


## Original Research

# Pregnancy Outcomes Following Previous Stillbirth: A 3-Year Single-Centre Retrospective Cohort Study

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## Abstract

**Background:** Stillbirth is a devastating pregnancy outcome. In 2020, there were 2273 stillbirths in Australia. Up to 80% of affected patients become pregnant again within 12 to 18 months. However, subsequent pregnancies are often accompanied by both medical and emotional challenges. The primary aim of this study was to describe the antenatal, birth, and neonatal outcomes of pregnancy following a previous stillbirth, and to inform the establishment of a Pregnancy After Loss Clinic (PALC) at our institution. Secondary aims were to describe the characteristics of the index stillbirth and to explore potential differences in antenatal care and pregnancy outcomes in the subsequent pregnancy based on the gestational age and mode of the index stillbirth. **Methods:** This was a 3-year, single-centre retrospective quantitative cohort study investigating patients who completed a pregnancy beyond 20 weeks at the Royal Women's Hospital between January 1, 2020, and December 31, 2022, following a previous pregnancy that ended in stillbirth. Descriptive statistical analyses and subgroup analyses were conducted to investigate the extent of care and outcomes in the subsequent pregnancy, based on the gestational age (<28 weeks or ≥28 weeks) and mode (fetal death in utero or termination of pregnancy) of index stillbirth. **Results:** Our study included 114 women and 120 infants. On average, 38 women with a history of stillbirth presented to the Royal Women's Hospital each year. Most pregnancies followed fetal death in utero due to fetal anomaly. These women conceived again within 1.8 years of their index stillbirth and received increased antenatal surveillance. There were high rates of labour induction (39.5%, n = 45) and caesarean delivery (41.3%, n = 47). Nearly a quarter of neonates were admitted to subsequent neonatal care (23.3%, n = 28). However, overall neonatal outcomes were reassuring, with most infants born at term (75.4%, n = 86) and a mean birthweight of 2945.0 g (95% confidence interval (CI): 2795.3–3094.5 g). **Conclusions:** Pregnancy following a previous stillbirth involves increased care provision and higher rates of intervention, but both pregnancy and neonatal outcomes are otherwise reassuring.

**Keywords:** pregnancy; stillbirth; fetal death in utero; termination of pregnancy; subsequent; outcomes; antenatal; birth; neonatal

## 1. Introduction

Stillbirth is a devastating outcome of pregnancy. In Australia, stillbirth is defined as “the birth of an infant of at least 20 weeks’ gestation or if gestation is unknown, weighing at least 400 grams, which shows no signs of life after birth” [1]. In 2020, there were 2273 stillbirths, or 7.7 stillbirths per 1000 births in Australia [1]. Furthermore in 2022, of the 8292 births at the Royal Women's Hospital (Parkville and Sandringham), stillbirth accounted for 1.5% (n = 124) of them [1,2].

Research shows that many patients who experience stillbirth will start thinking about conceiving again early on, and up to 80% become pregnant again within the next 12 to 18 months [3–5]. However, pregnancy after previous stillbirth comes with both medical and emotional challenges. A history of pregnancy loss increases risks of complications in a subsequent pregnancy; these include placenta-mediated complications such as pre-eclampsia, fetal growth restriction and abruption, premature birth, induction of labour and low birthweight [6–8]. The experience of those preg-

nant following a previous loss can include significant anxiety, depressive and post-traumatic syndrome symptoms, delayed antenatal attachment, isolation, and fear [8,9]. In addition, different aspects of antenatal care can also be triggering or come with conflicting emotional responses [8].

Providing a dedicated, individualised, consultant-led antenatal service providing continuity of care and emotional support is important to ameliorate perinatal anxiety and stress, aid with the navigation through grief, and improve the pregnancy experience. In addition, the most recent Stillbirth CRE guideline ([Approach to care | Stillbirth CRE eLearning](#)) outlines considerations for specific care needs for women in a subsequent pregnancy after stillbirth. The findings of our study will support the establishment of a dedicated Pregnancy After Loss Clinic (PALC) for parents with a history of stillbirth, as part of The Women's Strategic Plan (2022–2025) to improve patient experience, meet growing demand, and change people's expectations towards health care [10].



The primary aim of this study was to describe the antenatal, birth and neonatal outcomes of pregnancy after previous stillbirth. Secondary aims include describing the characteristics of the index stillbirth, and if gestational period of stillbirth, and whether the index stillbirth was fetal death in utero or termination of pregnancy, has implications on the extent of antenatal care, birth and neonatal outcomes in future pregnancies.

## 2. Methods

In this study, 'stillbirth' refers to "the birth of an infant at or after 20 weeks' gestation, or, if gestation is unknown, weighing at least 400 grams, and showing no signs of life after birth". 'Recurrent stillbirth' refers to the occurrence of stillbirths in two consecutive pregnancies. 'Woman' refers to the person who is pregnant and gives birth and encompasses a diverse spectrum of gender identities.

This study was a 3-year single-centre retrospective cohort study conducted at the Royal Women's Hospital (RWH) in Victoria, Australia's first and leading specialist maternity hospital with over 7000 births annually. Individual patient consent to participate was not obtained, as this was a cohort study with approval by the institutional ethics committee. Ethics approval was acquired by the Royal Women's Hospital Research Committee and Royal Women's Hospital Human Research Ethics Committee (Project ID: AQA23/13), in accordance with the principles outlined in the Declaration of Helsinki.

