Predictors of autopsy following stillbirth in Queensland, Australia: a population based study

Ibinabo IBIEBELE^{1,2}

Frances M BOYLE^{1,2}

Dell HOREY^{1,3}

Rohan LOURIE^{1,4}

Patricia WILSON⁵

Michael COORY^{6,7}

Vicki FLENADY^{1,2}

¹ Mater Research Institute-University of Queensland, Brisbane, Australia

² School of Public Health, University of Queensland, Brisbane, Australia

³ Department of Public Health, La Trobe University, Melbourne, Australia

⁴ Translational Research Institute, Brisbane, Australia

⁵ Mater Mothers' Hospital, Mater Health Services, Brisbane, Australia

⁶ Murdoch Childrens Research Institute, Melbourne, Australia

⁷ Department of Paediatrics, University of Melbourne, Melbourne, Australia

Address for correspondence

Level 2 Aubigny Place, Raymond Terrace,
South Brisbane, Queensland, 4101, Australia

Tel: +61731632555 Fax: +61731632550

Email: Ibinabo.Ibiebele@uqconnect.edu.au

Predictors of stillbirth autopsy in Queensland (short title)

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Abstract

Background: Accurate determination of causes of stillbirth is critical to effective prevention. Autopsy remains the gold standard investigation for stillbirth, however with low autopsy rates; many stillbirths are likely to be “unexplored” rather than “unexplained”.

Aim: To determine factors associated with autopsy following stillbirth.

Materials and methods: Routinely collected population-based data on all singleton stillbirths of at least 400g birthweight or 20 weeks gestation in Queensland between July 2000 and December 2011 were examined. Adjusted odds ratios [aOR, 99%CI] were calculated accounting for sociodemographic, pregnancy and medical factors. Of interest was initially unexplained stillbirth on the death certificate; analysis was stratified by gestational age group (<24, 24-27, 28-36 and ≥ 37 weeks).

Results: Of 3842 singleton stillbirths included in these analyses, 1356 (35.3%) had an autopsy performed. Initially unexplained stillbirth was associated with decreased odds of

autopsy at late gestation (28-36 weeks, aOR 0.63 [99% CI 0.42,0.93]; ≥ 37 weeks, aOR 0.53 [99% CI 0.35,0.81]) as was intrapartum stillbirth (<24 weeks, aOR 0.63[99%CI 0.43,0.94]; 28-36 weeks, aOR 0.37 [99%CI 0.14-0.98])). Congenital abnormality (<24 weeks, ≥ 37 weeks), small-for-gestational age (<24 weeks), and primigravidity (≥ 37 weeks) were associated with increased odds of autopsy following stillbirth.

Conclusions: Pregnancy factors are associated with stillbirth autopsy. These findings have implications for development of appropriate information for parents and education of clinical staff. Further research is needed into factors influencing autopsy following stillbirth.

Introduction

Stillbirth is a devastating pregnancy outcome for women and families across the world. Many high income countries like Australia have witnessed little improvement in stillbirth rates for several decades^{1,2}. Furthermore, within many high income countries, Indigenous and minority groups often have higher risk of stillbirth^{2,3}. A large proportion of stillbirths are unexplained²; although the reported proportion of unexplained stillbirths varies with the classification system used^{4,5}. Nevertheless, accurate information on the cause of death is necessary to inform effective prevention strategies.

Since thorough post mortem investigation reveals a cause of death in a substantial number of stillbirths of unknown clinical cause, it has been argued that many stillbirths are under-investigated rather than unexplained^{2,6,7}. Autopsy remains the gold standard examination for investigating stillbirth⁸, but steady declines in autopsy rates are well documented in Australia and other high income countries⁹. These declines contribute to the failure to improve in this area. We need to better understand the factors associated with autopsy following stillbirth to counter the decline in autopsy rates. Queensland stillbirth autopsy rates are around 37%³, a figure well below the recommended rate of 75%¹⁰. The objective of this study was to determine the maternal and pregnancy factors associated with autopsy following stillbirth in a high income setting.

