Changes in the modes of twin birth in Victoria, 1983–2015

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The known: The proportion of twins born by caesarean delivery has increased in Australia.

The new: The proportion of twins born by caesarean delivery in Victoria increased threefold, from 24% to 71% of all twin births, during 1983–2015. The proportion of twin births with twin pregnancy as the sole indication for caesarean delivery increased from 2% to 21%. The proportion of twin births by caesarean delivery differs between Victorian regions.

The implications: Exploring interventions that safely reduce the reliance on caesarean delivery of twins would be appropriate.

Abstract

Objectives: To examine changes in the modes of delivery of twins in Victoria over 33 years.

Design: Retrospective population-based study.

Setting, participants: All twin births in Victoria, 1 January 1983 – 31 December 2015.

Major outcomes: Mode of birth (vaginal, planned or unplanned caesarean delivery); indications for caesarean delivery.

Results: During 1983–2015, 32 187 twin pregnancies ended in live or stillbirths in Victoria. The proportion of twins born by caesarean delivery increased from 24% (156 twin deliveries) in 1983 to 71% (782 deliveries) in 2015. The proportion of twin births by planned caesarean delivery with twin pregnancy as the sole indication for caesarean delivery increased across this period from 1.8% (12 twin deliveries) to 21% (231 deliveries). The proportion of twin births by caesarean delivery and the proportion of caesarean twin deliveries with twin pregnancy as the principal indication each differed between Victorian regions.

Conclusion: During 1983–2015, the proportion of twins born in Victoria by caesarean delivery increased almost threefold, mostly because caesarean delivery has become the preferred mode of birth for twin pregnancies. Regional differences in the delivery of twins suggest that the number of caesarean deliveries can be reduced with appropriate system and training support.

About 2% of all pregnancies in Australia are twin pregnancies, but perinatal mortality and morbidity are disproportionately high for these pregnancies.[1,2] The numbers of twin births by caesarean delivery have been increasing worldwide,[3–5] and there have been calls to reduce the overall number of caesarean deliveries in countries with high rates, including Australia.[6,7] While factors that influence its use in singleton pregnancies have been investigated, including maternal age, parity, and obesity,[8] caesarean delivery of twins has received less attention. Given high level evidence that routine caesarean delivery of twins does not benefit mothers or babies[9,10] and the recent suggestion that vaginal birth may actually be preferable,[11] the mode of birth in uncomplicated twin pregnancies should be considered carefully.

In this study, we examined changes in the mode of delivery of twins in Victoria over 33 years, with a view to identifying opportunities for improving care and outcomes for women and their babies.

Methods

For our retrospective population-based study, we analysed de-identified data on births in Victoria of at least 20 weeks' gestation from the Consultative Council on Obstetric and Paediatric Mortality and Morbidity (CCOPMM) dataset, the accuracy of which has been validated.[12] Data for all twin births during 1 January 1983 – 31 December 2015 were included; we included women only once each by selecting birth records for the first-born twin. For comparative purposes, we also analysed data for singleton births during 1 January 1992 – 31 December 2015.

For some analyses, we analysed the data in three epochs: 1983–1998, 1999–2008, and 2009–2015. We compared the demographic characteristics of women who gave birth to twins during the first epoch with those of the third epoch in χ^2 tests. We assessed changes in the proportions of modes of birth over time (vaginal, planned or unplanned caesarean delivery) in χ^2 tests for trend. We also analysed these changes by logistic regression; adjusting for changes in maternal age and parity, we report adjusted odds ratios (aORs) with 95% confidence intervals (CIs) for caesarean delivery during each of the second and third epochs compared with the first epoch.

