**BACKGROUND:** In 2016 the Antenatal Late Preterm Steroids study was published, demonstrating that antenatal corticosteroid therapy given to women at risk of late preterm delivery reduces respiratory morbidity in infants. However, the administration of antenatal corticosteroid therapy in late-preterm infants remains controversial. Late-preterm infants do not suffer from the same rates of morbidity as preterm infants, and the short-term benefits of antenatal corticosteroid therapy are less pronounced; consequently, the risk of possible harm is more difficult to balance.

**OBJECTIVE:** This study aimed to evaluate the association between the publication of the Antenatal Late Preterm Steroids study and changes in antenatal corticosteroid therapy administration in late-preterm infants in the United States.

**STUDY DESIGN:** Data analyzed were publicly available US birth certificate data from January 1, 2016 to December 31, 2018. An interrupted time series design was used to analyze the association between publication of the Antenatal Late Preterm Steroids study and changes in monthly rates of antenatal corticosteroid administration in late preterm gestation (34+0 to 36+6 weeks). Births at 28+0 to 31+6 weeks’ gestation were used as a control. Antenatal corticosteroid therapy administration in women with births at 32+0 to 34+6 weeks was explored to analyze whether the intervention influenced antenatal corticosteroid therapy administration in women in the subgroup approaching 34 weeks’ gestation. Antenatal corticosteroid therapy administration in women with term births (>37 weeks’ gestation) was analyzed to explore if the intervention influenced the number of term babies exposed to antenatal corticosteroid therapy. Our regression model allowed analysis of both step and slope changes. February 2016 was chosen as the intervention period.

**RESULTS:** Our sample size was 18,031,950 total births. Of these, 1,056,047 were births at 34+0 to 36+6 weeks’ gestation, 123,788 at 28+0 to 31+6 weeks, 153,708 at 32 to 33 weeks, and 16,602,699 were term births. There were 95,708 births at <28 weeks’ gestation. There was a statistically significant increase in antenatal corticosteroid therapy administration rates in late preterm births following the online publication of the Antenatal Late Preterm Steroids study (adjusted incidence rate ratio, 1.48; 95% confidence interval, 1.36—1.61; \( P = .00 \)). A significant increase in antenatal corticosteroid therapy administration rates was also seen in full-term births following the online publication of the Antenatal Late Preterm Steroids study. No significant changes were seen in antenatal corticosteroid administration rates in gestational age groups of 32+0 to 33+6 weeks or 28+0 to 31+6 weeks.

**CONCLUSION:** Online publication of the Antenatal Late Preterm Steroids study was associated with an immediate and sustained increase in the rates of antenatal corticosteroid therapy administration in late preterm births across the United States, demonstrating a swift and successful implementation of the Antenatal Late Preterm Steroids study guidance into clinical practice. However, there is an unnecessary increase in full-term infants receiving antenatal corticosteroid therapy. Given that the long-term consequences of antenatal corticosteroid therapy are yet to be elucidated, efforts should be made to minimize the number of infants unnecessarily exposed to antenatal corticosteroid therapy.

**Key words:** antenatal corticosteroids, late preterm birth, prematurity, steroids, time series analysis

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**Introduction**

Antenatal corticosteroid therapy (ACT), given to women at risk of preterm delivery, has been estimated to decrease neonatal mortality by 31%. ACT has been a part of routine treatment for early-preterm birth (before 34 weeks’ gestation) in the United States for many years, since the 1994 National Institutes of Health Consensus Conference’s conclusion that glucocorticoids administered to women at risk of delivery before 34 weeks’ gestation reduced adverse neonatal outcomes. This recommendation did not extend to women at risk of late preterm delivery (34+0 to 36+6 weeks’ gestation) because of all but 1% of late-preterm infants surviving. However, late-preterm infants have a higher incidence of neonatal and childhood morbidities than term-born babies (birth after 37 weeks), and with >70% of preterm births occurring in the late preterm stage, potential treatments are of utmost importance.

In 2016, the Antenatal Late Preterm Steroids (ALPS) trial indicated that ACT administered to women at risk of imminent late preterm delivery reduced respiratory morbidity in neonates. Results from the trial were presented at the Society for Maternal-Fetal Medicine’s (SMFM) 36th annual meeting and published online on February 4, 2016 and in print on April 7, 2016. In response, the SMFM and the American College of Obstetricians and Gynecologists altered their guidelines regarding ACT administration to include women at risk of late preterm delivery.