Materials and methods

We undertook a population-based cross sectional study involving all singleton stillbirths in Queensland of at least 20 weeks gestation or 400 grams birthweight occurring between July

2000 and December 2011. Stillbirths resulting from terminations of pregnancy for maternal psychosocial reasons were excluded as factors affecting decisions for autopsy may differ within this group. Similarly analysis was restricted to singleton stillbirths because of differences in the type and distribution of cause of death which may influence autopsy rates¹¹. Data for this study were obtained from the Queensland Perinatal Data Collection (QPDC), a statewide registry capturing information on all registered births in Queensland.

This dataset included maternal demographic, pregnancy, medical information and birth outcomes. Maternal demographic information included: age, Indigenous status, region of birth, marital status, socioeconomic status and geographic location. Indigenous status was determined from maternal self-reporting as Australian Aboriginal or Torres Strait Islander or not. The latter two demographic factors were derived from maternal residential postcode. Socioeconomic status was derived by mapping postcodes to the Australian Bureau of Statistics Index of relative socioeconomic disadvantage, a measure ranking geographic areas according to social and economic wellbeing¹². Likewise, geographic location was derived by mapping postcodes to the Australian Standard Geographic Classification (ASGC) Remoteness structure, a measure of physical distance to the nearest urban centre¹³.

Pregnancy and medical data included: gravidity, hospital accommodation status (public, private), smoking, substance use, assisted conception use, diabetes (pre-existing and gestational), hypertensive disorders (pre-existing, pregnancy-induced and pre-eclampsia/eclampsia) and antepartum haemorrhage. Birth outcome data included: congenital abnormality, small-for-gestational age (defined as birthweight less than 10th Australian population percentile for gestational age, sex and plurality), gestational age at birth, diagnosis of unexplained stillbirth on the death certificate, and type of stillbirth (antepartum, intrapartum and unknown if antepartum or intrapartum). All variables were treated as categorical.

Statistical Analysis

The primary outcome measure was autopsy following stillbirth (either full or partial). Differences in characteristics between births where an autopsy was performed following stillbirth and those where it was not were assessed using Chi square test. Unadjusted association between characteristics and autopsy was explored using univariate logistic

regression. Significant interactions were found between gestational age and initially unexplained fetal death as well as between gestational age and the presence of a congenital abnormality. Multivariate analysis was undertaken including all predictors with a significant univariate association with stillbirth autopsy as well as other important maternal characteristics. Analysis was stratified by gestational age group (<24, 24-27, 28-36 and ≥ 37 weeks), although this was not specified a priori. A significance level of $p < 0.01$ was set due to multiple comparisons.

Statistical analysis was performed using Stata/SE for Windows 13.1 (StataCorp LP, College Station, TX, USA). Ethics approval was obtained from the Queensland Health Central Office (Ref: HREC/05/QHC/009), University of Queensland School of Population Health (Ref: II180313) and Mater Health Services (Ref: HREC/15/MHS/36/AM07) Human Research Ethics Committees.

Results

A total of 3,842 women with a singleton stillbirth between July 2000 and December 2011 were included in these analyses. Of these women, 1356 (35.3%) had an autopsy performed for their stillborn infant. The triennial autopsy rate ranged from 28.3% to 38.4% during the study period. There was no statistically significant change in overall autopsy rates over the study period, although rates increased by 9% per annum among stillbirths of 24-27 weeks ($p_{\text{trend}} < 0.01$).

The characteristics of the study cohort by autopsy status are given in Table 1. Women who had a stillbirth where an autopsy was performed were more likely to be primigravid, have a small-for-gestational age infant or an infant with a congenital abnormality than women who did not. They were less likely to be Indigenous, experience antepartum haemorrhage, deliver at less than 24 weeks, have an initially unexplained stillbirth or an intrapartum stillbirth (Table 1).