Patients who completed a pregnancy beyond 20 weeks at the Royal Women's Hospital between January 1, 2020, and December 31, 2022, whose previous pregnancy ended in stillbirth, were identified by a hospital Data and Systems Manager using the Victorian Perinatal Data Collection database, which collects and analyses information on the obstetric conditions, procedures, and outcomes of every birth in Australia. The 3-year time frame was chosen in consideration of the logistical challenges in accessing data and medical records prior to the introduction of the Electronic Medical Record (Epic) at the hospital. This resulted in a total sample size of 114 women and 120 infants.

We collected data in the following categories: maternal demographics, index stillbirth, and the antenatal, birth, and neonatal outcomes in subsequent pregnancy. The causes of stillbirth were classified per the major categories of the Perinatal Society of Australia and New Zealand Perinatal Death Classification system (PSANZ-PDC) [11].

A descriptive statistical approach was chosen in consideration for our sample size and stated objective of our study. Data was analysed using SPSS Version 29 (IBM SPSS Statistics, Chicago, IL, USA). Categorical variables are displayed as frequencies with the corresponding number of subjects, with all category cut-offs based on those reported by the Australian Institute of Health and Welfare, except for the total number of antenatal ultrasounds, which

they did not study [1]. Continuous variables are displayed as the mean value with 95% confidence intervals (CI).

Subgroup analyses were conducted to identify any differences in the extent of antenatal care and pregnancy outcomes of patients depending on gestation (<28 or ≥28 weeks) and mode (fetal death in utero or termination of pregnancy) of stillbirth. The Chi-squared test was used to compare categorical variables where the expected frequency was 5 or more. Fisher's exact test was used to compare categorical variables where the expected frequency was less than 5. The independent samples *t*-test, with two-sided *p* and equal variance not assumed, was used to compare the means of quantitative variables. Data is presented as frequencies and percentages, with accompanying *p* values.

## 3. Results

### 3.1 Maternal Demographics

114 women whose previous pregnancy ended in stillbirth gave birth at the Royal Women's Hospital between 2020 and 2022 inclusive. This accounted for 120 infants, including 4 sets of twins and 1 set of triplets. The mean maternal age at birth was 32.9 years (95% CI, 32.0–33.9). The mean maternal body mass index (BMI) pre-pregnancy was 26.5 kg/m<sup>2</sup> (95% CI, 25.3–27.7), with 26.3% (*n* = 30) and 21.1% (*n* = 24) of women having overweight (25.0–29.9 kg/m<sup>2</sup>) and obese (≥30.0 kg/m<sup>2</sup>) BMIs respectively.

Prior to their pregnancy, most patients had a parity of one (46.5%, *n* = 53) or two (31.6%, *n* = 36), identified as neither Aboriginal nor Torres Strait Islander (94.7%, *n* = 108), and were non-smokers at less than 20 weeks' gestation (93.9%, *n* = 107). Those who did smoke (6.1%, *n* = 7) all continued to do so for the rest of their pregnancy. Most pregnancies were spontaneously conceived (93.0%, *n* = 106). Most patients did not have pre-existing diabetes mellitus (95.6%, *n* = 109) or hypertension (99.1%, *n* = 113) (Table 1).

### 3.2 Index Stillbirth

The mean gestational age at which stillbirths occurred was 27.2 weeks (95% CI, 26.0–28.3, not stated *n* = 2). Most stillbirths occurred prior to 28 weeks' gestation (64.9%, *n* = 74), and were fetal deaths in utero (72.8%, *n* = 83) as opposed to terminations of pregnancy (27.2%, *n* = 31).

Per patient records, the leading three causes of stillbirth overall were congenital fetal anomaly (28.9%, *n* = 33), unexplained antepartum fetal death (14.0%, *n* = 16) and placental dysfunction (14.0%, *n* = 16). Per patient records, the leading three causes of fetal death in utero were unexplained antepartum fetal death (19.3%, *n* = 16), placental dysfunction (16.9%, *n* = 14) and spontaneous preterm labour or rupture of membranes (10.8%, *n* = 9). The leading cause of termination of pregnancy alone was by far congenital fetal anomaly (80.6%, *n* = 25), followed by maternal psychosocial indications (9.7%, *n* = 3) and placental dysfunction.

**Table 1. Population and health demographics of women at the time of their subsequent pregnancy after previous stillbirth.**

Age (years)	Count (n = 114)	%
<20	2	1.8
20–24	8	7.0
25–29	21	18.4
30–34	41	36.0
35–40	35	30.7
40 and over	7	6.1
Gravidity		
2	35	30.7
3	31	27.2
4	22	19.3
5 or more	26	22.8
Parity		
1	53	46.5
2	36	31.6
3	16	14.0
4	4	3.5
5 or more	5	4.4
Indigenous Status		
Neither Aboriginal nor Torres Strait Islander	108	94.7
Aboriginal but not Torres Strait Islander	6	5.3
Pre-pregnancy BMI (kg/m <sup>2</sup> )		
Overweight (25.0–29.9)	30	26.3
Obese ( $\geq 30.0$ )	24	21.1
Smoking status at <20 weeks		
Non-smoker	107	93.9
Smoker	7	6.1
Use of artificial reproductive therapy		
No	106	93.0
Yes	6	5.3
Not stated	2	1.7
Pre-existing diabetes mellitus		
None	109	95.6
Type 2	3	2.6
Type 1	2	1.8
Pre-existing hypertension		
None	113	99.1

BMI, body mass index.

tion (6.5%, n = 2). Women gave birth again on average 1.8 years (95% CI, 1.5–2.1, not stated n = 19) after their previous stillbirth (Table 2).

### 3.3 Antenatal Care

The mean gestational age at first antenatal visit was 11.9 weeks (95% CI, 10.9–12.8, no antenatal care n = 1), with approximately two-thirds of patients' booking visits occurring at less than 14 weeks (68.4%, n = 78). Most

patients had an obstetrician as their main antenatal care provider (88.6%, n = 101). One woman that did not seek antenatal care due to psychosocial reasons relating to a complex history of substance use disorder and involvement with child protection services.

