# Adverse outcomes of labour in public and private hospitals in Australia: a population-based descriptive study

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## ABSTRACT

**Objective:** To compare the rate of serious adverse perinatal outcomes of term labour between private and public maternity hospitals in Australia.

**Design, setting and participants:** A population-based study of 789 240 term singleton births in public and private hospitals in 2001–2004, using data from the National Perinatal Data Collection.

**Main outcome measures:** Third- and fourth-degree perineal injury, requirement for high level of neonatal resuscitation, Apgar score < 7 at 5 minutes, admission to neonatal intensive care unit or special care nursery, and perinatal death.

**Results:** 31.4% of the term singleton births occurred in private hospitals. After adjusting for maternal age, Indigenous status, parity, smoking status, diabetes, hypertension, remoteness of usual residence, and method of birth, the rates of all adverse outcomes studied were higher for public hospital births. For women, the adjusted odds ratio (AOR) for third- or fourth-degree perineal injury was 2.28 (95% CI, 2.16–2.40). For babies, the odds of a high level of resuscitation (AOR, 2.37; 95% CI, 2.17–2.59), low Apgar score (AOR, 1.75; 95% CI, 1.65–1.84), intensive care requirement (AOR, 1.48; 95% CI, 1.45–1.51) and perinatal death (AOR, 2.02; 95% CI, 1.78–2.29) were all higher in public hospitals.

**Conclusion:** For women delivering a single baby at term in Australia, the prevalence of adverse perinatal outcomes is higher in public hospitals than in private hospitals.


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The birth rate in Australia is increasing, with more births in 2006 than any year since the early 1970s. This trend has coincided with an increase in the number of births occurring in private maternity hospitals, which now comprise 31% of all deliveries.[1] The reasons for a trend towards private hospital maternity care are likely to be complex, but government financial support for private health insurance premiums might partly explain this phenomenon.[2]

Almost all women in Australia have free access to public hospitals, where intrapartum care is usually provided by a mixture of midwives, junior medical officers, specialty trainees, and specialist obstetricians. In contrast, women choosing to deliver in private hospitals have their care directly managed by specialist obstetricians. Compared with public hospitals, birth in Australian private hospitals is characterised by a higher rate of obstetric interventions such as induction of labour, episiotomy, instrumental delivery, and caesarean section,[3,4] and this has attracted criticism as being unnecessary.[5,6] In view of the government financial support available to women who take out private health insurance, it would be an obvious concern if the private hospital, obstetrician-led model of care, with its increased rates of medical intervention, did not provide measurable benefits for women and their babies when compared with the public hospital mixture of "all" models of care.

Studies published to date have emphasised the difference in intervention rates between private and public hospitals, yet maternal and neonatal outcomes have received little attention.[3,4] An assumption has been made that "in these low risk populations there are no differences in perinatal mortality or morbidity associated with these practices [obstetric interventions]".[5] However, such an assumption may not necessarily be valid. A comparison of intervention rates without reference to maternal and neonatal outcomes might mask information that would be of great interest to pregnant women making a choice between private and public hospitals as places to give birth. For example, a recent population-based study in Western Australia found that patients treated for colorectal cancer in private hospitals had significantly improved survival outcomes compared with those treated in public hospitals.[7] With this in mind, we aimed to compare the rates of serious adverse birth outcomes between private and public hospitals for women delivering at term.

## METHODS

Data were extracted from the National Perinatal Data Collection (NPDC), a population-based cross-sectional pregnancy and childbirth data collection. Information is included in the NPDC for all babies born in Australia, both live and stillborn, of at least 400 g birthweight or at least 20 weeks' gestation.

Our study included women who gave birth in hospital during the 4-year period from 1 January 2001 to 31 December 2004, and their babies. As pregnancies complicated by multiple gestation or prematurity have greatly increased rates of adverse outcomes, only singleton births occurring between 37 and 41 completed weeks' gestation (the definition of "term" for the purposes of the NPDC) were included.

