

Labor and delivery outcomes among young adolescents

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OBJECTIVE: We sought to determine whether young adolescents aged 11-14 years and teens aged 15-17 and 18-19 years have an increased risk of cesarean or operative delivery, as well as maternal or neonatal delivery-related morbidity, compared to young adults aged 20-24 years.

STUDY DESIGN: We conducted a retrospective population-based cohort study using Washington State birth certificate data linked to hospital records from 1987 through 2009 for 26,091 nulliparas with singleton gestations between 24-43 weeks. We compared young adolescents aged 11-14 years, young teens aged 15-17 years, and older teens aged 18-19 years to young adults aged 20-24 years. The primary outcome was method of delivery. Secondary outcomes included postpartum hemorrhage, shoulder dystocia, third- and fourth-degree perineal lacerations, chorioamnionitis, prolonged maternal length of stay, gestational age at delivery, birthweight, respiratory distress syndrome, neonatal length of stay, and death. We used multivariate regression to assess associations between age and delivery outcomes.

RESULTS: Young adolescents aged 11-14 years had a lower risk of cesarean (risk ratio [RR], 0.73; 95% confidence interval [CI],

0.65–0.83) and operative vaginal (RR, 0.87; 95% CI, 0.78–0.97) delivery compared to young adults aged 20-24 years. Compared to young adults, young adolescents had an increased risk of prolonged length of stay for both vaginal and cesarean delivery (RR, 1.34; 95% CI, 1.20–1.49, and RR, 1.71; 95% CI, 1.38–2.12, respectively), with no significant differences in indication for cesarean delivery or other measures of maternal morbidity. Young adolescents had an increased risk of preterm delivery (RR, 2.11; 95% CI, 1.79–2.48), low and very low birthweight (RR, 2.08; 95% CI, 1.73–2.50, and RR, 3.25; 95% CI, 2.22–4.77, respectively), and infant death (RR, 3.90; 95% CI, 2.36–6.44) compared to young adults.

CONCLUSION: Young adolescents have a decreased risk of cesarean and operative vaginal delivery compared to young adults; however, their neonates face higher risks of preterm delivery, low and very low birthweight, and death. This information can be used to inform clinical care for this population.

Key words: adolescent pregnancy, cesarean, low birthweight, perinatal mortality, preterm birth

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Although adolescent fertility rates have declined worldwide over the past 2 decades, rates in the United States remain significantly higher than other similar high-income countries. In 2013 alone, US adolescents aged 10-14 years experienced 3108 births (0.3 births/1000 women).¹ Multiple studies demonstrate that childbearing is associated with greater health consequences for teens

than for adult women. The occurrence of preterm delivery,²⁻⁵ low birthweight,^{2,4-6} hypertension,⁷ preeclampsia and eclampsia,^{5,8} anemia,^{7,9} and neonatal death¹⁰ are all higher among teens compared to 20- to 29-year-olds, with increased risk of low birthweight and preterm delivery in the youngest adolescent age groups.^{4,5,8} Although data regarding pregnancy among adolescents

<15 years of age are limited, this population has been shown to be less likely to have adequate prenatal care and more likely to have increased risks of intrauterine growth restriction, preterm delivery, stillbirth, and infant death.¹¹

It has been hypothesized that adolescents <15 years of age may have an increased risk of cesarean and operative vaginal delivery compared to adult

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women, possibly due to cephalopelvic disproportion resulting from underdeveloped bone structures.^{12,13} Multiple large database studies have demonstrated a decreased risk of cesarean delivery among teens^{5,11,14,15}; however, many of these studies have used samples composed primarily of adolescents age ≥ 16 years, with fewer young adolescents represented. One study among young adolescents <15 years-old, specifically, found an increased risk of cesarean, although the effect was limited to those with normal-weight or macrosomic infants.¹³ Two studies suggest an increased risk of birth trauma in the youngest adolescents, with higher risk of emergency cesarean delivery, perineal trauma,¹⁶ and forceps-assisted delivery⁷ compared to older teens with infants at comparable birthweight and gestational age. As few population-based studies have reported birth outcomes among young adolescents, we used data from Washington State to investigate method of delivery, including cesarean and operative vaginal delivery, and maternal and neonatal delivery complications among adolescents aged 11-14 years, young teens aged 15-17 years, and older teens aged 18-19 years compared to young adults aged 20-24 years.