The impact of the publication of ALPS trial findings on ACT administration is yet to be evaluated. Up-to-date quantification of ACT rates is relevant...
амid concerns that benefits provided by ACT in early-preterm birth are not as significant in late preterm birth, and that ACT may increase the risk of short-term and long-term harm. Consequently, several publications have advised caution in ACT administration in late preterm birth until further evidence surrounding ACT’s long-term effects is provided. Given this controversy, there is no current international consensus on ACT administration in late preterm gestation.

The translation of research into clinical practice is recurrently slow, even in the absence of controversy about findings, and changes to guidelines may have a limited effect on physicians’ behaviors. This study aims to elucidate whether the ALPS trial findings have been translated into clinical practice, using an interrupted time series (ITS) analysis to evaluate the impact of ALPS trial publication or subsequent guideline changes on ACT administration in late-preterm infants in the United States (Video 1). ITS analysis is a strong quasi-experimental study design appropriate for assessing the effect of an intervention when randomization cannot occur. It is particularly applicable for retrospective evaluation of population-level data.

Materials and Methods
This was a retrospective analysis of publicly available US birth certificate data from National Vital Statistics Online. An ITS study design was used to determine whether publication of ALPS data influenced recorded administration of ACT in babies. An ITS is a longitudinal study design that includes a statistical comparison of time trends before and after an intervention that occurs at a fixed point in time.

Ethics statement
The study was sponsored by the University of Edinburgh. Before commencement, the research was subject to the University of Edinburgh Usher Institute ethics/data protection oversight process. The ethics/data protection triage and overview self-audit of ethics/data protection issues confirmed the proposed research (fully anonymous secondary data analysis) posed no reasonably foreseeable ethics/data protection risks. This indicated that there was no requirement for proceeding to full formal ethics/data protection review.

Data source
The reporting of this study conforms to the Strengthening the Reporting of Observational studies in Epidemiology (STROBE) statement. This study was a secondary analysis of publicly available US birth certificate data from National Vital Statistics Online. In the United States, birth certificates are required by state laws to be completed for all births. Federal law mandates national collection and publication of births and other vital statistic data. These data are compiled by the National Vital Statistics System (NVSS) in collaboration with the National Center for Health Statistics (NCHS) at the Centers for Disease Control and Prevention (CDC) and all US states. Data are collected on standard forms, and model procedures are recommended to promote uniformity. The NVSS data have been widely used by the CDC and wider literature. Detailed descriptions of NVSS data collection methods, quality control, and vital statistics are available on the official website. All data variables recorded are included in the files for secondary analysis. A limited number of these were used in the final dataset. Data were cleaned and compiled by NVSS and checked for internal consistency, outliers, and missing data according to CDC guidance and according to biologically implausible values. Guidance for use of NVSS natality public use data was adhered to. The analysis time period was from January 2014 to December 2018. This period was chosen because a number of changes were made to the national birth file in 2014 after a review by the National Association for Public Health Statistics and Information Systems and the NCHS Good-to-Great Committee. Thus, inclusion of pre-2014 data would cause difficulty in deducing whether changes observed were true data changes or owing to data capture. The final date was chosen on the basis of the most recently published data at time of data cleaning.

Inclusion and exclusion criteria
We extracted birth certificate data on all infants delivered in the United States...
between January 1, 2014 and December 31, 2018. Analyses were restricted to singleton, live-born infants with no severe congenital anomalies. Records from regions that do not record ACT use, and those where gestation, ACT use, or neonatal unit admission were unknown, were excluded. The obstetrical estimate of gestational age, based on the birth attendant’s final estimate of gestation, in completed weeks and as recorded in the birth certificate, was used. The gestational age at steroid exposure was unknown.

**Outcome variables**

The primary outcome for this study was ACT administration in births at 34+0 to 36+6 weeks’ gestation. To test the robustness of our results, a control ITS analysis was repeated in births at 28+0 to 31+6 weeks. Secondary outcomes included ACT administration in births at 32+0 to 33+6 weeks (explored to analyze whether the intervention influenced ACT administration in women approaching 34 weeks’ gestation) and ACT administration in women at ≥37 weeks’ gestation (to explore if the intervention influenced the number of term babies exposed to ACT born at or beyond term). Births at <28 weeks were not included in any analysis because of variation and potential changes in practice of care of perivable or extreme preterm births within the study period.