Indications for caesarean delivery of twins

We examined changes in the indications for caesarean delivery, separately for planned and unplanned deliveries, in eight categories based on International Classification of Diseases, 9th (ICD-9) (until 1998) or 10th modification (ICD-10) (after 1998) codes:

- previous caesarean delivery (6542; O342);
- placentation problems (6410–6412, 6418, 6419, 6635; O440, O441, O459, O468, O469, O679, O694);
- malpresentation (6520, 6522–6529, 6600, 6696; O320–O329, O641–O643, O645, O649);
- hypertensive disorders (6420, 6422–6426, 6429; O100, O139, O141, O152, O149, O159);
- non-reassuring fetal status (typically abnormal cardiotocography; 6563, 6630, 6633; O680–O682, O688–O690, O692);
- failure to progress (6601, 6603, 6606–6612, 6620–6622, 6534, 6591, 6604, 6590; O610, O611, O618, O620, O622, O630, O631, O639, O640, O664, O665, O668, O669);
- other (including polyhydramnios, oligohydramnios, gestational diabetes, pre-existing diabetes, chorio-amnionitis) (6584; O409, O410, 6480, O244, O243);
- twin pregnancy (6510; O300).

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When more than one coded indication was recorded for a birth, we included the indication positioned highest in this list as the primary indication (ie, the most important indicator for caesarean delivery). We assessed changes in proportions of indications over time in χ^2 tests for trend.

We also examined changes in indications for caesarean delivery over time by maternal age group (under 35 years, 35 years or older) and parity (nulliparous, parous). The proportions of each type of caesarean delivery in the first and third epochs for each indication were compared with those for all other indications in χ^2 tests. We deemed $P < 0.01$ statistically significant.

Regional differences

We compared regional levels of recorded indications for caesarean delivery during 2010–2015 (excluding 2014, for which "region" data were not available) by multiple logistic regression adjusted for maternal age group, parity, body mass index group, admission type (public, private), previous caesarean delivery, and use of artificial reproductive technology. The North and West Metropolitan region, which had the highest number of twin births, served as the reference region.

Statistical analyses were undertaken in SPSS Statistics 25 (IBM) and Stata 15 (StataCorp).

Ethics approval

The study was approved by the Monash Health Human Research Ethics Committee (reference, 12126L).

Results

There were 32 187 twin pregnancies (live and stillbirths) in Victoria during 1983–2015. The proportion of twin births by caesarean delivery rose from 24% (156 of 658 twin deliveries) in 1983 to 71% (782 of 1102 deliveries) in 2015; the number of planned caesarean deliveries increased from 84 (13%) to 459 (42%) and that of unplanned caesarean deliveries from 72 (11%) to 323 (29%) (in each case: for trend, $P < 0.001$). Conversely, the proportion of vaginal twin births declined from 76% (502 of 658 twin deliveries) in 1983 to 29% in 2015 (320 of 1102 deliveries; $P < 0.001$) (Box 1). After adjusting for maternal age and parity, the odds of caesarean delivery were greater during both 1999–2008 (aOR, 2.9; 95% CI, 2.8–3.4) and 2009–2015 (aOR, 3.6; 95% CI, 3.4–3.8) than during 1983–1998.

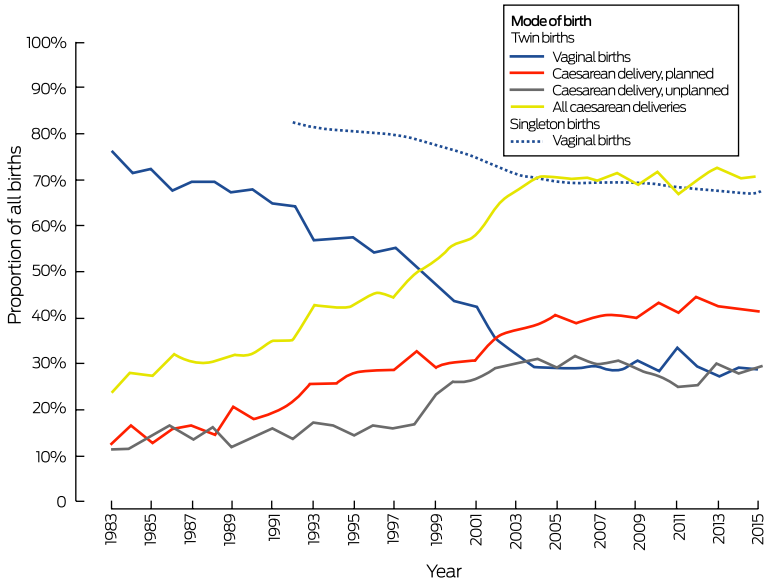
The rate of increase in the proportion of twin births by caesarean delivery was steepest during 1983–2003, with no substantial change since 2004. For the 1 647 245 singleton pregnancies during 1992–2015, the proportion of vaginal births declined from 82% (52 682 of 64 521 births) in 1992 to 67% (51 410 of 76 617 births) in 2015; the decline was most marked during 1997–2003 (Box 1).

