**Likelihood of primary caesarean delivery following induction of labour in singleton term pregnancies, compared to expectant management: a population-based, retrospective cohort study**

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**Declarations**

**Ethics approval and consent to participate:** The data used in this study were de-identified before use. All methods were performed in accordance with the Declaration of Helsinki. The Townsville Hospital and Health Service Human Research Ethics Committee (HREC; HREC/16/QTHS/223) and the Australian Institute of Health and Welfare HREC (EO2017-1-338) granted permission to access the raw data used in this study.

**Consent for publication:** Not applicable.

**Availability of data and materials:** Individual level data from this study cannot be shared by the research team, due to the ethics approval and access approvals granted. Requests for access to the individual level data may be made directly to the data custodians via the Queensland Health, Statistical Services Branch with appropriate ethics and relevant approvals. The authors can share the Data Dictionary upon request.

**Code availability:** SAS V9.4. The code used for this study is available from the corresponding author upon request.

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**Abstract**

*Background*: There has been a trend toward birth at earlier gestational age and increased use of both induction of labour (IOL) and caesarean section (CS) for women with term pregnancies in many countries, particularly high-income countries. Unnecessary use of obstetric interventions during pregnancy and birth is associated with an increased risk of adverse health outcomes for women and babies, as well as adding financial costs to the health care systems. Existing evidence regarding the association between IOL at term and CS is mixed and conflicting, and little evidence has been known about the differential effect at each gestation between 37+0 – 41+6 weeks, separately among nulliparous and parous women.

*Objective*: The aim of this study was to explore the association between IOL and primary CS for women with singleton term pregnancies, compared with expectant management (EM) of pregnancy.

*Methods*: We performed an analysis of population-based retrospective cohort data on women who gave birth in one Australian state (Queensland), between 01/07/2012 and 30/06/2018. All no-labour births (i.e., prelabour CS), multiple births (e.g., twins or triplets), and women with a prior CS were excluded. Five sub-datasets were created based on the time of birth following IOL (37+0 - 37+6; 38+0 - 38+6; 39+0 - 39+6; 40+0 - 40+6; and 41+0 - 41+6). Unadjusted relative risk (RR) and adjusted relative risk (aRR) were calculated in each sub-dataset to explore the risk of primary CS following IOL, compared to EM. Analysis was stratified by parity (nulliparas versus paras). Sensitivity analyses were conducted by limiting to women with low-risk pregnancies.

*Results*: The risk of primary CS following IOL was significantly higher for women with singleton pregnancies, compared with EM, before or after adjustment, at 38+0 - 38+6 (nulliparas: aRR = 1.14, 95% CI: 1.10 - 1.18; paras: aRR = 1.35, 95% CI: 1.25 - 1.46), at 39+0 - 39+6 (nulliparas: aRR = 1.18, 95% CI: 1.14 - 1.22; paras: aRR = 1.36, 95% CI: 1.24 - 1.49), at 40+0 - 40+6 (nulliparas: aRR = 1.25, 95% CI: 1.21 - 1.29; paras: aRR = 1.40, 95% CI: 1.26 - 1.56) and at 41+0 - 41+6 (nulliparas: aRR=1.42, 95% CI: 1.36 - 1.48; paras: aRR=1.61, 95% CI: 1.40 - 1.84). After adjusting for potential confounders, there was no significant difference in the risk of primary CS at 37+0 - 37+6 for nulliparas who had IOL and EM (aRR = 1.03, 95% CI: 0.95 - 1.12). Results remain stable in the sensitivity analyses.

*Conclusion*: Our results demonstrated that the risk of primary CS following IOL was higher at each weeks’ gestation between 38+0 - 38+6 – 41+0 - 41+6 for both nulliparas and paras with singleton pregnancies, compared with EM, and the risk increased with gestational age. This has important implications to support shared decision making between women and health professionals regarding best clinical management and optimal timing of birth.