**Bias**

The rate of ACT in births at 28+0 to 31+6 weeks’ gestation was used as an intervention-control ITS because there was no national change to ACT guidelines in this gestational age window during the study period, controlling for potential history bias because of interventions. A before-after counterfactual model was used to predict the proportion of births at 34+0 to 36+6 weeks’ gestation that would have been exposed to ACT, in the absence of the intervention.

**Impact model**

We hypothesized a priori that the intervention would result in an immediate level and a gradual slope change, given that the intervention was implemented gradually, with data being published online before publishing in print. We used February 2016, when data were first presented and published online, as the intervention breakpoint. No interventions were expected because there were no additional guideline changes that could have affected the outcome during the study period.

**Statistical methods**

We used a population-based ITS analysis, fitting a log-linear Poisson regression model, with log total births administered ACT at each gestation as the dependent variable. The model for each gestational age category included total number of births as an offset variable to model rates, adjusting for changes in the population over time, the intervention as a dummy variable, and months as a linear variable. Slope changes were modeled using an interaction between centered time and intervention indicator. Initial analysis confirmed the data for 34+0 to 36+6 weeks’ and ≥37 weeks’ gestation did not fit the statistical assumptions of a Poisson distribution, showing overdispersion (data not shown). A negative binomial regression model was chosen, allowing greater flexibility with overdispersed count data.

Spatial autocorrelation was assessed by examining residual plots, using the Durbin Watson statistic and plotting the autocorrelation function (ACF) and partial autocorrelation function (PACF). Seasonal autocorrelation was assessed by plotting raw time-series data, ACF, PACF and decomposing the time series. Spatial autocorrelation was adjusted for through inclusion of a lagged dependent variable. Seasonal autocorrelation was addressed by inclusion of harmonic terms and 2 sine/cosine pairs per 12-month period.

Primary (unadjusted) linear models fitted to the data allowed gradual (slope) changes in ACT administration to be analyzed. Secondary (adjusted) models accounted for seasonality in ACT rates and autocorrelation through inclusion of lagged dependent variable and harmonic terms. There were fitted to estimate the immediate (level) change in ACT administration after the intervention. Adjusted models performed better than unadjusted models, as assessed by the Akaike information criterion and Bayesian information criterion, suggesting a significant deviation from linearity, confirmed through residual analysis.

In preparatory ITS analyses, regression models were fitted to preintervention data to estimate the counterfactual scenario. This was compared with the observed trends after the intervention, allowing both immediate and gradual changes in ACT rates to be captured. An intervention-control analysis of births at 28+0 to 31+6 weeks’ gestation was performed as a control. A Poisson regression model was fitted.

Additional regression models were tested in sensitivity analyses, including models allowing only level change, with additional sine/cosine pairs, and with the intervention point at April 2016, when the data were first published in print.

A post hoc subgroup analysis was performed in women with pregestational diabetes mellitus. Women with pregestational diabetes mellitus on medication were excluded from the ALPS trial. Standard care for women with pregestational diabetes mellitus is insulin therapy, and many others are on alternative medication. Thus, we used this population to explore whether ALPS findings were extrapolated to populations not included in the trial.

A detailed statistical analysis protocol was made publicly available at the Open Science Framework on April 18, 2021. All analyses were performed in R (version 3.6.3; R Foundation for Statistical Computing, Vienna, Austria).

Summary statistics were derived and stratified by outcome. Statistical significance (2-sided) was accepted at the 5% level with corresponding 95% confidence intervals (CIs) presented. Descriptive statistics used mean (SD), median (interquartile range), and counts (with percentages), as appropriate. All hypothesis tests were 2-sided.

**Results**

Between January 1, 2014 and December 31, 2018, there were 19,133,773 births.
We excluded 658,025 (3.44%) multiple births, 298,073 (1.56%) singleton pregnancies with congenital anomalies, 128,170 births from nonreporting regions (0.67%), 11,511 (0.06%) births with missing gestation data, and 6044 (0.03%) births with missing ACT administration data. This left 18,031,950 births (94.24% of all births) for analysis. Of these, 1,056,047 (5.9%) were births at 28–0 to 36+6 weeks’ gestation, 123,788 (0.7%) at 28+0 to 31+6 weeks, 153,708 (0.9%) at 32+0 to 33+6 weeks, and 16,602,699 (92.1%) at ≥37 weeks. There were 95,708 (0.5%) births at <28 weeks’ gestation. Characteristics of the cohort, stratified by gestational age, are shown in Table 1.