The mean number of antenatal ultrasounds women underwent at the hospital was 5.9 (95% CI, 5.2–6.5, range 0–17), with nearly three-quarters of patients having 3 to 10 ultrasounds (72.8%, n = 83). The mean number of antenatal visits to the hospital was 12.4 (95% CI, 11.2–13.6, range 0–40). These do not include ultrasounds or antenatal visits outside of the hospital. 22.8% (n = 26) of women were diagnosed with gestational diabetes mellitus, most after 24 weeks of gestation (n = 17). Over a half of these women required management with insulin (61.5%, n = 16) (Table 3).

### 3.4 Birth Outcomes

Most women had an obstetrician as their intrapartum lead carer (74.6%, n = 85). The average gestational age at birth was 37.6 weeks (95% CI, 37.1–38.2), with majority giving birth at term (75.4%, n = 86). The most common mode of birth was a spontaneous vaginal birth (50.0%, n = 57), followed by planned caesarean birth (20.2%, n = 23) and then unplanned caesarean section without labour (15.8%, n = 18). The overall caesarean rate was 41.3% (n = 47).

Most women underwent an induction of labour (39.5%, n = 45), of whom 66.7% (n = 30) had a spontaneous vaginal birth, 22.2% (n = 10) an assisted vaginal birth and 11.1% (n = 5) proceeded to unplanned caesarean section without labour. The mean estimated blood loss in pregnancy was 464.9 mL (95% CI, 393.0–536.8). 28.0% (n = 25) of patients experienced postpartum haemorrhage, which we defined as >500 mL within 24 hours of birth, of whom 10.7% (n = 3) required blood transfusion (Table 4).

### 3.5 Neonatal Outcomes

120 infants were born between 2020 and 2022, including 4 sets of twins and 1 set of triplets. 97.5% (n = 117) were liveborn and 2.5% (n = 3) were stillborn and died before labour. Of those three stillborn, two were fetal deaths in utero due to antepartum haemorrhage and one was a medical termination of pregnancy.

Of the two fetal deaths in utero, one of these occurred at 29.9 weeks in a patient whose last stillbirth occurred 17 months prior at 36.0 weeks, due to severe fetal growth restriction <1st centile with abnormal dopplers. The other of these occurred at 25.0 weeks in a patient whose last stillbirth occurred three years prior at 24.7 weeks gestation, with unclear aetiology due to the patient refusing care, with long term disengagement with health services and substance abuse disorder.

The one termination of pregnancy at 25.0 weeks was due to fetal craniosynostosis syndrome, secondary to a de novo mutation identified on exome testing, in a patient

**Table 2. Characteristics of the index stillbirth, including the classification, timing and cause of stillbirth.**

Classification of stillbirth	Count (n = 114)	%
Fetal death in utero	83	72.8
Termination of pregnancy	31	27.2
Gestational age at stillbirth		
<28 weeks (Early)	74	64.9
≥28 + 0 weeks (Late)	38	33.3
Not stated	2	1.8
Overall causes of stillbirth		
Congenital fetal anomaly	33	28.9
Unknown, no records	17	14.9
Unexplained antepartum fetal death	16	14.0
Placental dysfunction or causative placental pathology	16	14.0
Spontaneous preterm labour or rupture of membranes	9	7.9
Antepartum haemorrhage	8	7.0
Specific perinatal conditions	6	5.3
Maternal psychosocial indications	3	2.6
Maternal medical condition	2	1.8
Perinatal infection	2	1.8
Congenital infection	1	0.9
Complications of multiple pregnancy	1	0.9
Causes of fetal death in utero	Count (n = 83)	%
Unknown, no records	17	20.5
Unexplained antepartum fetal death	16	19.3
Placental dysfunction or causative placental pathology	14	16.9
Spontaneous preterm labour or rupture of membranes	9	10.8
Congenital fetal anomaly	8	9.6
Antepartum haemorrhage	8	9.6
Specific perinatal conditions	6	7.2
Maternal condition	2	2.4
Perinatal infection	2	2.4
Complications of multiple pregnancy	1	1.2
Causes of termination of pregnancy	Count (n = 31)	%
Congenital fetal anomaly	25	80.6
Maternal psychosocial indications	3	9.7
Placental dysfunction or causative placental pathology	2	6.5
Congenital infection	1	3.2

Causes of stillbirth, fetal death in utero and termination of pregnancy are classified per the major categories of the Perinatal Society of Australia and New Zealand Perinatal Death Classification system (PSANZ-PDC).

whose last stillbirth seven months previously was also medically terminated for a fetal anomaly. This patient subsequently had a liveborn baby at 38.7 weeks without complications one year later.

53.3% (n = 64) of infants were female. The mean birthweight was 2945.0 g (95% CI, 2795.3–3094.5 g). Most babies had Apgar scores between 7 and 10 at both 1 minute and 5 minutes (87.5%, n = 105 and 94.2%, n = 113 respectively). 2.5% (n = 3) of infants were born with congenital anomalies, all of which were identified antenatally. Two were cardiac (truncus arteriosus, first-degree heart block) and one was cranial (craniosynostoses) (Table 5).

23.3% (n = 28) of infants were admitted to neonatal care after birth, half to the neonatal intensive care unit (53.6%, n = 15) and half to the special care nursery (46.4%, n = 13). Of the 28 babies born pre-term (<37 weeks), 42.8% (n = 12) were admitted to neonatal intensive care. Of those admitted to the neonatal intensive care unit, there is only one known mortality at 80 days old due to severe cardiac anomalies first detected in the antenatal period.

