disparities. There are at least two possibilities when it comes to c-sections: black, Hispanic, Native American, and low socioeconomic status (SES) mothers could be less likely to have needed cesareans, leading to more negative outcomes for both mothers and babies, or they could be more likely to have medically unnecessary cesareans, leading to more negative outcomes as a result of the surgery itself. This research uses data on all recorded births in the United States in 2006 to analyze differences in the odds of a cesarean delivery by race-ethnicity and SES. The analysis reveals that non-Hispanic black, Hispanic/Latina, and Native American mothers are more likely to have cesarean deliveries than non-Hispanic white or Asian mothers. Also, after accounting for medical indications, increasing education is associated with a decline in odds of a cesarean delivery, especially for non-Hispanic whites. The results suggest that high cesarean rates are an indicator of low-quality maternity care, and that women with racial and socioeconomic advantages use them to avoid medically unnecessary cesarean deliveries rather than to request them. Keywords: birth; cesarean section; choice; health disparities; inequality.

Disparities in cesarean delivery rates in the United States represent an important social problem because cesareans are related to maternal deaths and to the high cost of American health care. Cesarean section is the most common surgical procedure in the contemporary United States, where rates have skyrocketed from 4.5 percent of U.S. births in 1965 to 31.8 percent in 2007 (CDC 2009). Dramatic rises in cesarean rates have coincided with increasing maternal deaths, a significant proportion of which are connected to unnecessary cesareans (Amnesty International 2010; California Department of Public Health 2011; CDC 2007; Danel et al. 2003). Cesarean delivery can be a lifesaving procedure, but it also increases the risk of neonatal respiratory problems and maternal complications. Based on scientific evidence, the World Health Organization (WHO) recommends a cesarean rate of 10 to 15 percent: below 10 percent the benefits of the surgery outweigh the risks to mothers and infants, but cesarean rates above 15 percent of births increase maternal and neonatal mortality and morbidity related to the surgery itself (WHO 1985, 2009). The cesarean rate in the contemporary United States is more than double this recommended upper limit, suggesting significant overuse of this procedure.

Some might argue that overuse of cesarean delivery is not a problem, but cesarean delivery is not benign: it is a surgical procedure with risks of infection, blood loss, blood clots, injury to other organs, venous thromboembolism, anesthesia-related complications, and

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potential complications in subsequent pregnancies due to permanent scarring of the uterus (California Department of Public Health 2011; Goer 1995; Kuklina et al. 2009; Wagner 2006). Research on maternity care increasingly considers rising c-section rates to be a source of maternal mortality and morbidity (California Department of Public Health 2011). Three of the six leading causes of maternal mortality are associated with cesareans: hemorrhage, complications of anesthesia, and infection.

In fact, hundreds of women in the United States die as a result of pregnancy and childbirth every year, and many of those deaths are preventable (Amnesty International 2010; California Department of Public Health 2011; Tucker et al. 2007; WHO 2010). Some attribute increases in American maternal mortality rates since 1982 to rising maternal age and obesity, lack of access to quality care, and the under- or overuse of obstetrical interventions (California Department of Public Health 2011; Ford et al. 2008; Getahun et al. 2007; Porreco and Thorp 1996; Rosenberg et al. 2003; Wagner 2006). The United States ranks fiftieth among 59 developed countries for maternal mortality (Amnesty International 2010). Maternal mortality in the United States is also likely to be underreported because of weak accountability practices in the medical system, although vital statistics reporting has improved since 2003 (Amnesty International 2010; California Department of Public Health 2011; Wagner 2006).

An important feature of American maternity care is pervasive inequality in prenatal and postpartum care, leading to worse outcomes for low-income Americans, black Americans, and U.S.-born Hispanics (Amnesty International 2010; California Department of Public Health 2011; CDC 2007; Frisbie et al. 2004; Minino et al. 2007). Racial-ethnic and socioeconomic inequality in maternity care outcomes, such as infant and maternal mortality and morbidity rates, parallel disparities in American health care overall (Dressler, Oths, and Gravlee 2005; LaVeist 2000; LaVeist, Rolley, and Diala 2003; LaVeist, Wallace, and Howard 1995; Lutfey and Freese 2005; Macinko et al. 2003; Malat 2006; Shi 2001). African American women, U.S.-born Hispanic women, low-income women who receive Medicaid, and less educated women are more likely to have pregnancy-associated or pregnancy-related mortality (California Department of Public Health 2011; Kuklina et al. 2009; Tucker et al. 2007). Existing research demonstrates that African American women tend to begin prenatal care after the first trimester and are less likely to receive adequate care or high quality care (California Department of Public Health 2011; Daniels, Noe and Mayberry 2006). Yet there has been little scrutiny of connections between cesarean deliveries and racial-ethnic and socioeconomic disparities.

Are there disparities in c-sections and, if so, what direction do these disparities take? Do racial-ethnic minorities and low-SES mothers have a higher or lower probability of cesarean delivery after accounting for medical necessity? In this article, we use data from 2006 birth certificates to assess the relative odds of cesarean delivery by race, ethnicity, and socioeconomic status (SES) in the United States. This research uses quantitative data to highlight disparities in the most common surgical procedure in the United States, and draws out the implications of these disparities for our understandings of quality in maternity care.

Cesareans and Health Disparities in the United States

In the United States, African American women die from pregnancy-related causes more often than other racial-ethnic groups, and have a fourfold greater risk of maternal death than non-Hispanic white women (Amnesty International 2010; California Department of Public Health 2011; Minino et al. 2007). Latinas and non-Hispanic white and Asian women all share similar rates of maternal mortality, although rates appear to be rising among U.S.-born Hispanics (California Department of Public Health 2011). Negative maternal outcomes are also concentrated among low-income women, who tend to have less prenatal care, more discontinuity of care, and more risk factors (Aved et al. 1993; Cook et al. 1999; Teberg et al. 1989). Rates of maternal morbidity, defined

as illness or injury arising from complications of pregnancy or medical intervention, have also been rising in the United States over the last decade and follow similar patterns of racial, ethnic, and class disparities (California Department of Public Health 2011; Kuklina et al. 2009). Some examples of maternal morbidity include gestational diabetes, preeclampsia, and hemorrhage, and examples of severe morbidity include peripartum hysterectomy, renal failure, heart failure, stroke, pulmonary embolism, and septic shock. Some maternal complications are life threatening, cause long-term harm, and lead to infant mortality.

Existing research in public health shows that racial-ethnic minorities and low-income women are more likely to have pregnancy-related health risks that contribute to medically necessary cesarean deliveries (Aron et al. 2000; Frank, Frisbie, and Pullum 2000). At the same time, racial-ethnic minorities and low income populations in the United States have the least access to health care and often receive inadequate care (Dressler et al. 2005; LaVeist 2000; LaVeist et al. 2003; LaVeist et al. 1995; Lutfey and Freese 2005; Macinko et al. 2003; Malat 2006; Shi 2001). Lower SES is associated with worse health and higher mortality rates across the life course and this relationship has persisted over time, despite dramatic changes in the prevalence of some diseases and in medical treatments (Feinstein 1993; Lutfey and Freese 2005; Pappas et al. 1993). Income is the strongest predictor of access to health care and people of all races and ethnicities can have low incomes. However, while SES accounts for much of the observed racial disparities in health, racial-ethnic minorities are disproportionately represented among the poor and thus at a significant disadvantage compared to non-Hispanic whites (LaVeist 1996; Malat 2006; Shi 2001; Williams 1999). Existing research also demonstrates a significant effect of race on health, independent of SES, because race is a marker for exposure to racism (Cohen and Northridge 2000; LaVeist 2000, 2005; LaVeist et al. 2003; Williams 1999). There are also confounding effects of race and SES because SES appears to affect different racial-ethnic groups in different ways (Hummer 1996; Williams 1999). But how are disparities in cesarean delivery related to these documented health inequalities? Here the public health literature is equivocal.

