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Assisted reproductive technology in Australia and New Zealand 2002

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Preface

This is the first report using data from the Australian and New Zealand Assisted Reproduction Database (ANZARD). ANZARD was introduced at the beginning of 2002, replacing the previous Assisted Conception data collection. ANZARD data are provided to the AIHW National Perinatal Statistics Unit (NPSU) by all fertility centres operating in Australia and New Zealand. Unlike the previous collection, data are provided on a per cycle basis in electronic format. ANZARD allows improved consistency in data definitions, robust linkage of pregnancy outcomes to treatment characteristics, and more efficient collection and transfer of data from fertility centres to the NPSU. ANZARD was commissioned by the Fertility Society of Australia. Its implementation was managed by the NPSU.

This report presents data on all assisted reproductive technology (ART) treatments that took place in 2002 and their resulting pregnancies and births. This is a different format from that of previous reports in this series in which the treatment cycles from a select year were reported along with the babies born in the prior year. ANZARD permits the linkage of treatment cycles to pregnancies and births and, thus, allows the description of a single group: the treatment cycles from a select year and their resulting pregnancies and births. Accordingly, the babies discussed here were conceived in 2002 but born in either 2002 or 2003.

The new format of this report has been designed to provide information that is accessible to the broad audience interested in ART in Australia and New Zealand, including consumers of

Acknowledgments

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Abbreviations

ACT	Australian Capital Territory
AIHW	Australian Institute of Health and Welfare
ANZARD	Australian and New Zealand Assisted Reproduction Database
ART	Assisted reproductive technology
BESST	Birth emphasising successful singleton at term
DI	donor insemination
ET	embryo transfer
FET	frozen embryo transfer
GIFT	gamete intrafallopian transfer
ICS	intracytoplasmic sperm injection
IVF	in-vitro fertilisation
LMP	last menstrual period
n.a.	not available
n.p.	not published
NPSU	National Perinatal Statistics Unit
NSW	New South Wales
NT	Northern Territory
NZ	New Zealand
OHSS	ovarian hyperstimulation syndrome
OPU	oocyte pick-up
PESA	percutaneous epididymal sperm aspiration
PGD	preimplantation genetic diagnosis
Qld	Queensland
RTAC	Reproductive Technology Accreditation Committee
SA	South Australia
SUZI	subzonal insemination
Tas	Tasmania
Vic	Victoria
WA	Western Australia

Summary

Assisted Reproductive Technology in Australia and New Zealand 2002 is the eighth annual report on the use of assisted reproduction technology (ART) in Australia and New Zealand. This year, the introduction of a new and more robust data collection allows us to feature a more comprehensive description of ART treatment success as well pregnancy and birth outcomes.

Treatment characteristics

- During 2002, 36,483 treatment cycles were attempted in Australia and New Zealand. Of these, 90.3% (32,958) took place in Australia and 9.7% (3,524) in New Zealand.
- In Australia, there were 8.0 treatment cycles per 1,000 women of reproductive age (15–44 years). Correspondingly, in New Zealand, there were 4.2 cycles per 1,000 women of reproductive age (15–44 years).
- More than half (54.5%) of cycles involved fresh, non donor oocytes or embryos, a third (31.1%) used frozen, non donor oocytes or embryos and 4.8% used oocytes or embryos received from a donor. The remaining 9.4% of cycles were artificial insemination using donated sperm.
- The average age of women undergoing treatment in 2002 was 35.2 years. Their partners were aged on average 37.6 years. This was the first year in which national data were available on the age of consumers of assisted reproduction treatment.
- For fresh, non donor cycles, 18.3% of all cycles started resulted in the delivery of at least one live baby. For frozen, non donor cycles, 13.7% of all cycles in which embryos were thawed resulted in the delivery of at least one live baby. The success of fresh, non donor treatment varied among fertility centres. The highest ranked group of

fertility centres achieved live delivery in at least 21.8% of treatment attempts. The lowest ranked group of fertility centres achieved live delivery in less than 14.8% of treatment attempts.

- In 2002, the majority (94.2%) of treatment cycles transferred one or two embryos. This represents a considerable change in treatment protocol from 1993 in which less than half of cycles (44.6%) transferred one or two embryos.
- The success of fresh, non donor treatment varied by women's age.
 Women aged 25–29 years achieved the greatest success, with 25.9% of initiated cycles achieving a live delivery. Women aged 40–44 years had a success rate of 6.1%.



Live delivery per cycle started by women's age for fresh, non donor ART treatment, 2002

Pregnancies and births

• Overall, there were 7,577 pregnancies reported in the 2002 cohort, resulting in 6,816 live born babies.

1 Introduction

Assisted reproductive technology (ART) methods are used by medical professionals to help couples with fertility problems achieve pregnancy. The main ART methods reported here include:

- in-vitro fertilisation (IVF), where eggs and sperm are combined in the laboratory for fertilisation outside the body and replaced in the uterus;
- intracytoplasmic sperm injection (ICSI), where a single sperm is injected into an egg for fertilisation outside the body and replaced in the uterus; and
- gamete intrafallopian transfer (GIFT), where eggs and sperm are placed in the fallopian tubes for fertilisation inside the body.

The embryos arising from the IVF and ICSI method can be frozen and used in subsequent ART treatment where they are thawed and transferred to the uterus.

The first ART method used in Australia was IVF in 1979. This was followed by the first Australian-born IVF baby in 1980. In New Zealand, the first IVF baby was born in 1983. GIFT was introduced in Australia in 1985 but its use has been in sharp decline in recent years and now accounts for only a small proportion of ART treatment cycles. The first microinsemination technique for treating male infertility, subzonal insemination (SUZI), was introduced in 1990. However, lately this has been superseded by the more successful ICS technique.

The main purposes of this report are to place in the public domain:

- information on ART treatment cycles and the resulting pregnancy outcomes in Australia and New Zealand;
- evidence of quality improvement through monitoring ART treatment practices, success rates and perinatal outcomes; and
- information for national and international comparisons.

Data source

Data used in this report come from the Australian and New Zealand Assisted Reproduction Database. ANZARD includes information about the treatment methods of IVF, ICSI and GIFT. It also includes information about: treatment via the cryopreservation and thaw of embryos; donor insemination; treatment involving donated gametes or embryos; and the use of technologies such as assisted hatching, preimplantation genetic diagnosis and blastocyst culture. ANZARD contains details of all pregnancy and birth outcomes, including mode of delivery, birth status, birthweight, gestational age, plurality, perinatal mortality, congenital malformation and maternal morbidity. ANZARD does not contain information about artificial insemination using partner's sperm.

