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ORIGINAL RESEARCH

Trends in the use of induction of labor by methods and indications: A population-based study

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Abstract

Introduction: Induction of labor is a widely used obstetric intervention, with rates increasing globally. In Australia in 2022, over one-third of women gave birth following the induction of labor. Though the rate of induction has increased, changes in methods and indications for induction have not been analyzed for the state of Victoria. This study aims to analyze these trends in Victoria, Australia.

Material and Methods: A retrospective cohort study was conducted using de-identified data from the Victorian Perinatal Data Collection (VPDC) that includes all births statewide of at least 28 completed weeks' gestation from 2012 to 2020. The study analyzed trends in the onset of labor, methods used, and indications for induction over the study period, using descriptive statistics and average annual percentage change.

Results: A total of 701 324 births occurred during the study period, of which 223 672 (31.9%) were inductions. Induction of labor rates increased significantly from 25.4% in 2012 to 37.7% in 2020, with a notable rise at 38 and 39 weeks' gestation. Significant changes were observed in induction methods—the use of combination methods, particularly balloon catheter followed by pharmacological agents, increased, while the use of a standalone method declined. The findings suggest that gestational diabetes and fetal indications were major drivers of induction in recent years.

Conclusions: Labor induction practices in Victoria have changed significantly, reflecting shifts in clinical practices and changes in health profiles of pregnant women. Further research is needed to investigate the rising use of induction at early term gestation and the role of maternal preferences in driving induction in Victoria.

KEYWORDS
Australia, indications for induction, induction method, induction of labor, obstetric

Abbreviations: AAPC, average annual percentage change; ARM, artificial rupture of membrane; GDM, gestational diabetes mellitus; VPDC, Victorian Perinatal Data Collection.

1 | INTRODUCTION

Induction of labor is the process of artificially stimulating the commencement of labor through mechanical and/or pharmacological methods to initiate childbirth when it does not start spontaneously. The World Health Organization (WHO) recommends that induction of labor be performed for women who have reached 41 weeks of gestation in an uncomplicated pregnancy or when there is a clear medical indication.[1,2] In Australia, induction of labor is offered to women with low-risk pregnancies between 41 + 0 and 42 + 0 weeks.[3,4] Common medical indications for which induction is recommended in Australia include term pre-labor rupture of membranes (term PROM), preterm pre-labor rupture of membranes (PPROM), and preeclampsia.[3,4]

There are a range of methods used to induce labor, broadly categorized as pharmacological (such as prostaglandins or oxytocin) or mechanical (such as balloon catheter or artificial rupture of membranes). The recommended method varies between national guidelines and local protocols, as well as a woman's health condition and readiness for labor. Safer Care Victoria Australia (the quality and safety agency in Victoria, Australia) recommends using a cervical ripening balloon catheter placed in the cervix (eg. Foley catheter or Cook catheter) or prostaglandins (as a vaginal gel, pessary, or tablet) when the woman's cervix is unfavorable. If the woman's cervix is favorable, artificial rupture of membranes (ARM) and/or oxytocin infusion (Syntocinon) are recommended.[3]

Induction of labor is not risk-free and can result in iatrogenic complications, such as excessive bleeding, uterine hyperstimulation, uterine rupture, and poorer perinatal outcomes.[2,5,6] Evidence on the harms and benefits associated with induction in women with term pregnancies is somewhat conflicting. A recent Cochrane review of 34 randomized controlled trials (RCT) showed that when women with a low risk of complications at or beyond 37 weeks were induced, as opposed to managed expectantly, maternal and perinatal outcomes improved.[7] However, data from observational analyses in Australia have drawn different conclusions. A study on 42 950 births in Victoria showed induction in nulliparous women with uncomplicated pregnancies at 37–40 completed weeks' gestation led to twice the risk of emergency caesarean section when compared with spontaneous labor.[8]

In Australia, the proportion of women undergoing induction of labor has increased, from 26.5% in 2011 to 34.2% in 2021.[9] Despite the rising rates of induction of labor in Australia, relatively few studies have explored these trends and their determinants. Studies conducted in other Australian states (Queensland, New South Wales (NSW), and the Australian Capital Territory (ACT)) have reported rising rates of induction over the past decades.[10–13] These studies also suggest that the indications and methods of induction are changing over time. Prior studies using data from Victoria have primarily focused on term PROM or explored the association of induction with maternal and perinatal outcomes.[14,15] However, to the best of our knowledge, no prior analysis has been conducted on trends in induction, its indications, and methods in Victoria, the second most populous state in Australia. Such data are essential to guide clinicians and policymakers on this widely used practice and its implications for women and newborns in Victoria. Hence, this study aims to use population-wide data to explore these induction-related trends over the past decade.

Key message

The rate of induction of labor in Victoria increased between 2012 and 2020, notably at 38 and 39 weeks'. Significant changes were observed in induction methods and indications, with gestational diabetes and fetal indications emerging as major drivers.

2 | MATERIAL AND METHODS

2.1 | Data source

We conducted a retrospective cohort study using de-identified data from the Victorian Perinatal Data Collection (VPDC) system. VPDC is a mandated, population-based surveillance system that gathers comprehensive information on every birth in Victoria, Australia, on behalf of the Consultative Council on Obstetric and Paediatric Mortality and Morbidity (CCOPMM).[16] The VPDC includes births at 20 or more weeks' gestation or with a birthweight of at least 400 g (if gestational age is unknown). The accuracy of the VPDC indicators has been validated previously, showing high accuracy and specificity.[16]

2.2 | Study population

The study included all births completed at least 28 weeks of gestation in Victoria from 2012 to 2020 where the mode of labor onset was known (Figure 1). We considered the study period from 2012 onward because the mode of labor onset in the VPDC was consistently and accurately coded from this year onward. Variables related to demographic, maternal, and obstetric characteristics of these women were used for descriptive analysis.