*Keywords:* induction of labour, birth, caesarean section, expectant management

**Introduction**

There has been a trend toward birth earlier in gestation and increased use of both induction of labour (IOL) and caesarean section (CS) for women with term pregnancies in many countries, particularly high-income countries [1]. The average rate of CS in high-income countries has increased from 12% to 27% between 1990 and 2018, and is estimated to reach 37% by 2030 [2]. Similarly, the average rate of IOL has increased from 20% in 1990 [3-5] to 30% in 2019 [6-9] in high-income countries. Alongside these trends towards increasing use of provider-initiated birth, the average gestational age at birth has declined – for example, the USA and Australian data show a shift in average gestational age at birth from 40 to 39 weeks [10, 11]. Australia has higher rates of IOL and CS than the average for high-income countries. In Australia between 2010 to 2020, the proportion of women who gave birth at term had IOL increased from 25% to 37%, and the proportion of women who gave birth at term had CS increased from 31% to 36% [9]. By 2030, Australia’s CS rate is expected to reach 47% [2].

Performing a CS (with or without a clinical indication) is associated with an increased risk of adverse health outcomes for women (e.g., uterine rupture [12] and hysterectomy [12, 13]) and children (e.g., obesity [12, 14], asthma [12, 14], and autism spectrum disorders [15]). The rising rate of CS has significant financial consequences for individuals and the health care systems. The World Health Organization (WHO) estimated that US$2.32 billions of global health care expenditure could be avoided if medically unnecessary CS were not performed [16]. These financial burdens are further compounded if additional treatments for CS-related complications are required [6]. Strategies that can avoid unnecessary CS will lead to health and economic benefits, and is thus a global priority [16].

Previously, several studies (both the most recent (2020) Cochrane systematic review of 31 randomised controlled trials [17] and observational studies [18-20]) have been conducted to explore the risk of CS among women who had IOL at term ( 37 weeks of gestation), compared with expectant management (EM). However, the findings are mixed in the magnitude and direction of the association and little evidence has been known about the differential effect at each gestation between 37+0 – 41+6 weeks, separately among nulliparous and parous women. The Cochrane systematic review and meta-analysis, subgroup analysed the risk of CS after a policy of inducing at term by parity or weeks’ gestation at IOL (grouped into 37 – 40 weeks, 40 – 41 weeks and > 41 completed weeks), but no analyses were stratified by both parity and gestational age [17]. The findings of this systematic review showed a decreased risk of CS for both nulliparous and parous women at low risk of complications, and at 37 – 40 and > 41 completed weeks of gestation [17]. Of these included trials, the recent ARRIVE trial (2018) randomised 6,106 low-risk nulliparous women in the USA to planned IOL at 39+0 - 39+4 weeks or planned EM (awaiting the spontaneous onset of labour or until an indication for IOL is identified), and demonstrated a 4% absolute reduction in CS rates [21]. Conversely, a 2012 retrospective cohort study conducted in the UK revealed that the risk of CS following elective IOL at 37 and 38 completed weeks’ gestation were not significantly different with EM (at or beyond the gestation of birth following IOL), and there was an increased risk of CS at each gestation between 39 – 41 completed weeks [20].

Overall, there remains a shortage of evidence around the differential effect of IOL across gestational age and in different maternal populations [22]. This lacking information can lead to uncertainty for women and care providers around what options can be offered at each weeks’ gestation, and what their consequences might be. Thus, the aim of this study was to explore the risk of primary CS following IOL for women with singleton pregnancies at each gestation from 37+0 to 41+6 weeks, compared with EM at or beyond the gestation of birth following IOL.

**Methods**

*Dataset and analysis population*

A retrospective cohort study was designed using an existing population-based administrative dataset from the Queensland Perinatal Data Collection [23], which covers all live births, and stillbirths of at least 20 weeks’ gestation and/or at least 400 grams in weight that occurred in one Australian state (Queensland) between 01/07/2012 and 30/06/2018 (n = 365,231 births). Variables used in our study are maternal demographics and clinical characteristics occurring prior to and during pregnancy, labour and birth. Definitions of these variables are available in the supplementary material.

