Classification and description of stillbirths in New South Wales, 2002–2004

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ABSTRACT

Objective: To describe the pattern of stillbirths by cause and gestation period in New South Wales since the introduction of the Perinatal Society of Australia and New Zealand perinatal death classification (PSANZ-PDC); and to assess the agreement between classifications on cause of death between local hospital committees and the Perinatal Outcomes Working Party (POWP — a subgroup of the NSW Department of Health Ministerial Maternal and Perinatal Committee).

Design, participants and setting: Population-based retrospective cohort study of all 258 045 births in NSW and all 1264 stillbirths classified by the POWP in 2002–2004, based on linked data on perinatal deaths from the NSW Midwives Data Collection and the NSW Ministerial Maternal and Perinatal Committee.

Main outcome measures: Pattern of stillbirths by cause and gestation period; and interobserver agreement on classification of cause of death (according to the PSANZ-PDC) between local hospital review committees and the POWP.

Results: The most common classification was unexplained antepartum death, comprising 41.5% of the cohort and 60% of stillbirths of ⩾ 37 weeks' gestation. These unexplained stillbirths were more likely to have had an autopsy performed than the explained stillbirths (45% v 36%; $\chi^2 = 10.1$; df = 1; $P = 0.001$). Agreement on cause of death differed by cause of death classification, with an overall κ statistic of 0.638.

Conclusion: Unexplained antepartum death is the most common classification of stillbirths near term, and these stillbirths are more likely to have had an autopsy. Although reported interobserver agreement is high for PSANZ-PDC, in practice it is relatively low between hospital mortality review committees and the POWP.

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In Australia, stillbirth is defined as no sign of life after birth in babies of at least 20 weeks' gestation or at least 400 g birthweight. In the past 50 years, there has been a decline in the rate of both stillbirths and neonatal deaths in Australia and other developed countries. However, this decline has not been sustained and, in fact, stillbirth rates have remained static for the last 10 years.[1] The most recent Australian data from the National Perinatal Statistics Unit (NPSU) reports a stillbirth rate of 7.3 per 1000 births.[2] Stillbirths account for two-thirds of all perinatal deaths in Australia, and 28% of these remain unexplained.[2]

Classification of stillbirth is essential for both understanding and future prevention. In New South Wales, all perinatal deaths are reported to the Midwives Data Collection (MDC).[3] Hospital guidelines for review and reporting of perinatal deaths are described in a NSW Department of Health circular.[4] After hospital review, perinatal deaths of fetuses of at least 22 weeks' gestation or 500 g birthweight are reviewed by the Perinatal Outcomes Working Party (POWP), which is a subgroup of NSW Health's NSW Ministerial Maternal and Perinatal Committee.

New South Wales has been using the Perinatal Society of Australia and New Zealand perinatal death classification (PSANZ-PDC) since 2002.[5] This classification system was previously called the Australia and New Zealand antecedent classification of perinatal mortality, and includes both obstetric and fetal factors, as well as autopsy findings and placental abnormality.[6] It has reportedly high interobserver reliability, with a κ statistic ranging from 0.83–0.95.[6]

We undertook this study to describe the pattern of stillbirths by cause and gestation period in NSW since the introduction of the PSANZ-PDC, and to assess interobserver agreement of the PSANZ-PDC between local hospital review committees and the POWP committee.

METHODS

We performed a statewide population-based cohort study using de-identified linked data from the NSW MDC and the perinatal death data from the NSW Ministerial Maternal and Perinatal Committee. The MDC data were used to calculate rates, and the perinatal death data were used to both describe the cause of death and assess agreement on the classification of cause of death between hospital mortality review committees and the POWP. Ethical approval was obtained from the NSW Department of Health Ethics Committee.

The NSW MDC is a population-based surveillance system covering all births in NSW public and private hospitals, as well as home births. It encompasses all livebirths and stillbirths of at least 20 weeks' gestation or at least 400 g birthweight. The MDC relies on the attending midwife or doctor to complete a notification form when a birth occurs. Demographic, maternal health, pregnancy, labour, delivery, and perinatal outcomes data are collected.[3]

The NSW Ministerial Maternal and Perinatal Committee is a quality assurance committee established under the NSW *Health Administration Act 1982*, and is privileged under the Act to carry out confidential reviews of both maternal and perinatal deaths. Members are appointed by the NSW Minister for Health. The subgroup, POWP, reviews perinatal deaths of fetuses of at least 22 weeks' gestation or at least 500 g birthweight. The purpose of the slightly higher threshold is to focus attention on deaths that are more likely to be preventable, but since 2006, it has been lowered to 20 weeks' gestation in keeping with the MDC. Information available to the POWP at review is forwarded by hospitals, and includes a confidential report on perinatal death and autopsy and placental pathology reports, as well as any other information felt to be relevant by the local hospital perinatal death review committee. Information considered by the POWP is confidential.