2.3 | Study outcomes

Our primary outcome was the induction of labor, defined by the VPDC as *'a procedure performed to stimulate and establish labor in a woman who has not started labor spontaneously'*.[17]

VPDC allows users to record one or more of four induction methods (oxytocin, prostaglandins, ARM and cervical ripening-balloon catheter).[17] We created a new, all-inclusive, mutually exclusive variable for possible combinations of methods for induction (Box 1).

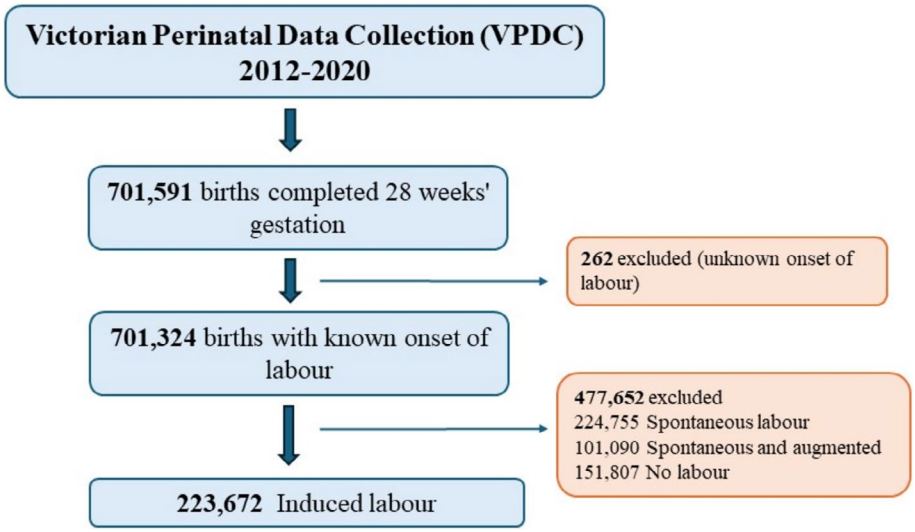

FIGURE 1 Selection of study population from VPDC data (2012–2020).

BOX 1 Methods of labor induction.

- Oxytocin (only)
- Prostaglandins (only)
- Artificial Rupture of Membrane ARM (only)
- Cervical ripening-balloon catheter (only)
- ARM + Pharmacological
- Balloon catheter + Pharmacological
- Other combination
- Not stated/inadequately described

For indications for labor induction, we used the list of indications provided by Safer Care Victoria and a recently published scoping review.[3,16] The International Statistical Classification of Diseases and Related Health Problems, 10th revision, Australian modification (ICD-10-AM, 12th Edition) was used to recode these indications, which were not mutually exclusive.[18] The VPDC allows for recording one or multiple indications per woman, depending on her clinical profile. A detailed definition and the subcategories used for coding, along with the Australian recommendations (where available) for each included indication, are provided in Table S1.

2.4 | Statistical analysis

We used descriptive statistics to analyze the baseline characteristics of the study population. Trends in the onset of labor over the study period were examined by calculating the Average annual percentage change (AAPC) using a log-linear regression model.[19,20] Log-transformed counts of each onset of labor type were regressed on the year, and the AAPC was derived from the slope of the regression model by exponentiating the coefficient for the year variable and subtracting one. This provides a percentage change in the incidence of each onset of labor type over time, assuming a constant rate of change. The 95% confidence intervals (CIs) were computed using the standard error of the year coefficient, and statistical significance was assessed at $p < 0.05$:

$$\text{AAPC} = \left(e^{\beta_{\text{year}}} - 1\right) \times 100.$$

Furthermore, for women whose labor did not begin spontaneously and were induced, we reported descriptive statistics on their demographic and maternal characteristics by year. Trends in methods and indications for induction were examined for women whose labor was induced. A Kruskal–Wallis test was performed to assess whether there were statistically significant differences in the distribution of induction methods, given the data were non-parametric.[21] The aforementioned AAPC was calculated to analyze trends in indications used for induction, where the log-transformed counts of each indication were regressed on the year to examine the changes. The consistency of definition for variables used in trend analysis was reviewed across all available VPDC manuals during the study period. All analyses were performed using STATA version SE 18.0.[22] A *p*-value of less than 0.05 was deemed statistically significant for all inferential analyses.

3 | RESULTS

A total of 701 324 births occurred from 2012 to 2020 (inclusive) in Victoria. Table 1 summarizes the baseline characteristics, showing that the number of births remained relatively consistent over this period. The majority of births occurred in public hospitals (75.8%), with most women admitted as publicly insured patients (73.7%). Spontaneous labor accounted for the largest proportion (32.1%) of births, followed by induced labor (31.9%) and no labor (planned and unplanned caesarean section before labor) (21.7%). Nearly half of all births were a non-instrumental vaginal births (49.1%), while 17.7% were planned caesarean births without labor. Most

TABLE 1 Baseline characteristics of all births by women who completed 28 weeks' gestation in Victoria from 2012 to 2020.