The proportion of women with twin pregnancies who were aged 35 years or more increased from 15.4% (2007 mothers) during 1983–1998 to 32.6% (2560 mothers) during 2009–2015 ($P < 0.001$); the proportion of nulliparous women increased from 40.1% (5247 mothers) to 45.5% (3618 mothers) ($P < 0.001$) (Box 2).

Indications for caesarean delivery of twins

The number of planned caesarean deliveries with twin pregnancy as the indication increased from 12 of 658 (1.8%) in 1983

1 Modes of birth for twins in Victoria, 1983–2015, and singleton vaginal births, 1992–2015

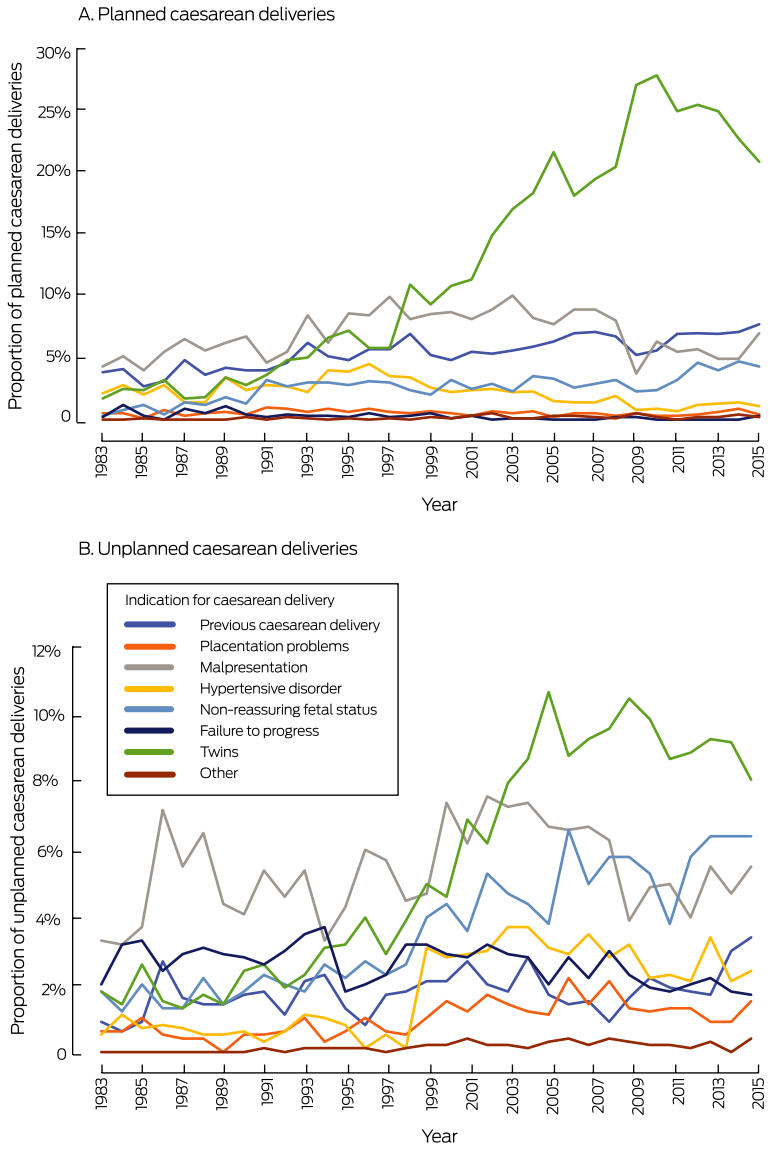


2 Characteristics of women giving birth to twins in Victoria, 1983–2015

	1983–1998	1999–2008	2009–2015
Total number of twin births	13 073	11 162	7952
Maternal age (years)			
< 20	253 (1.9%)	138 (1.2%)	96 (1.2%)
20–24	1765 (13.5%)	828 (7.4%)	601 (7.6%)
25–29	4565 (34.9%)	2573 (23.1%)	1768 (22.5%)
30–34	4481 (34.3%)	4313 (38.6%)	2834 (36.1%)
35–39	1768 (13.5%)	2809 (25.2%)	2083 (26.5%)
≥ 40	239 (1.8%)	501 (4.5%)	477 (6.1%)
Missing data	2 (0.2%)	0	93 (1.2%)
Parity (previous children)			
None	5247 (40.1%)	5131 (46.0%)	3618 (45.5%)
One	4331 (33.1%)	3596 (32.2%)	2612 (32.8%)
Two	2264 (17.3%)	1509 (13.5%)	1070 (13.5%)
Three or more	1230 (9.4%)	926 (8.3%)	648 (8.2%)
Missing data	1 (< 0.1%)	0	4 (< 0.1%)
Residential location*			
Metropolitan	9386 (71.8%)	6898 (61.8%)	4186 (61.6%)
Rural/regional	3464 (26.5%)	4252 (38.1%)	1483 (21.8%)
Outside Victoria	214 (1.6%)	11 (0.1%)	1120 (16.5%)
Missing data	9 (< 0.1%)	1 (< 0.1%)	2 (< 0.1%)

* Total number of twin births during 2009–2015 associated with residential location data was 6791 (data not reported for 2014). ◆

3 Indications for caesarean delivery of twins in Victoria, 1983–2015



to 231 of 1102 births (21%) in 2015, and that of unplanned caesarean deliveries from 16 of 658 (2.4%) to 93 of 1102 births (8.4%) (in each case: for trend, $P < 0.001$). These were the most marked rises for any single indication. The proportion of planned caesarean deliveries with previous caesarean delivery as the principal indication increased from 3.8% (25 of 658 deliveries) in 