Data on treatment cycles are collected at each fertility centre at the time of treatment and provided to the NPSU within 6 months. Fertility centre staff follow up patients for data on their pregnancy and birth outcomes, which is provided to the NPSU within 6–12 months. There are 25 fertility centres in Australia and 4 in New Zealand. Each provides data for ANZARD.

Report cohort

This report presents information on all treatment cycles that took place in 2002 and the resulting pregnancies and births. The babies discussed in this report were conceived in 2002 and born in either 2002 or 2003. The report also includes data from 1993 to 2002 where acknowledged.

Data accuracy

Most fertility centres have advanced data management systems and are able to provide the NPSU with high quality data. The NPSU subjects all data to an extensive process of validation. Inaccuracies are followed up with fertility centre staff. For 2002, less than 1% of treatment data and approximately 2% of pregnancy outcomes are not stated. The Reproductive Technology Accreditation Committee (RTAC) plays a role in ensuring the quality of ANZARD data by validating random data records against clinic files in their triennial inspections.

Data presentation

Each data case represents a treatment cycle and not a patient. Thus, it is possible that an individual woman can undergo more than one treatment in an annual cohort or experience more than one pregnancy. This also means that information reported about patient characteristics, such as age, parity, and cause of infertility, are based on calculations in which individuals may be counted several times.

For multiple pregnancies, mother items which may be different for each baby, such as gestational age and method of birth, are classified according to the features of the first born baby.

Where applicable, percentages in tables have been calculated including the Not stated category. Cell sizes of three or less have not been published, in accordance with the AIHW's policy on the reporting of small numbers. Exceptions to this are small numbers in Other and Not stated categories.

Data limitations

Follow-up of pregnancy information is limited because the ongoing care of pregnant patients is often carried out by non ART practitioners. Usually, the fertility centre follows up the outcome of the pregnancy with either the patient or her clinician. In a small proportion of cases this information is not available.

For pregnancies in which there is successful follow-up, data are limited by the self-reported nature of the information. These data include pregnancy complications, complications of fertility treatment, and infant morbidity (including birth anomaly). Fertility centre staff invest enormous effort into validating such information by obtaining medical records from clinicians or hospitals. Similarly, data about previous ART treatment and history of pregnancies are, in some cases, self-reported.

Structure of 2002 data presentation

ART data for 2002 are presented in two parts:

1) This report, which provide data on select treatment characteristics, pregnancy and birth outcomes for 2002, and summary trends since 1993.

Low birthweight—birthweight of less than 2,500 grams. *Very low birthweight*—birthweight of less than 1,500 grams.



number of treatment cycles attempted, which allows better appraisal of ART success. The dot in Figure 1 represents the total number of attempted treatments using the ANZARD definition. By this definition, there were 33,064 attempted ART treatment cycles and 3,419 donor insemination cycles, producing a total of 36,483 treatments in Australia and New Zealand in 2002 (Table R1). Trend data in future reports will follow from this data point.

Has the use of different ART methods changed since 1993?

Has the number of embryos transferred per treatment cycle changed since 1993?

Figure 3 demonstrates the decline in the number of treatment cycles transferring three or more embryos. While 55.3% of treatment cycles in 1993 transferred three or more embryos, this decreased to 5.8% of cycles in 2002 (Table R3). This trend has been motivated by concerns about the poorer outcomes associated with multiple pregnancies such as preterm birth, low birthweight and increased rates of perinatal mortality. These data demonstrate that it is now common practice in Australia and New Zealand to transfer no more than two embryos per embryo transfer cycle.



Figure 3: Proportion of fresh and frozen embryo transfer cycles transferring one, two, three or more embryos, Australia and New Zealand, 1993–2002

Has the success of ART treatment improved since 1993?

Figure 4 presents the steadily increasing success of ART treatment over the previous 10 years. ART treatment using fresh embryos demonstrates the greatest increase, with the success rate in 2002 (30.5 pregnancies per 100 embryo transfer cycles) being almost twice what it was in 1993 (16.3 pregnancies per 100 embryo transfer cycles) (Table R4). Likewise, the success of ART using frozen embryos has increased from 13.5% in 1993 to 19.9% in 2002 (Table R4).



2.2 ART treatment in 2002

A total of 36,483 ART treatment cycles took place in Australia and New Zealand in 2002. Of these, 90.3% (N=32,958) occurred in Australia and 9.7% (N=3,524) in New Zealand. In Australia there were 8.0 cycles per 1,000 women of reproductive age (15–44 years) and in New Zealand there were 4.2 cycles. Figure 5 depicts the number of treatment cycles by location for 2002. Fertility centres in Sydney and Melbourne accounted for half of all the treatment cycles that took place in 2002, with more than 9,000 cycles performed in each city. Fertility centres in other capital cities conducted considerably fewer cycles.

Note that the location of a fertility centre does not necessarily translate into the patient's place of residence since patients move between clinics and travel from overseas to receive treatment in Australia or New Zealand.



What types of ART treatments took place in Australia and New Zealand in 2002?

Figure 6 shows that the majority of ART treatment cycles in 2002 (54.5%, 19,883) used fresh, non donor eggs or embryos (Table R5). About a third (31.1%, 11,370) used frozen, non donor embryos (Table R7) and a small proportion (4.8%, 1,733) used donated oocytes or embryos that were either fresh or frozen (Table R5). The remaining 9.4% (3,419) of ART treatments involved artificial insemination using sperm donated from an anonymous or known donor (Table R5).

Of fresh, non donor cycles, almost half involved ICSI (9,627) and approximately a third used IVF (7,348) (Table R6). GIFT accounted for 1.0% (189) of all fresh, non donor cycles. The remaining 13.7% of fresh, non donor treatments include mixed IVF and ICSI cycles, cycles that did not successfully retrieve oocytes, and cycles that were cancelled prior to oocyte

How many embryos were transferred in embryo transfer cycles in 2002?

Figure 7 shows that most ART treatment cycles (94.2%) in 2002 involved the transfer of one or two embryos (Table R3). As Figure 3 demonstrated previously, this is a considerable change from earlier years, such as 1993, in which 44.6% of cycles transferred only one or two embryos (Table R3). In 2002, women aged 38 years or older tended to have more embryos replaced than those aged less than 38 years (Table R8).