We limited the dataset to 241,979 women with a singleton pregnancy, gave birth at or after 37 weeks’ gestation ( 37+0), had a vaginal birth (spontaneous or instrumental assisted with forceps or vacuum) or CS after labour, and did not have a previous CS (detailed in Figure S2). We excluded women who previously gave birth by CS to avoid overestimating the risk of CS due to the increased risk of needing a CS in a subsequent pregnancy, and the known low rates of vaginal birth after CS [24-26]. Women who had prelabour CS (i.e., no labour) were not included in the EM group to be consistent with previous studies [19, 21, 27, 28] and considering the desire to have a normal birth without obstetric intervention [29] and IOL attempts to achieve vaginal delivery. Women with missing information on weeks’ gestation at birth and potential confounders were also excluded. The same woman may be included more than once if she had multiple birth episodes between 01/07/2012 and 30/06/2018.

*Exposure group –* Women who gave birth following IOL

The exposure group for this analysis is women who gave birth following IOL as identified by the Queensland Perinatal Data Collection Manual(detailed definitions in the ‘Methods’ section of the supplementary file). Any attempted induction, for any reason, was identified. Women who gave birth following IOL were identified and classified separately using five time points, based on time of birth following IOL: 37+0 - 37+6; 38+0 - 38+6; 39+0 - 39+6; 40+0 - 40+6; and 41+0 - 41+6. We considered the weeks’ gestation at birth following IOL to be the index week for this analysis.

*Comparator group – Women who had EM*

The comparator group for women who gave birth following IOL in each index week was women who experienced EM in the same index week. This comparator group includes women who underwent spontaneous labour in the same weeks’ gestation, or whose pregnancy progressed to a later weeks’ gestation (detailed illustration in Figure 1). For example, for the exposure group of women who gave birth following IOL at 38+0 - 38+6 weeks’ gestation, the comparator group is women who gave birth following spontaneous onset of labour at 38+0 - 38+6 weeks’ gestation and women who gave birth following IOL or spontaneous onset of labour from 39+0 weeks’ gestation onwards.

In order to identify the exposure and comparison group at each index week, five sub-datasets were created based on different time of birth following IOL (37+0 - 37+6; 38+0 - 38+6; 39+0 - 39+6; 40+0 - 40+6; and 41+0 - 41+6). Figure 1 illustrates the process of sub-dataset creation and the number of women included in each comparison group.

*Outcome – Primary CS*

The outcome for this analysis was primary CS after labour, as defined by the Queensland Perinatal Data Collection Manual(detailed definitions in the ‘Methods’ section of the supplementary file).

*Analyses*

Initially, a descriptive analysis was conducted to quantify the trends of the proportion of women who gave birth following IOL among women who gave birth at pre-term (< 37+0 weeks’ gestation), term (37+0 – 41+0 weeks’ gestation) and post-term (> 41+0 weeks’ gestation).

For each comparison group at each index week, our null hypothesis was that IOL in the index week would not be associated with an increased risk of primary CS, compared with EM.

Firstly, the Breslow-Day test [30] was used to test the homogeneity of odds ratios between nulliparas (women who have never given birth after a pregnancy that has reached 20 weeks’ gestation) and paras (women who have given birth one or more times after pregnancies that have reached 20 weeks of gestation) for each sub-dataset. As the results were significant at 0.05 level for each index week between 37+0 - 37+6 and 39+0 - 39+6 weeks’ gestation, we separated all analyses by parity (treated it as a potential effect modifier) rather than including it as a potential confounder.

Univariate analyses were conducted to identify any differences in women’s characteristics between the IOL and EM groups at each index week, stratified by parity (nulliparous and parous women). The statistical significance of categorical variables was tested using the Wald Chi-Square [31] and the numerical variables used the Student’s t-test [32].

Potential confounders including demographic, socioeconomic, medical and obstetric variables were selected based on univariate analyses, expert consultation and relevant literature. This included mother’s age, pre-pregnancy body mass index (BMI), country of birth (grouped by region), Indigenous status, socioeconomic status, whether the birth was at a public or private hospital, use of pharmacological analgesia during labour, fetal presentation at birth and medical risk status of pregnancy (detailed definition in the ‘Methods’ section of the supplementary file). A period effect based on the year of birth event was used.