A number of births occurred in public hospitals to women who had private health insurance, and in private hospitals to women who were uninsured. There are likely to be many reasons for this crossover, including women using their private insurance to secure a single room and women whose insurance only covered private specialist care in public hospitals. To exclude cases where women who were anticipated to have serious adverse birth outcomes were booked to deliver in public hospitals by their private obstetricians, we excluded all cases where women reported as "private" delivered in public hospitals (44 937 births, 4.8%), as well as uninsured women who delivered in private hospitals (10 417 births, 1.1%). We also excluded cases where the hospital sector was not stated. Thus, "public" here represents all women who gave birth in a public hospital as a public patient, and "private" represents all women who gave birth in a private hospital as a private patient. Two smaller jurisdictions were excluded from analyses because of incomplete data for some of the key variables. In total, 14.3% of women who gave birth in

**1 Demographic characteristics of women who gave birth in private versus public hospitals, 2001–2004**

| Maternal characteristic | Private ($n$ = 247 489) | Public ($n$ = 541 751) |
|---|---|---|
| Mean maternal age (years) | 32.0 | 28.2 |
| Indigenous | 0.2% | 4.2% |
| Area of usual residence | | |
| Major cities | 82.2% | 64.6% |
| Regional | 16.6% | 32.4% |
| Remote | 1.2% | 2.9% |
| Born in Australia | 68.1% | 61.6% |
| Parity | | |
| None | 44.2% | 39.5% |
| One | 38.3% | 33.0% |
| Two | 13.3% | 16.4% |
| Three | 3.1% | 6.5% |
| Four or more | 1.1% | 4.5% |
| Previous caesarean section* | 30.1% | 19.8% |

*Reported by multiparous women. ◆

**2 Comparison of characteristics of women who gave birth in private versus public hospitals, 2001–2004**

| | Private ($n$ = 247 489) | Public ($n$ = 541 751) | |
|---|---|---|---|
| Maternal characteristic | No. (%) | No. (%) | OR (95% CI) |
| **Maternal age** | | | |
| 25–29 years | 57 695 (23.3%) | 168 842 (31.2%) | 1.00 |
| < 20 years | 965 (0.4%) | 35 486 (6.6%) | 12.57 (11.78–13.41)* |
| 20–24 years | 8 619 (3.5%) | 111 164 (20.5%) | 4.41 (4.30–4.51)* |
| 30–34 years | 114 219 (46.2%) | 149 700 (27.6%) | 0.45 (0.44–0.45)* |
| 35–39 years | 55 999 (22.6%) | 63 572 (11.7%) | 0.39 (0.38–0.39)* |
| ⩾ 40 years | 9 968 (4.0%) | 12 977 (2.4%) | 0.45 (0.43–0.46)* |
| Not stated | 24 (0.0%) | 10 (0.0%) | — |
| **Indigenous status** | | | |
| Non-Indigenous | 246 820 (99.7%) | 518 933 (95.8%) | 1.00 |
| Indigenous | 543 (0.2%) | 22 738 (4.2%) | 19.92 (18.29–21.69)* |
| Not stated | 126 (0.1%) | 80 (0.0%) | — |
| **Parity** | | | |
| Multiparous | 137 978 (55.8%) | 327 487 (60.4%) | 1.00 |
| Primiparous | 109 371 (44.2%) | 214 155 (39.5%) | 0.83 (0.82–0.83)* |
| Not stated | 140 (0.1%) | 109 (0.0%) | — |
| **Smoking status** | | | |
| Did not smoke | 115 641 (46.7%) | 216 755 (40.0%) | 1.00 |
| Smoked | 5 819 (2.4%) | 66 503 (12.3%) | 6.10 (5.93–6.27)* |
| Not stated | 126 029 (50.9%) | 258 493 (47.7%) | — |
| **Medical conditions/complications** | | | |
| No diabetes/hypertension | 222 103 (89.7%) | 478 719 (88.4%) | 1.00 |
| Diabetes/hypertension | 22 514 (9.1%) | 58 112 (10.7%) | 1.20 (1.18–1.22)* |
| Not stated | 2 872 (1.2%) | 4 920 (0.9%) | — |
| **Method of birth** | | | |
| Spontaneous vaginal | 119 764 (48.4%) | 374 023 (69.0%) | 1.00 |
| Assisted vaginal | 39 523 (16.0%) | 49 030 (9.1%) | 0.40 (0.39–0.40)* |
| Caesarean section | 88 160 (35.6%) | 118 656 (21.9%) | 0.43 (0.43–0.44)* |
| Not stated | 42 (0.0%) | 42 (0.0%) | — |