Stillbirths <24 weeks gestation

Among those with a stillbirth in the less than 24 week gestational age group, stillbirths that were small-for-gestational age (aOR 1.50, [99% CI 1.06,2.11]) or had a congenital abnormality (aOR 1.62 [99% CI 1.12,2.35]) were more likely to have an autopsy performed.

Type of stillbirth was associated with decreased odds of having an autopsy in this group: intrapartum stillbirth (aOR 0.63, [99% CI 0.43,0.94]) and stillbirths where it was unknown if they were antepartum or intrapartum (aOR 0.60, [99% CI 0.39-0.91]) (Table 2).

Stillbirths 24-27 weeks gestation

Among those with a stillbirth in the 24-27 week gestational age group, there were increased odds of autopsy for stillbirth among women with a small-for-gestational age infant (aOR 1.55, [99% CI 0.90,2.67]), However the result did not reach statistical significance.

Conversely, autopsy was less likely for stillbirths where it was unknown if the stillbirth was antepartum or intrapartum (aOR 0.23, [99% CI 0.05,0.78]) (Table 2).

Stillbirths 28-36 weeks gestation

Women who had an intrapartum stillbirth (aOR 0.37, [99% CI 0.14,0.98]) or an initially unexplained stillbirth (aOR 0.63, [99% CI 0.42,0.93]) were less likely to have had an autopsy for their baby (Table 2).

Stillbirths ≥ 37 weeks gestation

Among those women who had term stillbirths, primigravidity (aOR 1.74, [99% CI 1.13,2.68]) and the presence of a congenital abnormality (aOR 2.90, [99% CI 1.61,5.22]) were associated with increased odds of having an autopsy performed following stillbirth. In contrast, initially unexplained stillbirth (aOR 0.53, [99% CI 0.35,0.1]) was associated with decreased odds of autopsy (Table 2).

Discussion

This population study found various pregnancy factors were associated with autopsy post stillbirth and that associations varied with gestational age.

It was a paradoxical finding that stillbirths occurring in late gestation (at 28 weeks gestation or more) that were unexplained at the time of completing the death certificate and prior to many stillbirth investigations being completed, were less likely to have an autopsy. The reason for this is not immediately clear. We were unable to determine which investigations

besides autopsy were conducted. However, among stillbirths that were described as unexplained on the death certificate, the leading categories after subsequent investigation and classification were: unexplained antepartum fetal death (55.8%), spontaneous preterm (11.7%), antepartum haemorrhage (9.0%) and fetal growth restriction (5.5%). Classification to the latter three categories was less likely to rely on autopsy findings⁴. Furthermore, these findings may reflect barriers to autopsy consent that have been observed in surveys of health care professionals' view and practices, these include gaps in knowledge and training² and an underestimation of the value of autopsy¹⁴. More broadly, an attitude of fatalism or "these things happen" is prevalent in relation to stillbirth^{2, 15} and combined with the message from some healthcare providers that the autopsy may not reveal an explanation for the cause of death¹⁶ may deter parents who are faced with this difficult decision.

We found intrapartum stillbirth was associated with decreased odds of autopsy for preterm stillbirths. These findings are in accordance with a qualitative study which showed that parents were more likely to have an autopsy for antepartum stillbirth than intrapartum stillbirth¹⁷. These findings may reflect the importance of having time to separate the autopsy decision from the immediate shock of the baby's death. Further analysis of these preterm intrapartum stillbirths showed that the leading categories of stillbirth were: congenital abnormality (44.3%), spontaneous preterm (34%) and antepartum haemorrhage (8.0%). Apart from congenital abnormality, classification to the latter two categories depend largely on information from clinical history⁴.

Although not statistically significant after adjustment for pregnancy factors, we found Indigenous women were less likely to have an autopsy for their stillborn baby. These findings are particularly important as Indigenous women have higher rates^{1, 3} and risk¹⁸ of stillbirth, as well as higher rates of unexplained stillbirth³. There is limited research into the views and experiences of Indigenous parents and families following stillbirth or cultural perceptions of stillbirth, and further research into the underlying factors affecting decision making is needed. The presence of antepartum haemorrhage was associated with decreased odds of autopsy for stillbirths occurring at 24 weeks or more gestation, though not statistically significant. This may reflect the ability of clinicians to discern cause of death from maternal clinical history and presentation in such instances^{4, 19}; and that post mortem examination may not necessarily provide much additional information.