How many embryos were stored in 2002?

The NPSU collects information about the number of embryos removed from/ added to storage in fertility centres each year. While these data are accurate for counts in a single year, their accuracy over time is less dependable since a small amount of error compounds with each annual calculation. Thus, information about total number of embryos in storage in Australia and New Zealand at the end of 2002 should be considered with caution.

In 2002, there were 9,645 fresh cycles where excess embryos were frozen (Table R9). A total of 44,911 excess embryos were stored for the purposes of future treatment. Another 12,117 cycles involved the thawing of embryos for treatment purposes where 29,805 embryos were thawed. A further 4,192 embryos were removed from storage due to patient request, government regulation or donation to research. This contributed a net 10,914 embryos to the current pool of embryos available for treatment, leaving 92,541 embryos in storage at 31 December 2002 (Table R9).

What was the average age of couples undergoing ART treatment in 2002?

2002 was the first year in which national data were collected about the age of people undergoing ART treatment. Women ranged in age from 19–59 years, with an average age of 35.2 years (Table R10). Men tended to be older and ranged in age from 19–67 years, with an average age of 37.6 years (Table R11).

2.3 Success of ART in 2002

The success of different types of ART procedures can be compared by measuring the number of live deliveries per embryo transfer cycle. Table A presents the number of live deliveries per embryo transfer as a percentage for each ART treatment type (Table R12). In 2002, 23.5% of fresh non donor embryo transfer cycles resulted in the delivery of one or more live babies, compared to 14.8% of frozen non donor embryo transfer cycles.

However, calculating the number of successful embryo transfer cycles is only one means of measuring ART success. Because the processes behind fresh and frozen treatment are different it is often more accurate to use measures of success that are specific to fresh or frozen ART treatment. These are presented in the following sections 2.3.1–2.3.3.

Table A: Live delivery per embryo transfer cycle, by treatment type, Australia and New Zealand,2002

Description		Live delivery per embryo transfer (%)
Non donor oocytes/embryos	Fresh	23.5
	Frozen	

2.3.1 Success of fresh, non donor ART treatment in 2002

How is fresh, non donor ART success measured?

Figure 8 presents the total number of fresh, non donor cycles started in 2002 and how many of these progressed to the stage of oocyte retrieval, embryo transfer, pregnancy and the delivery of at least one live baby. The treatment process can be discontinued at any stage for a variety of reasons, including inadequate oocy

What is the BESST endpoint for measuring fresh, non donor ART success?

Concerns about the high rate of multiple pregnancies associated with ART have prompted the introduction of the BESST (birth emphasising successful singleton at term) endpoint (Min et al. 2004). This measure takes as its starting point all fresh, non donor cycles initiated in which ovulation drugs are administered. It defines the successful endpoint as a single, live baby at full gestation of 37 weeks or more. Table C demonstrates that, for Australia and New Zealand in 2002, 12.9% of all fresh, non donor, stimulated cycles started resulted in a live, full-term, singleton baby.

Stage of treatment	Number	Per cent of cycles started
Cycles started	19,472	
Pregnancies	4,697	24.1
Viable pregnancies	3,690	19.0
Live deliveries (all)	3,599	18.5
Live multiple deliveries	795	4.0
Preterm	496	2.4
Term	299	1.5
Live singleton deliveries	2,804	14.4
Preterm	296	1.5
Term	2,508	12.9

Table C: Birth emphasising successful singleton at term (BESST) for fresh, non donor stimulated cycles, Australia and New Zealand, 2002

Did ART success vary by type of treatment in 2002?

Table D presents the number of live deliveries per cycle started as a percentage for IVF and ICSI treatment. In 2002, treatment by IVF and ICSI achieved similar success (Table R12). There were too few treatment cycles to report a success rate for GIFT.

Table D: Live delivery per cycle started by type of fresh, non donor ART treatment, Australia andNew Zealand, 2002

Type of fresh, non donor ART treatment	Live delivery per cycle started (%)
IVF	21.2
ICSI	20.6
GIFT	n.p.

n.p. not published due to small cell size.

Did ART success vary by cause of infertility?

Table E presents the number of live deliveries per cycle started as a percentage for fresh, non donor cycles by different causes of infertility. In 2002, couples in which the infertility resided with the male partner achieved the greatest success. Those with female factors of infertility, such as tubal disease or endometriosis, had comparatively less success. The relative success of couples with male factor infertility is to be expected when considering that the female partner usually has normal reproductive physiology.

Table E: Live delivery per cycle started by cause of infertility for fresh, non donor ART treatment, Australia and New Zealand, 2002

Cause of infertil	ity	Number of cycles started	Number of live deliveries	Live delivery per cycle started (%)
Male factor only		5,250	1,107	21.1
Female factor	Tubal disease	1,986	332	16.7
only	Endometriosis	1,189	221	18.6
Multiple causes		6,224	1,044	16.8
Unexplained		3,313	646	19.5
Other (including f premature ovaria	ibroids, ovulation disorders, n failure)	1,921	290	15.1

Did ART success vary by women's age in 2002?

Figure 9 indicates how the success of fresh, non donor cycles varied among women of different ages in 2002 (Table R13). Women's age is one of the key factors associated with ART success when women use their own oocytes. The figure demonstrates how success is greatest when women are aged in their mid-20s to mid-30s but declines steadily from this age onwards. For women over the age of 40 years the chance of achieving a live delivery is, on average, less than 2% (Table R13).



2.4 Variation in success rates among fertility centres

How did fresh, non donor ART success vary among fertility centres in Australia and New Zealand in 2002?

The variation in success among fertility centres is best measured using quartiles which rank individual centre success rates and report the success of the top and bottom 25% of centres.

For fresh, non donor ART treatment in 2002, the top 25% of fertility centres (first quartile) achieved live delivery in at least 21.8% of treatment attempts (first quartile range 21.8–27.3%). The bottom 25% of fertility centres (fourth quartile) achieved live delivery in less than 14.8% of treatment attempts. The remaining 50% of fertility centres achieved success rates (live delivery per cycle started) between 14.9 and 21.7% (Table R14).

The variation in fertility centre success persists across age groups. Table F presents the rankings for fresh, non donor ART treatment by women's age group. For women aged 40 years or older, the top 25% of fertility clinics achieved live delivery in at least 7.8% of treatment attempts (first quartile range 7.8–18.8%).