### 3.6 Sub-group Analysis Per Gestation

Years before next birth was unknown for 18 women due to incomplete patient records, thus total number was

**Table 3. Antenatal outcomes of pregnancy after previous stillbirth, including extent of antenatal care and antenatal complications.**

Gestational age at booking	Count (n = 114)	%
Less than 14 weeks	78	68.4
14 to 20 weeks	30	26.3
After 20 weeks	5	4.4
No antenatal care	1	0.9
Antenatal care provider		
Obstetrician	101	88.6
Midwife	11	9.6
General Practitioner	1	0.9
None	1	0.9
Number of antenatal visits		
0	1	0.9
1 to 6	9	7.9
7 to 9	18	15.8
10 or more	69	60.5
Not stated	17	14.9
Number of ultrasounds		
0	7	6.1
1 to 2	8	7.0
3 to 10	83	72.8
10 to 20	16	14.0
Fetal growth restriction		
Yes	3	2.6
No	111	97.4
Gestational diabetes mellitus		
None	88	77.2
Diagnosed $\leq 24$ weeks	9	7.9
Diagnosed $> 24$ weeks	17	14.9
Management of gestational diabetes mellitus	Count (n = 26)	%
Insulin	16	61.5
Diet and exercise	9	34.6
Oral hypoglycemics	1	3.8

94. The total number of antenatal visits was unknown for 15 women due to incomplete patient records, thus total number was 97 (Table 6).

### 3.7 Sub-group Analysis Per Mode of Stillbirth

There was no significant relationship between neither gestation ( $< 28$  vs.  $\geq 28$  weeks) or mode (fetal death in utero vs. termination of pregnancy) of stillbirth, and the antenatal, birth and neonatal outcomes of the subsequent pregnancy. Namely, there was no statistically significant difference in the gestational age at booking and the number of antenatal visits or ultrasound scans, gestational age, mode of birth, labour in subsequent pregnancy, livebirth rates and baby birthweights (Table 7).

**Table 4. Birth outcomes of pregnancy after previous stillbirth, including timing, mode and indications for elective caesarean.**

Gestation at birth	Count (n = 114)	%
$< 37$ weeks (Preterm)	28	24.6
$\geq 37$ weeks (Term)	86	75.4
Mode of birth		
Spontaneous vaginal	57	50.0
Elective caesarean section	23	20.2
Emergency caesarean section without labour	18	15.8
Assisted vaginal	10	8.7
Emergency caesarean section with labour	6	5.3
Labour		
Induction of labour	45	39.5
Spontaneous	36	31.6
No labour	33	28.9
Lead intrapartum carer		
Obstetrician	85	74.6
Midwife	28	24.6
Not stated	1	0.9
Indication for elective caesarean	Count (n = 23)	%
Repeat caesarean section	10	43.5
Obstructed labour	5	21.7
Poor obstetric history	3	13.0
Multiple gestation	3	13.0
Pregnancy related condition	1	4.3
Severe intrauterine growth restriction	1	4.3

## 4. Discussion

### 4.1 Maternal Baseline

Our results highlight a potential need for more lifestyle counselling surrounding weight loss and smoking cessation, with the average BMI of 26.5 kg/m<sup>2</sup> corresponding to the overweight category, and 6.1% of patients who continued smoking beyond 20 weeks' gestation in their pregnancy. BMI and smoking are both established modifiable risk factors for stillbirth, and improving smoking cessation rates has been a long-time national priority to reduce stillbirth rates [12,13].

### 4.2 Antenatal Care

Most women gave birth again within 1.8 years of their index stillbirth, which is consistent with previous studies [3–5]. This may reflect many patients' intense desires for parenthood after stillbirth as one patient described, "there is such a gap, it has to be filled" [4,5]. The optimum time to conceive after stillbirth has been widely debated with no clear consensus, although a prior international cohort study of 14,452 births by Regan *et al.* [14] demonstrated that conception within one year of stillbirth was not associated with increased rates of stillbirth, preterm birth or small-for-gestational age birth.



**Table 5. Neonatal outcomes in pregnancy after previous stillbirth including birth status, neonatal health and need for post-birth care.**

Birth status	Count (n = 120)	%
Liveborn	117	97.5%
Infant sex		
Female	64	53.3%
Birthweight (g)		
<2500	24	20.0
2500–4000	90	75.0
>4000	6	5.0
Apgar at 1		
0–3	7	5.8
4–6	7	5.8
7–10	105	87.5
Not stated	1	0.8
Apgar at 5		
0–3	4	3.3
4–6	2	1.7
7–10	113	94.2
Not stated	1	0.8
Congenital anomaly		
None	112	93.3
Detected antenatally	3	2.5
Detected postnatally	5	4.2
Post-birth neonatal care		
None	92	76.7
Neonatal intensive care	15	12.5
Special care nursery	13	10.8

Reassuringly, most women who have had a history of stillbirth had an obstetrician as their primary care provider in the antenatal and intrapartum setting in their subsequent pregnancy. The Australian Pregnancy Care Guidelines by the Department of Health and Aged Care (2020) recommends 7 antenatal visits for multiparous patients with uncomplicated pregnancies, and more if they have experience stillbirth in a previous pregnancy [15]. It is therefore reassuring to see that patients attended on average 12.4 antenatal visits throughout their pregnancy.

Patients in our cohort received, on average, more ultrasound scans than the standard two typically offered to all pregnant women. The standard schedule usually includes one scan between 8 to 14 weeks to assess gestational age, and another between 18 to 20 weeks for fetal morphology assessment [15]. This increased antenatal surveillance aligns with existing research and guidelines. For example, due to the higher risk of bearing a small-for-gestational-age infant, the Royal College of Obstetricians and Gynaecologists (RCOG) recommends serial growth scans from 26–28 weeks for pregnancies following stillbirth [16–18].