The presence of congenital abnormality was associated with increased odds of autopsy, in stillbirths occurring at 20-23 weeks gestation and at term (≥ 37 weeks). This finding may reflect the value of autopsy to determine or confirm the cause of death in stillbirths where the suspected cause of death is congenital abnormality^{20, 21}. Antenatal diagnosis of congenital abnormality is likely to have involved multiple consultations between parents, families and specialists with development of trust. Rapport with the health care provider is important for seeking autopsy consent⁴. Clinicians may be motivated to seek consent as a result of interest in “interesting cases” or to confirm antenatal diagnosis.

We found increased odds of autopsy associated with small-for-gestational age (SGA) for stillbirths occurring at less than 24 weeks. SGA is a proxy measure for fetal growth restriction which is an important risk factor for stillbirth²². It is determined from biometric measurements at autopsy or antenatal ultrasound evidence of growth restriction after excluding infection and congenital abnormality which are associated with SGA⁴. A subset of pregnancies with SGA may have been monitored intensively and parents would have been informed of the poor prognosis. Similar to preterm intrapartum stillbirths, these parents may have had more time to reach some degree of acceptance of the loss. Information from autopsy may assist in management of subsequent pregnancies as there is evidence of increased risk of SGA recurrence²³.

This study found primigravidity was associated with increased odds of autopsy where stillbirth occurred at term. This may reflect parents’ concerns or need for reassurance about achieving a successful future pregnancy outcome. Autopsy results can assist in determining cause of death and inform management of future pregnancies⁴.

Perinatal autopsy has been shown to improve understanding of the cause of death in 20-86% of cases²⁴; and placental histology provides information regarding cause of death in 52% of cases²⁵. However the quality of autopsy varies²⁶; and improved quality of autopsy as well as reporting and interpretation was found when performed by a perinatal pathologist^{27, 28}.

Furthermore, a significant barrier to improving the quality of information on cause of death is a shortage of perinatal pathologist². It is unclear which clinical scenario results in the highest yield of information for autopsy following stillbirth. Nevertheless, autopsy together with placental examinations could contribute to decreasing the rate of unexplained stillbirths²⁹.

This large population study is to our knowledge the first study exploring the association between autopsy and maternal factors in a quantitative manner using population data within an Australian context. The main limitations of the study related to the use of routinely collected data. Whether or not autopsy was performed could have been used as a proxy measure to indicate parental consent for autopsy, as consent was required for autopsy. However this was problematic as data were unavailable for the proportion of parents who were approached for consent. Furthermore, there may be instances where consent was given but autopsy was not performed although we suspect this would have occurred in a very small number of cases with minimal effect on the study findings. In addition, it was not possible to evaluate the comprehensiveness of stillbirth investigations as data were unavailable on the other tests or investigations performed.

This study highlights the need for further research into the factors that drive parental decision-making among the subgroups identified, particularly for parents less likely to consent to autopsy. This study also emphasises the need to ensure parents are given appropriate counselling regarding stillbirth autopsy to ensure they make an informed decision which is best for them. The importance of clinician education about the value of autopsy and approaching parents for consent is also emphasised.

Conclusion

This population study confirms that pregnancy factors are associated with autopsy after stillbirth. The study findings can be used to inform the development of appropriate parent-focussed information resources as well as education of clinical staff. Of concern is the decreased likelihood of autopsy for unexplained stillbirths. Further research is needed to understand the various underlying factors influencing autopsy following stillbirth.