		Live deliv	ery per cycle started	(%)	
Women's age group (years)	Average for all fertility centres	First quartile	Second quartile	Third quartile	Fourth quartile
<35 years	24.9	30.1–40.7	23.0–30.0	18.5–22.9	<18.4
35–39 years	17.9	20.6–33.3	15.5–20.5	13.6–15.4	<13.5
40 years	5.7	7.8–18.8	4.7–7.7	3.4-4.6	<3.3

Table F: Quartiles for fertility centres for fresh, non donor ART treatment, by women's age group, Australia and New Zealand, 2002

Note: one fertility centre missing from this calculation.

How did frozen, non donor ART success vary among fertility centres in Australia and New Zealand in 2002?

For frozen, non donor ART treatment in 2002, the top 25% of fertility centres (first quartile) achieved live delivery in at least 17.2% of treatment attempts (first quartile range 17.2–23.3%) (Table R15). The bottom 25% of fertility centres (fourth quartile) achieved live delivery in less than 11.3% of treatment attempts (Table R15). The remaining 50% of fertility centres achieved success rates (live delivery per cycle started) between 11.4 and 17.1% (Table R15). Table G presents the rankings for frozen, non donor ART treatment by women's age group.

Table G: Quartiles for fertility centres for frozen, non donor ART treatment, by women's age group, Australia and New Zealand, 2002

	Live delivery per attempted thaw cycle (%)						
Women's age group (years)	Average for all fertility centres	First quartile	Second quartile	Third quartile	Fourth quartile		
<35 years	16.0	20.1–36.0	16.2–20.0	13.8–16.1	<13.7		
35–39 years	13.0	16.0–25.0	13.2–15.9	9.1–13.1	<9.0		
40 years	7.1	11.1–33.3	9.1–11.0	3.7–9.0	<3.6		

Note: one fertility centre missing from this calculation.

2.5 Complications of ART treatment in 2002

ANZARD includes morbidity information that is specifically related to ART treatment but only where hospital admission is required. Treatment morbidity data are self-reported by patients and validated later with hospital records by fertility centre staff. It is possible that there is under-reporting of this information.

In 2002, there were 246 cases in which women were admitted to hospital with complications of ART treatment, representing 0.7% of all treatment cycles. Of these, most (78%, 192) were hospitalised for symptoms of ovarian hyperstimulation syndrome (OHSS) (Table R16). OHSS is a complication of ovulation induction therapy and includes symptoms of abdominal pain and fluid retention. Other treatment–related complications in 2002 included abdominal pain, bleeding, and infection.

Has the proportion of multiple births changed since 1993?

Figure 12 demonstrates the decline in the proportion of triplets or higher order deliveries since 1993. In 1993, 2.0% of deliveries were of triplets or higher order multiples. However, in the 2002 conception cohort, only 0.6% of deliveries were of triplets and there were no quadruplet or higher order deliveries. Since 1993 the proportion of twin deliveries has remained relatively steady between 17.1 and 21.1% (Table R17).



3.2 Pregnancies achieved from ART treatment in 2002

In 2002, a total of 7,577 pregnancies were reported in Australia and New Zealand. Of these, 88% (6,675) were reported from fertility centres in Australia and 12% (902) from centres in New Zealand.

What was the outcome of ART pregnancies in Australia and New Zealand?

Figure 13 presents the outcome of pregnancies conceived using ART in 2002. The majority of pregnancies (75.7%) resulted in the delivery of one or more live babies. Of these, 81.3% were live singleton deliveries and 18.7% involved the delivery of two or more live babies. Approximately 22% of pregnancies resulted in other outcomes, including stillbirth, neonatal death, miscarriage or ectopic pregnancy. The outcome for 2.2% of pregnancies was not stated (Table R18).



What was the risk of multiple pregnancy in relation to the number of embryos transferred?

Table H correlates the number of embryos transferred in a treatment cycle to the number of babies resulting from that transfer. The majority of pregnancies in 2002 resulted from treatment cycles transferring two embryos. Most twins came from two-embryo transfers, although a small proportion arose from single-embryo transfers meaning they were spontaneously occurring monozygotic twins. Likewise, most triplets arose from two-embryo transfers, also suggesting the occurrence of monozygotic twinning.

Table H: Plurality of pregnancies of20 weeks gestation, by number of embryos transferred,Australia and New Zealand, 2002

Plurality of		Number of embryos transferred					
pregnancies weeks	20	1	2	3	4 or more	Not applicable	Total deliveries
Singleton		1,098 (23.1%)	3,122 (65.8%)	176 (3.7%)	13 (0.3%)	339 (7.1%)	4,748
Twin		27 (2.5%)	958 (89.5%)	49 (4.6%)	5 (0.5%)	31 (2.9%)	1,070
Triplet		n.p.	21 (63.6%)	9 (27.3%)	n.p.	n.p.	33

n.p. not published due to small cell size.

Note: Not applicable includes treatments in which no embryos were transferred, such as donor insemination and GIFT.

Did pregnancy outcome vary with maternal age?

What pregnancy complications were experienced in ART pregnancies in 2002?

ANZARD includes pregnancy morbidity information that is self-reported by patients and, if relevant, validated with hospital records by fertility centre staff. It is possible that there is inexact reporting of this information.

Of all pregnancies in 2002, 13.2% (998) reported a complication. Pregnancy-induced hypertension was reported in 1.9% (144) of all pregnancies, gestational diabetes in 1.8% (135), placenta praevia in 1.1% (83) and antepartum hemorrhage in 1.0% (72). Other complications, such as premature rupture of membranes (67), intrauterine growth retardation (42) and pre-eclampsia (46), occurred in less than 1.0% of pregnancies.

How many deliveries w

3.3 Babies conceived in 2002

There were a total of 6,987 live and stillborn babies of at least 20 weeks gestation delivered in the 2002 conception cohort. Of these, 68.0% (4,748) were singletons, 30.6% (2,140) were twins, and 1.4% (99) were triplets (Table R22, Table R23). There were 6,816 live born babies, representing 97.3% of all ART babies. Of these, 87.3% (5,953) were conceived at fertility centres in Australia and 12.7% (863) in New Zealand.

What was the risk of preterm birth for ART babies in 2002?

The average gestational age for all babies of at least 20 weeks gestation in the 2002 conception cohort was 37.2 weeks (Table R22). This means that the average ART baby in the 2002 cohort was born at full-term gestation (37 weeks).