Baseline characteristics of all births		*N* = 701 324	%
Birth year	2012	77 301	11.0
	2013	77 108	11.0
	2014	77 983	11.1
	2015	78 172	11.2
	2016	79 744	11.4
	2017	78 724	11.2
	2018	77 783	11.1
	2019	78 297	11.2
	2020	76 212	10.9
Hospital type	Public	531 809	75.8
	Private	169 511	24.2
	Not stated/inadequately described	<5	0.0
Admission status	Public in public hospital	516 506	73.7
	Private in public hospital	15 307	2.2
	Private in private hospital	167 804	23.9
	Public in private hospital	48	0.0
	Unknown	1659	0.2
Maternity capability level (public hospital only, *N* = 531 809)[a]	1	1360	0.2
	2	1592	0.3
	3	25 649	4.8
	4	138 752	26.1
	5	158 246	29.8
	6	202 927	38.2
	Unknown	3283	0.6
Residential status of mother (*N* = 230 791)[b]	Metropolitan	176 783	76.6
	Rural[c]	51 320	22.2
	Interstate, other	2664	1.2
	Overseas/unknown	24	0.0
Maternal Indigenous status	Indigenous	9738	1.4
	Non-Indigenous	688 029	98.1
	Unknown	3557	0.5
Labor type	Spontaneous	224 755	32.1
	Spontaneous and augmented	101 090	14.4
	Induced labor	223 672	31.9
	No labor	151 807	21.7
Method of birth	Vaginal birth-non-instrumental	344 433	49.1
	Forceps	55 226	7.9
	Vacuum extraction	52 669	7.5
	Planned caesarean-no labor[d]	124 169	17.7
	Unplanned caesarean section after labor[e]	84 011	12.0
	Planned caesarean-labor[f]	5806	0.8
	Unplanned caesarean-no labor[g]	34 981	5.0
	Other operative birth	<5	0.0
	Not stated/inadequately described	26	0.0
Vital status at time of birth	Liveborn	699 738	99.8
	Stillborn	1574	0.2
	Not stated/inadequately described	12	0.0

[a]Services operate in a networked system across six levels of care, classified based on the level of services that can be provided to meet the needs of the women. Only public maternity hospitals are assigned a maternity capability level.

[b]Data for this is only available from 2018 onward.

[c]The term 'rural and remote' encompasses all areas outside Australia's *Major* cities.

[d]Caesarean takes place as a planned procedure before the onset of labor.

[e]Caesarean is undertaken for a complication after the onset of labor, whether that onset is spontaneous or induced.

[f]Caesarean was a planned procedure, but it occurs after spontaneous onset of labor.

[g]Procedure is undertaken for an urgent indication before the onset of labor.

babies were born alive (99.8%), with stillbirths representing 0.2% of total births.

3.1 | Trends in the onset of labor

Table 2 and Figure 2 present the distribution of labor onset for the study population between 2012 and 2020, along with the AAPC and statistical significance (*p*-value) for each type of labor. During this period, there was a statistically significant increase in the proportion of women undergoing induced labor (AAPC +5.5%; 95% CI: 4.6–6.4; $p < 0.05$) and no labor (AAPC +2.6%; 95% CI; 2.4–2.8: $p < 0.05$). While spontaneous labor (AAPC −3.5%; 95% CI: −4.1 to −2.9; $p < 0.05$) and spontaneous, augmented labor (AAPC −7.5%; 95% CI: −8.7 to −6.3; $p < 0.05$) declined over time.

3.2 | Trends in labor induction by maternal and obstetric characteristics

A total of 223 672 women were induced during the study period. The demographic and maternal characteristics of induced women for each year are reported in Table S2. Figure 3 depicts selected characteristics of induced women from 2012 to 2020. Over the study period, the majority of inductions occurred in women aged 30–34 years. Induction both at 38 and 39 weeks gestation increased steadily from 17.9% and 19.3% in 2012 to 26.3% and 28.7% in 2020, respectively. The proportion of induction at 41 weeks decreased from 24.7% to 10.2% during the study period. Another notable trend was the rise in inductions among women with higher BMI. The induction rate increased similarly for both overweight and obese women over the years.

3.3 | Trends in methods used for induction

Amongst women who were induced, the distribution of induction methods from 2012 to 2020 is summarized in Table 3 while the changes in these methods over time are in Figure 4. The use of oxytocin only and prostaglandin only decreased from 18.1% to 11.0% in 2012 to 11.2% and 4.7% in 2020, respectively. ARM in combination with a pharmacological method was the most common, accounting for 58.7% of inductions overall (Table 3), its usage began to decline after peaking at 65.3% in 2016, dropping to 51.1% in 2020 (Figure 4). Meanwhile, the use of balloon catheter combined with a pharmacological method was 1.2% in 2016, sharply increasing in later years to 21.3% in 2020. The distribution of induction methods changed significantly over time, $\chi^2(8) = 6092$, $p < 0.05$, as demonstrated by the Kruskal–Wallis test.

3.4 | Trends in indications used for induction

For all women who were induced from 2012 to 2020, the proportions for various indications and the AAPC (95% CI, *p*-value) are presented

TABLE 2 Average Annual Percent Change (AAPC) in the proportion of the onset of labor in women giving birth in Victoria, 2012 to 2020.