Before the intervention, the percentage of women with births at 34+0 to 36+6 weeks’ gestation administered ACT stayed level at an average of 5.12%. An immediate increase in ACT administration in women with births at 34+0 to 36+6 weeks’ gestation was observed after the intervention, followed by a gradual increase until the end of the study period.

The effects of online publication of the ALPS trial in February 2016 on ACT administration in each gestational category are summarized in Table 2. The table exhibits incidence risk ratios (IRRs), comparing the periods before and after February 2016. There was a statistically significant level change increase in ACT rate in the 34+0 to 36+6 weeks’ gestation age category in the unadjusted linear and seasonally adjusted models (adjusted IRR, 1.48; 95% CI, 1.36–1.61; P<.00) (Figure 1). There was also a significant change to postintervention slope in the unadjusted linear model, with a statistically significant increase in ACT rate (IRR, 1.01; 95% CI, 1.00–1.01; P=.00) (Figure 2), thus showing a statistically significant increase in full-term babies born at ≥37 weeks’ gestation being exposed to ACT. Characteristics of babies born at ≥37 weeks’ gestation who were and were not exposed to ACT are shown in the Supplemental Table.

All models tested in sensitivity analyses showed increased ACT administration rates in women with births at 34+0 to 36+6 weeks’ gestation after February 2016 (Appendix A). Post hoc subgroup analysis showed a statistically significant increase in ACT administration in women with pregestational diabetes mellitus (IRR, 1.93; 95% CI, 1.56–2.39; P=.00) (Appendix B).

Discussion

Principal findings

This study is the first to analyze whether publication of ALPS data affected ACT administration in late preterm birth. The analyses indicate that publication of ALPS data in February 2016 resulted in a significant increase in ACT administration rates in infants born at 34+0 to 36+6 weeks in the United States. There was no corresponding change in ACT rates in the control group (28+0 to 31+6 weeks), indicating a causal relationship between publication of ALPS data and the significant change seen in ACT administration rates in late-preterm infants. The publication of ALPS data was also associated with a statistically significant increase in ACT administration in infants born at ≥37 weeks’ gestation in the United States.

Strengths and limitations

Percentage rates of ACT administration in all gestational ages seem low. This may be partially because of not all eligible women receiving ACT; studies suggesting 75% to 86% of eligible women being administered ACT in United States imply underreporting of administration within the NVSS dataset. Nevertheless, it seems unlikely that ALPS would influence reporting levels, and our study reported no change in our control gestation category. Under-reporting is therefore unlikely to bias the IT’s methodological: This study lacked control for time-varying confounders; this limitation was minimized through a priori model specification and an offset variable in our regression model. Strengths of this study include the intervention-control comparison, controlling for history bias, and allowing greater causality to be drawn from the observed significant effects of the intervention.

Clinical implications

The study demonstrates that the ALPS trial publication has influenced clinical practice. Because of the large number of late-preterm infants, this swift and successful implementation is likely to have reduced respiratory morbidities. However, taking into consideration that the ALPS trial found a 60% increase in hypoglycemia with ACT vs placebo, the increased ACT use in this population may have resulted in harm. There is conflicting evidence over whether neonatal hypoglycemia is associated with long-term harm. Furthermore, the lack of long-term follow-up data results in uncertainty about sustained health benefits or the absence of long-term effects. Adverse effects on neurodevelopment have been associated with term birth after ACT exposure.