Figure 15 shows the distribution of gestational age for all babies in the 2002 cohort. Most (72.7%, 5,083) reached full-term gestation of at least 37 weeks (Table R22). This is a higher proportion than the 67.4% of ART babies that were born at full term in the 2000 cohort (AIHW: Dean & Sullivan 2003). Nevertheless, 21.1% (1,476) of babies in 2002 were born at 32–36 weeks and a further 6.1% at 20–31 weeks (Table R22).

The proportion of preterm babies is possibly related to the high incidence of multiple births resulting from ART pregnancies. While the average gestational age for singletons was 38.4 weeks, for twins this was reduced to 35.0 weeks and for triplets 30.5 weeks (Table R22). Similarly, while only 11.1% of singletons were born preterm this increased to 59.8% of twins and 100% of triplets (Table R22).



What was the risk for low birthweight for ART babies in 2002?

The average birthweight for all babies of at least 20 weeks gestation in the 2002 conception cohort was 2,985 grams. Live born babies had an average birthweight of 3,011 grams. The average birthweight for ART babies was less than the average of 3,362 grams for the Australian population in 2001 (AIHW: Laws & Sullivan 2004). Of all ART babies, 21.7% were classified as having low birthweight (<2,500g) (Table R17.12 656.9011 Tm((Table R17..7% were)Tj0.001 Tc 0.

What was the sex distribution for ART babies in 2002?

In the 2002 cohort, there were 104.6 male babies for every 100 female babies (Table R24). This is similar to that reported in the 2000 ART cohort in which there were 105.0 males per 100 females (AIHW: Dean & Sullivan 2003). Fresh ICSI treatment had a lower ratio of 100.2 males to 100 females and fresh IVF treatment had a higher ratio of 116.1 males to 100 females (Table R24).

What was the risk for perinatal mortality among ART babies conceived in 2002?

Perinatal mortality refers to foetal deaths (stillbirths) of at least 20 weeks gestation or 400 grams and the deaths of neonatal babies occurring within 28 days of birth. In the 2002 conception cohort there were 121 reported perinatal deaths, giving a perinatal death rate of 17.3 deaths per 1,000 ART births in Australia and New Zealand (Table R25). This was higher than the 10.0 deaths per 1,000 births reported in the Australian population in 2001 (AIHW: Laws & Sullivan 2004) but is lower than the rate of 20.7 reported for ART babies in 2000 cohort.

Perinatal mortality correlates with plurality of ART pregnancies. Singletons had the lowest rate: 10.9 deaths per 1,000 births. Twins had a higher rate: 29.3 deaths per 1,000 births, and triplets reported the highest rate: 60.6 deaths per 1,000 births (Table R25).

Glossary

This glossary is authored by the International Committee for the Monitoring of Assisted Reproductive Technologies (ICMART) and is endorsed by the World Health Organization.

Aspiration cycle: initiated ART cycle in which one or more follicles are punctured and aspirated irrespective of whether or not oocytes are retrieved.

Assisted hatching: an *in vitro* procedure in which the zona pellucida of an embryo (usually at 8-cell stage or a blastocyst) is perforated by chemical, mechanical or laser-assisted methods to assist separation of the blastocyst from the zona pellucida.

Assisted reproductive technology (ART): all treatments or procedures that include the *in vitro* handling of human oocytes and sperm or embryos for the purpose of establishing a pregnancy. This includes, but is not limited to, *in vitro* fertilization and trans-cervical embryo transfer, gamete intrafallopian transfer, zygote intrafallopian transfer, tubal embryo transfer, gamete and embryo cryopreservation, oocyte and embryo donation and gestational surrogacy. ART does not include assisted insemination (artificial insemination) using sperm from either a woman's partner or sperm donor.

Birth defect: Structural, functional or developmental abnormalities present at birth or later in life, due to genetic or nongenetic factors acting before birth.

Blastocyst: an embryo with a fluid-filled blastocele cavity (usually developing by five or six days after fertilization).

Cancelled cycle: an ART cycle in which ovarian stimulation or monitoring has been carried out with the intent of undergoing ART but which did not proceed to follicular aspiration, or in the case of a thaw ed embryo, to transfer.

Clinical abortion: an abortion of a clinical pregnancy which takes place between the diagnosis of pregnancy and 20 completed weeks' gestational age.

Clinical pregnancy: evidence of pregnancy by clinical or ultrasound parameters (ultrasound visualization of a gestational sac). It includes ectopic pregnancy. Multiple gestational sacs in one patient are counted as one clinical pregnancy.

Clinical pregnancy rate: number of clinical pregnancies expressed per 100 initiated cycles, aspiration cycles or embryo transfer cycles. When clinical pregnancy rates are given, the denominator (initiated, aspirated or embryo transfer cycles) must be specified.

Controlled ovarian hyperstimulation (COH): medical treatment to induce the development of multiple ovarian follicles to obtain multiple oocytes at follicular aspiration.

Cryopreservation: freezing and storage of gametes, zygotes or embryos.

Delivery rate: number of deliveries expressed per 100 initiated cycles, aspiration cycles or embryo transfer cycles. When delivery rates are given, the denominator (initiated, aspirated or embryo transfer cycles) must be specified. It includes deliveries that resulted in a live birth and/ or stillbirth. The delivery of a singleton, twin or other multiple pregnancy is registered as one delivery.

Early neonatal death: death occurring within the first seven days after delivery.

Ectopic pregnancy: a pregnancy in which implantation takes place outside the uterine cavity.

Embryo: product of conception from the time of fertilization to the end of the embryonic stage eight weeks after fertilization (the term 'pre-embryo' or dividing conceptus has been replaced by embryo).

Embryo donation: the transfer of an embryo resulting from gametes that did not originate from the recipient and/ or her partner.

Embryo transfer (ET): procedure in which embryo(s) are placed in the uterus or fallopian tube.

Embryo transfer cycle: ART cycle in which one or more embryos are transferred into the uterus or fallopian tube.

Fertilization: the penetration of the ovum by the spermatozoon and fusion of genetic materials resulting in the development of a zygote.

Foetus: the product of conception starting from completion of embryonic development (at eight completed weeks after fertilization) until birth or abortion.

Full-term birth: a birth that takes place at 37 or more completed weeks of gestational age. This includes both live births and stillbirths.