Some public health research finds that women of color and low-income women have higher cesarean rates (Aron et al. 2000; Braveman et al. 1995; Getahun et al. 2009; Newton and Higgins 1989; Stafford 1991). For example, David C. Aron and colleagues (2000) examined racial-ethnic differences in the odds of surgical delivery and found that black women were substantially more likely to deliver by c-section than white women. Moreover, racial-ethnic differences were particularly large among women with the lowest clinical risk, so that higher risk pregnancies were not the cause of this disparity. In fact, rates of cesarean delivery were nearly identical for women of all races with strong clinical indications (Aron et al. 2000). Thus, this study revealed disparities in the direction of overuse of cesarean surgery among women of color.

However, other public health researchers have argued that unnecessary cesareans are more common among non-Hispanic white and higher-SES women (Gemmel 2002; Gould, Davey, and Stafford 1989; Placek and Taffel 1988; Stafford, Sullivan, and Gardner 1993; Wagner 2006). In fact, general claims that women are choosing primary cesarean deliveries imply that this surgery is a prerogative of affluent and privileged women (Brink 2002; Park 2008; Song 2004). Within the American for-profit health care system, overuse of medical procedures often occurs when providers are sure of payment, like when they serve affluent populations with private insurance (Brownlee 2007; Gawande 2009; Keeler and Brodie 1993; Perkins 1998; Tussing and Wojtowycz 1997). This could lead higher-SES populations to experience more cesarean deliveries without medical indications. In support of this contention, some public health research finds higher cesarean rates among whites, higher-income populations, and the privately insured (Gould et al. 1989; Placek and Taffel 1988; Stafford et al. 1993). These studies argue that medical providers over treat affluent women because of incentives in the health care system. For example, a highly cited study on SES variation in c-section rates found that affluent women had much higher

cesarean rates independent of maternal age, parity, and medical complications (Gould et al. 1989).[1]

Thus, the public health literature exhibits some variation in the direction of racial-ethnic and class differences in cesarean rates. The discrepancy in the existing findings may be a result of the fact that existing studies have used a variety of data sources and measures, but they also pose a puzzle. If cesarean surgery is overused, in the sense that some women have cesarean deliveries even when clinical indications are weak, which SES and racial-ethnic groups are more likely to experience this overuse? Is overuse more common among low-SES and racial-ethnic minority populations, suggesting low quality care, or is it more common in high-SES and non-Hispanic white populations, indicating either quality care, emphasis on generating fees-for-services, or both? The existing research suggests at least two possibilities for racial-ethnic and SES disparities in c-sections: (1) Hispanic/Latina, non-Hispanic black, and Native American, and low-income mothers are less likely to have *medically necessary* cesareans, leading to more negative outcomes for both mothers and babies; and (2) Hispanic/Latina, non-Hispanic black and Native American, and low-income mothers are more likely to have *medically unnecessary* cesareans, leading to more negative outcomes as a result of the surgery itself. While it is likely that low-SES mothers and women of color receive worse maternity care, this could either lead to more or fewer cesarean deliveries for pregnancies with the same risk profiles. If cesarean deliveries represent higher quality care and a desirable method of delivery for women and their families, then we expect that high-SES and non-Hispanic white women will have higher probability of cesarean delivery relative to other women with similar clinical profiles. If, however, cesarean sections represent low-quality care and a cause of negative health outcomes, then we expect women of color and less educated women to have them more often, controlling for clinical indications.

Explaining High Cesarean Delivery Rates

There are nonclinical reasons that cesarean rates are high and have risen over time, which may mediate racial-ethnic and SES disparities. These influences are largely *institutional*, as individual physicians have limited power to resist standard obstetrical training, time pressures, or hospital protocols (Burns, Geller, and Wholey 1995; Davis-Floyd 2003; Moore 2005; Simonds, Rothman, and Norman 2007).[2] Public health research has demonstrated that physician training and experience, financial incentives, scheduling issues, and practice characteristics all influence physicians' decisions to perform c-sections in cases where they have discretion over the method of delivery (Barber et al. 2011; Burns et al. 1995). Recent clinical research has affirmed that "more subjective indications" for cesarean delivery (such as nonreassuring fetal status, suspected high birth weight, and arrest of dilation) have contributed more to recent increases in the primary cesarean rate than "more objective indications" (such as breech presentation, multiple gestation, cord prolapse, and placenta previa) (Barber et al. 2011). The use of cesarean delivery when indications are more subjective may occur because cesarean deliveries offer greater financial rewards or scheduling efficiencies compared to vaginal birth.

For example, financial pressures sometimes encourage cesarean deliveries. Hospitals and physicians charge more for cesareans, and insurers pay more for them. There is even evidence that some hospitals pressure obstetricians with low cesarean rates to increase them (Gemmel

1. In this study, mothers living in census tracts with a median family income of $30,000 or more had a c-section rate of 22.9 percent, compared to 3.2 percent for those living in areas where the median income was under $11,000 (Gould et al. 1989).

2. Some argue that the growing number of obstetricians that are women has changed hospital practices surrounding childbirth, and some research has found that male obstetricians are more likely to perform c-sections than their female colleagues (Mitler, Rizzo, and Horwitz 2000). However, other research suggests that institutional forces powerfully influence obstetricians, regardless of their gender (Simonds, Rothman, and Norman 2007).

2002; Moore 2005; Myers 2004). Profit motives might lead one to expect affluent women to have a higher likelihood of cesarean delivery, and some have attributed high cesarean rates to overuse of unnecessary procedures on affluent women (Gemmel 2002; Keeler and Brodie 1993; Plante 2009; Wagner 2006). In a highly cited study, Jeffrey B. Gould, Becky Davey, and Randall S. Stafford (1989) found that women with higher SES had much higher cesarean rates than low-income women, independent of maternal age, parity, and medical complications. Since payment from poor mothers is less certain and is likely to be lower, hospitals may provide these women with lower cost care. Race-ethnicity and SES are correlated, although there is significant SES variation within each race and significant racial-ethnic variation within classes. However, findings that class-privileged women have more cesarean deliveries would lead to a similar expectation that race-privileged (non-Hispanic white) women would have higher c-section rates than women of color with the same clinical indications.

Another important institutional mechanism that motivates cesarean delivery involves scheduling. Cesarean deliveries require much less time as well as a much more predictable amount of time than waiting for spontaneous vaginal birth (Gemmel 2002; Keeler and Brodie 1993). Accordingly, physicians and hospitals encourage births to occur during regular working hours and on weekdays by inducing or speeding up labors and scheduling cesarean deliveries (Gemmel 2002; Keeler and Brodie 1993; Lerchl and Reinhard 2008). This has lead to a weekend birth dearth: one would expect 14.3 percent of births to occur on each day of the week, but fewer occur on Saturday and Sunday.[3] Most doctors and hospitals also use timetables for each stage of labor and engage in interventions like amniotomy (breaking the amniotic sac) and the use of Pitocin (artificial oxytocin) to speed up labor (Davis-Floyd 2003; Keeler and Brodie 1993; Rothman 1982; Simonds et al. 2007; Wagner 2006). When these interventions fail to produce a timely delivery, or overstimulate uterine contractions to the point of fetal distress, a c-section is the likely result.