1983 to 7.7% (85 of 1102 deliveries) in 2015; the proportion of unplanned caesarean deliveries with this indication increased from 0.9% (six of 658 deliveries) to 3.4% (38 of 1102 deliveries; in each case: for trend, $P < 0.001$). The proportion of planned caesarean deliveries with non-reassuring fetal status as primary indication increased from 0.3% (two of 658 deliveries) to 4.3% (47 of 1102 deliveries; $P < 0.001$) and of unplanned caesarean deliveries from 1.8% (12 of 658 deliveries) to 6.4% (70 of 1102 deliveries; for trend, $P < 0.001$) (Box 3).

For both age groups (under 35 years, 35 years or more; Box 4) and both parity groups (nulliparous, parous; Box 5), the most common indication for caesarean delivery (both planned and unplanned) during 1983–1998 was malpresentation, but twin pregnancy was the most common indication for all groups during 2009–2015. There were no other consistent changes between epochs.

During 2009–2015, two or more indications were recorded for 2401 caesarean twin deliveries (43%) and for 36 678 caesarean singleton deliveries (22%).

Regional differences

In Gippsland, the Victorian health region with the lowest rate of caesarean delivery of twins during 2010–2013 (100 of 187 deliveries, 54%), the proportion of caesarean twin deliveries with twin pregnancy as the sole indication was also relatively low (31 of 100 caesarean deliveries, 31%) (Box 6). After adjusting for potential confounders, the odds of caesarean delivery of twins were lower than those for the reference region (North and West Metro) in the Gippsland, Eastern Metropolitan, Hume, and Southern Metropolitan regions, and non-significantly higher in the Barwon–South Western region (Box 7).

Discussion

The proportion of twins born in Victoria by caesarean delivery almost tripled during 1983–2015. This change appears linked with the rises in the proportions of all twin births and of twin caesarean deliveries for which the twin pregnancy was the sole indication for caesarean delivery; these rises applied to both younger (under 35 years) and older mothers and to both nulliparous and parous women.