Types of labor	2012 *n* (%)	2013 *n* (%)	2014 *n* (%)	2015 *n* (%)	2016 *n* (%)	2017 *n* (%)	2018 *n* (%)	2019 *n* (%)	2020 *n* (%)	AAPC (95% CI)	*p*-value
Spontaneous labor	28 267 (36.6)	27 034 (35.1)	26 715 (34.3)	26 504 (33.9)	25 709 (32.2)	24 390 (31.0)	22 666 (29.1)	22 409 (28.6)	21 061 (27.6)	−3.5% (−4.1 to −2.9)	0.000
Spontaneous, augmented labor	14 177 (18.3)	13 916 (18.1)	13 238 (17.0)	12 292 (15.7)	12 052 (15.1)	9827 (12.5)	8842 (11.4)	8676 (11.1)	8070 (10.6)	−7.5% (−8.7 to −6.3)	0.000
Induced labor	19 610 (25.4)	20 640 (26.8)	22 047 (28.8)	23 051 (29.5)	25 153 (31.5)	27 077 (34.4)	28 545 (36.7)	28 848 (36.9)	28 701 (37.7)	+5.5% (4.6–6.4)	0.000
No labor	15 247 (19.7)	15 518 (20.1)	15 983 (20.5)	16 325 (20.9)	16 830 (21.1)	17 430 (22.1)	17 730 (22.8)	18 364 (23.5)	18 380 (24.1)	+2.6% (2.4–2.8)	0.000
Total (*N* = 701 324)	77 301	77 108	77 983	78 172	79 744	78 724	77 783	78 297	76 212	-	-

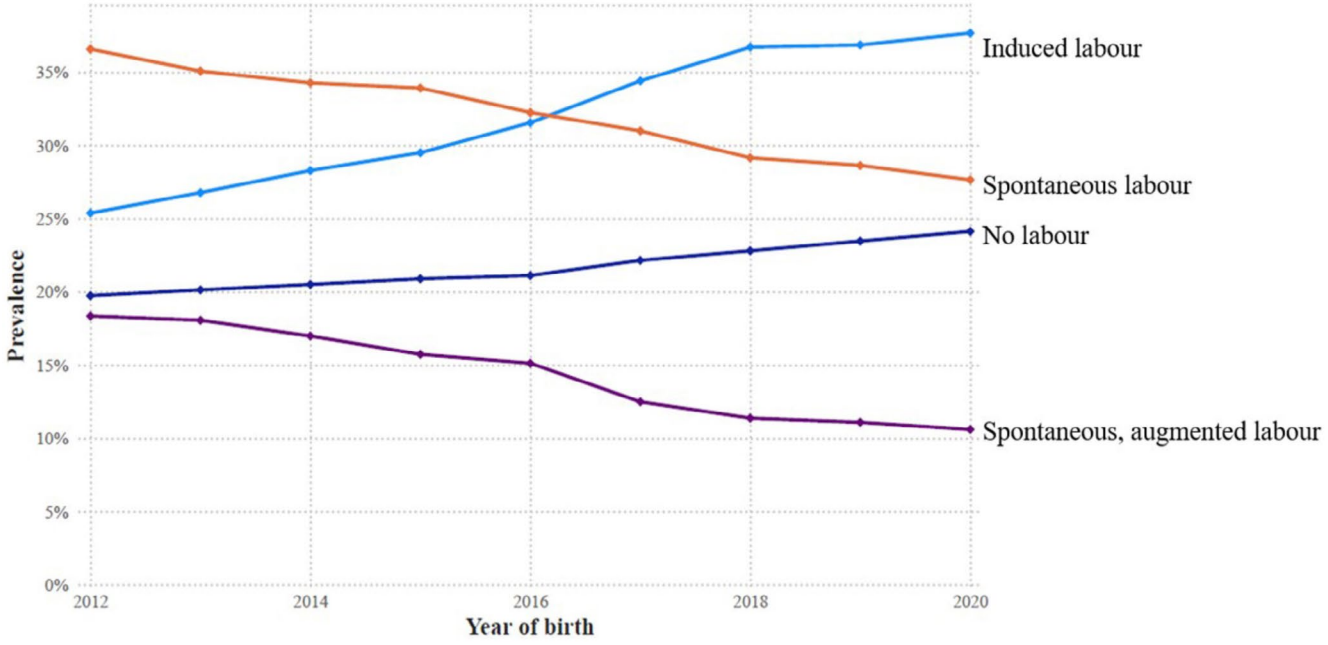

FIGURE 2 Trends in the onset of labor in Victoria, Australia, 2012–2020.