OR = odds ratio. * $P < 0.05$. ◆

hospital to a term singleton baby during 2001–2004 were excluded.

Maternal demographic characteristics were compared for public and private patients, including age, Indigenous status, parity, smoking during pregnancy status, any reported pre-existing or pregnancy-related diabetes or hypertension, remoteness of usual residence (assessed with the Accessibility/Remoteness Index of Australia[8]), and method of birth. Third- or fourth-degree perineal tear was the only maternal outcome with data available for study. Differential data quality, including missing data, precluded assessment of postpartum haemorrhage. For babies, the severe adverse perinatal outcomes examined were: low Apgar score (defined as an Apgar score < 7 at 5 minutes); admission to a neonatal intensive care unit or special care nursery; requirement for high level of resuscitation (defined as endotracheal intubation and/or use of external cardiac massage and ventilation); and perinatal mortality.

Descriptive and logistic regression analyses were conducted. Crude and adjusted odds ratios and 95% confidence intervals were calculated using SPSS, version 15.0 (SPSS Inc, Chicago, Ill, USA).

Ethics approval was granted from the Australian National University (LESC-CMHS 2007/0036), the University of New South Wales (HREA ref 9_03_91) and the Australian Institute of Health and Welfare Ethics Committee.

## RESULTS

During the 4-year study period, 789 240 term singleton births were recorded in Australia, of which 247 489 (31.4%) occurred in private maternity hospitals. Demographic differences between the groups of women delivering in public and private hospitals are shown in Box 1. Women delivering in private hospitals had a higher mean age and were more likely to be having their first baby. A much greater proportion of multiparous women delivering in private hospitals reported a previous caesarean section. Larger proportions of Indigenous women and those who lived outside major cities delivered in public hospitals.

To allow adjustment for potentially influential variables, these demographic differences were compared (Box 2). The proportion of teenage women giving birth was much higher in the public hospital group, whereas private hospitals had about twice the proportion of women aged ⩾ 40 years as public hospitals. Self-reported smoking was much higher in the public hospital population, and medical complications of pregnancy (diabetes and/or hyper-

**3 Perinatal outcomes for babies of women who gave birth in private hospitals compared with women who gave birth in public hospitals, 2001–2004**

| | Private | Public | | |
|---|---|---|---|---|
| Perinatal outcome | No. (%) | No. (%) | OR (95% CI) | AOR* (95% CI) |
| High level of resuscitation†‡ | 685 (0.3%) | 2 886 (0.5%) | 1.99 (1.82–2.16)§ | 2.37 (2.17–2.59)§ |
| Apgar score < 7 at 5 minutes‡ | 1 914 (0.8%) | 6 686 (1.2%) | 1.59 (1.51–1.68)§ | 1.75 (1.65–1.84)§ |
| Admitted to NICU/SCN‡ | 21 114 (8.5%) | 58 152 (10.7%) | 1.29 (1.27–1.31)§ | 1.48 (1.45–1.51)§ |
| Perinatal death | 343 (0.1%) | 1 377 (0.3%) | 1.84 (1.63–2.07)§ | 2.02 (1.78–2.29)§ |

OR = odds ratio. AOR = adjusted odds ratio. NICU = neonatal intensive care unit. SCN = special care nursery. * Adjusted for maternal age, Indigenous status, parity, smoking during pregnancy status, reported diabetes/hypertension, remoteness of usual residence, and method of birth. † Endotracheal intubation and/or external cardiac massage and ventilation. ‡ Includes live births only. § $P < 0.05$. ◆

tension) were also more common. The rates of induced labour (30.7% v 24.0%), instrumental vaginal birth (16.0% v 9.1%) and caesarean birth (35.6% v 21.9%) were all higher in the private hospital group.