Gamete intrafallopian transfer (GIFT): ART procedure in which both gametes (oocytes and sperm) are transferred to the fallopian tubes.

Gestational age: age of an embryo or foetus calculated by adding 14 days (2 weeks) to the number of completed weeks since fertilization.

Gestational carrier: a woman in whom a pregnancy resulted from fertilization with thirdparty sperm and oocytes. She carries the pregnancy with the intention or agreement that the offspring will be parented by one or both of the persons that produced the gametes.

Gestational sac: a fluid-filled structure containing an embryo that develops early in pregnancy usually within the uterus.

Hatching: it is the process that precedes implantation by which an embryo at the blastocyst stage separates from the zona pellucida.

Host uterus: see gestational carrier.

Implantation: the attachment and subsequent penetration by the zona-free blastocyst (usually in the endometrium) which starts five to seven days following fertilization.

In vitro fertilization (IVF): an ART procedure which involves extracorporeal fertilization.

Infertility: failure to conceive after at least one year of unprotected coitus.

Initiated cycles: A RT treatment cycles in which the woman receives ovarian stimulation, or monitoring in the case of spontaneous cycles, irrespective of whether or not follicular aspiration is attempted.

Intracytoplasmatic (intracytoplasmic) sperm injection (ICSI): IVF procedure in which a single spermatozoon is injected through the zona pellucida into the oocyte.

Live birth: a birth in which a foetus is delivered with signs of life after complete expulsion or extraction from its mother, beyond 20 completed weeks of gestational age. (Live births are counted as birth events, e.g. a twin or triplet live birth is counted as one birth event.)

Live-birth delivery rate: number of live-birth deliveries expressed per 100 initiated cycles, aspiration cycles or embryo transfer cycles. When delivery rates are given, the denominator (initiated, aspirated or embryo transfer cycles) must be specified. It includes deliveries that

resulted in at least one live birth. The delivery of a singleton, twin or other multiple birth is registered as one delivery.

Malformation rate: includes all structural, functional, genetic and chromosomal abnormalities identified in aborted tissue or diagnosed before or subsequent to birth.

Medically assisted conception: conception brought about by noncoital conjunction of the gametes. Includes ART procedures and intrauterine, intracervical and intravaginal insemination with semen of husband/ partner or donor.

Micromanipulation (also referred to as **assisted fertilization**): the use of special micromanipulative technology that allows operative procedures to be performed on the oocyte, sperm or embryo.

Microscopic epididymal sperm aspiration (MESA): procedure in which spermatozoa are obtained from the epididymis, by either aspiration or surgical excision.

Missed abortion: a clinical abortion where the products of conception are not expelled spontaneously from the uterus.

Neonatal death: death within 28 days of birth.

Newborns or infants born: the number of live births plus stillbirths.

Oocyte donation: an ART procedure performed with third-party oocytes.

Preclinical abortion: an abortion that takes place before clinical or ultrasound evidence of pregnancy.

Preclinical pregnancy (biochemical pregnancy): evidence of conception based only on biochemical data in the serum or urine before ultrasound evidence of a gestational sac.

Preimplantation genetic diagnosis (PGD): screening of cells from preimplantation embryos for the detection of genetic and/ or chromosomal disorders before embryo transfer.

Preterm birth: a birth which takes place after at least 20, but less than 37, completed weeks of gestation. This includes both live births and stillbirths. Births are counted as birth events (e.g. a twin or triplet live birth is counted as one birth event).

Recipient: in an ART cycle refers to the woman who receives an oocyte or an embryo from another woman.

Spontaneous abortion: spontaneous loss of a clinical pregnancy before 20 completed weeks of gestation or, if gestational age is unknown, a weight of 500 g or less.

Stillbirth: a birth in which the foetus does not exhibit any signs of life when completely removed or expelled from the birth canal at 329.007 T9.1a.i6te70.91.84.7.

Subject		Table
Success of ART treatment	Type of treatment	R12
	Women's age	R13
	Fertility centre	R14, R15
Women's age	ce of treatment R	
	Success of ART treatment	R13
	Pregnancy outcome	R19, W8
	Method of delivery	R21
	No. of embryos transferred	R8
	Gestational age/Duration of pregnancy	W9
	Multiple pregnancy	W10
	Perinatal mortality	W17
	Ten-ye	

Subject		Table
Birthweight	Multiple pregnancy	R23
	Type of treatment	W13
	Pregnancy outcome	W15
Perinatal mortality	Multiple pregnancy	R25
	Type of treatment	W16
	Women's age	W17
Other	OHSS	R16
	Storage of embryos	R9
	Birth anomalies	W18
	Preimplantation genetic diagnosis (PGD)	W19
	Assisted hatching	W20
	Blastocyst culture	W21
	Special techniques of sperm retrieval	W22

Table data

Table R1: Number of treatment cycles started, pregnancies and live deliveries, 1993–2002

Stage of treatment

Year

T procedure	Number	Per cent
lonor	19,883	54.5
donor	11,370	31.1
r	1,084	3.0
or	649	1.8
nination	3,419	9.4
	78	0.2
S	36,483	100.0

Types of ART procedures, number of cycles started, 2002

Types of fresh ART procedures, number of cycles started, 2002

	Nondonor oocytes	/embryos	Donor oocytes/embryos		
sh ART procedure	Number	Per cent	Number	Per cent	
	7,348	37.0	219	20.2	
	9,627	48.4	274	25.3	
	189	1.0	_	0	

 Table R8: Proportion of fresh and frozen embryo transfer cycles transferring one, two, three, and four or more embryos, by age group, 2002

Women's age (years) Number of embryos 24 25–29 3

	Non	donor oocy	/tes/embryc	os	Donor			
Maternal age group	Fresh all	Fresh ICSI	Fresh IVF	Frozen	oocytes/ embryos	DI	Not stated	All
			Nur	nber				
24	266	154	75	135	n.p.	60	n.p.	468
25–29	2,213	1,182	751	1,382	74	475	9	4,153
30–34	6,131	3,048	2,373	4,223	199	922	25	11,500
35–39	6,935	3,316	2,585	4,014	316	1,228	31	12,524
40–44	3,971	1,780	1,457	1,512	382	652	9	6,526
45	344	139	101	95	262	68	0	765
Not stated	23	8	6	9	n.p.	14	n.p.	547
Total cycles	19,883	9,627	7,348	11,370	1,733	3,419	78	36,483
Mean age	35.3	35.0	35.3	34.5	39.4	35.1	_	35.2
			Per	cent				
24	1.3	1.6	1.0	1.2	_	1.8	_	1.3
25–29	11.1	12.3	10.2	12.2	4.3	13.9	_	11.4
30–34	30.8	31.7	32.3	37.1	11.5	27.0	_	31.5
35–39	34.9	34.4	35.2	35.3	18.2	35.9	_	34.3
40–44	20.0	18.5	19.8	13.3	22.0	19.1	_	17.9
45	1.7	1.4	1.4	0.8	15.1	2.0	_	2.1
Not stated	0.1	0.1	0.1	0.1	_	0.4	_	1.5
Total cycles	100.0	100.0	100.0	100.0	100.0	100.0	_	100.0