Alternately, explanations for high cesarean rates that focus on clinical rather than institutional influences emphasize changing risk profiles of childbearing women in the United States, such as trends toward higher maternal age and high rates of obesity. But while obesity increases the probability of a cesarean delivery, obesity rates rose during a period when c-section rates dropped (1990–1996), and then stabilized during the period when the cesarean rate skyrocketed (1999–2004) (Flegal et al. 2002; Getahun et al. 2009; Ogden et al. 2006). This suggests that obesity is not the primary cause of the rising rate of cesarean delivery in the United States. Similarly, rates of high birth weight and advanced maternal age have been stable since at least the early 2000s, while c-section rates have risen dramatically (Barber et al. 2011). C-section rates have risen faster than changes in pregnancy risks would warrant, so that trends over time are likely to be more a consequence of institutional factors than changes in risk profiles (Declercq 2009).

Of course, variation in clinical risks across the population might still explain a significant proportion of racial-ethnic and SES variation in method of delivery. Racial-ethnic minorities and low-income populations have greater incidence of health conditions that increase the risk of medically indicated cesarean delivery, such as diabetes and hypertension (Frank et al. 2000). Health care providers may also make assumptions about patients from different populations, leading to "statistical discrimination" whereby providers make assumptions about a patient based on statistical probabilities and those assumptions influence both diagnosis and the delivery of care (Aronowitz 2008; Balsa and McGuire 2001; 2003; Balsa, McGuire, and Meredith 2005; Maserejian, Lutfey, and McKinlay 2009). This could encourage more cesarean deliveries among disadvantaged women, although these deliveries would be tied to medical diagnoses.

In addition to pointing to changes in characteristics of the childbearing population, some have argued that many women *prefer* cesarean deliveries in order to fit delivery into their busy schedules and to avoid the pain of childbirth (ACOG 2007; Barber et al. 2011; Beckett 2005; Gossman,

3. In 2006, 10.7 percent and 9.4 percent of births occurred on Saturday and Sunday respectively, compared to 14.7 percent on Mondays, 16.0 to 16.4 percent on Tuesdays through Fridays.

Joesch and Tanfer 2006). Some media discussions of elective cesareans suggest that affluent mothers are "choosing" cesareans without medical indications (Park 2008), and accounts of celebrity mothers who have had surgical deliveries described them as "too posh to push" (Brink 2002; Song 2004). The notion that women choose cesarean surgery co-opts the rhetoric of "choice" from the consumer choice movement, which promotes an atomized view of individuals as rational choice actors, and from the reproductive rights and women's health movements, which highlight women's ability to make active, informed choices about their health (Braun 2009; Lippman 1999). However, the marketing of "choices" may also affect women's decision making, and medical providers may portray women's bodies as problematic in ways that encourage women to seek surgical solutions (Braun 2009). Within the last decade, the "marketing" of choices in childbirth has included highly publicized findings that vaginal birth increased the risk of damage to the pelvic floor and incontinence compared to cesarean delivery (Klein 2005). (Findings that pelvic floor tone and incontinence differences disappear three to six months postpartum received less publicity.) Public expressions of concern over possible changes in sexual function have also become part of the language surrounding elective cesarean (Wagner 2006). Concerns about these issues could encourage women to request cesarean deliveries.

But how might maternal request for cesarean delivery influence racial-ethnic and SES disparities in the procedure? On one hand, different racial-ethnic and SES groups are likely to have different preferences (Hurst and Summey 1984; Lazarus 1994; Nelson 1983), but higher income, more educated, and non-Hispanic white populations tend to have more choices in medical care than racial-ethnic minorities and low-income populations. They may exercise these choices to demand cesarean deliveries that are not medically indicated, to give birth at home, or to choose some other method and place of delivery. If these women prefer cesarean delivery even when it is not medically necessary, then they are the most likely to exercise this preference. On the other hand, one expects that poor and minority women with a preference for a more medically expensive choice, cesarean delivery, would be less able to exercise that choice except insofar as it aligns with institutional and organizational interests.

It is worth noting, however, that there are empirical questions about how often women request primary cesarean delivery (Declerq et al. 2006; Hopkins 2000; Potter et al. 2001). Using a representative sample of mothers, the *Listening to Mothers II* survey found that only 1 of 252 mothers with a primary cesarean (.2 percent) had surgery at her request for no medical reason, whereas 9 percent of the 1,573 survey participants felt pressured to have a cesarean by their health care provider (Declercq et al. 2006). Studies explicitly examining women's preferences have also found that the vast majority of women (of all social classes) prefer to deliver vaginally and that alleged maternal demand for cesarean delivery is actually physician induced (Hopkins 2000; Potter et al. 2001). The idea that maternal request is driving cesarean deliveries also invites skepticism, since even informed individuals routinely make suboptimal choices or no choices at all when it comes to medical care (Abraham et al. 2011; Harris 2003; Hibbard and Jewett 1997; Hoerger and Howard 1995; Lupton, Donaldson, and Lloyd 1991). Many people choose their physician, but often make that choice on the basis of superficial considerations. They also typically continue to see the physician primarily because they have no real way of discerning whether the physician is good or bad and the costs and inconvenience of finding another one are quite high (Harris 2003; Lupton et al. 1991).

Overall, both the empirical research and existing understandings of institutional motivations and maternal choices support opposing alternatives in the relationship between SES and race-ethnicity and high cesarean rates: some research suggests that overuse of cesareans is more common in privileged populations, while other studies point to more overuse among race or class disadvantaged women. This study contributes to this literature by clarifying the empirical relationships between race-ethnicity, SES, and cesarean deliveries using recent data and a large sample size. We also aim to adjudicate between alternative explanations and highlight the implications of disparities in cesarean deliveries for the quality of maternity care. Toward that goal, we conduct multivariate analyses of data from all birth certificates in the United States in 2006 to tease out the

effects of race-ethnicity, SES, and the interactions between them. The findings illuminate what racial-ethnic and SES patterns in cesarean delivery mean for whether high cesarean rates represent high or low quality care.

Data and Methods

In this study, we examine the relative odds of cesarean delivery using individual-level data from the Natality Detail Files for 2006 (U.S. Department of Health and Human Services 2008). We use data from 2006 because it was the most recent available year, but racial-ethnic and educational disparities were similar using data from 2000–2005. The data contain birth certificate information from all recorded live births in the 50 states and DC in 2006 (4,273,225 cases). Public health and medical research makes extensive use of the Natality Detail Files, which have historically been used to address questions about racial and ethnic health disparities (CDC 2006). Since cesarean rates have increased over time in all populations and across all risk factors (Declercq 2009), longitudinal data are unnecessary for this analysis of racial-ethnic and SES disparities.[4]

There are some problems with data quality in the Natality Detail Files because hospitals must collect the data, submit it to state vital records offices, and then the Natality Branch creates a national data set. Data quality thus depends critically on the training of the hospital staff completing the birth certificate, which is left largely to the states. There is no national standard with follow-up or oversight, resulting in inconsistent quality. Lean budgets have also produced lower standards for the timeliness and quality of data since the late 1990s (CDC 2006). Birth certificates are imperfectly correlated with medical record data, where medical record data represent the "gold standard" (DiGiuseppe et al. 2002). Agreement between birth certificates and medical records is "almost perfect" for measures of delivery type, prior obstetrical history, and infant Apgar score. Since delivery type is the outcome of interest, this level of agreement is important for this analysis. Agreement with medical records is also "substantial" for several other important variables including gestational age and prenatal care. However, agreement is only moderate for most maternal risk factors and comorbidities and for several complications of pregnancy and labor and delivery, which could lead to misestimates of clinical differences (DiGiuseppe et al. 2002). In most cases, these misestimates are likely to be undercounts of risks and complications, leading to a possibility that some cesarean deliveries will appear to have no medical indications when these indications are actually present. For this reason, we build models starting with the most reliable measures and later add available clinical measures. Even though these clinical measures are imperfect, they are the best indicators of clinical risk that are available at the population level.