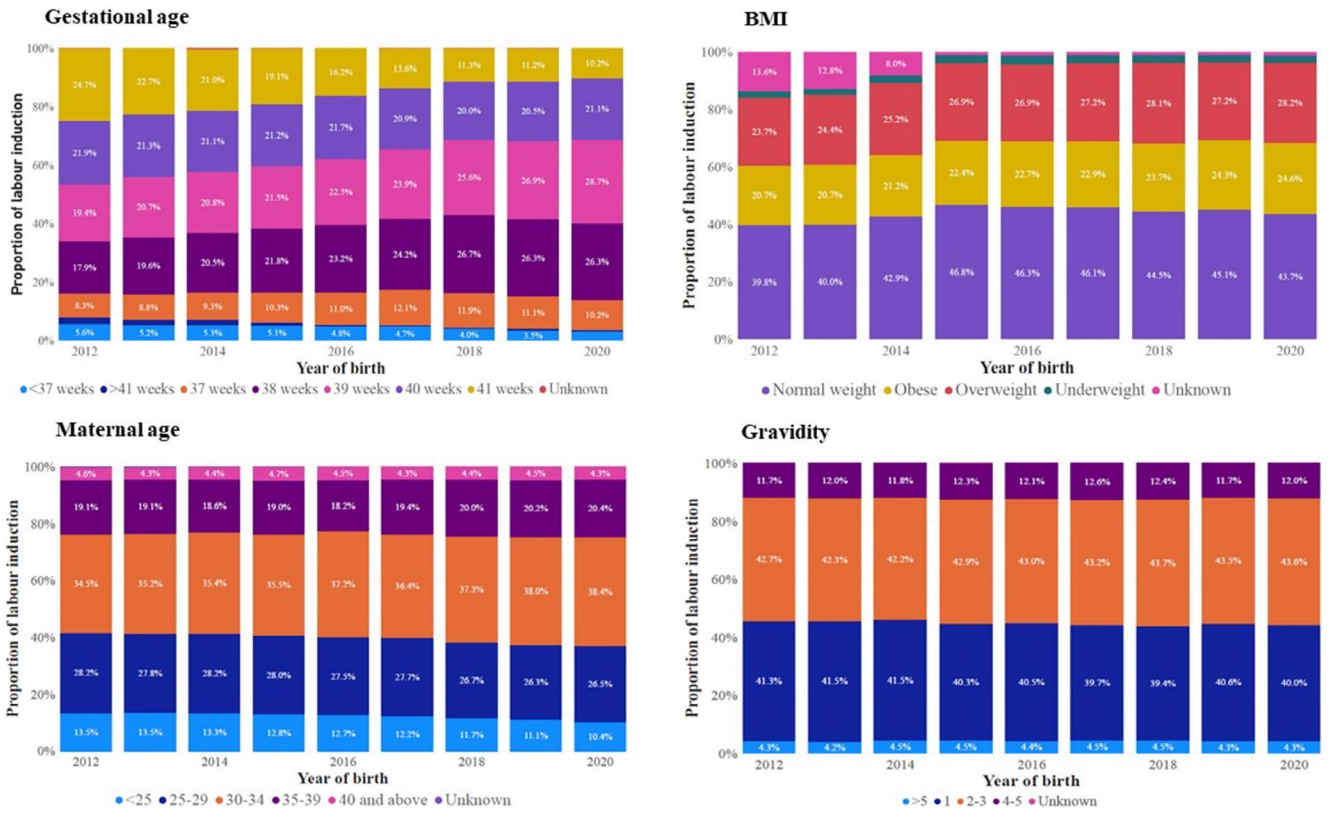

FIGURE 3 Trends in demographic and maternal characteristics of women who were induced in Victoria from 2012 to 2020.

in Table 4. Figure 5 reflects the changes in these indications over time. The indication post-term/prolonged pregnancy declined over time, from 32.0% in 2012 to 16.3% in 2020 (AAPC −5.2%; 95% CI: −7.0 to −3.3; $p < 0.05$). However, a sharp increase was observed in induction for diabetes mellitus in pregnancy, rising from 8.5% to 15.3% (AAPC +12.1%; 95% CI: 9.8–14.4; $p < 0.05$). There was also a significant increase in fetal indications, including known or suspected fetal problem/abnormality/damage, fetal growth restriction, and

suspected fetal macrosomia. The proportion of other indications—PROM, hypertensive disorders of pregnancy, and antepartum hemorrhage—was relatively stable over the study period and not statistically different (and are not shown in Figure 5).

4 | DISCUSSION

In Victoria, Australia, between 2012 and 2020, the rate of labor induction significantly increased from 25.4% in 2012 to 37.7% in 2020—inductions increase annually by 5.5% on average. This aligns with data from other Australian states and the national level data.[9,10,20,23] Among women who were induced, the proportion who were overweight or obese has increased steadily over the period, which is further consistent with the state and national level data.[24] The increase in inductions at 38 and 39 weeks' gestation, alongside the marked decline in inductions at 41 weeks, represents a departure from Safer Care Victoria recommendations, which advise offering induction between 41 + 0 and 42 + 0 weeks for women with uncomplicated pregnancies.[3] One plausible explanation for this shift is the findings of the influential ARRIVE trial, a large multicentre randomized controlled trial, which demonstrated that elective induction at 39 weeks in low-risk nulliparous women was associated with lower rates of caesarean section and hypertensive disorders, as well as improved neonatal outcomes, which was further supported by a meta-analysis.[25,26]

Despite the increased rate of induction, it is notable that the rates of stillbirth and caesarean section in Victoria did not improve over this period.[9] The rate of stillbirth and neonatal deaths has remained largely unchanged since 2015, while the caesarean section rate has risen from 21.2% in 2010 to 35.9% in 2020.[27] Another possible explanation for the increasing rate of caesarean section is the rising rates of pregnancy-related complications or comorbidities, which may have led to more women opting for electively timed births rather than waiting for spontaneous labor.

The methods used for induction have changed significantly over time, with an increasing preference for a combination of balloon catheter followed by pharmacological methods, while standalone methods have steadily declined. The observed trend contrasts with findings from a Queensland study, where prostaglandin use increased over time.[10] One reason for this shift may be that the balloon

TABLE 3 Distribution of induction methods for women who had labor induced between 2012 and 2020.