References

1. Hilder L, Li Z, Zeki R, Sullivan AE. Stillbirths in Australia, 1991-2009. Perinatal Statistics Series No. 29. Cat. no. PER 63. Canberra: AIHW National Perinatal Epidemiology and Statistics Unit, 2014.
2. Flenady V, Wojcieszek AM, Middleton P, et al. Stillbirths: recall to action in high-income countries. *The Lancet* 2016; **387**(10019): 691-702.
3. Ibiebele I, Coory M, Boyle FM, Humphrey M, Vlack S, Flenady V. Stillbirth rates among Indigenous and non-Indigenous women in Queensland, Australia: is the gap closing? *BJOG: An International Journal of Obstetrics & Gynaecology* 2015; **122**(11): 1476-83.
4. Flenady F, King J, Charles A, et al. Clinical practice guideline for perinatal mortality. Version 2.2 April 2009. www.psanz.com.au. Brisbane, 2009.
5. Korteweg FJ, Gordijn SJ, Timmer A, Holm JP, Ravise JM, Erwich JJ. A placental cause of intra-uterine fetal death depends on the perinatal mortality classification system used. *Placenta* 2008; **29**(1): 71-80.
6. Measey MA, Charles A, d'Espaignet ET, Harrison C, Deklerk N, Douglass C. Aetiology of stillbirth: unexplored is not unexplained. *Aust N Z J Public Health* 2007; **31**(5): 444-9.
7. The Stillbirth Collaborative Research Network Writing Group. Causes of death among stillbirths. *JAMA* 2011; **306**(22): 2459-68.
8. Ernst LM. A pathologist's perspective on the perinatal autopsy. *Seminars in Perinatology* 2015; **39**(1): 55-63.
9. Stock SJ, Goldsmith L, Evans MJ, Laing IA. Interventions to improve rates of post-mortem examination after stillbirth. *Eur J Obstet Gynecol Reprod Biol* 2010.
10. Royal College of Pathologists. Guidelines on autopsy practice: Report of a working group of the Royal College of Pathologists. 2002.
http://www.rcpath.org/NR/rdonlyres/412AEB13-F5B8-4C6B-A087-2833223C7A4D/0/main_document.pdf2004).

11. Li Z, Zeki R, Hilder L, Sullivan AE. Australia's mothers and babies 2011. Perinatal statistics series no. 28. Cat. no. Per 59. Canberra: AIHW National Perinatal Epidemiology and Statistics Unit, 2013.
12. Australian Bureau of Statistics. An Introduction to Socio-Economic Indexes for Areas (SEIFA) 2006. ABS Cat. No. 2039.0. Canberra: ABS, 2008.
13. Australian Bureau of Statistics. Statistical Geography Volume 1 - Australian Standard Geographical Classification (ASGC). ABS Cat. No. 1216.0. Canberra: ABS, 2006.
14. Heazell AEP, McLaughlin MJ, Schmidt EB, et al. A difficult conversation? The views and experiences of parents and professionals on the consent process for perinatal postmortem after stillbirth. *BJOG: An International Journal of Obstetrics & Gynaecology* 2012; **119**(8): 987-97.
15. Frøen JF, Cacciatore J, McClure EM, et al. Stillbirths: why they matter. *The Lancet* 2011; **377**(9774): 1353-66.
16. Cartledge PH, Dawson AT, Stewart JH, Vujanic GM. Value and quality of perinatal and infant postmortem examinations: cohort analysis of 400 consecutive deaths. *BMJ* 1995; **310**(6973): 155-8.
17. Meaney S, Gallagher S, Lutomski JE, O' Donoghue K. Parental decision making around perinatal autopsy: a qualitative investigation. *Health Expectations* 2014.
18. Ibiebele I, Coory M, Smith GCS, et al. Gestational age specific stillbirth risk among Indigenous and non-Indigenous women in Queensland, Australia: a population based study. *BMC Pregnancy and Childbirth* 2016; **16**: 159.
19. ACOG Practice Bulletin No. 102: management of stillbirth. *Obstet Gynecol* 2009; **113**(3): 748-61.
20. Laing IA. Clinical aspects of neonatal death and autopsy. *Semin Neonatol* 2004; **9**(4): 247-54.
21. Silver RM, Varner MW, Reddy U, et al. Work-up of stillbirth: a review of the evidence. *Am J Obstet Gynecol* 2007; **196**(5): 433-44.