Another data limitation is a substantial amount of missing data for variables related to prenatal care, maternal risk factors, and complications of labor and delivery. Since the hospital has a major influence over who does or does not deliver by cesarean, and hospitals that provide low-quality birth certificate data are likely to be low quality in other dimensions, listwise deletion of cases with missing values would select for better-than-average hospitals and significantly bias the data. Consequently, we multiply imputed missing values for all independent and control variables with more than 2 percent of cases missing (CDC 2006). In the 2006 data, the CDC had already imputed some missing data: maternal age (3.4 percent), maternal race (4.3 percent), and gestation (4.8 percent). We multiply imputed missing values for the adequacy of prenatal care utilization index (APNCU), education, parity, weight gain, and maternal risk factors. We used listwise deletion for cases that were missing on the dependent variable (method of delivery), or had missing data for less than 2 percent cases, leaving a working *N* of 4,188,775.

Variables in the data set include place of delivery (hospital, home, or birthing center), person in attendance (doctor, midwife, or other), parity, and medical and health data such as the number

4. We are conducting longitudinal analyses on the Natality Detail Files to address other research questions.

of prenatal visits, method of delivery, obstetrical procedures, medical risk factors, and infant health characteristics. Demographic variables include the infant's sex, birth weight, and date of birth, the age, race, and ethnicity of the mother and father, and the marital status, education level, and national origin of the mother. For race-ethnicity, we constructed mutually exclusive indicator variables for whether a mother identifies as Hispanic/Latina, or non-Hispanic white, black, Native American, or Asian/Pacific Islander. (Non-Hispanic whites are the reference category in the models.)

The data lack direct information on income so we rely on mothers' education as a proxy for SES (see Dubay, Kaestner, and Waldmann 1999 for use of a similar strategy). Maternal education is measured with a four-category ordinal variable (less than high school, high school graduate, some college/associate degree, and bachelor's or higher degree). We also ran the models using dummy variables for each educational category, and the results did not change. It is important to note that race-ethnicity and SES are separate constructs even though they are often correlated. The multivariate models test the effects of each while accounting for the effects of all other variables, so that the effects of race-ethnicity are independent of the effects of education.

Models include marital status, which is an important indicator of social support that can influence pregnancy outcomes. A recent study of maternal care quality in the United States found that unmarried women were more likely to experience pregnancy-related death: they represented 31 percent of mothers, but 42 percent of maternal mortalities (California Department of Public Health 2011). We also control for adequacy of prenatal care using the APNCU index, in order to rule out the possibility that differences in access to prenatal care drive inequality in delivery outcomes. The APNCU accounts for the month in which prenatal care began, the number of visits, and gestation length, and it provides a more precise measure of prenatal care than the trimester or month in which prenatal care began. The index ranges from 1 (inadequate) to 4 (adequate+).

Both maternal age and obesity are associated with higher rates of pregnancy-related risks, such as diabetes and hypertension, and lead to a higher probability of cesarean delivery (Dulitzki et al. 1998; Ecker et al. 2001; Getahun et al. 2007; Peipert and Bracken 1993; Porreco and Thorp 1996; Rosenberg et al. 2003). We measure maternal age in years. The data contain no information about pre-pregnancy weight or body mass index (BMI) but gestational weight gain is an independent risk factor, so that weight gain exceeding the recommended upper limit (40 pounds for underweight women and 20 pounds for obese women) represents a risk (Institute of Medicine 2009). Research has also found that excessive weight gain occurs more frequently among women whose pre-pregnancy BMIs are in the overweight or obese categories and least often among women who are underweight before pregnancy (California Department of Health 2011). To operationalize excessive weight gain that is likely to be correlated with clinical obesity, we coded gestational weight gain of 45 pounds or more as a risk factor for cesarean delivery.[5]

To measure pregnancy characteristics that increase the risk of a medically necessary c-section, we include indicators for pre-term birth (less than 37 weeks gestation) and multiple gestation (twins, triplets, etc.), both of which typically result in cesarean delivery. Models also include indicators for low birth weight, clinically defined as less than 2,500 grams, and high birth weight, defined as over 4,500 grams, both of which increase the probability of a cesarean delivery. We also include a measure for parity, since women with previous vaginal births are less likely to have a primary cesarean than women having a first baby. Maternal conditions that increase the probability of a cesarean delivery include diabetes, chronic hypertension, pre-eclampsia (pregnancy-induced hypertension), and eclampsia.

Some complications of labor and delivery also provide a clinical rationale for cesarean sections. These include placenta previa (covering the cervix), breech or other malpresentation of the fetus, prolonged labor, and fetal distress. Placenta previa is an absolute indication for cesarean section (vaginal delivery is dangerous for both mother and baby), and breech is a typical indication

5. Weight gain in pounds had a mean of 30.75, a median of 30.0, and a standard deviation of 13.2. Our measure is based on weight gain that exceeds 1 standard deviation above the mean (rounded up to the nearest 5 pounds). Approximately 87 percent of mothers gained less than 45 pounds, so that this measure captures the top 13 percent of cases.

(very few health care providers attend vaginal breech births). On the other hand, some diagnoses are flexible and discretionary—they depend on the perspective of the health care provider making the diagnosis, the timetables that the provider uses to gauge labor, and previous interventions into labor (Barber et al. 2011; Davis-Floyd 2003; Goer 1995; Simonds et al. 2007; WHO 1985). Among these subjective diagnoses that often form the medical basis for cesarean delivery, we include a measure for diagnosis of prolonged labor in the models, but exclude measures of cephalopelvic disproportion (pelvis too small) and dysfunctional labor because of the extreme number of missing cases.[6] Models also include a measure for the premature rupture of membranes because obstetric guidelines strongly recommend that delivery occur within 24 hours of rupture of the amniotic sac in order to reduce the risk of infection, and this time pressure increases the likelihood of cesarean delivery. Accounting for diagnoses that are likely to lead to cesareans may isolate cases where the method of delivery is truly discretionary.

Results

Table 1 presents descriptive statistics and metrics for all variables and cases in the models, revealing that 31 percent of all births in the United States in 2006 occurred via cesarean section. Among mothers with no previous cesarean, the rate of cesarean delivery was 22 percent. Among mothers with a previous cesarean, 92 percent had a repeat cesarean delivery. Table 1 also shows that 62 percent of mothers were married, 25 percent identified as Hispanic/Latina, and the most common racial-ethnic identification was non-Hispanic white (55 percent).

Table 2 breaks down descriptive statistics by race-ethnicity. Table 2 reveals some racial-ethnic differences in the primary and total c-section rate, while the likelihood of a repeat c-section is relatively stable across groups of women with a previous cesarean delivery. Overall c-section rates are lower among Native American women and higher among non-Hispanic black women, although the rate does not differ much descriptively between blacks and whites (33 versus 31 percent) or between Hispanics and non-Hispanic whites (30 versus 31 percent). Table 2 also illustrates some expected racial-ethnic differences. For example, non-Hispanic white and Asian mothers have higher average age, education, and marriage rates than other racial-ethnic groups. White and Asian mothers also utilized somewhat more prenatal care. Black women had higher rates of preterm and low birth-weight births than other groups. Asian and Native American mothers were more likely to have diabetes. Table 2 also reveals that Latinas and Asian women were less likely to gain excessive weight during pregnancy or to experience pre-eclampsia than other groups.