Unadjusted relative risk (RR) and adjusted relative risk (aRR) were calculated for each comparison group, stratified by parity. The modified Poisson regression was used to calculate aRR with robust error variance estimation [33]. The ratio of relative risk (RRR) was calculated to test the significant difference of relative risks (interaction effect) between subgroup analyses (nulliparous and parous women) [34]. Wald statistics and 95% confidence interval (CI) were calculated for each RR, aRR and RRR.

Sensitivity analyses were conducted by limiting women in the primary analysis to women who had low-risk pregnancies only (detailed definition in the ‘Methods’ section of the supplementary file) using the same method of primary analyses, which enabled us to explore the possible effects of whether a woman’s risk profile (which is related to underlying medical indications) affected any association.

All analyses were performed using SAS V9.4. Values of p less than 0.05 were considered statistically significant. All research was conducted in accordance with the principles outlined in the Declaration of Helsinki.

**Results**

Overall, more than 31% of women with singleton pregnancies gave birth had IOL among women who gave birth at term (37+0 – 41+0 weeks’ gestation) and the proportion increased over the years (2012 – 2018) (Figure S1).

Of the 353,683 women recorded in our dataset, 241,979 women were eligible for inclusion in our statistical analyses (Figure S1). These women with term and post-term singleton pregnancies, had a mean gestational age at birth of 39.3 weeks, a mean age of 29.4 years and a mean BMI of 25.2 kg/m2 (Table 1). In total, 72.8% of these women were born in Australia, 5.9% were identified as Aboriginal and/or Torres Strait Islander, 47.6% were nulliparous, 23.5% were classified as having a high-risk pregnancy and 31.9% gave birth in a private facility (Table 1). We identified 87,358 (36.10%) women who gave birth at or beyond term following IOL and 17,628(20.18%) of them had CS.

In comparison with women who had EM, women who gave birth following IOL at each index week between 38+0 - 38+6 and 41+0 - 41+6 weeks’ gestation were significantly more likely to be older, overweight or obese at or prior to conception (BMI>24.9), socioeconomically advantaged, gave birth in a private facility, be classified as having a high-risk pregnancy, received pharmacological analgesia during labour and had a higher proportion of primary CS, regardless of parity (Table S1). Compared with nulliparous women, the absolute rates of primary CS were lower for parous women in either the IOL or EM group at each index week (Table S1).

The unadjusted risk of primary CS following IOL was significantly higher in both nulliparous and parous women with singleton pregnancies at each index week between 37+0 - 37+6 and 41+0 - 41+6 weeks’ gestation, compared to women who had EM (Figure 2). After adjusting for potential confounding factors, similar increased risk of primary CS following IOL was found at 38+0 - 38+6 (nulliparas: aRR = 1.14, 95% CI: 1.10 - 1.18; multiparas: aRR = 1.35, 95% CI: 1.25 - 1.46), at 39+0 - 39+6 (nulliparas: aRR = 1.18, 95% CI: 1.14 - 1.22; multiparas: aRR = 1.36, 95% CI: 1.24 - 1.49), at 40+0 - 40+6 (nulliparas: aRR = 1.25, 95% CI: 1.21 - 1.29; multiparas: aRR = 1.40, 95% CI: 1.26 - 1.56) and at 41+0 - 41+6 (nulliparas: aRR=1.42, 95% CI: 1.36 - 1.48; multiparas: aRR=1.61, 95% CI: 1.40 - 1.84) (Figure 2). Sensitivity analyses limiting the women in the primary analyses to women with low-risk pregnancies only (n = 185,056, 76.5% of 241,979) showed similar results when compared with the primary analyses at each index week (Figure 3).

The relative risks (both adjusted and unadjusted) were significantly higher for parous women at each index week, up to 40+0 - 40+6 (Table 2). After adjusting for potential confounding factors, parous women with singleton pregnancies had a 19% increase in the risk of primary CS following IOL at 38+0 to 38+6 weeks’ gestation, compared to nulliparous women with singleton pregnancies (Table 2). There was no significant difference in the risk of primary CS following IOL between parous women and nulliparous women with singleton pregnancies at 41+0 - 41+6 weeks’ gestation (Table 2).