Methods of inductions	*N* = 223 672 *n* (%)
Oxytocin (only)	31 122 (13.9)
Prostaglandins (only)	16 406 (7.3)
Artificial rupture of membrane ARM (only)	14 196 (6.4)
Cervical ripening-balloon catheter (only)	1821 (0.8)
ARM + Pharmacological	131 188 (58.7)
Balloon catheter + Pharmacological	18 200 (8.1)
Other combination	10 812 (4.8)
Not stated/inadequately described	27 (0.0)

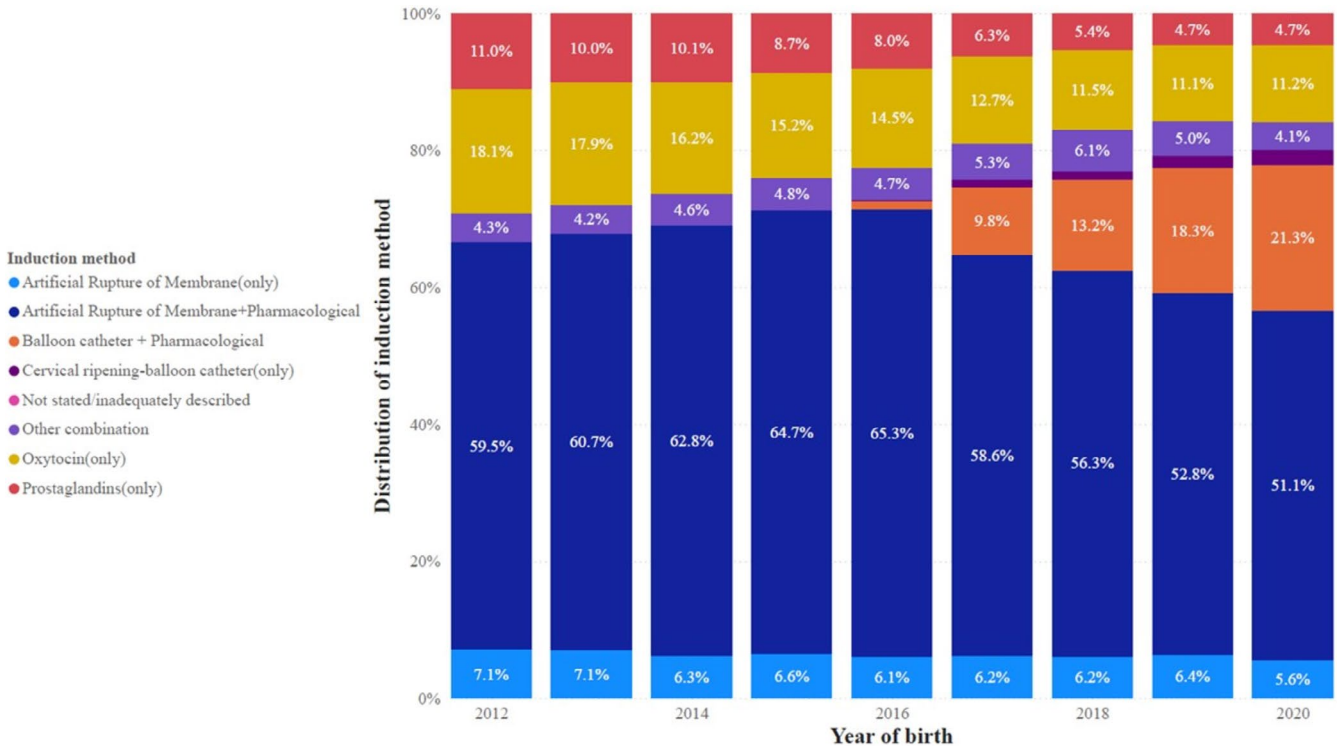

FIGURE 4 Distribution of induction methods for women who had labor induced by year.

TABLE 4 Proportion of indications for induction of labor, among induced women in Victoria, 2012 to 2020.

Main indications for induction	2012 *n* = 19 610	2013 *n* = 20 640	2014 *n* = 22 047	2015 *n* = 23 051	2016 *n* = 25 153	2017 *n* = 27 077	2018 *n* = 28 545	2019 *n* = 28 848	2020 *n* = 28 701	AAPC (95% CI)	*p*-value
Post-term pregnancy/prolonged pregnancy	6273 (32.0)	5873 (28.5)	5650 (25.6)	5344 (23.2)	4954 (19.7)	4668 (17.2)	4252 (14.9)	3757 (13.0)	4690 (16.3)	−5.2% (−7.0 to −3.3)	**0.001**
Premature rupture of membrane at term (PROM)	2433 (12.4)	2535 (12.3)	2589 (11.7)	2522 (10.9)	2501 (9.9)	2380 (8.8)	2380 (8.3)	2331 (8.1)	2917 (10.2)	+0.41% (−1.4 to 2.2)	0.663
Multiple gestation	365 (1.9)	323 (1.6)	328 (1.5)	323 (1.4)	257 (1.0)	293 (1.1)	296 (1.0)	299 (1.0)	289 (1.0)	−2.4% (−4.3 to −0.5)	**0.046**
Poly/Oligohydramnios	917 (4.7)	1115 (5.4)	1011 (4.6)	995 (4.3)	1027 (4.1)	1161 (4.3)	1179 (4.1)	1143 (4.0)	1176 (4.1)	+2.6% (1.0–4.2)	**0.014**
Diabetes mellitus in pregnancy	1659 (8.5)	2046 (9.9)	2415 (11.0)	2853 (12.4)	3240 (12.9)	3224 (11.9)	3900 (13.7)	3812 (13.2)	4391 (15.3)	+12.1% (9.8–14.4)	**0.000**
Maternal obesity	<5 (0.0)	<5 (0.0)	<5 (0.0)	<5 (0.0)	<5 (0.0)	12 (0.0)	48 (0.2)	189 (0.7)	184 (0.6)	+97.6% (61.1–142.3)	**0.000**
Hypertensive disorders in pregnancy	2157 (11.0)	2150 (10.4)	2094 (9.5)	1949 (8.5)	2050 (8.2)	1957 (7.2)	1924 (6.7)	1878 (6.5)	2151 (7.5)	−1.0% (−2.2 to 0.3)	0.178
Antepartum hemorrhage	358 (1.8)	362 (1.8)	397 (1.8)	437 (1.9)	465 (1.8)	428 (1.6)	415 (1.5)	397 (1.4)	444 (1.5)	+2.0% (0.1–4.0)	0.078
Known or suspected fetal problem/ abnormality/damage	1333 (6.8)	1616 (7.8)	1664 (7.5)	1724 (7.5)	2655 (10.6)	3697 (13.7)	4308 (15.1)	4099 (14.4)	5387 (18.8)	+20.2% (16.0–24.3)	**0.000**
Fetal death	129 (0.7)	122 (0.6)	118 (0.5)	114 (0.5)	102 (0.4)	122 (0.5)	92 (0.3)	94 (0.3)	85 (0.3)	−4.7% (−6.5 to −2.9)	**0.002**
Fetal growth restriction	1444 (7.4)	1699 (8.2)	1715 (7.8)	1859 (8.1)	2248 (8.9)	2649 (9.8)	2870 (10.1)	2797 (9.7)	3315 (11.6)	+10.9% (9.3–12.6)	**0.000**
Suspected fetal macrosomia	606 (3.1)	680 (3.3)	723 (3.3)	683 (3.0)	993 (3.9)	1521 (5.6)	1702 (6.0)	1615 (5.6)	1796 (6.3)	+17.0% (12.4–21.6)	**0.000**