Notably, there is limited high-level evidence to guide the management of pregnancies following a stillbirth, meaning that care remains largely non-standardized and dependent on individual clinician judgment [19]. Several interventions are widely recognized as beneficial, including fetal growth monitoring, smoking cessation, and the optimization of comorbidities such as hypertension and diabetes. The increased number of ultrasound scans and antenatal visits in our cohort likely reflects the implementation of increased growth monitoring. However, the low incidence of smoking and patients with pre-existing hypertension or diabetes, constrain our ability to fully assess the effects of the other interventions.

Other recommendations, such as advising mothers to sleep on their side or to monitor fetal movements, likely played a role in antenatal care but were not consistently documented, making it difficult to quantify their impact in preventing recurrent stillbirth. Similarly, additional support options, such as access to bereavement counselling, direct contact with care providers, and specialist antenatal classes for bereaved parents, may offer benefits but were not routinely offered or measured. Future studies should explore the effects of these interventions in preventing recurrent stillbirth and improving pregnancy outcomes.

Given the variety of care options available, the provision of additional surveillance and interventions must be carefully evaluated to ensure clinical necessity. Many women seek individualised patient-centred care such as additional ultrasound scans and ready access to fetal monitoring, which are in general benign and provide reassurance. In our public hospital system, these services do not incur additional costs, and women usually welcome the choice regarding induction of labour and planned caesarean birth. However, it is also important to consider that such additional care may cause distress in some patients, incur greater costs to the healthcare system, and lead to higher rates of interventions without significantly improving outcomes [20–23]. These interventions also carry their own risks, including infection, uterine rupture, and increased risks in subsequent pregnancies, such as miscarriage, stillbirth, placenta previa, placenta accreta, and placental abruption [24].

#### 4.3 Index Stillbirth

In 2020 in Australia, the leading three causes of stillbirth in descending order included congenital anomaly (31.5%), maternal conditions (13.6%) and unexplained antepartum death (12.7%) [1]. This is in line with data from the Royal Women's Hospital in 2022, where congenital anomaly was also the leading cause of stillbirth (38%), followed by maternal conditions (27%) including psychosocial reasons and then unexplained antepartum fetal death (8.1%).

Interestingly, in our cohort, while congenital anomaly (28.9%, n = 33) and unexplained antepartum fetal death (14.0%, n = 16) were top causes of stillbirth, they were

**Table 6. Subgroup analysis of antenatal, birth and neonatal outcomes by gestational period of index stillbirth (n = 112, estimated gestational age at index stillbirth not available for 2 women).**

	Early stillbirth (<28 weeks) (n = 74)		Late stillbirth (≥28 weeks) (n = 38)		p value
Years before next birth (n = 94)	n	%	n	%	
0 to 1	16	17.6	14	38.9	0.467 <sup>1</sup>
1 to 2	26	44.8	15	41.7	
More than 2	16	17.6	7	19.4	
Gestational age at booking (n = 112)					
Less than 14 weeks	54	73.0	24	63.2	0.302 <sup>2</sup>
14 to 20 weeks	16	21.6	12	31.6	
After 20 weeks	4	5.4	1	2.6	
No antenatal care	0	0.0	1	2.6	
Antenatal visits (n = 97)					
Less than 10	17	25.0	11	37.9	0.226 <sup>1</sup>
10 or more	51	75.0	18	62.1	
Ultrasound scans (n = 112)					
0 to 2	12	16.2	3	7.9	0.141 <sup>1</sup>
3 to 10	49	66.2	32	84.2	
10 to 20	13	17.6	3	7.9	
Gestation at birth (n = 112)					
<37 weeks (Preterm)	16	21.6	11	28.9	0.485 <sup>1</sup>
≥37 weeks (Term)	58	78.4	27	71.1	
Mode of birth (n = 112)					
Vaginal	41	55.4	25	65.8	0.091 <sup>1</sup>
Elective caesarean	19	25.7	3	7.9	
Emergency caesarean	14	18.9	10	26.3	
Labour (n = 112)					
Spontaneous	23	31.1	13	34.2	0.745 <sup>1</sup>
Induction	28	37.8	16	42.1	
None	23	31.1	9	23.7	
Birth status (n = 112)					
Liveborn	73	98.6	37	97.4	1.000 <sup>2</sup>
Stillborn	1	1.4	1	2.6	
Birthweight (g) (n = 112)					
<2500	12	16.2	6	15.8	0.261 <sup>2</sup>
2500 to 4000	60	81.1	28	73.7	
>4000	2	2.7	4	10.5	
	Mean	95% CI	Mean	95% CI	p value
Gestation at birth (n = 112)	37.7	37.4–38.0	37.4	36.9–38.0	0.624 <sup>3</sup>
Ultrasounds (n = 112)	6.01	5.5–6.5	5.55	5.1–6.0	0.497 <sup>3</sup>
Antenatal visits (n = 97)	13.0	12.2–13.8	11.0	10.2–11.9	0.103 <sup>3</sup>

<sup>1</sup>Chi-squared test (Exact 2-sided significance), <sup>2</sup>Fisher's exact test (Exact 2-sided significance), <sup>3</sup>Independent samples *t*-test, equal variance not assumed, two-sided *p*.

alongside placental dysfunction (14.0%, n = 16) instead. The reasons for this discrepancy are unclear, however we hypothesise that maternal conditions causing stillbirth may affect fertility and impact patients' chances of becoming pregnant again, or predispose them to miscarry in future pregnancies prior to 20 weeks.