The increased proportion of twins born by caesarean delivery in Victoria mirrors trends in other parts of Australia[13,14] and overseas.[4,5,7] The proportion of caesarean delivery twin births in Victoria in 2015 (71%) was similar to that for multiple births in Australia overall (69%)[14] and in some high income nations, including the United States (92%),[4] Germany (75%) and Scotland (73%),[5] but higher than in most European countries, and much higher than in Scandinavia (47–60%), the Netherlands (44%), and England (63%).[5] The increasing use of caesarean section for twin births in Victoria is not explained by changes in maternal age or parity. We were unable to explore the significance of increasing rates of assisted reproduction or improved detection of twin–twin transfusion syndrome for caesarean delivery rates because the CCOPMM dataset has captured relevant data only very recently. However, most twin pregnancies are unassisted and the rate of severe twin–twin transfusion syndrome is very low; only 49 twin pregnancies with the syndrome required laser photocoagulation in Victoria during 2006–2011.[15] It is therefore improbable that these factors explain the tripling of the twin caesarean delivery proportion.

The increase in the proportion of twins born by caesarean delivery has been accompanied by a marked rise in the proportion of such deliveries with twin pregnancy as the reason for surgery; removing interventions with this factor as the main indication would reduce the twin caesarean delivery proportion in Victoria to 40–50%. Our data cannot provide insights into the reasons for an apparent change in preference regarding twin births. Information is not collected on whether the mother, her obstetrician, or both preferred caesarean delivery to a planned vaginal birth. When the value of caesarean delivery is uncertain

4 Indications for caesarean delivery of twins in Victoria, by maternal age group

Indication for caesarean delivery	Maternal age group: Under 35 years				35 years or more			
	Epoch 1 1983–1998	Epoch 2 1999–2008	Epoch 3 2009–2015	*P* (epoch 3 *v* 1)*	Epoch 1 1983–1998	Epoch 2 1999–2008	Epoch 3 2009–2015	*P* (epoch 3 *v* 1)*
Planned caesarean deliveries	2320	2635	2108		549	1463	1257	
Twins	463 (20.0%)	1134 (43.0%)	1247 (59.2%)	< 0.001	134 (24.4%)	700 (47.8%)	726 (57.8%)	< 0.001
Previous caesarean delivery	481 (20.7%)	403 (15.3%)	291 (13.8%)	< 0.001	129 (23.5%)	268 (18.3%)	234 (18.6%)	0.017
Placentation	61 (2.6%)	28 (1.1%)	16 (0.8%)	< 0.001	21 (3.8%)	26 (1.8%)	23 (1.8%)	0.011
Malpresentation	718 (30.9%)	676 (25.7%)	302 (14.3%)	< 0.001	148 (27.0%)	282 (19.3%)	129 (10.3%)	< 0.001
Hypertensive disorders	319 (13.8%)	159 (6.0%)	46 (2.2%)	< 0.001	61 (11.1%)	66 (4.5%)	37 (2.9%)	< 0.001
Non-reassuring fetal status	221 (9.5%)	212 (8.0%)	192 (9.1%)	0.63	50 (9.1%)	106 (7.2%)	98 (7.8%)	0.35
Failure to progress	49 (2.1%)	9 (0.3%)	5 (0.2%)	< 0.001	6 (1%)	4 (0.3%)	0	< 0.001
Other	8 (0.3%)	14 (0.5%)	9 (0.4%)	0.66	0	11 (0.8%)	10 (0.8%)	0.036
Unplanned caesarean deliveries	1639	2325	1505		307	912	714	
Twins	257 (15.7%)	610 (26.2%)	462 (30.7%)	< 0.001	63 (20.5%)	276 (30.3%)	274 (38.4%)	< 0.001
Previous caesarean delivery	156 (9.5%)	135 (5.8%)	110 (7.3%)	0.026	44 (14.3%)	75 (8.2%)	68 (9.5%)	0.024
Placentation	62 (3.8%)	117 (5.0%)	65 (4.3%)	0.45	14 (4.6%)	49 (5.4%)	30 (4.2%)	0.80
Malpresentation	552 (33.7%)	571 (24.6%)	288 (19.1%)	< 0.001	82 (26.7%)	176 (19.3%)	93 (13.0%)	< 0.001
Hypertensive disorders	72 (4.4%)	249 (10.7%)	129 (8.6%)	< 0.001	8 (3%)	104 (11.4%)	73 (10.2%)	< 0.001
Non-reassuring fetal status	227 (13.8%)	381 (16.4%)	322 (21.4%)	< 0.001	37 (12.1%)	157 (17.2%)	134 (18.8%)	0.008
Failure to progress	308 (18.8%)	240 (10.3%)	117 (7.8%)	< 0.001	58 (18.9%)	69 (7.6%)	39 (5.5%)	< 0.001
Other	5 (0.3%)	22 (0.9%)	12 (0.8%)	0.06	1 (0.3%)	6 (0.7%)	3 (0.4%)	0.82