As a whole, Table 2 suggests an unusual picture with respect to racial-ethnic disparities. In the American health care system, Native Americans, Hispanics, and blacks are typically disadvantaged relative to non-Hispanic whites, but for two groups cesarean rates are lower (Native Americans and, to a lesser extent, Latinas), while for another they are slightly higher (non-Hispanic blacks). Non-Hispanic whites, who usually have the best access to health care and the best experiences in the health care system, fall in the middle of the distribution. This raises questions about how to explain these patterns? A possible reason for this could be racial-ethnic differences in clinical risks, but there were few substantial differences by race-ethnicity.

To begin to explore SES-related disparities, Table 3 illustrates descriptive statistics by education level. This table reveals that cesarean rates increase as education increases, thus suggesting a positive SES-cesarean relationship. (Table 3 also reconfirms the substantial racial-ethnic segregation of the American socioeconomic structure, with Latinas and non-Hispanic black and Native American women overrepresented among those with less than high school education while

6. Some hospitals continued to use codes based on the 1989 revision of the standard birth certificate, while others used the 2003 revision. As a result, some variables that were only measured using the 1989 revision had extreme numbers of missing cases.

Table 1 • *Descriptive Statistics and Metrics for Key Variables, Natality Detail File, 2006*

Variable	*Metric*	*Mean*	*Std. Dev.*
Dependent measures			
Cesarean	1 = yes	.31	.46
Primary CS[a]	1 = yes	.22	.42
Repeat CS[b]	1 = yes	.92	.27
Independent measures			
Mother's education	1 = < HS, to 4 = 16+ years	2.53	1.10
Hispanic/Latina mother	1 = yes	.25	.43
White (non-Hispanic)	1 = yes	.55	.50
Black (non-Hispanic)	1 = yes	.15	.35
Native American (non-Hispanic)	1 = yes	.01	.10
Asian (non-Hispanic)	1 = yes	.05	.23
Maternal age	In years	27.36	6.16
Mother married	1 = yes	.62	.49
APNCU	1 = inadequate, to 4 = adequate+	2.88	.94
Preterm	< 37 weeks gestation	.13	.33
Multiple birth	1 = yes	.03	.18
Parity	1 = 1st birth to 8 = 8th or more	2.07	1.22
Low BW	Birth-weight < 2,500g	.08	.28
High BW	Birth-weight > 4,500g	.01	.10
Weight gain > 45lbs	1 = yes	.13	.34
Weight gain	In pounds	30.76	13.20
Diabetes	1 = yes	.04	.20
Chronic hypertension	1 = yes	.01	.10
Pre-eclampsia	1 = yes	.04	.19
Eclampsia	1 = yes	.00	.05
Breech	1 = yes	.05	.22
Premature rupture	1 = yes	.02	.15
Prolonged labor	1 = yes	.01	.09
Fetal distress	1 = yes	.04	.21
N		4,188,775	

[a]In births to 3,654,104 women without a previous cesarean. Primary cesareans accounted for 19.3 percent of all births in 2006.
[b]In births to 542,832 women with a previous cesarean. Repeat cesareans accounted for 11.7 percent of all births in 2006.

whites and Asians are far more likely to have a college degree.) Maternal age is also strongly related to education, as expected, so that mothers with less education are younger than more educated mothers. Probably related to their higher age, more educated mothers are more likely to have multiples (Martin, Hamilton, and Osterman 2012). In terms of other risks and complications, there are few differences by education. Overall, Table 3 suggests that more educated women are more likely to have primary cesareans, in support of theories that cesareans without medical necessity represent a form of overtreatment of affluent women (Gould et al. 1989; Hurst and Summey 1984; Wagner 2006).

In sum, the descriptive results in Tables 2 and 3 suggest that there are few racial-ethnic differences in cesarean rates and that differences that exist are very small, while cesarean rates tend to increase as education increases. Taken together, these tables imply that overuse of cesarean surgery is more common among high-SES women. However, in order to test the effects of race-ethnicity and SES independent of one another while accounting for medical risks, we ran logistic regression models to analyze the odds of a cesarean delivery. We analyzed primary cesareans (versus vaginal delivery) in cases where the mother had not had a prior cesarean delivery separately from repeat cesareans in births where the mother had at least one prior c-section (versus vaginal birth after cesarean, or VBAC). We focus our discussion on primary cesareans because

Table 2 • *Descriptive Statistics for Variables by Race/Ethnicity*

Variable	*Hispanic/Latina*	*White*	*Black*	*Asian*	*Native American*
Dependent measures					
Cesarean	.30 (.46)	.31 (.46)	.33 (.47)	.31 (.46)	.27 (.45)
Primary CS[a]	.20 (.40)	.23 (.42)	.24 (.43)	.23 (.42)	.18 (.39)
Repeat CS[b]	.92 (.27)	.92 (.28)	.92 (.28)	.92 (.28)	.90 (.30)
Independent measures					
Education	1.83 (.97)	2.85 (1.03)	2.28 (.97)	3.12 (1.04)	2.10 (.92)
Maternal age	26.24 (6.10)	28.12 (6.01)	25.55 (6.19)	30.22 (5.40)	25.15 (5.88)
Married	.50 (.50)	.73 (.44)	.29 (.46)	.85 (.36)	.35 (.48)
Parity	2.21 (1.26)	1.98 (1.14)	2.20 (1.37)	1.82 (1.04)	2.39 (1.50)
APNCU	2.65 (.94)	3.01 (.89)	2.78 (1.06)	2.92 (.82)	2.57 (1.08)
Pre-term	.12 (.33)	.12 (.32)	.18 (.39)	.11 (.31)	.14 (.35)
Multiple birth	.02 (.15)	.04 (.19)	.04 (.19)	.03 (.17)	.02 (.16)
Low BW	.07 (.25)	.07 (.26)	.14 (.35)	.08 (.27)	.08 (.26)
High BW	.01 (.10)	.01 (.11)	.01 (.08)	.01 (.08)	.02 (.13)
Weight gain (in lbs)	28.96 (11.47)	32.02 (13.58)	29.35 (14.83)	30.20 (9.85)	29.94 (14.79)
Weight gain > 45lbs	.08 (.27)	.16 (.37)	.14 (.35)	.07 (.25)	.15 (.35)
Diabetes	.04 (.20)	.04 (.20)	.04 (.19)	.07 (.26)	.07 (.25)
Chronic hypertension	.01 (.07)	.01 (.10)	.02 (.14)	.01 (.08)	.01 (.12)
Pre-eclampsia	.03 (.17)	.04 (.20)	.05 (.21)	.02 (.14)	.05 (.23)
Eclampsia	.00 (.04)	.00 (.05)	.00 (.06)	.00 (.04)	.00 (.07)
Breech	.06 (.23)	.05 (.23)	.04 (.20)	.05 (.22)	.04 (.20)
Premature rupture	.02 (.13)	.02 (.16)	.03 (.16)	.02 (.15)	.03 (.18)
Prolonged labor	.01 (.09)	.01 (.09)	.01 (.08)	.01 (.09)	.01 (.11)
Fetal distress	.03 (.18)	.05 (.21)	.05 (.23)	.04 (.21)	.04 (.18)
N	1,028,964	2,283,728	609,901	224,563	41,619

Source: Natality Detail File 2006 (U.S. Department of Health and Human Services 2008)
[a]In births to women without a previous cesarean.
[b]In births to women with a previous cesarean.

clinical conditions and complications of labor and delivery contribute substantially to primary cesareans, whereas the cause of most repeat cesareans is the fact that there was a primary cesarean.