The 14.0% (n = 16) rate of unexplained antepartum fetal death, while the second most common cause of stillbirth in our cohort, is lower compared to other studies which have reported rates of 16% to 44% [7,25].

#### 4.4 Birth and Neonatal Outcomes

The rate of recurrent stillbirth was 2.5% in our cohort, the same as that reported by Lamont *et al.* [6] in a systematic review and metaanalysis of 16 studies accounting for 3,412,079 pregnancies. It is controversial whether previous stillbirth confers higher risk of stillbirth in future pregnancies, with some studies reporting no to minimal increase, and others up to a five-fold increase [13,26–28]. The risk of recurrence may also depend on the characteristics of the index stillbirth, with studies suggesting that re-

**Table 7. Subgroup analysis of antenatal, birth and neonatal outcomes by mode of index stillbirth.**

	Fetal death in utero (n = 83)		Termination of pregnancy (n = 31)		p value
	n	%	n	%	
Years before next birth (n = 95)					
0 to 1	23	34.3	7	25.0	0.075 <sup>1</sup>
1 to 2	24	35.8	17	60.7	
More than 2	20	29.9	4	14.3	
Not stated	16		3		
Gestational age at booking (n = 114)					
Less than 14 weeks	60	73.2	14	51.9	0.057 <sup>2</sup>
14 to 20 weeks	22	26.8	13	48.1	
Not stated	1		4		
Antenatal visits (n = 97)					
Less than 10	22	26.5	6	42.9	0.219 <sup>2</sup>
10 or more	61	73.5	8	57.1	
Not stated	0		17		
Ultrasound scans (n = 114)					
0 to 2	12	14.5	3	9.7	0.720 <sup>2</sup>
3 to 10	63	75.9	24	77.4	
11 to 20	8	9.6	4	12.9	
Gestation at birth (n = 114)					
<37 weeks (Preterm)	19	22.9	9	29.0	0.625 <sup>1</sup>
≥37 weeks (Term)	64	77.1	22	71.0	
Mode of birth (n = 114)					
Vaginal	50	60.2	17	54.8	0.646 <sup>1</sup>
Elective caesarean	15	18.1	8	25.8	
Emergency caesarean	18	21.7	6	19.3	
Labour (n = 114)					
Spontaneous	30	36.1	6	19.4	0.194 <sup>1</sup>
Induction	32	38.6	13	41.9	
None	21	25.3	12	38.7	
Birth status (n = 114)					
Liveborn	80	96.4	31	100.0	0.561 <sup>2</sup>
Stillborn	3	3.6	0	0.0	
Birthweight (g) (n = 114)					
<2500	13	15.7	7	22.6	0.687 <sup>2</sup>
2500 to 4000	65	78.3	22	71.0	
>4000	5	6.0	2	6.5	
	Mean	95% CI	Mean	95% CI	p value
Gestation at birth (n = 114)	37.7	37.0–38.4	37.4	36.5–38.4	0.629 <sup>3</sup>
Ultrasounds (n = 114)	6.2	5.0–6.6	5.8	4.8–7.5	0.600 <sup>3</sup>
Antenatal visits (n = 97)	12.3	11.0–13.5	13.3	7.8–18.6	0.629 <sup>3</sup>

<sup>1</sup>Chi-squared test (Exact 2 sided significance), <sup>2</sup>Fisher's exact test (Exact 2 sided significance), <sup>3</sup>Independent samples *t*-test, equal variance not assumed, two-sided *p*.

currence is particularly associated with early gestation and intrapartum stillbirths, and those caused by placental dysfunction [23,29–32].

The high rate of caesarean births (41.3%, *n* = 47) and induction of labour (39.5%, *n* = 45) aligns with prior studies that have reported an increased risk of both interventions in patients with a history of stillbirth, with the recommendation of inducing labour at 37 to 38 weeks' gestation to reduce perinatal death [7,32]. Overall, it is reassuring that most patients gave birth at term (75.4%, *n* = 86), with unas-

sisted vaginal birth being the most common mode of birth (50.0%, *n* = 57).

There is little existing literature on the neonatal outcomes of babies born in a pregnancy after stillbirth. It is reassuring to see most babies' birthweights were between 2500 and 4000 g (75.0%, *n* = 90). The high proportion of preterm babies admitted to neonatal intensive care (42.8%, *n* = 12 of 15) is also similar to that reported by Roseingrave *et al.* [16] in their retrospective cohort study of 145 pregnancies in a large tertiary maternity hospital in Ireland.



#### 4.5 Subgroup Analysis According to Gestational Age at Stillbirth

Our findings that the extent of antenatal care and outcomes in subsequent pregnancy after previous stillbirth, regardless of gestational age and mode of index stillbirth, affirms that patients received similar care with similar outcomes. This is reassuring, as it suggests that patients received consistent care and experienced comparable outcomes. This contrasts a study of 2716 parents by Wojcieszek *et al.* [17], which found that patients whose stillbirth occurred at or after 30 weeks' gestation were more likely to receive more antenatal care visits and ultrasound scans in their subsequent pregnancy. Per Wojcieszek *et al.* [17], this differential allocation of services did not appear justified, as the risk of stillbirth recurrence and patients' emotional needs are no less important for those whose stillbirths occurred at earlier gestations.