* For comparison of proportions (χ^2 tests). ◆

for women with a particular indication, such as twin pregnancy, clinical practice may be more influenced by professional and socio-cultural factors that more generally influence views about caesarean delivery.[5] That is, in countries with a generally higher caesarean delivery rate, including Australia, this preference also applies to twin births. It is notable that the region in our study with the lowest adjusted odds of twin caesarean delivery, Gippsland, has one of the lowest overall caesarean delivery rates in Victoria, including a low rate of elective repeat caesarean deliveries.[16]

If reducing the proportion of children born by caesarean delivery is desirable,[7] understanding the cultural influences underlying birth decisions is essential. In a 2004 study, most Canadian women bearing twins preferred vaginal birth,[17] but data on the preferences of Australian women have not been reported. Twin pregnancies are more common in older women, in women with a high body mass index, and in women conceiving with assisted reproduction support,[2,14] and these women and their obstetricians might prefer caesarean delivery if vaginal birth is regarded as more risky. However, vaginal delivery of twins is not less safe than a planned caesarean delivery, although high level evidence has only recently been reported. Earlier retrospective cohort studies had suggested that caesarean delivery was the safer option,[18,19] but a more recent multicentre, randomised controlled trial coordinated in Canada but including several Australian hospitals (published in 2013)[9] and a systematic review (2015)[10] did not confirm this view. The shifting direction of the evidence may have influenced women's decisions, but we found that the proportion of twins born by caesarean delivery in Victoria has been stable since 2003; that is, well before any of these reports were published, suggesting that the cultural shift may have had other reasons.

The rise in the proportion of caesarean twin deliveries may principally reflect clinician preference, a possibility supported by the regional variation in caesarean delivery rates we found. Changes in clinician preference may be partly explained by increasing awareness that earlier delivery of twins improves outcomes for the children,[13,20] leading to induced labour or planned caesarean deliveries being preferred. Until fairly recently, inducing labour was thought to increase the risk of an emergency caesarean delivery,[21] and, given the extra risk associated with twin pregnancies, a planned caesarean delivery could reasonably be seen as the better option.

The preference for caesarean delivery of twins may also reflect changes in clinician training, skills, and confidence with vaginal twin births;[22] clinicians with limited experience are more likely to prefer caesarean to vaginal deliveries.[23] If women are to make meaningful choices about how their children are born,