Study population

Records for babies from the MDC and perinatal deaths data compiled by the POWP were linked using probabilistic record linkage methods in Automatch software (MatchWare Technologies Inc, Silver Spring,

1 Number and rates of stillbirths among 258 045 total births in New South Wales in 2002–2004

	Stillbirths	
	⩾ 20 weeks' gestation	⩾ 22 weeks' gestation
Total stillbirths	1599	1291
Rate per 1000 births	6.2	5.0
Unexplained rate per 1000 births*	—	2.0

* Presented only for stillbirths at ⩾ 22 weeks' gestation because these stillbirths are reviewed by the Perinatal Outcomes Working Party, which focuses on potentially preventable outcomes. ◆

Md, USA). Both datasets covered the 3 years 2002–2004.

Stillbirth rates were calculated from the MDC. Cause of death classification (according to the PSANZ-PDC) was extracted from the perinatal death database of the NSW Ministerial Maternal and Perinatal Committee for all stillborn infants who had been reviewed by the POWP. Gestation was categorised into four groups when assessing cause of death. The early gestation group extended to 20 weeks to comply with the definition of stillbirth, but most reviewed cases were at 22 or more weeks' gestation in accordance with the focus of the POWP. Classification of cause of death by the POWP was compared with the classification by local hospital review committees to assess agreement.

Statistical analysis

Data analysis was performed with SPSS, version 14.0 (SPSS Inc, Chicago, Illinois, USA). Independent proportions were compared using the χ^2 test. Agreement between cause of death classifications by hospital review committees and the POWP was determined with pairwise κ statistics.[7] The κ values were interpreted following previously described guidelines.[8]

RESULTS

There were 258 045 births over the 3-year study period. Total perinatal deaths numbered 1877, comprising 1264 stillbirths and 613 neonatal deaths. The 1264 stillbirths reviewed by the POWP comprised 98% of the 1291 stillbirths of 22 or more weeks' gestation reported to the MDC. An autopsy was performed in 472 cases (37.5%), and placental histopathology was examined in 1071 cases (84.7%).

Incidence

Total stillbirths and stillbirth rates for the study period are shown in Box 1. Rates are presented for stillbirths at both 20 or more and 22 or more weeks' gestation. Stillbirth rates were below 1 per 1000 undelivered pregnancies for gestation periods ranging from for 22–39 weeks; the rate increased markedly at later gestational ages with the rate for 40 weeks' gestation being 1.56 per 1000, for 41 weeks' being 7.75 per 1000 and for 42 weeks' being 10.71 per 1000 undelivered pregnancies.

Cause of death

The classification of cause of death after review by the POWP is shown in Box 2. The most common classification was unexplained antepartum death. Over 60% of the stillbirths were attributable to the three most common classifications: unexplained antepartum death; congenital abnormality; and spontaneous preterm delivery. Fetal growth restriction as a classification of cause of death was attributed in only 3.2% of cases, however, infants in 288 stillbirths (22.8%) had a birthweight below the 10th percentile. This is likely to reflect the fact that further evidence (eg, placental evidence or ultrasound of growth restriction) is required for the classification of fetal growth restriction to be applied.

2 Causes of death for stillbirths reviewed by the Perinatal Outcomes Working Party according to the perinatal death classification of the Perinatal Society of Australia and New Zealand

Cause of death	No. (%) of cases
Unexplained antepartum death	524 (41.5%)
Congenital abnormality	168 (13.3%)
Spontaneous preterm delivery	131 (10.4%)
Antepartum haemorrhage	105 (8.3%)
Perinatal conditions	96 (7.6%)
Hypertension	69 (5.5%)
Maternal disease	59 (4.7%)
Fetal growth restriction	40 (3.2%)
Perinatal infection	39 (3.1%)
Hypoxic peripartum death	31 (2.5%)
No obstetric antecedent	2 (0.2%)
Total	1264 (100%)

