Three noteworthy and potential very consequential trends in maternal and child health have been unfolding in the U.S. over the past two decades. First, the gestational age distribution of births has been changing. Notably (but not well known), among births that are full term (37–41 weeks completed gestation; almost 90% of all births), those at 40 and 41 weeks have decreased and those at 37, 38 and 39 weeks have increased (Figure 1, from U.S. natality data). Second, rates of child disability have increased substantially, and have been driven by cognitive and behavioral disorders such as ADHD, learning disabilities, and autism (Halfon e al. 2012). Third, rates of caesarian section (C-section) delivery and inductions of labor have risen dramatically; C-sections now account for over 1/3 of all births and almost 1/4 of all births are induced (Figure 2, from U.S. natality data). While the earlier increases in C-sections were accompanied by reductions in infant and fetal mortality, the increases since 2000 have coincided with no such improvements and the current rates of C-sections and inductions are substantially higher than what would be expected based on risk factors, suggesting that large portions of these interventions are not medically necessary.

A growing body of research points to possible connections between these 3 trends. Particular attention has been paid to “late preterm” (34–36 week) (LPT) infants, who have a postnatal morbidity rate ~8 times that of term infants (Ramachandrappa & Jain 2009) and are at increased risk for cognitive and behavioral impairments (Baron et al. 2012), conditions that account for the majority of cases of child disability in the U.S. today (Halfon et al. 2012). A 2005 NICHD workshop brought attention to this large, growing, and (until then) understudied group and highlighted emerging findings that LPT birth is associated with neonatal complications and intensive care use (Raju et al. 2006). The rate of LPT birth declined somewhat afterward, perhaps owing to widespread campaigns not to deliver infants prior to 37 weeks unless medically necessary. However, births at 37–39 weeks have been increasing and those at 40–41 weeks have been decreasing. There has been speculation that changes in the gestational age distribution over time have resulted from increases in “elective” (non-medically necessary) C-sections and inductions, but this allegation has not to date been tested.

In recent research, we found that late preterm birth is associated with neonatal outcomes (respiratory conditions and jaundice) that are associated with developmental impairments, and that the late preterm/full term dichotomy obscures important patterns by week of gestation, even among full term infants. We found, in both between- and within-mother models, that the odds of a respiratory condition decrease significantly with each consecutive week through week 39, and that the odds of jaundice decrease significantly each week through week 40—strongly suggesting (and consistent with allegations by others) that every week of gestation matters for child health (Reichman et al. 2015).
In this paper, we use data from the New Jersey Electronic Birth Certificate & Perinatal Database, which includes records for all births in the state from 1996–2012 (>1.6 million births) and has been linked to maternal and infant hospital discharge records, to investigate the effects of gestational age (which is directly impacted by elective interventions) and method of delivery (C-sections, inductions, both, neither), as well as interactions between the two, on relevant newborn morbidities and hospital resource use outcomes (as proxies for infant health) in low risk pregnancies. New Jersey is a racially and ethnically diverse state, which notably, had the highest rate of C-sections in the U.S. in 2013 (38.4% of all births), while the rate of inductions in that same year, at 19.1%, was lower than the national rate of 23% (calculated from U.S. natality statistics).

Low risk pregnancies will be identified using newly-released Joint Commission guidelines for the perinatal core outcomes of “decreasing the C-section rate in nulliparous women with a term, singleton baby in a vertex position” and “decreasing the rate of elective deliveries.” Guidelines for defining the relevant populations for measuring these outcomes, based on characteristics of pregnancies and identified lists of conditions, were compiled by a panel of perinatal experts and implemented in 2014 as part of an effort to monitor perinatal outcomes for hospital accreditation purposes. We will use these criteria to define the low risk population, which consists of uncomplicated full-term pregnancies, for which many C-sections and inductions are likely to be medically unnecessary. We will use the Joint Commission guidelines as our main criteria for identifying low risk pregnancies, but we will also consider a much more conservative measure that goes beyond those guidelines by excluding mothers with any medical risk factor or labor/delivery complication recorded in either the birth or the discharge records. This alternative specification will identify a stringent low risk sample that will provide conservative bounds for our estimates.

Using both between- and within-mother models, we will estimate effects of week of gestational age (37 through 41) and delivery method on neonatal respiratory conditions, jaundice, hospital costs, length of hospital stay, and NICU use, as well as interactive associations between gestational age and delivery methods. Preliminary evidence from the 1996–2006 linked NJ birth data suggests that, even among low-risk term pregnancies, shorter gestational age and obstetric interventions (inductions and C-sections) are associated with adverse neonatal health outcomes and increased hospitalization costs, and that in some cases there may be interactive effects. For all 3 outcomes, each additional week of gestational age throughout the full-term period reduces risks. Risks are higher among C-section deliveries (whether or not they result from failed inductions) than for vaginal deliveries. Successful inductions (those that result in vaginal deliveries) also appear to be associated with adverse outcomes (relative to vaginal deliveries that are not induced), though the magnitude of the difference is much smaller. These preliminary results suggest that elective interventions that shorten gestational age have been occurring and that they have adverse effects on infant health outcomes that are associated with adverse developmental trajectories.

Population-based studies of children’s health and developmental trajectories have focused almost exclusively on low birthweight (<2500 grams) as the sole indicator of health status at the “starting gate” (e.g., Case, Lubotsky & Paxson 2002; Conley, Strully & Bennett 2003; Case, Fertig & Paxson 2005), although there is increased recognition that fetal growth and health can have consequences for health over the lifecourse through mechanisms that are not necessarily reflected in birthweight (e.g., Barker 1992). The vast majority of full term infants are not low birthweight. This paper identifies the costs, in terms of infant health, of implementing elective deliveries even a week or two early—a practice that is both common and increasing. As such, this study provides essential information about the production of health at the starting gate, which sets the stage for health across the lifecourse.
References