The rate of third- or fourth-degree perineal injury was higher in public hospitals (0.8% v 1.4%; OR, 1.81; 95% CI, 1.72–1.91). After adjusting for maternal age, Indigenous status, parity, smoking during pregnancy status, reported diabetes or hypertension, remoteness of usual residence, and method of birth, the adjusted odds ratio (AOR) for perineal injury also favoured private hospitals (AOR, 2.28; 95% CI, 2.16–2.40). To confirm that this difference was not an artefact of the adjustment for method of birth, resulting from the lower proportion of vaginal births in the private hospitals group, we directly compared the rates of third- and fourth-degree tears by individual method of birth: the rates for spontaneous vaginal birth (0.6% v 1.3%), ventouse delivery (2.3% v 4.7%) and forceps delivery (3.7% v 7.9%) were all lower in private hospitals.

After adjusting for the same maternal variables, serious adverse neonatal outcomes showed similar differences between the two hospital groups. Term babies born in public hospitals were more likely to require high levels of resuscitation, to have an Apgar score < 7 at 5 minutes, and to require admission to a neonatal intensive care facility or special care nursery (Box 3). Perinatal death was twice as likely for babies born in public hospitals. Even using a composite for adverse perinatal outcome (patients with at least one adverse outcome), the unadjusted OR was 1.30 (95% CI, 1.28–1.33) for public hospital deliveries.

When the adverse perinatal outcomes were compared individually by method of birth, the differences between public and private hospital sectors persisted for all the adverse outcomes studied (data not shown). For example, for spontaneous vaginal births, the rate of Apgar score < 7 at 5 minutes was 0.9% in the public group compared with 0.6% in the private group. The differences for forceps deliveries (1.6% v 1.1%), ventouse deliveries (2.1% v 1.4%), and caesarean sections (1.3% v 0.5%) showed a similar pattern. The rates of perinatal death were similarly lower in private hospitals for each method of birth: spontaneous vaginal birth (0.2% v 0.1%); forceps delivery (0.5% v 0.2%); ventouse delivery (0.2% v 0.1%); and caesarean section (0.3% v 0.1%).

## DISCUSSION

This study of term singleton births in Australian public and private hospitals over a recent 4-year period found that women giving birth in public hospitals were younger, with a greater proportion admitting to smoking tobacco during pregnancy. Public hospitals also had a higher proportion of first births, Indigenous women giving birth, women who lived outside major cities, and women with medical conditions such as hypertension or diabetes. However, after adjusting for the potentially confounding variables available in the NPDC, we found that, in comparison with public hospitals, delivery of a singleton baby at term in an Australian private hospital is associated with a significant reduction in the rate of important adverse outcomes for babies. This finding was noted for all of the adverse outcomes studied, including a composite measure of perinatal health, with no adverse outcome less common in public hospitals.

There are obviously potential limitations imposed by the data available in a national population-based study of this nature. It is not possible to identify the proportion of women delivering in each group with important comorbidities such as obesity, which increases the risk of adverse outcomes[9] and is common in Australia.[10] However, obesity is associated with diabetes and hypertension,[9] so our adjustment for these comorbidities might have partially addressed the clinical effect of obesity on pregnancy outcome.