Table 4 presents logistic regression models of the odds of a primary cesarean. Model 1 examines the effects of race-ethnicity, education, age, marital status, and parity. Clinical evidence suggests that older mothers are more likely to have cesareans, and mothers having a first birth are substantially more likely to deliver by primary cesarean than mothers with previous vaginal births. Model 1 confirms these well-known findings: each additional year of maternal age increases the odds of a primary cesarean 1.07 times. The effect of parity suggests that each additional birth to a mother who has no prior c-section significantly decreases the odds of a primary cesarean. Model 1 also demonstrates that married women have .88 times the odds of delivering by primary c-section as their unmarried counterparts, suggesting that the social support and other health advantages that are associated with marriage increase the odds of a vaginal birth.

We also know from Tables 2 and 3 that non-Hispanic white and Asian mothers and more educated mothers tend to be older than mothers of other races and mothers with less education, so Model 1 teases apart the effects of age, race-ethnicity, and education. In this multivariate model, contrary to what Table 3 implies, education is *negatively* related to primary cesarean delivery, so that more educated women have lower odds of having primary c-sections after controlling for race-ethnicity, marital status, age, and parity. Partially confirming the descriptive picture from Table 2, however, there are nearly no differences between Latinas, Native American women, and non-Hispanic white women in the odds of a primary cesarean. This is somewhat unexpected,

Table 3 • *Descriptive Statistics for Variables by Education*

Variable	*Less Than High School*	*High School Grad*	*Some College*	*College Grad+*
Dependent measures				
Cesarean	.27 (.44)	.30 (.46)	.33 (.47)	.34 (.48)
Primary CS[a]	.18 (.38)	.21 (.41)	.24 (.43)	.26 (.44)
Repeat CS[b]	.91 (.29)	.92 (.27)	.92 (.27)	.92 (.27)
Independent measures				
Hispanic/Latina	.54 (.50)	.23 (.42)	.16 (.37)	.08 (.27)
White	.28 (.45)	.53 (.50)	.62 (49)	.74 (.44)
Black	.15 (.36)	.19 (.40)	.16 (.37)	.07 (.26)
Asian	.02 (.15)	.04 (.19)	.04 (.21)	.11 (.31)
Native American	.01 (.11)	.01 (.12)	.01 (.10)	.00 (.06)
Maternal age	24.18 (6.20)	25.67 (5.70)	27.79 (5.49)	31.54 (4.55)
Married	.37 (.48)	.49 (.50)	.66 (.47)	.92 (.27)
Parity	2.32 (1.43)	2.10 (1.23)	2.03 (1.15)	1.83 (.97)
APNCU	2.54 (1.01)	2.84 (.99)	2.99 (.89)	3.12 (.77)
Pre-term	.14 (.35)	.14 (.34)	.13 (.33)	.11 (.31)
Multiple birth	.02 (.15)	.03 (.17)	.03 (.18)	.05 (.21)
Low BW	.09 (.29)	.09 (.29)	.08 (.27)	.07 (.25)
High BW	.01 (.09)	.01 (.10)	.01 (.11)	.01 (.11)
Weight gain (in lbs)	29.01 (13.15)	30.67 (14.17)	31.38 (13.66)	31.89 (11.55)
Weight gain > 45lbs	.11 (.31)	.15 (.35)	.15 (.35)	.12 (.33)
Diabetes	.04 (.19)	.04 (.20)	.05 (.21)	.04 (.20)
Chronic hypertension	.01 (.08)	.01 (.11)	.01 (.12)	.01 (.10)
Pre-eclampsia	.03 (.17)	.04 (.20)	.05 (.21)	.04 (.19)
Eclampsia	.00 (.05)	.00 (.05)	.00 (.05)	.00 (.05)
Breech	.05 (.22)	.05 (.21)	.05 (.23)	.06 (.23)
Premature rupture	.02 (.14)	.02 (.15)	.02 (.16)	.03 (.16)
Prolonged labor	.01 (.09)	.01 (.09)	.01 (.09)	.01 (.10)
Fetal distress	.04 (.19)	.05 (.21)	.05 (.21)	.05 (.21)
N	825,445	1,139,982	986,225	1,081,321

Source: Natality Detail File 2006 (U.S. Department of Health and Human Services 2008)
[a]In births to women without a previous cesarean.
[b]In births to women with a previous cesarean.

given that Latinas have lower rates of health insurance than other groups and Native American women often receive midwifery-based maternity care through the Indian Health Service, which one would expect to influence the method of delivery (Mahoney and Malcoe 2005). However, Model 1 does reveal some statistically significant racial-ethnic differences: non-Hispanic black mothers have 1.29 times higher odds of having a primary c-section than non-Hispanic white mothers of similar age, education, marital status, and parity, while Asian mothers have .85 the odds of a primary c-section as non-Hispanic white mothers.

Of course, it is possible that differences in the pregnancy characteristics of non-Hispanic black and Asian women could explain the racial-ethnic differences in Model 1 or, alternately, they could make those differences larger. To test these possibilities, Model 2 adds controls for pregnancy characteristics. Accordingly, prenatal care utilization increases the odds of a cesarean, so that women who received more prenatal care are more likely to deliver surgically than those who received less care. This could be caused by greater prenatal care utilization by women with higher risk pregnancies or by greater opportunities for care providers to diagnose problems or encourage interventions. Weight gain of more than 45 pounds increases the odds of a primary cesarean by 1.46 times. As expected, preterm births, multiples, and low- or high-birth-weight babies have much higher odds of being delivered by cesarean.

Table 4 • *Logistic Regression Models for Probability of a Primary Cesarean*

	Model 1		*Model 2*		*Model 3*		*Model 4*	
Variable	*Coeff.*	*Odds*	*Coeff.*	*Odds*	*Coeff.*	*Odds*	*Coeff.*	*Odds*
Race-ethnicity								
Hispanic/Latina	−.03 (.00)	.98	.06 (.00)***	1.06	.07 (.00)***	1.07	−.25 (.01)***	.78
Black	.25 (.00)***	1.29	.24 (.00)***	1.27	.29 (.00)***	1.33	.06 (.01)***	1.07
Asian	−.17 (.01)***	.85	−.11 (.01)***	.90	−.07 (.01)***	.93	−.34 (.02)***	.72
Native American	.01 (.01)	1.01	.04 (.02)***	1.07	.05 (.02)***	1.05	−.09 (.03)**	.92
Demographics								
Education level	−.05 (.00)***	.95	−.07 (.00)***	.93	−.06 (.00)***	.94	−.12 (.00)***	.89
Age	.07 (.00)***	1.07	.07 (.00)***	1.07	.07 (.00)***	1.07	.07 (.00)***	1.07
Married	−.13 (.00)***	.88	−.11 (.00)***	.90	−.11 (.00)***	.89	−.10 (.00)***	.90
Parity	−.52 (.00)***	.59	−.59 (.00)***	.56	−.58 (.00)***	.56	−.58 (.00)***	.56
Pregnancy characteristics								
APNCU			.06 (.00)***	1.06	.05 (.00)***	1.05	.04 (.00)***	1.04
Pre-term			.24 (.00)***	1.27	.17 (.01)***	1.18	.17 (.01)***	1.18
Multiple birth			2.07 (.01)***	7.93	1.96 (.01)***	7.08	1.97 (.01)***	7.14
Low BW			.61 (.01)***	1.83	.46 (.01)***	1.58	.45 (.01)***	1.57
High BW			1.14 (.01)***	3.14	1.23 (.01)***	3.42	1.24 (.01)***	3.44
Weight gain > 45lbs			.38 (.00)***	1.46	.37 (.00)***	1.45	.36 (.00)***	1.44
Maternal health risks								
Diabetes					.48 (.01)***	1.62	.48 (.01)***	1.61
Hypertension					.63 (.01)***	1.87	.62 (.01)***	1.87
Pre-eclampsia					.62 (.01)***	1.85	.62 (.01)***	1.85
Eclampsia					.89 (.03)***	2.43	.89 (.03)***	2.43
Complications of labor and delivery								
Breech/ non-vertex					2.63 (.01)***	13.90	2.64 (.01)***	13.95
Premature rupture					−.16 (.01)***	.85	−.16 (.01)***	.85
Prolonged labor					.63 (.01)***	1.88	.63	1.88
Fetal Distress					2.04 (.01)***	7.65	2.03 (.01)***	7.63
Interaction terms								
Hispanic/Latina* Education							.15 (.00)***	1.16
Black* Education							.09 (.00)***	1.10
Asian* Education							.09 (.01)***	1.10
Native Am* Education							.06 (.01)***	1.06
Constant	−1.95 (.01)***		−2.24 (.01)***		−2.53 (.01)***		−2.40 (.01)***	
−2 LL	3,725,602.52		3,502,377.40		3,120,309.82		3,117,983.11	
N	3,654,104		3,654,104		3,654,104		3,654,104	