Table R10: Women's age at time of treatment, by treatment type, 2002

Note: data are collected on a per treatment cycle basis and not on a per patient basis. Therefore, some individuals may be counted several times. n.p. not published due to small cell size.

	Nor	Doper						
Paternal age group	Fresh all	Fresh	Fresh			DI	Not stated	All
24	72	36	26	38	n.p.	28	n.p.	139
25–29	1,229	595	459	680	50	184	8	2,151
30–34	4,677	2,141	1,899	2,868	157	426	11	8,139
	5,517	2,553	6					

Table R11: Men's age at time of treatment, by treatment type, 2002

Table R15: Success for frozen non donor ART treatment, by grouped fertility centres, 2002

Fertility centre ranking	First quartile	Second quartile	Third quartile	Fourth quartile	All
Includes centres that achieved a live delivery per cycle started (%) of:	17.2–23.3	14.5–17.1	11.4–14.4	<11.3	

	Singleton d	elivery	Twin de	elivery	Triplet d	Triplet delivery		
Year	Number	Per cent	Number	Per cent	Number	Per cent	deliveries	
1993	1,666	80.0	375	18.0	41	2.0	2,082	
1994	1,903	80.6	403	17.1	56	2.4	2,362	
1995	2,043	79.9	465	18.2	49	1.9	2,557	
1996	2,250	80.1	508	18.1	52	1.9	2,810	
1997	2,480	79.4	591	18.9	51	1.6	3,122	
1998	2,748	79.9	645	18.8	47	1.4	3,440	
1999	3,014	78.2	789	20.5	50	1.3	3,853	
2000	3,335	78.0	901	21.1	42	1.0	4,278	
2001	4,087	78.3	1,097	21.0	35	0.7	5,219	
2002	4,748	81.1	1,070	18.3	33	0.6	5,851	

 Table R17: Incidence of singleton, twin and higher order pregnancies, 1993–2002

 Table R18: Outcome of ART pregnancies, by treatment type, 2002

		Women's age (years)								
	<20	20–24	25–29	30–34	35–39	40–44	45	Not stated	Total	
Pregnancies	4	104	1,070	2,958	2,614	738	81	8	7,577	
Per cent of total	0.1	1.4	14.1	39.0	34.5	9.7	1.1	0.1	100.0	
Live deliveries	4	79	870	2,348	1,937	435	58	6	5,737	
Per cent of total	0.1	1.4	15.2	40.9	33.8	7.6	1.0	0.1	100.0	
Live delivery per pregnancy (%)	100.0	76.0	81.3	79.4	74.1	58.9	71.6	_	75.7	

Table R19: Total number of pregnancies and live deliveries, by maternal age, 2002

Table R20: Method of delivery for all pregnancies 20 weeks gestation, by plurality, 2002

		Method of delivery										
-	Caesarean	section	Ot	her	Not st	Total						
Plurality	Number	Per cent	Number	Per cent	Number	Per cent	deliveries					
Singleton	2,015	42.4	2,701	56.9	32	0.7	4,748					
Twin	761	71.1	n.p.	—	n.p.	—	1,070					
Triplet	31	93.9	n.p.	_	n.p.							

Gestational age	Singletons		Tw	ins	Triplets		Total babies	
(weeks)	Number	Per cent	Number	Per cent	Number	Per cent	Number	Per cent
20–27	62	1.3	108	5.0	15	15.2	185	2.6
28–31	60	1.3	150	7.0	33	33.3	243	3.5
32–36	403	8.5	1,022	47.8	51	51.5	1,476	21.1
20–36	525	11.1	1,280	59.8	99			

 Table R22: Gestational age for all babies of
 20 weeks, by plurality, 2002

	I	Non donor oo	Donor		N <i>i</i>			
	Fresh all	Fresh IVF	Fresh ICSI	Frozen	oocytes/ embryos	DI	Not stated	All
			N	umber				
Male	2,331	1,044	1,229	861	144	194	13	3,543
Female	2,190	899	1,226	914	109	164	9	3,386
Not stated	32	18	14	21	2	3	0	58

Table R24: Sex of all babies of20 weeks gestation, by treatment type, 2002

ANZARD data items

Item name	Description	Codes
unit	Unit identifier	
site	Site of main treatment	For centres with multiple sites, this identifies location of most significant part of the treatment.
pat_id	Unit ID/Medical Record Number	Unique ID for patient.
mdob	Woman's date of birth	Day/month/year.
pdob	Husband/male partner DOB	Day/month/year.
don_age	Egg/embryo donor's age	Completed years at time of donation.
n_13200	Previous Medicare item 13200s	The number of billed Australian Medicare item 13200. New Zealand units leave this field blank.
ci_tube	Cause of Infertility: tub e.T2j02	2 663.0803 Tm(unit)Tj0 0 7tg13fub eae 20i <u>b</u> fas(ci <u>t</u> ube)TjETEMC/P <<>BDCBT/