**Discussion**

This analysis of a state-wide (Queensland, Australia) observational dataset demonstrated that the risk of primary CS following IOL was higher between 38+0 - 38+6 – 41+0 - 41+6 for women with singleton pregnancies, regardless of parity and risk status of pregnancy, and the risk increased with gestational age. After adjustments of potential confounders, parous women with singleton pregnancies were 1.61 times more likely to have primary CS following IOL at 41+0 - 41+6 weeks’ gestation, compared to EM. Sensitivity analyses of low-risk women with term singleton pregnancies only made similar findings. Compared with nulliparous women with singleton pregnancies, the relative risk of primary CS associated with IOL was significantly higher for parous women with singleton pregnancies (women who previously had one or more times of vaginal birth only). This held true at each index week up to 40+0 - 40+6, whilst its absolute rates of primary CS were significantly lower.

In comparison with findings from other comparable observational studies, a 2012 retrospective cohort study in the UK used the same definition of the EM group (including women who gave birth following spontaneous labour at the same gestation age as the IOL group) and made similar findings with regard to an increased risk of CS associated with IOL at each gestation between 39+0 – 41+6 weeks, while no significant difference was shown at 38+0 – 38+6 weeks of gestation [20]. In addition, our findings align with another 2006 observational study that was conducted in the USA for women with term, singleton and cephalic presentation pregnancies and made findings that the risk of CS was higher following IOL at each gestation between 38+0 – 41+6 weeks for nulliparas, compared with EM (beyond the gestation of birth following IOL) [28]. Further, our results are supported by a 2020 observational study conducted in Austria reported a higher risk of CS following non-medically indicated IOL at each gestation between 38+0 – 39+6 weeks of gestation compare with EM (beyond the gestation of birth following IOL), for nulliparous women with singleton pregnancies, whilst the opposite association (i.e., decreased risk of CS) were found for births after IOL at 40+0 – 40+6 and 41+0 – 41+6 weeks’ gestation in nulliparas [27]. But our findings of increased risk of CS at 41+0 – 41+6 weeks’ gestation are aligned with a secondary analysis of the WHO multi-country (21 countries in Africa, Asia, Latin America and the Middle East) survey that reported IOL was associated with a significant higher risk of CS in low-risk women at 41+0 – 41+6 weeks’ gestation, compared with EM (at or beyond the gestation of birth following IOL) [35].

However, our findings conflict with another Australian retrospective cohort study (2019), which defined EM differently from our study (women who gave birth beyond the median gestational age of birth in the IOL group) and reported no significant difference in the risk of CS between IOL at 38+0 to 39+6 weeks and EM at 39+2 among nulliparous women [19]. A 2019 systematic review and meta-analysis identified five cohort studies conducted in the USA reported that elective IOL at 39+0 – 39+6 weeks among nulliparous women was associated with a lower risk of CS, compared to EM (beyond the gestation of birth following IOL), which differs from our results at the same gestational age [18].

*Implications for clinical practice*

There is significant variation in clinical guidelines regarding both labour options and timing of birth, driven largely by inconsistent evidence [36-38]. Many current clinical guidelines recommend that clinicians inform low-risk women that they are less likely to give birth by CS if they opt for IOL at or after 41+0 weeks’ gestation [39, 40], which conflicts with our finding of significantly increased risks at 41+0 - 41+6 weeks’ gestation (nulliparas: aRR=1.42, 95% CI: 1.36 - 1.48; multiparas: aRR=1.61, 95% CI: 1.40 - 1.84).