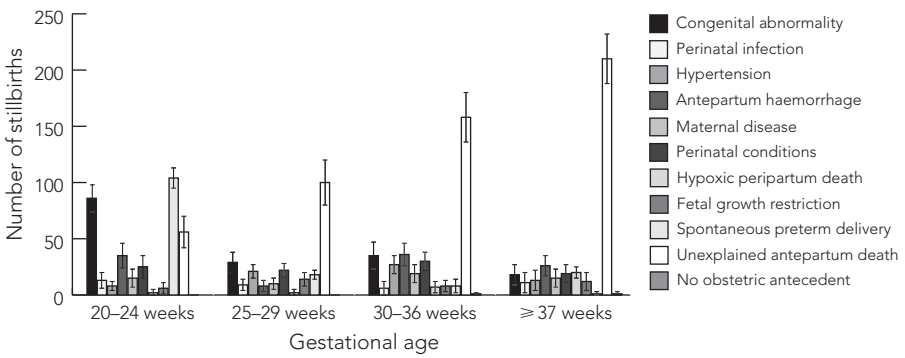
Cause of death by gestational age

The most common causes of death differed by gestational age group, and are shown in Box 3. For extremely preterm stillbirths at 20–24 weeks' gestation, the most common classification was spontaneous preterm delivery, whereas for stillbirths at 37 or more weeks' gestation, unexplained antepartum death was the most common classification.

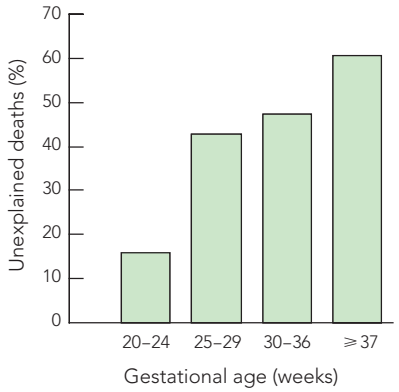
Unexplained deaths

The proportion of stillbirths classified as unexplained antepartum death increased with increasing gestational age (Box 4).

3 Classification of causes of death by gestational age for 1264 stillbirths reviewed by the Perinatal Outcomes Working Party



4 Proportion of unexplained antepartum deaths by gestational age among 1264 stillbirths in New South Wales, 2002–2004



Stillbirths classified as unexplained antepartum death were significantly more likely to have had an autopsy performed (221/489 [45%] v 251/697 [36%]; $\chi^2 = 10.1$; df = 1; $P = 0.001$)].

Interobserver agreement on the classification system

Agreement on classifications of causes of death between the POWP and hospital review committees is shown in Box 5. Agreement varied according to cause of death, with greater than 80% agreement for congenital abnormality, antepartum haemorrhage and hypoxic peripartum death. Stillbirths with these three causes of death were less likely to have had an autopsy performed (96/304 [31.6%] v 376/960 [39.2%]; $P = 0.017$) or placental abnormality (233/304 [76.6%] v 838/960 [87.3%]; $P < 0.001$).

DISCUSSION

In this large population-based study in NSW, unexplained antepartum death was the most common classification of stillbirths near term, and near-term stillborn infants were more likely to have had an autopsy. Although reported interobserver agreement for the PSANZ-PDC is high,[6] we found that in practice it is relatively low between hospital perinatal mortality review committees and the POWP, particularly for unexplained stillbirths.

Our population-based cohort of stillbirths was one of the largest studied to date, evaluating 1264 stillbirths from 258 045 births, and a standardised classification system of cause of death was used. Having an expert committee centrally review all deaths and agree on cause of death: (i) means that by the time of review, important information that may change the classification, such as autopsy or placental results, will be available; and (ii) negates the use of official death certificates for cause of death, which may be unreliable. The PSANZ-PDC is used to classify both stillbirths and neonatal deaths, so

5 Agreement between hospital review committees and the Perinatal Outcomes Working Party (POWP) on the cause of perinatal deaths for the 815 stillbirths reviewed by both, according to the classification of the Perinatal Society of Australia and New Zealand (overall $\kappa = 0.638$)