Note: A total column is not included as the indications are not mutually exclusive; individual women may be counted in more than one category. Bold values indicate statistically significant AAPC at $p < 0.05$.

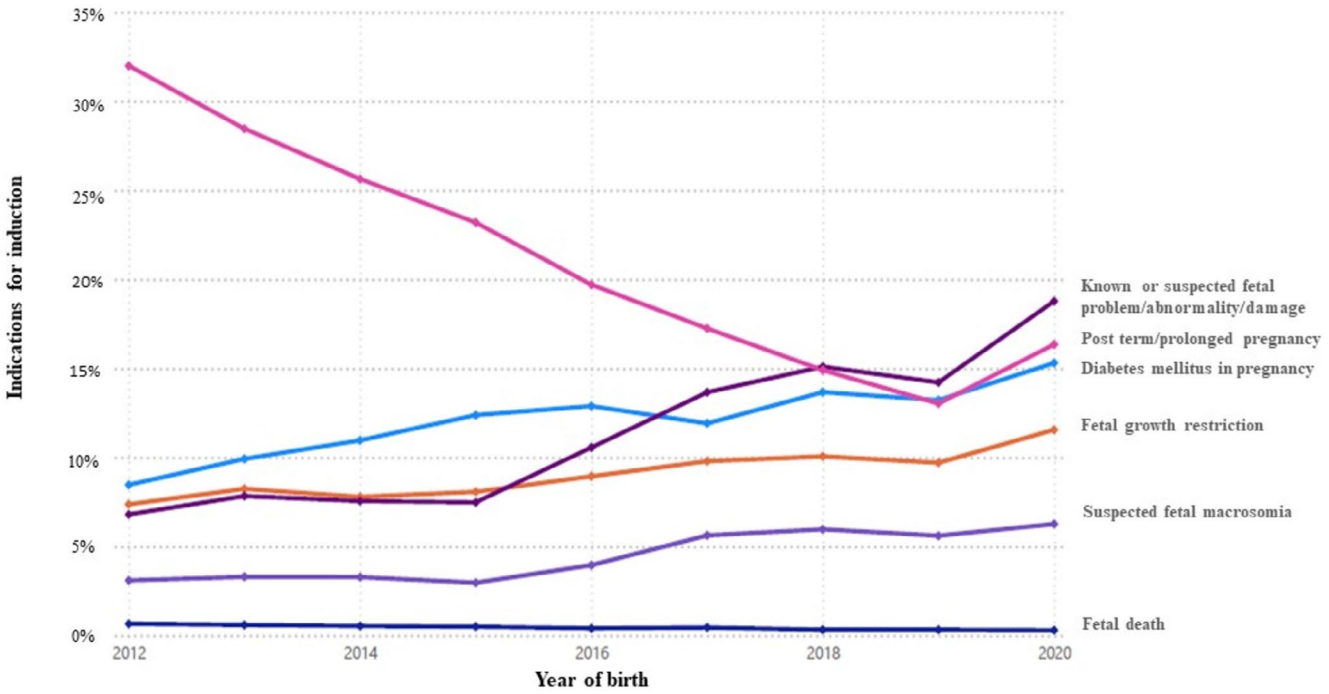

FIGURE 5 Proportion of indications for induction in women who were induced.

catheter is a lower-cost method that can be managed outside the hospital after insertion without continuous monitoring for up to 24 h (usually 12–18 h).[28,29] The rise in inductions at 37 or 38 weeks, when the cervix is often unfavorable, may further explain the growing use of balloon catheters for cervical dilation. However, the increased use of combination methods suggests that while balloon catheters facilitate the ripening of the cervix, further pharmacological intervention is typically required to progress labor.