On average, 21% of women who had IOL gave birth by CS in Australia [9]. Unnecessary CS is associated with substantial financial burden to families and governments [6, 41, 42] and an increased risk of adverse health outcomes, thus optimising its use in clinical practice is an international health priority [43]. This can include the experience of psychological trauma and depression for women [44], as well as increased risk of adverse outcomes in children born following CS (chronic health conditions including allergies, asthma, diabetes, gastroenteritis, autism and attention deficit/hyperactivity disorder [15, 45]). As such, considering the increased risk of CS following IOL as demonstrated in our study and the potential harms of unnecessary CS reported in current literature, it is important to consider these clinical and financial risks when discussing labour options with women [20, 46].

In addition to the risk of CS following IOL, the association between IOL at term and other maternal outcomes (e.g., morbidity) and neonatal outcomes (e.g., morbidity or neonatal intensive care unit (NICU) admission) is suggested to be further analysed at each weeks’ gestation to explore the potential benefits and harms of IOL. Apart from these, women’s preferences, experiences, accessible resources and available support also affect the decision being made around IOL [47]. Given the complexity of the decision making process and the development of clinical practice guidelines, further analysis and discussion are needed before suggesting any substantial practice change. There is a need to develop strategies to optimise the use and timing of provider-initiated birth, ensuring the benefits clearly outweigh any potential harm.

*Strengths and limitations*

A key strength of our study is that we drew on data from a whole-of-population routine administrative dataset which allow us to create five sub-datasets (each gestation between 37+0 – 41+6 weeks) with a large number of women. Our analysis included a wide range of demographic, socioeconomic and obstetric potential confounders, and stratified the results by parity at each weeks’ gestation to potentially support shared decision making on labour options at each week as pregnancies progress.

Nonetheless, our study has some limitations. Firstly, we were unable to differentiate between IOL with, and without, a clinical indication. This limitation might lead to an overestimation of the risk of CS among the IOL group, considering many of these indications are independently associated with a higher risk of CS [48]. Our sensitivity analysis and adjusted relative risks however serve to partially adjust for the effect of these indications. Secondly, although our sample size is relatively large, it was collected from one state (Queensland) in Australia, so may be influenced by local health system factors, which limit the generalisability of our findings. Finally, there is potential that other important clinical factors not available in our dataset (e.g., cervical length [49], fetal weight and BMI before delivery [50]) affecting the association were not included in this study due to the nature of our routinely collected dataset.

*Implications for research*

Future research is recommended to explore further the differential effect between non-clinical-indicated and clinical-indicated IOL on the risk of various maternal and neonatal outcomes, and characterize the association in other populations and practice settings. It is also strongly suggested further studies determine the risk factors of a range of perinatal outcomes following IOL and build up reliable risk prediction models, which offer more personalised information to assist women and clinicians in weighing potential risks and benefits of IOL and EM during shared decision making.

**Conclusion**

This study assessed the association between IOL and primary CS at different gestational ages and maternal populations. Our results demonstrate that the risk of primary CS following IOL was higher at each weeks’ gestation between 38+0 - 38+6 – 41+0 - 41+6 for both nulliparas and paras with singleton pregnancies, compared with EM, and the risk increased with gestational age. This has important implications to support shared decision making between women and health professionals regarding best clinical management and optimal timing of birth.