The ALPS trial excluded women with pregestational diabetes mellitus on medication before pregnancy. Although our study was unable to specifically
| Label                          | Levels                  | <28 wk (0.5) | 28–31 wk (0.7) | 32–33 wk (0.9) | 34–36 wk (5.9) | Term/postterm (92.1) |
|-------------------------------|-------------------------|--------------|----------------|----------------|----------------|---------------------|
| Total N (%)                   |                         | 95,708       | 123,788        | 153,708        | 1,056,047      | 16,602,699          |
| Maternal age                  | Under 20                | 7724         | 8579           | 10,122         | 65,545         | 929,144             |
|                               | 20–24 y                 | 21,572       | 26,472         | 31,968         | 222,498        | 3,481,476           |
|                               | 25–29 y                 | 25,934       | 32,579         | 40,224         | 289,281        | 4,869,835           |
|                               | 30–34 y                 | 23,059       | 31,364         | 40,081         | 276,508        | 4,622,527           |
|                               | 35–39 y                 | 13,708       | 18,941         | 24,115         | 158,282        | 2,220,950           |
|                               | 40–44 y                 | 3430         | 5381           | 6524           | 40,391         | 448,648             |
|                               | 45 y and over           | 281          | 472            | 674            | 3542           | 30,119              |
| Maternal race                 | Non-Hispanic White      | 32,524       | 51,060         | 67,970         | 502,826        | 8,728,812           |
|                               | Non-Hispanic Black      | 32,781       | 33,159         | 35,092         | 195,387        | 2,278,605           |
|                               | Hispanic                | 21,670       | 27,935         | 35,860         | 253,289        | 3,902,498           |
|                               | Non-Hispanic other or more than 1 race | 7295 | 10,451 | 13,385 | 96,147 | 1,560,902 |
|                               | Origin unknown          | 1438         | 1183           | 1401           | 8398           | 131,882             |
| BMI category (kg/m²)          | <18.5                   | 3221         | 5046           | 6583           | 44,284         | 557,721             |
|                               | 18.5–24.9               | 29,898       | 44,234         | 57,308         | 412,742        | 7,203,284           |
|                               | 25.0–29.9               | 22,129       | 29,120         | 36,383         | 255,058        | 4,221,305           |
|                               | 30.0–34.9               | 15,963       | 19,344         | 23,117         | 156,422        | 2,295,139           |
|                               | 35.0–39.9               | 9317         | 10,571         | 12,551         | 82,484         | 1,104,432           |
|                               | 40.0                    | 7773         | 8412           | 10,027         | 65,959         | 766,423             |
|                               | Unknown                  | 7407         | 7061           | 7739           | 39,098         | 454,395             |
| Payment source                | Medicaid                | 50,592       | 64,189         | 78,121         | 515,188        | 7,043,789           |
|                               | Private insurance       | 35,480       | 48,755         | 62,246         | 452,217        | 8,096,313           |
|                               | Other                   | 8533         | 9827           | 12,110         | 81,116         | 1,354,852           |
|                               | Unknown                  | 1103         | 1017           | 1231           | 7526           | 107,745             |
| Parity                        | Primiparous             | 33,356       | 41,337         | 49,436         | 315,778        | 5,278,435           |
|                               | Multiparous             | 61,180       | 81,285         | 102,964        | 732,239        | 11,217,854          |
|                               | Unknown                  | 1172         | 1166           | 1308           | 8030           | 106,410             |
| Cigarette use                 | Yes                     | 9802         | 13,867         | 17,584         | 110,318        | 1,173,823           |
|                               | No                      | 84,208       | 108,320        | 134,334        | 935,053        | 15,292,070          |
| Hypertensive disorder         | Prepregnancy hypertension| 5258         | 8285           | 9158           | 43,617         | 247,191             |
|                               | Gestational hypertension| 8941         | 23,085         | 28,224         | 146,106        | 844,132             |
|                               | Preeclampsia             | 797          | 1846           | 1866           | 7033           | 20,911              |
|                               | Unknown                  | 176          | 162            | 151            | 954            | 8563                |
|                               | None                     | 80,536       | 90,410         | 114,309        | 858,337        | 15,481,902          |

Kearsey. The impact of the Antenatal Late Preterm Steroids trial. Am J Obstet Gynecol 2022. (continued)
analyze women with pregestational diabetes mellitus on medication, subgroup analysis of all women with pregestational diabetes mellitus showed an increase in ACT rates after ALPS publication, demonstrating a possible indication creep. The SMFM have published an update specifically recommending against women with pregestational diabetes mellitus receiving ACT given the risk of worsening neonatal hypoglycemia. Our findings therefore suggest this indication creep may result in potential harm.

Our study demonstrates increased ACT administration rates in late-preterm infants immediately after online publication of the ALPS study and a continual increase throughout the study, maximizing potential patient benefit. This is likely attributable to the instantaneous communication available to clinicians in the 21st century. The timing of increased ACT use relates to publication and presentation of trial findings, and predates guideline change.