1T

Item name	Description	Codes
n_eggs	Number of eggs retrieved	Number of eggs retrieved at OPU. Include any immature oocytes that are identified.
n_donate	Number of eggs donated	Number of eggs donated to someone else.
n_recvd	Number of eggs received	Number of eggs received from someone else.
n_gift	Number of eggs GIFT	Number of eggs replaced in a GIFT procedure.
n_insem	Number of eggs IVF	Number of eggs treated with IVF.
n_icsi	Number of eggs ICSI	Number of eggs treated with ICSI.
sp_site	Site of sperm used	Site of sperm extraction: ejaculated, epididymal (whether by open biopsy or by PESA), testicular or other.
sp_persn	Person from which sperm derives	Husband/partner, known donor, or anonymous donor.
n_fert	Number of eggs fertilised normally	The number of eggs fertilised normally in the opinion of the treating embryologist.
pgd	Preimplantation genetic diagnosis	Yes —preimplantation genetic diagnosis in any form (including aneuploidy screening or sex selection) has been performed on any of the embryos (transferred or not).
		No-pgd not performed.
ass_hatc	Assisted hatching	Yes—where assisted hatching in any form has been performed on any of the embryos (transferred or not).
		No—assisted hatching not performed.
emrecimp	Number of embryos received from someone else or imported into the unit	To minimise the number of required fields in the data collection, this field serves two purposes: 1. Records the number of embryos that are to be received from donation (recipient cycle); or 2. Records the number of embryos to be imported into the current unit from another unit.
n_clthaw	Number of cleavage embryos thawed	Number of zygotes or cleavage stage embryos (up to 4 days) thawed with intention of performing an embryo transfer if they survive.
n_blthaw	Number of blastocysts thawed	Number of blastocysts (i.e. greater than 4 days culture from fertilisation) thawed with intention of performing an embryo transfer if they survive.
et_date	ET date	Embryo transfer date.
n_emb_et	Number of early embryos transferred	Number of zygote or cleavage stage embryos (i.e. up to 4 days since fertilisation) transferred.
n_bl_et	Number of blastocysts transferred	Number of blastocyst embryos (i.e. >4 days since fertilisation) transferred.
emb_icsi	Any embryos ICSI?	Yes— any embryos transferred were fertilised by ICSI.
		No— no transferred embryos were fertilised by ICSI.
n_clfroz	Number of zygotes/cleavage stage embryos frozen	Number of zygote or cleavage stage embryos (i.e. up to 4 days since fertilisation) frozen.
n_blfroz	Number of blastocysts frozen	Number of blastocyst embryos (i.e. >4 days since fertilisation) frozen.

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pr_ectop Ectopic pregnancy Yes— pregnancy is an ectopic pregnancy, or a combined ectopic and uterine (heterotopic) pregnancy. pr_top Elective termination of pregnancy Yes— pregnancy is terminated. pr_reduc Selective reduction performed Yes— selective reduction not performed. abn_less Foetal abnormality in a pregnancy ending <20 weeks or in a foetus removed by selective reduction	Item name	Description	Codes
pr_top Elective termination of pregnancy Yes— pregnancy is terminated. pr_reduc Selective reduction performed Yes— selective reduction not performed. abn_less Foetal abnormality in a pregnancy ending <20 weeks or in a foetus removed by selective reduction	pr_ectop	Ectopic pregnancy	Yes— pregnancy is an ectopic pregnancy, or a combined ectopic and uterine (heterotopic) pregnancy.
pr_top Elective termination of pregnancy Yes— pregnancy is terminated. pr_reduc Selective reduction performed Yes— selective reduction was performed due to foetal abnormality. No— selective reduction not performed. abn_less Foetal abnormality in a pregnancy ending <20 weeks or in a foetus removed by selective reductions of pregnancy and foetal reductions due to foetal abnormality. weeks or in a foetus removed by selective reduction			No- pregnancy not ectopic or heterotopic.
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pr_reducSelective reduction performedYes— selective reduction was performed due to foetal abnormality. No— selective reduction not performed.abn_lessFoetal abnormality in a pregnancy ending <20 			No— pregnancy not terminated.
performedNo— selective reduction not performed.abn_lessFoetal abnormality in a pregnancy ending <20 weeks or in a foetus removed by selective reductionDetails of elective terminations of pregnancy and foetal reductions due to foe abnormality.mat_compMaternal complications of pregnancyDescribes morbidity related to pregnancy.n_delivNumber of babies delivered after 20 weeksInclude all live born and stillborn babies.CSCaesarean delivery woeksYes— delivery by planned or emergency Caesarean section. No— other.bab1_outBaby 1 outcomeLive born, stillborn or neonatal death.bab1_sexBaby 1 sexMale or female.bab1_wtBaby 1 birthweightWeight in grams.	pr_reduc	Selective reduction performed	Yes— selective reduction was performed due to foetal abnormality.
abn_lessFoetal abnormality in a pregnancy ending <20 weeks or in a foetus removed by selective reductionDetails of elective terminations of pregnancy and foetal reductions due to foet abnormality.mat_compMaternal complications of pregnancyDescribes morbidity related to pregnancy.n_delivNumber of babies delivered after 20 weeksInclude all live born and stillborn babies.CSCaesarean delivery bab1_outYes— delivery by planned or emergency Caesarean section. No— other.bab1_outBaby 1 outcomeLive born, stillborn or neonatal death.bab1_sexBaby 1 sexMale or female.bab1_wtBaby 1 birthweightWeight in grams.			No— selective reduction not performed.
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n_deliv Number of babies delivered after 20 weeks Include all live born and stillborn babies. CS Caesarean delivery Yes— delivery by planned or emergency Caesarean section. bab1_out Baby 1 outcome Live born, stillborn or neonatal death. bab1_sex Baby 1 sex Male or female. bab1_wt Baby 1 birthweight Weight in grams.	mat_comp	Maternal complications of pregnancy	Describes morbidity related to pregnancy.
CS Caesarean delivery Yes— delivery by planned or emergency Caesarean section. No— other. No— other. bab1_out Baby 1 outcome Live born, stillborn or neonatal death. bab1_sex Baby 1 sex Male or female. bab1_wt Baby 1 birthweight Weight in grams.	n_deliv	Number of babies delivered after 20 weeks	Include all live born and stillborn babies.
bab1_out Baby 1 outcome Live born, stillborn or neonatal death. bab1_sex Baby 1 sex Male or female. bab1_wt Baby 1 birthweight Weight in grams.	cs	Caesarean delivery	Yes— delivery by planned or emergency Caesarean section.
bab1_outBaby 1 outcomeLive born, stillborn or neonatal death.bab1_sexBaby 1 sexMale or female.bab1_wtBaby 1 birthweightWeight in grams.			No— other.
bab1_sexBaby 1 sexMale or female.bab1_wtBaby 1 birthweightWeight in grams.	bab1_out	Baby 1 outcome	Live born, stillborn or neonatal death.
bab1_wt Baby 1 birthweight Weight in grams.	bab1_sex	Baby 1 sex	Male or female.
	bab1_wt	Baby 1 birthweight	Weight in grams.

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