**Table 1:** **Characteristics of included women**

| **Characteristics**  N (%) | **Total**  241,979 |
| --- | --- |
| **Demographic characteristics** | |
| **Mother’s age** (Years) | |
| 13 - 19 | 8,658 (3.58) |
| 20 - 34 | 188,696 (77.98) |
| 35 - 54 | 44,625 (18.44) |
| Mean (Standard deviation) | 29.41 (5.55) |
| **Pre-pregnancy BMI** (kg/m2) | |
| 11.8 - 18.5 (Underweight) | 14,560 (6.02) |
| 18.5 - 24.9 (Normal weight) | 130,041 (53.74) |
| 25.0 - 29.9 (Overweight) | 54,030 (22.33) |
| 30.0 - 86.6 (Obesity) | 43,348 (17.91) |
| Mean (Standard deviation) | 25.15 (5.89) |
| **Mother’s country of birth** (Grouped in regions) | |
| Australia | 176,248 (72.84) |
| Oceania (Excludes Australia) | 17,870 (7.38) |
| Asia | 26,880 (11.11) |
| Europe | 11,525 (4.76) |
| The Americas | 3,712 (1.53) |
| Africa | 5,744 (2.37) |
| **Mother’s Indigenous status** (Aboriginal and/or Torres Strait Islander) | |
| Yes | 14,259 (5.89) |
| No | 227,720 (94.11) |
| **Socioeconomic status (**SEIFA) | |
| 1st quintile (The most disadvantaged) | 17,379 (7.18) |
| 2nd quintile | 10,422 (4.31) |
| 3rd quintile | 43,039 (17.79) |
| 4th quintile | 92,596 (38.27) |
| 5th quintile (The most advantaged) | 78,543 (32.46) |
| **Birthplace** | |
| Public hospital | 164,691 (68.06) |
| Private hospital | 77,288 (31.94) |
| **Obstetric characteristics** | |
| **Presentation of the fetus at birth** | |
| Cephalic **(**Includes cephalic, vertex, face or brow presentations**)** | 238,207 (98.44) |
| Others | 3,772 (1.56) |
| **Pharmacological analgesia used during labour** | |
| Yes | 181,389 (74.96) |
| No | 60,590 (25.04) |
| **Risk status of pregnancy** | |
| Low-risk | 185,056 (76.48) |
| High-risk | 56,923 (23.52) |
| **Parity** | |
| Nulliparous | 115,231 (47.62) |
| Parous | 126,748 (52.38) |
| **Onset of labour** | |
| Spontaneous onset of labour | 154,621 (63.90) |
| Induction of labour | 87,358 (36.10) |
| **Mode of birth** | |
| Vaginal birth | 209,010 (86.38) |
| Vaginal birth following spontaneous onset of labour | 139,280 (66.64) |
| Vaginal birth following induction of labour | 69,730 (33.36) |
| Caesarean section | 32,969 (13.62) |
| Caesarean section following spontaneous onset of labour | 15,341 (46.35) |
| Caesarean section following induction of labour | 17,628 (53.47) |
| **Weeks’ gestation at birth** | |
| 37+0 - 37+6 | 18,176 (7.51) |
| 38+0 - 38+6 | 45,071 (18.63) |
| 39+0 - 39+6 | 68,700 (28.39) |
| 40+0 - 40+6 | 72,517 (29.97) |
| 41+0 - 41+6 | 36,302 (15.00) |
| 42+0 - 42+6 – 44+0 - 44+6 | 1,213 (0.50) |
| Mean (Standard deviation) | 39.28 (1.16) |
| **Year of birth event** | |
| 2012 | 20,731 (8.57) |
| 2013 | 41,616 (17.20) |
| 2014 | 41,327 (17.08) |
| 2015 | 40,091 (16.57) |
| 2016 | 40,139 (16.59) |
| 2017 | 38,555 (15.93) |
| 2018 | 19,520 (8.07) |

BMI: Body Mass Index; SEIFA: Socio-Economic Indexes for Areas.

% is column percentage.**Table 2: Ratios of relative risk (interaction effect) of primary caesarean section for women who had induction of labour, compared to women who had expectant management, between nulliparous and parous women**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Index week** | **Parous women/Nulliparous women** | | | | | |
| RRR | 95% CI | | RaRR\* | 95% CI | |
| **37+0 - 37+6** | 1.58 | 1.41 | 1.78 | 1.42 | 1.27 | 1.60 |
| **38+0 - 38+6** | 1.28 | 1.18 | 1.38 | 1.19 | 1.09 | 1.29 |
| **39+0 - 39+6** | 1.22 | 1.12 | 1.34 | 1.15 | 1.05 | 1.27 |
| **40+0 - 40+6** | 1.19 | 1.07 | 1.32 | 1.12 | 1.00 | 1.25 |
| **41+0 - 41+6** | 1.24 | 1.08 | 1.43 | *1.13* | *0.98* | *1.31* |

RRR: Ratio of Relative Risk; RaRR: Ratio of adjusted Relative Risk; CI: Confidence Interval.