Similarly, women at social disadvantage will be over-represented in the public hospital population.[1] Social disadvantage and socioeconomic status are clearly important influences on pregnancy outcome, and individual assessment of this effect for women was beyond the scope of this study. The major adverse outcome associated with social disadvantage is low birthweight,[11] and there were more babies with a birthweight < 2500 g delivered in public hospitals (2.1% v 1.1%, $P < 0.05$), but the absolute numbers were small. Other surrogate markers of social disadvantage such as tobacco smoking,[12] teenage pregnancy,[13] and Indigenous status[14] were controlled for in the analysis. The quality of self-reported data regarding smoking status during pregnancy is open to question, but has been previously addressed in detail.[15] It should be noted that after adjustment for the variables available in the Australian national dataset, the differences in adverse outcome rates not only persisted, but actually increased.

Another potential confounding influence is that obstetricians may have transferred women with an expectation of complications to public hospitals, whereas no transfer was possible from the public hospital sector. However, the commonest circumstance for such transfer is likely to be prematurity, and these births were excluded from the study.

A number of important birth outcomes were not available for analysis in this dataset, including rates of breastfeeding, postpartum depression, maternal satisfaction, and measures of severe maternal morbidity. Previous studies have suggested that breastfeeding rates are lower in public hospital populations.[16] Furthermore, it is not possible for a study such as this to provide a cost–benefit analysis in terms of the interventions.

The differences in the rates of intervention between the two hospital settings confirms findings of previous studies from NSW in the 1990s.[3,4] In our study, birth in a private hospital was associated with increased rates of induced labour, instrumental delivery, and caesarean section. This is an important consideration, as each of these interventions

should increase the risk of adverse outcomes for either mother or baby. For example, induction of labour has been associated with increased rates of epidural anaesthesia, emergency caesarean delivery, and adverse neonatal events such as requirement for resuscitation and admission to a special care nursery.[17,18] Similarly, instrumental delivery is a strong independent risk factor for third- and fourth-degree perineal injuries.[19-21] Caesarean delivery itself is associated with an increased risk of respiratory morbidity in babies, even after 37 weeks' gestation.[22] Importantly, we found that a much greater proportion of women delivering in private hospitals had a history of previous caesarean section, which alone increases the risk of adverse maternal outcomes in subsequent pregnancies.[23-25] It is thus a notable and unexpected finding that in private hospitals with higher rates of interventions, each of which would be predicted to increase the risk of adverse outcomes, the rates of serious adverse outcome were, at a population level, lower overall than those in public hospitals. Although it remains possible that there were confounding factors that were not accounted for, the results were robust after adjustment for all variables known to influence obstetric outcome available in the national dataset.

It is a long-held orthodoxy that increased rates of obstetric intervention are "bad" for women and their babies. Our results show that although the model of obstetrician-led care is characterised by increased rates of intervention, outcomes for women with a single baby delivered at term are no worse, and further studies may determine there are benefits for women and their babies. This is consistent with findings from both the United Kingdom[26] and developing countries[27] that increases in the rate of caesarean section are associated with a reduction in the rate of perinatal mortality.

Previous smaller studies comparing obstetrician-led intrapartum care with other models have focused on rates of intervention, with no reference to outcomes.[3-6] The strengths of our study are that it used data from a large and comprehensive cohort of births, and that well defined objective outcomes (perinatal death and third- or fourth-degree perineal injury in particular) were used. The weaknesses relate to the subjective nature of some of the data available for study, and the nature of some of the exclusion criteria. For example, there is a possibility that avoiding a potential bias introduced by women transferred from private hospitals to public hospitals for care by excluding them might introduce another bias. As there is no way of knowing the individual circumstances of women with private insurance who delivered in public hospitals, the effects could only be resolved by detailed prospective study.

Despite these caveats, adjustment during analysis actually increased the ORs, and all the differences favoured obstetrician-led care. We hope that the results of this population-based study will stimulate further research into the effect of different models of intrapartum care on pregnancy outcome.

## COMPETING INTERESTS

None identified.

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