Source: Natality Detail File 2006 (U.S. Department of Health and Human Services 2008)
*$p < .05$ ** $p < .01$ *** $p = .000$ (two-tailed tests)

What happens to the racial-ethnic and education effects in Model 2? The difference in odds of a primary cesarean delivery for Asian women narrows slightly, suggesting that some of the difference in Model 1 is a result of Asian women's lower pregnancy risks. The difference between non-Hispanic white and black women remains similar to that in Model 1, signifying that pregnancy-related risks are not the cause of this disparity and do nothing to mediate or aggravate

it. Also, Latina ethnicity and Native American race-ethnicity become significant in this model, suggesting higher odds of a primary cesarean for these groups than for non-Hispanic whites with the same pregnancy characteristics. Latinas have 1.06 times higher odds and Native American women have 1.07 times higher odds of having a primary cesarean than non-Hispanic white women with similar pregnancy characteristics. Education continues to exhibit a negative pattern, whereby more educated women have lower odds of a primary cesarean delivery after accounting for race-ethnicity, age, marital status, parity, and pregnancy risks. In fact, the magnitude of this negative effect increases over Model 1. The effects of age, marital status, and parity remain stable. A likelihood ratio test reveals that Model 2 significantly improves upon Model 1 ($p < .001$).[7]

Model 3 reinforces these results while accounting for complications of labor and delivery that often provide the clinical rationale for cesarean deliveries. Complications have the predicted effects on the likelihood of cesarean delivery, while racial-ethnic and SES disparities from Model 2 remain. Non-Hispanic black mothers have 1.33 times the odds, Hispanic/Latina mothers have 1.07 times the odds, and Native American mothers have 1.05 times the odds of having a primary c-section as non-Hispanic white mothers with the same risks and complications. Asian mothers have .93 times the odds of a primary cesarean as non-Hispanic white mothers with the same risk profiles. Educational differences remain relatively stable, so that more educated women are less likely to have primary cesarean deliveries, after accounting for all other factors. The effects of age, marital status, and parity remain unchanged. The likelihood ratio again indicates that Model 3 is a statistically significant improvement over Model 2 ($p < .001$).

It is, of course, possible that maternal risks and complications of labor and delivery are more important precursors to cesarean delivery in some populations, while demographic variables like maternal age and marital status might be more relevant for others. In order to determine whether similar or different influences were leading to cesarean deliveries across populations, Model 4 includes interaction terms for race-ethnicity by education, and we ran separate models for each race-ethnicity and education level (results not shown). The negative main effects for Hispanic/Latina and Native American race-ethnicity are striking, especially since they change direction from positive in Model 3 to negative in Model 4. The main effects for non-Hispanic blacks and Asians also exhibit a large change in magnitude from Model 3. These changes from Model 3 to Model 4 suggest that education (SES) substantially mediates the racial-ethnic effects.

Combining the main effects for race-ethnicity and education with the interaction effects reveals how education influences the odds of a primary cesarean for Latinas, Asians, and Native Americans compared non-Hispanic whites. These interactions demonstrate that each additional level of education reduces the odds of a primary cesarean by .97 times for non-Hispanic black women and Asian women, .94 times for Native American women, and .89 times the odds for non-Hispanic white women. Alternately, each increasing level of education *increases* the odds of a primary cesarean for Latinas (1.03 times higher odds with each level of education).[8] In other words, education appears to have the opposite effect for Hispanic/Latina mothers than for other racial-ethnic groups, mainly because Latinas with less than a high school education have lower c-section rates than other women with the same level of education. Black women have higher odds than white women at all education levels, while white women experience a larger reduction in the odds of a primary cesarean from education than any other racial-ethnic group. Among women with less than a high school education, Latinas, Asians, and Native Americans all have lower odds than non-Hispanic whites. However, as education increases the advantages of non-Hispanic white women become apparent: race and class privilege together lead to fewer cesareans with weak medical indications. Among high school graduates and women with some college, only Asian mothers have lower odds of a

7. The formula for the likelihood ratio (lr) test statistic is $lr = -2\ ln\ (L(m1)/L(m2)) = 2\ (ll(m2) - 1ll(m1))$, where $L(m^*)$ represents the likelihood of the respective model, and $ll(m^*)$ denotes the natural log of the model's likelihood (i.e. the log likelihood). The lr statistic has a Chi-square distribution.

8. Odds in this paragraph are based on the combination of the main effect of education (−.12) plus the interaction effect for (education*race-ethnicity), and thus do not correspond to the odds column for Model 4.

primary cesarean than non-Hispanic white women. Among college graduates, white women have the lowest odds of a primary cesarean, followed closely by Asian women. Separate models by race-ethnicity and education level produce very similar results and reveal that class privilege reduces the odds of a primary c-section more for non-Hispanic white women than for other racial-ethnic groups, while some Latinas with less than a high school education have lower rates than their more educated counterparts. (Results of separate models are available from the first author).

Disparities in delivery by repeat c-section follow similar trends to primary cesareans, with smaller disparities in general (results not shown).[9] The main noteworthy effect in these models was that non-Hispanic whites who have had a previous cesarean have 1.19 times higher odds of a repeat cesarean than Asian women, suggesting a substantial difference in favor of VBAC among Asian women. Overall, the results again suggest that more educated, married, and non-Hispanic white or Asian mothers are more likely to choose and/or have access to VBAC in subsequent births after a c-section. In terms of understanding disparities, however, the models of repeat cesareans are less illuminating than models of primary cesareans, because the main cause of most repeat cesareans is the fact that there was a primary cesarean. It is common to schedule repeat cesareans without labor and many hospitals and obstetric practices ban VBAC and routinely schedule repeat cesareans for women with a previous c-section because the American College of Obstetricians and Gynecologists (ACOG) issued a bulletin in 1999 that restricted vaginal birth after cesarean (VBAC) except under highly constrained circumstances (ACOG 1999; Leeman and Plante 2006; Myers 2004; Wagner 2006). Models of repeat cesarean deliveries also confound what we want to observe, namely disparities in health care, with higher-parity births.