5 Indications for caesarean delivery of twins in Victoria, by parity group

Indication for caesarean delivery	Parity: Nulliparous Epoch 1 1983–1998	Nulliparous Epoch 2 1999–2008	Nulliparous Epoch 3 2009–2015	Nulliparous *P* (epoch 3 *v* 1)*	Parous Epoch 1 1983–1998	Parous Epoch 2 1999–2008	Parous Epoch 3 2009–2015	Parous *P* (epoch 3 *v* 1)*
Planned caesarean deliveries	1223	1911	1517		1646	2187	1840	
Twins	300 (24.5%)	1045 (54.7%)	1028 (67.8%)	< 0.001	297 (18.0%)	789 (36.1%)	942 (51.2%)	< 0.001
Previous caesarean delivery	NA	NA	NA		604 (36.7%)	668 (30.5%)	500 (27.2%)	< 0.001
Placentation	37 (3.0%)	28 (1.5%)	17 (1.1%)	< 0.001	45 (2.7%)	26 (1.2%)	22 (1.2%)	0.001
Malpresentation	433 (35.4%)	478 (25.0%)	209 (13.8%)	< 0.001	433 (26.3%)	480 (21.9%)	221 (12.0%)	< 0.001
Hypertensive disorders	270 (22.1%)	164 (8.6%)	64 (4.2%)	< 0.001	110 (6.7%)	61 (2.8%)	19 (1.0%)	< 0.001
Non-reassuring fetal status	149 (12.2%)	177 (9.3%)	164 (10.8%)	0.26	122 (7.4%)	141 (6.4%)	125 (6.8%)	0.48
Failure to progress	24 (2.0%)	4 (0.2%)	4 (0.3%)	< 0.001	31 (1.9%)	9 (0.4%)	1 (0.1%)	< 0.001
Other	4 (0.3%)	12 (0.6%)	9 (0.6%)	0.31	4 (0.2%)	13 (0.6%)	10 (0.5%)	0.16
Unplanned caesarean deliveries	1639	2325	1505		307	912	714	
Twins	190 (18.1%)	528 (28.3%)	285 (29.7%)	< 0.001	130 (14.5%)	358 (26.1%)	285 (29.7%)	< 0.001
Previous caesarean delivery	NA	NA	NA		198 (22.1%)	207 (15.1%)	170 (17.7%)	0.018
Placentation	29 (2.8%)	76 (4.1%)	44 (4.6%)	0.028	47 (5.3%)	90 (6.6%)	44 (4.6%)	0.51
Malpresentation	317 (30.2%)	387 (20.8%)	197 (20.6%)	< 0.001	317 (35.4%)	360 (26.2%)	197 (20.6%)	< 0.001
Hypertensive disorders	63 (6.0%)	269 (14.4%)	50 (5.2%)	0.45	17 (1.9%)	84 (6.1%)	50 (5.2%)	< 0.001
Non-reassuring fetal status	175 (16.7%)	342 (18.3%)	179 (18.7%)	0.23	89 (9.9%)	196 (14.3%)	179 (18.7%)	< 0.001
Failure to progress	270 (25.7%)	245 (13.1%)	28 (2.9%)	< 0.001	96 (10.7%)	64 (4.7%)	28 (2.9%)	< 0.001
Other	5 (0.5%)	15 (0.8%)	5 (0.5%)	0.88	1 (0.1%)	13 (0.9%)	5 (0.5%)	0.12

NA = not applicable. * For comparison of proportions (χ^2 tests). ◆

a skilled specialist workforce must be maintained. But, as fewer than one-third of twins are now born by vaginal delivery, the opportunity for obstetric trainees to become proficient in twin vaginal births is much more limited than it once was. This problem is not restricted to Victoria or to twin births; the number of specialist trainees performing operative vaginal deliveries of any sort has declined in Australia over the past few decades.[24,25] In 2007, only one in ten Australian obstetric trainees planned to offer vaginal birth for breech presentations after completing training,[24] and only one in five intended to undertake rotational forceps deliveries.[25]

Obstetric trainees want more training in vaginal twin births.[22] Increasing the rate of twin vaginal births would require guided mentorship, among other specific measures, an approach that has reversed declining rates of obstetric forceps use.[26] That the proportion of planned caesarean deliveries for twins has been stable over the past decade suggests that training in vaginal twin births is still feasible; the recent decline in planned caesarean deliveries with twin pregnancy as the sole indication (Box 3) may reflect changes in clinician preference stimulated by evidence of the safety of vaginal delivery.[9] The Royal Australian and New Zealand College of Obstetricians and Gynaecologists (RANZCOG) curriculum for the training of specialist obstetricians and gynaecologists requires that trainees are able to "safely manage and conduct all obstetric procedures involved in intrapartum care … including a detailed knowledge of … vaginal twin birth",[27] but a trainee is required to attend a total of only 20 complex vaginal births (twin births, breech births, other unspecified complications).

Given calls to reduce caesarean delivery rates in general[7] and the safety of vaginal delivery for twin births,[9,10] it would be desirable to increase the twin vaginal birth rate in Australia. Increasing caesarean delivery of twins is not explained by the complexity of twin pregnancies nor by rates of maternal comorbid conditions.[28] Had all Victorian women who gave birth to twins by caesarean delivery in 2015 with twin pregnancy as the sole indication attempted vaginal birth, and half of these attempts were successful (as generally reported[9,11]), the vaginal birth rate for twins would have been 15 percentage points higher (rising from 29% to 44%), similar to those of France, Sweden and the Netherlands (46–56%).[5] This is feasible; nearly half the twin births in Gippsland during 2010–13 were vaginal births.