MATERIALS AND METHODS

We conducted a population-based retrospective cohort study using Washington State birth certificate data linked to deidentified maternal and neonatal hospital discharge records following delivery from the Comprehensive Hospital Abstract Reporting System (CHARS). Inclusion criteria for our subjects were nulliparity, age <25 years, singleton pregnancy, cephalic presentation, gestational age between 24-43 weeks, and delivery from 1987 through 2009. We categorized age into young adolescents aged 11-14 years, young teens aged 15-17 years, older teens aged 18-19 years, and young adults aged 20-24 years and used young adults aged 20-24 years as the reference group, in concordance with categories used by the Centers for Disease Control and Prevention for Vital Statistics reporting.¹ A total of 2007 11- to 14-year-olds delivering from 1987

through 2009 met our inclusion criteria, matched at a 1:4 ratio with the other 3 age groups by year of delivery to improve power. The University of Washington Institutional Review Board determined that the study qualified for exempt status and did not require full institutional review board approval.

We obtained data using electronic data sources including: (1) the birth certificate database, which includes demographic, pregnancy, and delivery-related information; and (2) CHARS records, which contain *International Classification of Diseases, Ninth Revision (ICD-9)* diagnosis and procedure codes. A covariate was classified as present if documented in at least 1 data source. Our primary outcome was method of delivery (cesarean vs vaginal). Among vaginal deliveries, we compared spontaneous vs operative vaginal delivery methods, including vacuum and forceps. Both birth certificate and CHARS records were used to capture mode of delivery, with spontaneous vaginal (*ICD-9* diagnosis code 650), operative vaginal (*ICD-9* procedure codes 72.0-72.4 and 72.7-72.9), and cesarean (*ICD-9* diagnosis code 669.7 and procedure codes 74-74.2 and 74.4-74.9).

Our secondary outcomes were maternal complications (corresponding with *ICD-9* codes) including postpartum hemorrhage (666), third- and fourth-degree perineal lacerations (664.2-664.3), shoulder dystocia (660.4), and chorioamnionitis (658.4), all obtained from both birth certificate and CHARS data. We obtained information about length of stay from CHARS data, and categorized this as >3 days for a vaginal delivery (yes/no) and >5 days for a cesarean delivery (yes/no), including antepartum, intrapartum, and postpartum time. We also assessed neonatal complications using both birth certificate and CHARS data, including preterm delivery (645.10-645.13, and 645.20-645.23); low and very low birthweight (764.6-764.8, 765.6-765.8 and 764.1-764.5, 765.1-765.5, respectively); small for gestational age (SGA), or weight <10 th percentile for gestational age (764); and respiratory distress syndrome (RDS) (769). Neonatal length of stay

>5 or <5 days, and neonatal and infant death were obtained from CHARS data alone. Maternal complications were stratified by vaginal vs cesarean delivery. Perineal lacerations and shoulder dystocia were evaluated only among vaginal deliveries, while all other complications were evaluated among both modes of delivery.

We also evaluated demographic and pregnancy characteristics. Race, place of residence (urban, rural), insurance status, and adequacy of prenatal care were obtained using birth certificate data. Adequacy of prenatal care was measured using the Kotelchuck¹⁷ Index, which combines the initiation of prenatal care and number of visits compared with the expected visits, adjusted for gestational age of initiation of care and delivery. Tobacco use (306.1 and 649.0); prepregnancy weight (codes in adults and children: 649.1, 278.0-278.02, 783.2, and V85); and pregnancy comorbidities such as diabetes (648, 250), chronic hypertension (642.0-642.3, 642.9, 401), preeclampsia (642.4-642.5, 642.7) and eclampsia (642.6), and fetal anomalies (740-760) were obtained using both birth certificate and CHARS data.

We compared demographic and obstetric characteristics of the 4 age groups using χ^2 testing. To assess the risk of adverse maternal and neonatal outcomes among the youngest adolescents, we performed multivariate regression analyses and estimated the risk ratios (RRs) and 95% confidence intervals (CIs). We built separate models for each primary and secondary outcome, using logistic regression for most maternal and neonatal outcomes and Poisson regression with a robust variance estimator for common outcomes including cesarean delivery, operative delivery, maternal length of stay for vaginal and cesarean deliveries, and SGA. We adjusted for variables that we identified as potential confounders based on our literature review of factors associated with adolescent pregnancy and birth outcomes and a change in the RR estimate of $>10\%$ comparing crude and adjusted RR. We adjusted for infant birthweight in delivery method models (cesarean, operative). For maternal complications

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