\*Adjusted for mother’s age group, body mass index (BMI) group, country of birth (group by region), Indigenous status, socioeconomic status, birth at a public or private hospital, use of pharmacological analgesia during labour, cephalic presentation or not, and year of birth event.

*Italics indicated insignificance at 0.05 level*.

**Figure 1: An illustration of the exposure and comparator group at each index week (i.e., weeks’ gestation of birth following labour induction)**



IOL: Induction of Labour; SL: Spontaneous onset of Labour.

**Figure 2: Relative risk of primary caesarean section for women who had induction of labour, compared to women who had expectant management, stratified by parity**



|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Index week** | **Nulliparous women** | | | | | | **Parous women** | | | | | |
| RR | 95% CI | | aRR\* | 95% CI | | RR | 95% CI | | aRR\* | 95% CI | |
| **37+0 - 37+6** | 1.16 | 1.10 | 1.22 | *1.03* | *0.98* | *1.09* | 1.83 | 1.65 | 2.03 | 1.47 | 1.32 | 1.63 |
| **38+0 - 38+6** | 1.36 | 1.32 | 1.41 | 1.14 | 1.10 | 1.18 | 1.73 | 1.61 | 1.87 | 1.35 | 1.25 | 1.46 |
| **39+0 - 39+6** | 1.36 | 1.32 | 1.41 | 1.18 | 1.14 | 1.22 | 1.67 | 1.53 | 1.82 | 1.36 | 1.25 | 1.49 |
| **40+0 - 40+6** | 1.41 | 1.37 | 1.46 | 1.25 | 1.21 | 1.29 | 1.67 | 1.51 | 1.85 | 1.40 | 1.26 | 1.56 |
| **41+0 - 41+6** | 1.51 | 1.45 | 1.58 | 1.42 | 1.36 | 1.48 | 1.88 | 1.64 | 2.15 | 1.61 | 1.40 | 1.84 |

RR: Unadjusted Relative Risk; aRR: Adjusted Relative Risk; CI: Confidence Interval.

\* Adjusted for mother’s age, body mass index (BMI), country of birth, Indigenous status, socioeconomic status, whether the birth was at a public or private hospital, use of pharmacological analgesia during labour, fetal presentation at birth, medical risk status of pregnancy and year of birth event.

*Italic indicated insignificance at 0.05 level.*

**Figure 3: Relative risk of primary caesarean section for women who had induction of labour, compared to women who had expectant management, stratified by parity, women with low-risk pregnancies only**



|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Index week** | **Nulliparous women** | | | | | | **Parous women** | | | | | | |
| RR | 95% CI | | aRR\* | 95% CI | | RR | 95% CI | | aRR\* | 95% CI | |
| **37+0 - 37+6** | *1.04* | *0.96* | *1.13* | *1.03* | *0.95* | *1.12* | 1.57 | 1.34 | 1.85 | 1.48 | 1.26 | 1.74 |
| **38+0 - 38+6** | 1.22 | 1.16 | 1.29 | 1.13 | 1.07 | 1.19 | 1.37 | 1.23 | 1.53 | 1.20 | 1.08 | 1.34 |
| **39+0 - 39+6** | 1.30 | 1.25 | 1.36 | 1.18 | 1.13 | 1.24 | 1.51 | 1.35 | 1.68 | 1.28 | 1.14 | 1.43 |
| **40+0 - 40+6** | 1.36 | 1.31 | 1.42 | 1.23 | 1.19 | 1.29 | 1.59 | 1.41 | 1.79 | 1.34 | 1.18 | 1.52 |
| **41+0 - 41+6** | 1.53 | 1.45 | 1.60 | 1.44 | 1.37 | 1.51 | 1.85 | 1.58 | 2.15 | 1.61 | 1.38 | 1.87 |

RR: Unadjusted Relative Risk; aRR: Adjusted Relative Risk; CI: Confidence Interval.

\*Adjusted for mother’s age, body mass index (BMI), country of birth, Indigenous status, socioeconomic status, whether the birth was at a public or private hospital, use of pharmacological analgesia during labour, fetal presentation at birth, and year of birth event.

*Italic indicated insignificance at 0.05 level.*

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