22. Gardosi J, Madurasinghe V, Williams M, Malik A, Francis A. Maternal and fetal risk factors for stillbirth: population based study. *BMJ* 2013; **346**.
23. Voskamp B, Kazemier B, Ravelli ACJ, Schaaf J, Mol BW, Pajkrt E. Recurrence of small-for-gestational-age pregnancy: analysis of first and subsequent singleton pregnancies in The Netherlands. *Am J Obstet Gynecol* 2013; **208**: 374.e1-6.
24. Downe S, Kingdon C, Kennedy R, Norwell H, McLaughlin MJ, Heazell A. Post-mortem examination after stillbirth: views of UK-based practitioners. *European Journal of Obstetrics and Gynecology and Reproductive Biology* 2012; **162**(1): 33-7.
25. Bukowski R, Carpenter M, Conway D, et al. Causes of death among stillbirths. *JAMA* 2011; **306**(22): 2459-68.
26. Vujanic GM, Cartlidge PH, Stewart JH, Dawson AJ. Perinatal and infant postmortem examinations: how well are we doing? *J Clin Pathol* 1995; **48**(11): 998-1001.
27. Khong TY, Gordijn SJ. Quality of placental pathology reports. *Pediatr Dev Pathol* 2003; **6**(1): 54-8.
28. Sun CC, Revell VO, Belli AJ, Viscardi RM. Discrepancy in pathologic diagnosis of placental lesions. *Arch Pathol Lab Med* 2002; **126**(6): 706-9.
29. Bonetti LR, Ferrari P, Trani N, et al. The role of fetal autopsy and placental examination in the causes of fetal death: a retrospective study of 132 cases of stillbirths. *Arch Gynecol Obstet* 2011; **283**(2): 231-41.

Table 1: Maternal and pregnancy characteristics by autopsy status for 3,842 women with a singleton stillbirth, Queensland, mid 2000-2011

Characteristics	Autopsy (n=1 356)	No Autopsy (n=2 486)	Unadjusted Odds Ratio (95% CI)[§]
Maternal age			
≤18 years	39 (2.9)	71 (2.9)	1.03 (0.69-1.55)
19-24 years	368 (27.1)	558 (22.5)	1.24 (1.04-1.48)
25-30 years	422 (31.1)	794 (31.9)	1.00 (Reference)
31-34 years	279 (20.6)	489 (19.7)	1.07 (0.89-1.30)
35+ years	248 (18.3)	574 (23.1)	0.81 (0.67-0.98)
Smoker[†]	204 (15.0)	375 (15.1)	0.89 (0.73-1.08)
Indigenous	89 (6.6)	265 (10.7)	0.59 (0.46-0.76)
Maternal region of birth			
Africa	21 (1.5)	27 (1.1)	1.43 (0.81-2.55)
Americas and Caribbean	13 (1.0)	20 (0.8)	1.20 (0.59-2.42)
Eastern Asia	16 (1.2)	40 (1.6)	0.74 (0.41-1.32)
Central, South and West Asia	22 (1.6)	36 (1.4)	1.13 (0.66-1.92)
South East Asia	33 (2.4)	63 (2.5)	0.97 (0.63-1.48)
Europe	63 (4.6)	81 (3.3)	1.43 (1.02-2.01)
Australia and New Zealand	1 164 (85.8)	2 145 (86.3)	1.00 (Reference)
Oceania	20 (1.5)	68 (2.7)	0.54 (0.33-0.90)
Socioeconomic status			
Highest ranked 20%	174 (12.8)	270 (10.9)	1.00 (Reference)
Middle ranked 60%	926 (68.3)	1 679 (67.5)	0.86 (0.70-1.05)
Lowest ranked 20%	251 (18.5)	531 (21.4)	0.73 (0.58-0.93)
Substance Use	28 (2.1)	38 (1.5)	1.36 (0.83-2.22)
Primiparity	473 (34.9)	662 (26.6)	1.47 (1.28-1.70)
Assisted Conception	51 (3.8)	96 (3.9)	0.97 (0.69-1.38)
Public patient	1 113 (82.1)	2 020 (81.3)	1.05 (0.89-1.25)
Antepartum haemorrhage	201 (14.8)	497 (20.0)	0.70 (0.58-0.83)