#### 4.6 Strengths and Limitations

The strengths of this study are that it is the first at The Women's exploring pregnancy outcomes after previous stillbirth. It is based on local hospital data, with details on individual patient outcomes. The limitations of this study mainly relate to its small sample size and the lack of a control group, which reduce its statistical power and external validity. Therefore, while our results may be indicative, they are not necessarily generalisable to the broader country or international population. There is a lack of data on antenatal complications, patients' emotional needs, and pregnancies that ended prior to 20 weeks' gestation, meaning we may be underestimating the effects of prior stillbirth on future pregnancy. The definition of stillbirth also slightly varies across different countries, and different studies may use different stillbirth classification systems.

### 5. Conclusions

On average, 38 women with a prior stillbirth present to the Royal Women's annually for pregnancy care. Most of these pregnancies are following fetal death in utero due to congenital anomaly and have occurred within two years of stillbirth. These women receive increased antenatal surveillance in the forms of more appointments and ultrasound scans. There is a high rate of intervention (caesarean birth and induction of labour) and admission into neonatal care. However, neonatal outcomes are overall reassuring, with most infants born at term with appropriate birthweights. These findings will be useful in counselling pregnant patients with a history of stillbirth, as part of the Women's 'Pregnancy After Loss' Clinic.

### Availability of Data and Materials

The data sets generated and analyzed during the current study are available in the Victorian Perinatal Data Collection repository, access to which can be requested at <https://vahi.freshdesk.com/support/home>.

### Author Contributions

JH and JU designed the project and acquired the data. JH analysed the data and wrote the manuscript. Both authors contributed to editorial changes in the manuscript. Both authors read and approved the final manuscript. Both authors have participated sufficiently in the work and agreed to be accountable for all aspects of the work.

### Ethics Approval and Consent to Participate

The study was conducted in accordance with the Declaration of Helsinki. Ethics approval was acquired by the Royal Women's Hospital Research Committee and Royal Women's Hospital Human Research Ethics Committee (Project ID: AQA23/13). Individual patient consent to participate was not obtained, as this was a retrospective cohort study with approval by the institutional ethics committee.

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### Conflict of Interest

The authors declare no conflict of interest.

### References

- [1] Australian Institute of Health and Welfare. Stillbirths and neonatal deaths. Australian Institute of Health and Welfare: Canberra. 2022.
- [2] The Royal Women's Hospital Victoria. Perinatal Mortality Report. The Royal Women's Hospital Victoria: Melbourne. 2022.
- [3] Cuisinier M, Janssen H, de Graauw C, Bakker S, Hoogduin C. Pregnancy following miscarriage: course of grief and some determining factors. *Journal of Psychosomatic Obstetrics and Gynaecology*. 1996; 17: 168–174. <https://doi.org/10.3109/01674829609025678>.
- [4] Forrest GC, Standish E, Baum JD. Support after perinatal death: a study of support and counselling after perinatal bereavement. *British Medical Journal (Clinical Research Ed.)*. 1982; 285: 1475–1479. <https://doi.org/10.1136/bmj.285.6353.1475>.
- [5] Meaney S, Everard CM, Gallagher S, O'Donoghue K. Parents' concerns about future pregnancy after stillbirth: a qualitative study. *Health Expectations: an International Journal of Public Participation in Health Care and Health Policy*. 2017; 20: 555–562. <https://doi.org/10.1111/hex.12480>.
- [6] Lamont K, Scott NW, Jones GT, Bhattacharya S. Risk of recurrent stillbirth: systematic review and meta-analysis. *BMJ (Clinical Research Ed.)*. 2015; 350: h3080. <https://doi.org/10.1136/bmj.h3080>.
- [7] Black M, Shetty A, Bhattacharya S. Obstetric outcomes subsequent to intrauterine death in the first pregnancy. *BJOG: An International Journal of Obstetrics and Gynaecology*. 2008; 115: 269–274. <https://doi.org/10.1111/j.1471-0528.2007.01562.x>.