Research implications
In addition to an increase in ACT administration rates in late-preterm infants, there was an increase in term-born babies receiving ACT. This may be attributed to the challenge of predicting the timing of imminent preterm delivery. The ALPS study reported that 16% of women who received ACT delivered at term. Full-term infants do not suffer from the same risk of respiratory morbidities and mortality as those born preterm, nor benefit from ACT, and can therefore become unnecessarily exposed to potential harm via ACT. The challenge of predicting delivery
Timing may result in births outside the optimal window for ACT, reducing treatment efficacy and causing potential harm. Further studies are needed to optimize timing of ACT administration, and developing better ways to accurately diagnose preterm labor is of key importance.

**Conclusions**

This study has shown that ALPS trial publication resulted in increased ACT administration rates in late preterm and full-term births, showing that the ALPS trial findings were rapidly implemented in clinical practice. However, there was a concurrent increase in ACT administration rates in infants born at ≥37 weeks’ gestation. Until ACT’s long-term effects are elucidated, efforts should be made to improve the prediction of preterm delivery, minimizing unnecessary exposure to ACT.
FIGURE 2
Time Series Plots of ACT Administration in Gestational Age Categories

Time-series plots with nonlinear unadjusted regression models and linear adjusted regression models in each gestational age category. Seasonally adjusted models of antenatal corticosteroid administration rates at: (A) 28 to 31 weeks’ gestation, (B) 32 to 33 weeks’ gestation, (C) 34 to 36 weeks’ gestation, and (D) full-term gestation from 2014 to 2018. Red line shows the observed rate based on regression model adjusted for seasonality and autocorrelation; the black line shows the observed rate based on the nonadjusted model; gray box represents the postintervention period (after February 2016).


direction of line

ACT, antenatal corticosteroid therapy.

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Appendix A

SUPPLEMENTAL FIGURE 1
Time Series Plot of ACT Administration Rate in 34-36 Weeks Gestation

Seasonally adjusted model of antenatal corticosteroid administration rate at 34 to 36 weeks’ gestation, with intervention point set on April 2016. Red line shows the observed rate based on regression model adjusted for seasonality and autocorrelation; gray box represents the post-intervention period (after April 2016).

ACT, antenatal corticosteroid therapy.

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Seasonally adjusted model of antenatal corticosteroid administration rate at 34 to 36 weeks’ gestation with additional sine/cosine pairs. Red line shows the observed rate based on regression model adjusted for seasonality and autocorrelation; gray box represents the postintervention period (after February 2016).

ACT, antenatal corticosteroid therapy.

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SUPPLEMENTAL FIGURE 3
Time Series Plot of ACT Administration Rate in 34-36 Weeks Gestation

Seasonally adjusted model of antenatal corticosteroid administration rate at 34 to 36 weeks’ gestation with no slope change. Red line shows the observed rate based on regression model adjusted for seasonality and autocorrelation; gray box represents the postintervention period (after February 2016).

ACT, antenatal corticosteroid therapy.
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SUPPLEMENTAL FIGURE 4
Antenatal Corticosteroid Therapy in Pregestational Diabetics Birth 34-36 Weeks

Seasonally adjusted model of antenatal corticosteroid administration rates in women with pregestational diabetes mellitus from 2014 to 2018. Red line shows the observed rate and the blue dotted line the predicted counterfactual rate based on the regression model adjusted for seasonality and autocorrelation; gray box represents the postintervention period (after February 2016).

ACT, antenatal corticosteroid therapy.

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## Characteristics of births at ≥37 weeks’ gestation stratified by whether antenatal corticosteroid therapy was received