Discussion and Conclusions

These results illuminate some possible reasons for contradictory results of existing public health research on disparities in cesarean deliveries. The findings illustrate a basic direct effect between SES and c-sections: when one examines only education, it is clear that more educated women have more primary c-sections (see Table 3), and this is what one would expect if cesarean surgery were overused on more affluent populations (Gould et al. 1989; Placek and Taffel 1988; Stafford et al. 1993; Wagner 2006). However, multivariate models reveal this effect to be spurious: it is largely an effect of maternal age, whereby more educated mothers tend to be older, and higher maternal age increases the odds of a primary c-section. After accounting for pregnancy characteristics, maternal conditions, and complications of labor and delivery, the education effect reverses direction and more educated women are less likely to have a primary cesarean with weak clinical indications. All race-ethnicities except Latinas experience smaller odds as education increases, so that higher SES has a protective effect against primary c-sections unless there are medical indications. (For Latinas, there is a positive effect of education because those with less than high school have lower odds. It is possible that these less-educated women are immigrants who choose low-tech care and/or do not give birth in hospitals with obstetricians attending.) In general, lower-SES women are more likely to have primary cesarean deliveries than higher-SES women with similar risks and complications, which we would expect if high rates of primary cesareans represented a negative health outcome.

In terms of race-ethnicity, raw numbers in Table 2 suggest no clear pattern except a lower primary cesarean rate among Native Americans and, to a lesser extent, Latinas.[10] This is something one would expect if primary cesareans represented higher quality care, since Native Americans and Hispanic populations tend to have less access to care and to receive worse care than non-Hispanic whites.

9. Analysis is available from the authors upon request.

10. Native Americans' lower rates may be a result of practices that are common in the Indian Health Service, such as greater reliance on midwives as primary maternity care providers (Mahoney and Malcoe 2005). Thus, the difference in the health care services that Native American women utilize may explain their lower base rates.

However, multivariate results again reveal that these racial-ethnic groups do, in fact, have higher odds of a primary cesarean after accounting for clinical indications, and demonstrate what one would expect for something negative: after accounting for risks and complications, non-Hispanic blacks, Latinas, and Native Americans are more likely to have primary cesareans than non-Hispanic white women, while Asian mothers are less likely (Aron et al. 2000; Braveman et al. 1995; Frank et al. 2000; Getahun et al. 2009; Newton and Higgins 1989). Moreover, SES confounds these effects by decreasing the odds of a primary cesarean more for non-Hispanic whites than for other racial-ethnic groups and actually increasing the odds for Latinas. Thus, in general, higher education, which is associated with access to health care, more continuity of care, better physician-patient communication, and more effective health advocacy, offers a protective effect against primary c-sections with weak medical indications, especially for white women. The fact that SES influences racial-ethnic groups differently also highlights how c-sections with weak clinical indications represent a negative health outcome that is more common among Latina, black, and Native American mothers, for whom higher SES provides a less protective effect (Hummer 1996; LaVeist 2005; Williams 1999; Williams and Jackson 2005). Women with cumulative advantages (white women with a college education) have the lowest odds of having a cesarean delivery, all else being equal.

With these findings, we aim to contribute to debates over maternal choice and quality implications of high c-section rates. First, the higher odds of a primary cesarean delivery with weak clinical indications among low-SES mothers and some racial-ethnic minorities suggest either that these groups have (and exercise) different preferences or that medical institutions and care providers respond to social characteristics independent of clinical factors. While we lack direct data on preferences, it is likely that some women might choose cesarean delivery, just as others choose home birth, and these choices may differ on the basis of race, ethnicity, or SES. However, to the extent that women have strong feelings about the method of delivery, it is likely that highly educated women and non-Hispanic white women have more opportunities to realize their preferences than less educated women and women of color because they tend to have better access to quality prenatal care, more continuity of care, better communication with care providers, and stronger provider-patient relationships (Burgess, Fu, and van Ryn 2004; Hopkins 2000; Hurst and Summey 1984; Kreps 2006; Lazarus 1994; Malat 2001; Perloff et al. 2006; Potter et al. 2001; Schnittker 2004). Whether or not they share the same preferences, racial-ethnic minorities and less-educated populations are likely to have fewer opportunities to realize their preferences because of generally lower power and status vis-à-vis their care providers, more discontinuities in care, and fewer opportunities to express their wishes or participate in their own care (Cornelius, Bankins, and Brown 2008; Kreps 2006; Perloff et al. 2006).

Thus, if women request primary cesareans, it is most likely non-Hispanic white women and women with more education whose choices are likely to be honored in American medicine. However, the idea that women request cesarean delivery frames choice as an autonomous expression of individualism and ignores structural constraints on women's abilities to choose (Braun 2009; Gill 2007; Lippman 1999). The assertion that maternal request is driving increases in c-section rates relies on assumptions that individual actors have full agency, knowledge, and control over the health care that they receive. Yet there is evidence that individuals exercise less consumer choice in medical care than in other arenas, and are highly susceptible to influence from their care providers (Abraham et al. 2011; Balsa and McGuire 2001; 2003; Balsa et al. 2005; Harris 2003; Hoerger and Howard 1995; Malat 2001; Maserejian et al. 2009; Perloff et al. 2006; Schnittker 2004; van Ryn and Fu 2003). Many, if not most, women believe in the legitimacy of medical authority and few will resist or defy their doctor's orders, especially if they believe that it could endanger their babies.

These results have implications for debates about quality in maternity care as well as questions of maternal choice. In this case, overuse of this method of delivery is more common in populations with fewer resources, which is the opposite of what one would expect if cesarean deliveries represented higher quality care (Brownlee 2007; Wagner 2006). This conforms to medical evidence that

high cesarean rates have negative implications for maternity care quality: evidence-based "best practices" for optimal management of birth include low rates of medical intervention, doula support, freedom of movement, physiologic positions, and a midwifery model of care (Goer 1995).[11] It appears that women with racial and socioeconomic advantages use them to avoid medically unnecessary cesarean deliveries rather than to request them. These women, in fact, are more likely to receive quality health care and to be able to advocate for their own interests and preferences within the health care system, and they appear to be doing so in the direction of vaginal birth. In contrast, lower-SES and racial-ethnic minority women are more likely to receive the type of standard obstetrical care that encourages cesarean deliveries without a strong clinical rationale, which may serve institutional profit and scheduling needs but which poorly serves these women and their families.

Of course, there are limitations to the Natality Detail data for exploring health disparities in cesarean deliveries, including the lack of a measure of income so that we must base conclusions about SES on education alone. Another significant problem is that clinical indications are likely to be undercounted in birth certificate data, so that some cesarean deliveries that appear to be medically unnecessary may actually have strong clinical indications. We cannot discern the extent to which the underreporting of complications might be related to health disparities, since it is possible that hospitals that underreport complications are lower quality in other respects and/or serve underprivileged populations. However, while some relevant pregnancy characteristics are not measured completely accurately, the Natality Detail data are the best available for examining population-level variation in method of delivery. This analysis demonstrates that cesarean deliveries are more common, after accounting for medical necessity, in the non-Hispanic black, Latina, and low-SES populations that also suffer from rising maternal mortality and morbidity rates (Amnesty International 2010; California Department of Public Health 2011). These deliveries may contribute to long-term and cumulative health disparities in which privileged populations receive better quality and more individualized care, while racial-ethnic minorities and low SES populations receive lower quality care (Dressler et al. 2005; LaVeist 2000; LaVeist et al. 2003; LaVeist et al.1995; Lutfey and Freese 2005; Macinko et al. 2003; Malat 2006; Shi 2001).

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11. A doula is a labor coach, or an assistant who provides support to a woman in labor.

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