- [8] Mills TA, Ricklesford C, Cooke A, Heazell AEP, Whitworth M, Lavender T. Parents' experiences and expectations of care in pregnancy after stillbirth or neonatal death: a metasynthesis. *BJOG: an International Journal of Obstetrics and Gynaecology*. 2014; 121: 943–950. <https://doi.org/10.1111/1471-0528.12656>.
- [9] Lamb EH. The impact of previous perinatal loss on subsequent pregnancy and parenting. *The Journal of Perinatal Education*. 2002; 11: 33–40. <https://doi.org/10.1624/105812402X88696>.
- [10] The Royal Women's Hospital Victoria. The Women's Strategic Plan 2022–2025. The Royal Women's Hospital Victoria: Melbourne. 2022.
- [11] Perinatal Society of Australia and New Zealand. Section 7: The PSANZ Classification System for Stillbirths and Neonatal Deaths. Perinatal Society of Australia and New Zealand: Mornington. 2020.
- [12] Consultative Council on Obstetric and Paediatric Mortality and Morbidity. Victoria's Mothers, Babies and Children. Consultative Council on Obstetric and Paediatric Mortality and Morbidity: Victoria. 2020.
- [13] Graham N, Stephens L, Heazell AE. Care in pregnancies subsequent to stillbirth or perinatal death. *The Obstetrician & Gynaecologist*. 2021; 23: 48–59. <https://doi.org/10.1111/tog.12708>.
- [14] Regan AK, Gissler M, Magnus MC, Håberg SE, Ball S, Malacova E, *et al.* Association between interpregnancy interval and adverse birth outcomes in women with a previous stillbirth: an international cohort study. *Lancet* (London, England). 2019; 393: 1527–1535. [https://doi.org/10.1016/S0140-6736\(18\)32266-9](https://doi.org/10.1016/S0140-6736(18)32266-9).
- [15] Australian Government Department of Health. Clinical Practice Guidelines: Pregnancy Care. Australian Government Department of Health: Canberra. 2020.
- [16] Roseingrave R, Murphy M, O'Donoghue K. Pregnancy after stillbirth: maternal and neonatal outcomes and health service utilization. *American Journal of Obstetrics & Gynecology MFM*. 2022; 4: 100486. <https://doi.org/10.1016/j.ajogmf.2021.100486>.
- [17] Wojcieszek AM, Boyle FM, Belizán JM, Cassidy J, Cassidy P, Erwich J, *et al.* Care in subsequent pregnancies following stillbirth: an international survey of parents. *BJOG: an International Journal of Obstetrics and Gynaecology*. 2018; 125: 193–201. <https://doi.org/10.1111/1471-0528.14424>.
- [18] Morris RK, Johnstone E, Lees C, Morton V, Smith G, Royal College of Obstetricians and Gynaecologists. Investigation and Care of a Small-for-Gestational-Age Fetus and a Growth Restricted Fetus (Green-top Guideline No. 31). *BJOG: an International Journal of Obstetrics and Gynaecology*. 2024; 131: e31–e80. <https://doi.org/10.1111/1471-0528.17814>.
- [19] Wojcieszek AM, Shepherd E, Middleton P, Lassi ZS, Wilson T, Murphy MM, *et al.* Care prior to and during subsequent pregnancies following stillbirth for improving outcomes. *The Cochrane Database of Systematic Reviews*. 2018; 12: CD012203. <https://doi.org/10.1002/14651858.CD012203.pub2>.
- [20] Gravensteen IK, Jacobsen EM, Sandset PM, Helgadóttir LB, Rådestad I, Sandvik L, *et al.* Healthcare utilisation, induced labour and caesarean section in the pregnancy after stillbirth: a prospective study. *BJOG: An International Journal of Obstetrics and Gynaecology*. 2018; 125: 202–210. <https://doi.org/10.1111/1471-0528.14750>.
- [21] Gower S, Luddington J, Khosa D, Thaivalappil A, Papadopoulos A. Subsequent pregnancy after stillbirth: a qualitative narrative analysis of Canadian families' experiences. *BMC Pregnancy and Childbirth*. 2023; 23: 208. <https://doi.org/10.1186/s12884-023-05533-5>.
- [22] Camacho EM, Whyte S, Stock SJ, Weir CJ, Norman JE, Heazell AEP. Awareness of fetal movements and care package to reduce fetal mortality (AFFIRM): a trial-based and model-based cost-effectiveness analysis from a stepped wedge, cluster-randomised trial. *BMC Pregnancy and Childbirth*. 2022; 22: 235. <https://doi.org/10.1186/s12884-022-04563-9>.
- [23] Wood SL, Tang S. Risk of recurrent stillbirth: a cohort study. *BJOG: an International Journal of Obstetrics and Gynaecology*. 2021; 128: 1775–1781. <https://doi.org/10.1111/1471-0528.16718>.
- [24] Ganeriwala SA, Ryan GA, Purandare NC, Purandare CN. Examining the role and relevance of the critical analysis and comparison of cesarean section rates in a changing world. *Taiwanese Journal of Obstetrics & Gynecology*. 2021; 60: 20–23. <https://doi.org/10.1016/j.tjog.2020.11.004>.
- [25] Clemenza S, Serena C, Vannuccini S, Farsi E, Huri M, Toscano F, *et al.* Pregnancy Outcomes Subsequent to Stillbirth—A Single Tertiary-Care Center Experience. *Clinical and Experimental Obstetrics & Gynecology*. 2022; 49: 247. <https://doi.org/10.31083/j.ceog4911247>.
- [26] Sharma PP, Salihu HM, Kirby RS. Stillbirth recurrence in a population of relatively low-risk mothers. *Paediatric and Perinatal Epidemiology*. 2007; 21: 24–30. <https://doi.org/10.1111/j.1365-3016.2007.00834.x>.
- [27] Lurie S, Eldar I, Glezerman M, Sadan O. Pregnancy outcome after stillbirth. *The Journal of Reproductive Medicine*. 2007; 52: 289–292.
- [28] Robson S, Chan A, Keane RJ, Luke CG. Subsequent birth outcomes after an unexplained stillbirth: preliminary population-based retrospective cohort study. *The Australian & New Zealand Journal of Obstetrics & Gynaecology*. 2001; 41: 29–35. <https://doi.org/10.1111/j.1479-828x.2001.tb01290.x>.
- [29] Nijkamp JW, Korteweg FJ, Holm JP, Timmer A, Erwich JJHM, van Pampus MG. Subsequent pregnancy outcome after previous foetal death. *European Journal of Obstetrics, Gynecology, and Reproductive Biology*. 2013; 166: 37–42. <https://doi.org/10.1016/j.ejogrb.2012.10.008>.
- [30] Monari F, Pedrielli G, Vergani P, Pozzi E, Mecacci F, Serena C, *et al.* Adverse Perinatal Outcome in Subsequent Pregnancy after Stillbirth by Placental Vascular Disorders. *PloS One*. 2016; 11: e0155761. <https://doi.org/10.1371/journal.pone.0155761>.
- [31] Surkan PJ, Stephansson O, Dickman PW, Cnattingius S. Previous preterm and small-for-gestational-age births and the subsequent risk of stillbirth. *The New England Journal of Medicine*. 2004; 350: 777–785. <https://doi.org/10.1056/NEJMoa031587>.
- [32] Nijkamp JW, Ravelli ACJ, Groen H, Erwich JJHM, Mol BWJ. Stillbirth and neonatal mortality in a subsequent pregnancy following stillbirth: a population-based cohort study. *BMC Pregnancy and Childbirth*. 2022; 22: 11. <https://doi.org/10.1186/s12884-021-04355-7>.