	Hospital classification											
POWP classification	Congenital abnormality	Perinatal infection	Hypertension	Antepartum haemorrhage	Maternal disease	Perinatal conditions	Hypoxic peripartum death	Fetal growth restriction	Spontaneous preterm delivery	Unexplained antepartum death	No obstetric antecedent	Total
Congenital abnormality	113 (95.0%)	0	0	0	0	1	1	0	2	2	0	119
Perinatal infection	0	13 (56.5%)	0	0	0	1	1	0	5	3	0	23
Hypertension	0	0	24 (49.0%)	10	1	2	2	4	0	4	2	49
Antepartum haemorrhage	0	1	0	64 (90.1%)	1	0	1	0	2	2	0	71
Maternal disease	0	0	2	2	17 (44.7%)	1	1	2	5	7	1	38
Perinatal conditions	3	0	0	1	1	45 (77.6%)	1	1	0	5	1	58
Hypoxic peripartum death	0	1	0	0	0	0	17 (81.0%)	0	0	2	1	21
Fetal growth restriction	0	0	0	1	0	1	1	19 (65.5%)	2	5	0	29
Spontaneous preterm delivery	1	0	0	8	1	3	4	1	70 (76.1%)	3	1	92
Unexplained antepartum death	5	5	2	12	6	14	31	30	8	185 (59.1%)	15	313
No obstetric antecedent	1	0	0	0	0	0	0	0	0	0	1 (50.0%)	2
Total	123	20	28	98	27	68	60	57	94	218	22	

causes of perinatal deaths overall are presented in national reports.[2] It is important to report neonatal deaths and stillbirths separately as we have done in this study, as aetiologies may be quite distinct. Significantly, we assessed cause of death by gestational age group because causes of stillbirths differ depending on gestation period. We were able to assess stillbirth rates because of the linkage to the birth data from the MDC.

The weakness of large population-based datasets is that analysis is restricted to the information collected. Importantly, in assessing classification of cause of death, we were unable to assess the extent of investigations performed apart from autopsy and placental examination, as other information is not routinely collected. We were also unable to know what information was available to local hospital committees at the time of classifying the cause of death and completing the confidential report form, or to know the expertise of the committee. However, the requirement that all hospitals must have a multidisciplinary team review all perinatal deaths as part of the recommended quality improvement process usually dictates that the team is experienced in mortality audit, and that the classification of cause of death is performed some time after the birth, when the results of most investigations are available.

The percentage of unexplained stillbirths in our cohort was 41.5%. Previous literature on unexplained stillbirth has reported proportions of unexplained stillbirths from around 10% up to as high as 70%. The contribution of unexplained deaths varies considerably depending on the classification system used. Classification systems that have a particular focus, for example, on placental causes or growth restriction have low proportions of unexplained deaths.[9,10] Older classification systems, which are widely used in both developed and developing countries (eg, the extended Wigglesworth or modified Aberdeen classifications[11-13]), have very high proportions of unexplained deaths. The PSANZ-PDC definition of unexplained antepartum deaths states: "deaths of normally formed fetuses before the onset of labour where no predisposing factors are considered likely to have caused the death". This definition of unexplained death does not include autopsy findings and, coupled with the low autopsy rate in our cohort, means that many of these unexplained deaths were also unexplored.

The proportion of unexplained deaths has been shown to be lower in studies with an extensive test protocol and higher autopsy rates.[14,15] Tests and autopsy findings lead to deaths that might have been classified as unexplained being classified in an explained category. In the datasets we used, unexplained deaths had more autopsies performed, suggesting that there was more of an attempt to investigate stillbirths with no apparent cause than those that were otherwise explained.

It is known (and is also clear from our data) that the principal causes of death differ by gestational age group.[16] Despite this, standard investigation protocols usually request the full gamut of suggested tests for all stillbirths regardless of gestational age. The PSANZ Perinatal Mortality Audit Guidelines recommend a "non-selective" approach to investigation.[5] From our data, it would appear that, for early stillbirths, investigations that focus on known or suspected causes of preterm birth (eg, infection) would be most important. Later stillbirths that are more likely to be unexplained require as full a set of investigations as possible, including an autopsy.

The interobserver agreement on the PSANZ-PDC between hospital committees and the POWP varied substantially, and is lower in our study than in previous reports.[6] This may be because when interobserver reliability of the system was initially reported, all those using the system had a high degree of experience in perinatal mortality audit. National consensus to use the PSANZ-PDC at the PSANZ Congress in Adelaide in 2005 has not been followed by a widespread local hospital implementation program, and the poor interobserver agreement seen in our study may reflect that. However, it does provide useful information to guideline developers about which perinatal death classifications may require more explanation for classifiers, and could help determine educational strategies to help hospital perinatal audit groups use the system.

Population surveillance like this study is extremely important for documenting where improvements in health care could be implemented, and strategies to increase the autopsy rate in NSW could represent a suitable target for policymakers and clinicians. Future research clearly needs to focus particularly on unexplained stillbirths, as they occur most commonly at or near term, and are both a tragedy for the family and a dilemma for clinicians in managing future pregnancies.

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COMPETING INTERESTS

None identified.

AUTHOR DETAILS

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