Characteristics	Autopsy (n=1 356)	No Autopsy (n=2 486)	Unadjusted Odds Ratio (95% CI) [§]
Pre-existing diabetes	35 (2.6)	52 (2.1)	1.24 (0.80-1.91)
Gestational diabetes	56 (4.1)	71 (2.9)	1.47 (1.03-2.09)
Pre-existing hypertension	28 (2.1)	52 (2.1)	0.99 (0.62-1.57)
Pregnancy-induced hypertension	34 (2.5)	39 (1.6)	1.61 (1.01-2.57)
Pre-eclampsia and Eclampsia	58 (4.3)	82 (3.3)	1.31 (0.93-1.85)
Gestational age group			
20-23 weeks	441 (32.5)	1 106 (44.5)	0.56 (0.47-0.67)
24-27 weeks	186 (13.7)	311 (12.5)	0.84 (0.67-1.06)
28-36 weeks	377 (27.8)	571 (23.0)	0.93 (0.77-1.12)
≥ 37 weeks	348 (25.7)	490 (19.7)	1.00 (Reference)
Gender			
Female	612 (45.1)	1 171 (47.1)	1.00 (Reference)
Male	721 (53.2)	1 284 (51.6)	1.07 (0.94-1.23)
Undetermined	23 (1.7)	29 (1.2)	1.52 (0.87-2.65)
Small for gestational age	460 (33.9)	716 (28.8)	1.28 (1.11-1.48)
Congenital abnormality	483 (35.6)	741 (29.8)	1.30 (1.13-1.50)
Unexplained stillbirth[*]	523 (38.6)	1 071 (43.1)	0.83 (0.72-0.95)
Type of stillbirth			
Antepartum	1 024 (75.5)	1 574 (63.3)	1.00 (Reference)
Intrapartum	179 (13.2)	501 (20.2)	0.55 (0.46-0.66)
Unknown	153 (11.3)	411 (16.5)	0.57 (0.47-0.70)
Geographic location			
Major city	803 (59.2)	1 358 (54.6)	1.00 (Reference)
Regional	501 (36.9)	1 009 (40.6)	0.84 (0.73-0.96)
Remote	51 (3.8)	119 (4.8)	0.72 (0.52-1.02)
Epoch			
2000-2002	282 (20.8)	452 (18.2)	1.00 (Reference)
2003-2005	260 (19.2)	659 (26.5)	0.63 (0.51-0.78)
2006-2008	378 (27.9)	674 (27.1)	0.90 (0.74-1.09)

Characteristics	Autopsy (n=1 356)	No Autopsy (n=2 486)	Unadjusted Odds Ratio (95% CI) [§]
2009-2011	436 (32.2)	701 (28.2)	1.00 (0.82-1.21)

[†] Data on maternal smoking collected from mid 2005 onwards.

[‡] Stillbirth unexplained on death certificate (ICD10AM code: P95)

[§] Odds of autopsy relative to no autopsy

Percentages may add up to greater than 100% due to rounding.