The challenge for Victorian and other Australian obstetricians is to re-examine current practice and, in the light of evidence, decide to change and "bend the cesarean-delivery curve for twin

6 Caesarean deliveries of twins as proportions of all deliveries of twins in Victoria, 2010–2013, by region of residence and indication

Indication for caesarean delivery	Region							
	North and West Metro	Southern Metro	Eastern Metro	Barwon–South Western	Loddon Mallee	Hume	Gippsland	Grampians
All twin births	1637	1066	674	267	227	210	187	157
Twin births by caesarean delivery	1198 [73.2%]	715 [67.1%]	485 [70.4%]	206 [77.1%]	160 [70.5%]	139 [66.2%]	100 [53.5%]	125 [79.6%]
Previous caesarean delivery	140 (12%)	89 (12%)	40 (8.4%)	31 (15%)	29 (18%)	25 (18%)	7 (7%)	18 (14%)
Placentation	29 (2.4%)	20 (2.8%)	7 (2%)	4 (2%)	2 (1%)	1 (0.7%)	6 (6%)	2 (2%)
Malpresentation	168 (14%)	113 (16%)	50 (1%)	31 (15%)	24 (15%)	30 (22%)	37 (37%)	14 (11%)
Hypertension	74 (6.2%)	28 (3.9%)	24 (5.1%)	11 (5.3%)	6 (4%)	7 (5%)	3 (3%)	6 (5%)
Fetal status	140 (12%)	98 (14%)	70 (15%)	25 (12%)	23 (14%)	13 (9.4%)	9 (9%)	15 (12%)
Failure to progress	33 (2.8%)	18 (2.5%)	12 (2.5%)	3 (2%)	1 (0.6%)	7 (5%)	6 (6%)	6 (5%)
Other	6 (0.5%)	2 (0.3%)	2 (0.4%)	1 (0.5%)	1 (0.6%)	0	1 (1%)	1 (0.8%)
Twin pregnancy	608 (50.8%)	347 (48.5%)	270 (56.8%)	100 (48.5%)	74 (46%)	56 (40%)	31 (31%)	63 (50%)

7 Caesarean twin deiveries in Victoria, 2010–2013 and 2015, by region of residence

Region	Adjusted odds ratio* (95% CI)	*P*
Barwon–South Western	1.37 (1.04–1.82)	0.26
Grampians	1.01 (0.71–1.43)	0.96
North and West Metro	1	—
Loddon Mallee	0.94 (0.71–1.26)	0.69
Southern Metro	0.71 (0.60–0.83)	< 0.001
Hume	0.70 (0.53–0.92)	0.012
Eastern Metro	0.69 (0.58–0.82)	< 0.001
Gippsland	0.46 (0.35–0.61)	< 0.001

* Adjusted for maternal age, body mass index, parity, admission type (public, private), use of artificial reproductive technology, and previous caesarean delivery. ◆

pregnancies".[29] However, the choice of birth mode ultimately lies with the mother if there are no complicating factors.[30]

Strengths and limitations

One strength of our study is that we have specifically explored the indications for caesarean delivery of twins, not simply changes in the rate of caesarean twin deliveries.[3] Further, as we analysed whole-of-population data, our findings can probably be generalised across Australia, to high and low risk pregnancies, private and public care, and to metropolitan and regional services.

There are two key limitations to our study. As caesarean delivery has become increasingly accepted for delivering twins, clinicians may have be more likely to list twin pregnancy as the sole indication rather than specifying another salient reason. This would inflate the number of deliveries with twin pregnancy as the sole indication. However, two or more indications were recorded for 43% of twin caesarean delivery births, twice the rate for singleton caesarean deliveries, suggesting that indications are not under-reported. Our selecting the records for the first-born twin means that a small proportion of births in which the first twin was born vaginally and the second by emergency intrapartum caesarean delivery will have been included in the vaginal birth group. This occurs in only 1% of all twin births (data not shown), and would, in any case, have diluted the effect we have described.

Conclusion

We found that the proportion of twins born by caesarean delivery in Victoria almost tripled during 1983–2015. The proportion of twin caesarean deliveries, however, differed considerably between regions. Our findings are probably generalisable, and therefore have implications for women, their babies, and obstetric practice across Australia. We should ensure that we have a skilled and competent workforce to enable women to have a real choice in how their babies are born.

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