The significant reduction in induction for a post-term pregnancy is expected, given the high percentage of induction at or around term gestations. The findings indicate a rising trend in diabetes mellitus during pregnancy and fetal indications as reasons for induction over time. This aligns with other recently published population-based studies that analyzed trends in indications for labor induction. For example, a 2019 study analyzing data from the Canberra Birth Database (2012–2016) identified gestational diabetes mellitus (GDM) as a leading reason for induction.[12] Similarly, another population-based study from Iceland reported trends in labor induction indications over a 20-year period, highlighting a significant increase in induction indicated by gestational diabetes.[30] The impact of the 2014 update to the Australasian Diabetes in Pregnancy Society (ADIPS) guideline is evident in these trends. The shift from a two-step approach for high-risk women to a universal single-step 75 g oral glucose tolerance test at 24–28 weeks has led to more diagnoses of gestational diabetes and the concurrent rise in inductions due to diabetes.[31]

By 2020, the leading indication for induction was a somewhat heterogeneous group of fetal-related indications. Several studies have identified decreased fetal movement as a significant factor driving the decision for induction.[10,32] Additionally, decisions around induction can sometimes be influenced by the mother's perception of altered fetal movements, which has gained prominence through the Safer Baby Bundle initiative aimed at reducing stillbirths in Australia.[33] It is possible that some elective inductions are being captured under the fetal indication group in the VPDC dataset due to the lack of specific coding for elective induction. For instance, if clinicians are noting 'fetal concerns' based on maternal perceptions of fetal well-being or slight deviations in fetal growth without clear diagnostic markers, these cases may be classified under 'Known or suspected fetal problems/abnormality/damage'. Given these uncertainties, we recommend that future VPDC data collection incorporate greater specificity for these fetal indications. "We also suggest greater specificity be included in the dataset when clinicians are documenting 'elective induction' or 'induction on maternal request' to assist in further understanding the drivers of this change."

Amongst induced women, the indication for fetal growth restriction grew on average by 10.9% per year. A controlled study demonstrated that training healthcare providers in standardized fundal height measurement significantly increased the antenatal detection of small-for-gestational-age (SGA) and large-for-gestational-age fetuses.[34] The recent adoption of standardized growth charts for fundal height measurement[35] in antenatal clinics in Australia may have led to an increased detection of fetal growth restriction, or at least more referrals for growth scans and follow-up. This might explain the rising inductions for this indication. The statistically significant reduction in induction of labor for fetal death by 4.7% per year warrants further investigation. Although induction of labor is preferred management in the setting of fetal demise, the increasing caesarean section rates during the period may explain the reduction in induction for fetal death, with the presence of previous hysterotomy

(particularly previous classical incision or multiple previous caesarean deliveries) modifying management.[36] Currently, limited data exist to guide clinical practice in these women. Additionally, the indication of suspected fetal macrosomia grew by 17% per year, suggesting clinicians' decisions favoring induction for these women. This may be linked to GDM, which is associated with larger fetal size,[37] GDM prevalence in Australia is rising,[38] and the proportion of women induced for GDM nearly doubled in our study period.

This study used robust, population-level surveillance data over an extended period (2012–2020), offering comprehensive insights into trends in labor induction. The validated data accurately represent state-wide births in Victoria, minimizing selection bias by including all births.[16] Indications for induction were directly extracted from the dataset and coded using ICD 10, avoiding proxy indicators. Furthermore, VPDC data entry is performed by healthcare providers, helping ensure clinical accuracy. The use of AAPC provided valuable insights into changes in labor onset, induction practices, and indications over time. We acknowledge some important limitations. Indications such as decreased fetal movements, elective induction, and maternal preference are not explicitly captured in VPDC, which may impact their interpretation. Additionally, we were unable to analyze combinations (or overlap) of indications, nor the sequence in which multiple induction options were used. While the study's findings may not be generalizable to other regions or countries with different healthcare systems and guidelines, we nonetheless consider these findings insightful for other settings where induction rates are rising.

The upward trend in labor induction rates at earlier gestations highlights a critical area for policy evaluation, particularly concerning adherence to recommended guidelines. Future research should focus on understanding the decision-making processes around elective inductions, particularly how maternal perceptions and non-medical factors influence induction rates. Investigating patient outcomes associated with induction at different gestational ages and methods would further inform best practices and support guideline refinement.

5 | CONCLUSION

Labor induction has significantly increased in Victoria by an average of 5.5% per year between 2012 and 2020, particularly at 38 and 39 weeks' gestation. This rise is accompanied by shifts in both the methods and indications for induction, reflecting changes in clinical and obstetric practices. The increase in fetal indications warrants further exploration, particularly in light of the updated Safer Baby Bundle guidelines and the recent inclusion of decreased fetal movements in the VPDC dataset as an explicit indication for induction. Future research should address data gaps, including maternal choice, and evaluate the long-term outcomes of these trends.

AUTHOR CONTRIBUTIONS

The study is a part of a PhD research project of Samia Aziz. Prof. Joshua P. Vogel and Samia Aziz conceptualized the study. Samia Aziz and Dr. Fiona Bruinsma contributed to data acquisition, data sorting, and performed statistical analysis. All authors contributed substantially to data interpretation, reviewing, and write-up.

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CONFLICT OF INTEREST STATEMENT

The authors declare no competing interests.

ETHICS STATEMENT

The study was approved by the Monash University Human Research Ethics Committee (MUHREC) on June 27, 2023 under the title 'Levels, trends, determinants, outcomes and facility-level reference rates for Induction of Labour in Victoria, Australia'.

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SUPPORTING INFORMATION

Additional supporting information can be found online in the Supporting Information section at the end of this article.

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