Table 2: Maternal and pregnancy factors associated with stillbirth autopsy, Queensland, mid 2000-2011

Characteristics	Adjusted odds ratios (99% confidence interval) [§]			
	< 24 weeks (n=1547)	24-27 weeks (n=497)	28-36 weeks (n=948)	≥37 weeks (n=838)
Maternal Age (Reference: 25-30 years)				
≤18 years	1.28 (0.46-3.58)	0.63 (0.12-3.30)	0.91 (0.34-2.42)	0.91 (0.18-4.56)
19-24 years	1.24 (0.82-1.89)	1.54 (0.73-3.24)	1.44 (0.90-2.32)	1.13 (0.66-1.92)
31-34 years	0.94 (0.60-1.45)	1.16 (0.56-2.41)	1.06 (0.63-1.77)	1.26 (0.72-2.20)
35+ years	0.70 (0.45-1.10)	0.59 (0.28-1.23)	0.78 (0.46-1.32)	1.03 (0.59-1.80)
Australian Indigenous status (Reference: Non Indigenous)				
Indigenous	0.53 (0.27-1.04)	0.45 (0.14-1.52)	0.83 (0.41-1.71)	0.55 (0.25-1.19)
Socioeconomic status (Reference: Highest ranked 20%)				
Middle ranked 60%	0.71 (0.45-1.14)	0.78 (0.33-1.82)	1.24 (0.68-2.26)	1.00 (0.53-1.90)
Lowest ranked 20%	0.58 (0.32-1.03)	0.59 (0.22-1.60)	1.35 (0.67-2.75)	0.81 (0.38-1.73)
Primigravidity (Reference: No)				
Yes	1.14 (0.80-1.63)	1.02 (0.56-1.86)	1.45 (0.97-2.17)	1.74 (1.13-2.68)
Antepartum haemorrhage (Reference: No)				
Yes	1.26 (0.81-1.94)	0.53 (0.27-1.86)	0.70 (0.45-1.09)	0.59 (0.31-1.13)
Small for gestational age (Reference: No)				
Yes	1.50 (1.06-2.11)	1.55 (0.90-2.67)	0.84 (0.57-1.23)	1.13 (0.73-1.75)
Unexplained fetal death (Reference: No)				
Yes	0.86 (0.56-1.34)	0.71 (0.39-1.30)	0.63 (0.42-0.93)	0.53 (0.35-0.81)
Congenital abnormality (Reference: No)				
Yes	1.62 (1.12-2.35)	0.99 (0.51-1.94)	1.10 (0.70-1.73)	2.90 (1.61-5.22)

Characteristics	Adjusted odds ratios (99% confidence interval) [§]			
	< 24 weeks (n=1547)	24-27 weeks (n=497)	28-36 weeks (n=948)	≥37 weeks (n=838)
Type of stillbirth (Reference: Antepartum)				
Intrapartum	0.63 (0.43-0.94)	0.37 (0.14-1.00)	0.37 (0.14-0.98)	1.03 (0.53-2.03)
Unknown	0.60 (0.39-0.91)	0.20 (0.05-0.78)	0.60 (0.25-1.42)	0.77 (0.38-1.55)
Remoteness (Reference: Major City)				
Regional	0.95 (0.68-1.34)	0.78 (0.44-1.37)	0.90 (0.61-1.34)	0.90 (0.59-1.38)
Remote	1.77 (0.78-4.03)	0.65 (0.15-2.75)	0.94 (0.35-2.53)	0.32 (0.09-1.19)
Epoch (Reference: 2000-2002)				
2003-2005	0.57 (0.35-0.94)	0.70 (0.30-1.68)	0.77 (0.45-1.32)	0.59 (0.33-1.05)
2006-2008	0.86 (0.55-1.35)	1.36 (0.58-3.18)	0.90 (0.53-1.52)	1.02 (0.57-1.81)
2009-2011	0.84 (0.54-1.32)	1.57 (0.71-3.47)	1.26 (0.75-2.12)	0.91 (0.52-1.60)

[§] Odds of autopsy relative to no autopsy. Multivariate logistic model adjusted for maternal age, Indigenous status, socioeconomic status, gravidity, presence of antepartum haemorrhage, small for gestational age, initially unexplained fetal death, congenital abnormality, type of stillbirth, remoteness and study period (epoch).

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Author/s:

Ibiebele, I;Boyle, FM;Horey, D;Lourie, R;Wilson, P;Coory, M;Flenady, V

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