| Characteristics                        | No ACT | ACT  |
|----------------------------------------|--------|------|
| Total N (%)                            | 16,519,304 (99.5) | 83,395 (0.5) |
| Maternal age                           |        |      |
| Under 20                               | 924,132 (5.6)  | 5012 (6.0)  |
| 20—24 y                                | 3,463,321 (21.0) | 18,155 (21.8) |
| 25—29 y                                | 4,845,684 (29.3) | 24,151 (29.0) |
| 30—34 y                                | 4,600,380 (27.8) | 22,147 (26.6) |
| 35—39 y                                | 2,209,858 (13.4) | 11,092 (13.3) |
| 40—44 y                                | 446,029 (2.7)  | 2619 (3.1)  |
| 45 y and over                          | 29,900 (0.2)   | 219 (0.3)   |
| Maternal race                          |        |      |
| Non-Hispanic White                     | 8,681,999 (52.6) | 46,813 (56.1) |
| Non-Hispanic Black                     | 2,263,916 (13.7) | 14,689 (17.6) |
| Hispanic                               | 3,887,747 (23.5) | 14,751 (17.7) |
| Non-Hispanic other or >1 race          | 1,554,450 (9.4) | 6452 (7.7)   |
| Origin unknown                         | 131,192 (0.8)  | 690 (0.8)   |
| BMI category (kg/m²)                   |        |      |
| <18.5                                  | 554,049 (3.4)  | 3672 (4.4)  |
| 18.5—24.9                              | 7,168,610 (43.4) | 34,674 (41.6) |
| 25.0—29.9                              | 4,200,957 (25.4) | 20,348 (24.4) |
| 30.0—34.9                              | 2,283,393 (13.8) | 11,746 (14.1) |
| 35.0—39.9                              | 1,098,192 (6.6) | 6240 (7.5)   |
| ≥40.0                                  | 761,343 (4.6)  | 5080 (6.1)  |
| Unknown                                | 452,760 (2.7)  | 1635 (2.0)  |
| Payment source                         |        |      |
| Medicaid                               | 7,006,050 (42.4) | 37,739 (45.3) |
| Private insurance                      | 8,055,391 (48.8) | 40,922 (49.1) |
| Other                                  | 1,350,500 (8.2) | 4352 (5.2)   |
| Unknown                                | 107,363 (0.6)  | 382 (0.5)   |
| Parity                                 |        |      |
| Primiparous                            | 5,254,906 (31.8) | 23,529 (28.2) |
| Multiparous                            | 11,158,309 (67.5) | 59,545 (71.4) |
| Unknown                                | 106,089 (0.6)  | 321 (0.4)   |
| Cigarette use                          |        |      |
| Yes                                    | 1,165,440 (7.1) | 8383 (10.1) |
| No                                     | 15,217,563 (92.1) | 74,507 (89.3) |
| Unknown                                | 136,301 (0.8)  | 505 (0.6)   |
| Hypertensive disorder                  |        |      |
| Prepregnancy hypertension              | 243,833 (1.5)  | 3358 (4.0)  |
| Gestational hypertension               | 833,173 (5.0)  | 10,959 (13.1) |

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### SUPPLEMENTAL TABLE

**Characteristics of births at ≥37 weeks’ gestation stratified by whether antenatal corticosteroid therapy was received** (continued)

| Characteristics                   | No ACT          | ACT            |
|-----------------------------------|-----------------|----------------|
| **Preeclampsia**                  |                 |                |
| Unknown                           | 8520 (0.1)      | 43 (0.1)       |
| None                              | 15,413,117 (93.3)| 68,785 (82.5)  |
| **Diabetes mellitus**             |                 |                |
| **Prepregnancy diabetes mellitus**|                 |                |
| Unknown                           | 8520 (0.1)      | 43 (0.1)       |
| None                              | 15,458,138 (93.6)| 75,425 (90.4)  |
| **Gestational diabetes mellitus** |                 |                |
| Unknown                           | 8520 (0.1)      | 43 (0.1)       |
| **Previous preterm birth**        |                 |                |
| **No previous preterm birth**     |                 |                |
| Unknown                           | 8520 (0.1)      | 43 (0.1)       |
| **Gestational age**               |                 |                |
| Mean (SD)                         | 39.0 (1.1)      | 38.2 (1.1)     |
| **Mode of birth**                 |                 |                |
| Vaginal                           | 11,682,893 (70.7)| 52,383 (62.8)  |
| Cesarean delivery                 | 4,831,437 (29.2)| 30,994 (37.2)  |
| Unknown                           | 4974 (0.0)      | 18 (0.0)       |
| **Sex of infant**                 |                 |                |
| Female                            | 8,109,406 (49.1)| 40,248 (48.3)  |
| Male                              | 8,409,898 (50.9)| 43,147 (51.7)  |
| **Birthweight**                   |                 |                |
| Mean (SD)                         | 3383.0 (459.8)  | 3174.7 (527.8) |

*ACT, antenatal corticosteroid therapy; BMI, body mass index; SD, standard deviation.*

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