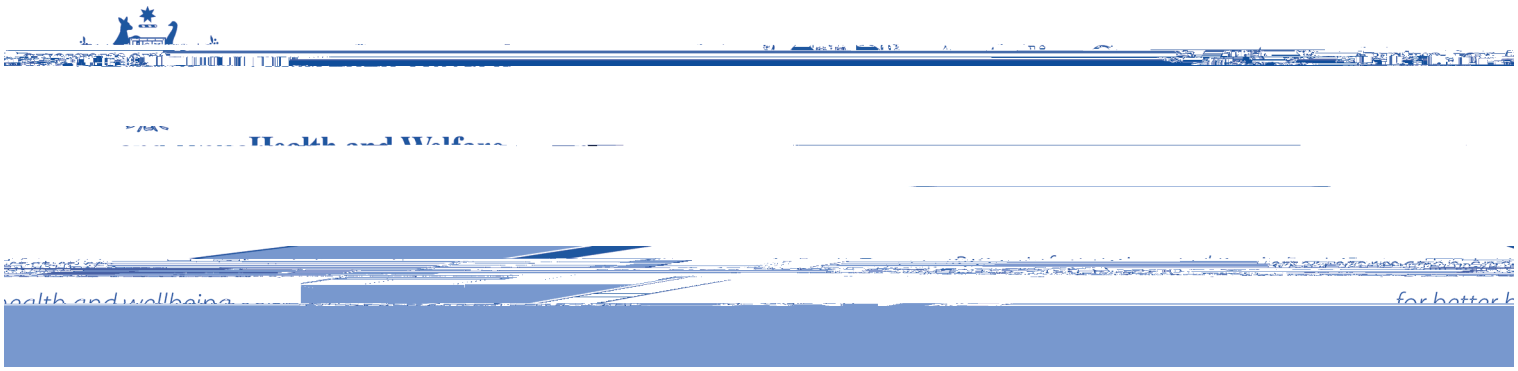

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The Australian and New Zealand Assisted Repr oduction Database (ANZARD), funded by the Fertility Society of Australia, is a collaborati ve effort between the Australian Institute of Health and Welfare's (AIHW) National Perinatal Statistics Unit (NPSU) and fertility centres in Australia and New Zealand. We recognise and thank all staff in the fertility centres for their efforts in compiling the data and providin g additional information when requested.

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AIHW	Australian Institute of Health and Welfare
ANZARD	Australian and New Zealand Assisted Reproduction Database
ART	assisted reproductive technology
CI	confidence intervals
DET	double embryo transfer
DI	donor sperm insemination or artificial insemination with donated sperm
FSA	Fertility Society of Australia
FSH	follicle stimulating hormone
GIFT	gamete intrafallopian transfer
ICSI	intracytoplasmic sperm injection
IVF	in vitro fertilisation
NPSU	National Perinatal Statistics Unit
OHSS	ovarian hyperstimulation syndrome
OPU	oocyte pick-up
PGD	preimplantation genetic diagnosis
RR	rate ratio
SET	single embryo transfer
UNSW	The University of New South Wales
WHO	World Health Organization
. .	not applicable

Assisted reproductive technologies (ART) — such as in vitro fertilisation (IVF) — are a group of procedures used to assist women to become pregnant. ART usually involves removing oocytes (eggs) from a woman's ovaries, fertilising them in the laboratory and then transferring the resulting embryo(s) back into a woman's uterus. Over the last five years, the number of ART procedures has increased by over 10% per year on average in Australia and New Zealand. ART children now account for an estimated 3.3% and 2.0% of children born in

Over the last three decades, ART has evolved to encompass complex ovarian

There were 61,929 ART treatment cycles reported from Australian and New Zealand clinics in 2008 (Table 1). Of these, 91.9% (56,923) were from Australian clinics and 8.1% (5,006) were from New Zealand clinics. In Australia there were 12.6 cycles per 1,000 women of reproductive age (15–44 years) compared to 5.5 cycles per 1,000 women of reproductive age in New Zealand.

About 95% of cycles in 2008 were autologous cycles where a woman intended to use, or used her own oocytes or embryos. Of the 58,740 autologous cycles, 63.5% were fresh cycles and 36.5% were thaw cycles. Other treatment cycles

This chapter presents data on initiated autologous cycles, oocyte donation cycles and oocyte/embryo recipient cycles. Because GIFT cycles (including intended GIFT cycles) and surrogacy cycles accounted for 0.4% of all treatment cycles, they are presented separately in Chapter 5.

An autologous cycle is defined as an ART trea

The average age of women undergoing autologous and oocyte/embryo recipient cycles in 2008 was 35.9 years. For women undergoing oocyte/embryo recipient cycles the mean age was 41.0 years, over five years older than forautologous cycles (35.7 years). Almost one in four cycles (24.6%) were undertaken by women aged 40 years or older (Table 2). The average age of partners was 38.2 years, with 35.6% being aged 40 years or older (Table 3).

Table 2: Number of autologous and recipient cycles by women's age group and treatment type, Australia and New Zealand, 2008

< 30	3,895	10.4	2,478	11.6	70	3.5	6,443	10.6
30–34	9,369	25.1	6,785	31.7	180	9.0	16,334	26.9
35–39	14,120	37.8	8,452	39.4	453	22.7	23,025	37.9
40–44	9,258	24.8	3,405	15.9	768	38.4	13,431	22.1
• 45	671	1.8	306	1.4	528	26.4	1,505	2.5
Not stated	1	0.0	0	0.0	0	0.0	1	0.0

(a) Age at time of treatment.

Note: Data are collected for each treatment cycle. Therefore, some individuals may be counted more than once.

Table 3: Number of autologous and recipient cycles by women's partners' age group and treatment type, Australia and New Zealand, 2008

< 30	2,315	6.2	1,312	6.1	48	2.4	3,675	6.1
30–34	7,821	21.0	5,183	24.2	216	10.8	13,220	21.8
35–39	11,896	31.9	7,242	33.8	468	23.4	19,606	32.3
40–44	8,038	21.5	4,234	19.8	502	25.1	12,774	21.0
• 45	5,673	15.2	2,696	12.6	496	24.8	8,865	14.6
Not stated	1,571	4.2	759	3.5	269	13.5	2,599	4.3

(a) Age at time of treatment.

Note: Data are collected for each treatment cycle. Therefore, some individuals may be counted more than once.

Of the 50,495 embryo transfer cycles, 38.6% involved the transfer of blastocysts. Of autologous cycles, blastocyst transfers made up44.4% of thaw cycles compared to 35.1% of fresh cycles (Table 7).

Table 7: Number of embryo transfer cycles by treatment type and stage of embryo development, Australia and New Zealand, 2008

In 2008, there were 37,314 initiated autologous fresh cycles, comprising 36,846 (98.7%) ovarian stimulated cycles and 468 (1.3%) unstimulated cycles. There were 56 cycles in which thawed oocytes were used for fertilisation.

Of the 37,314 initiated autologous fresh cycles, 92.2% (34,398) were from Australian clinics and 7.8% (2,916) were from New Zealand clinics.

Figure 1 shows the main stages of autologous fresh cycles and the resulting treatment outcomes.

Of the 37,314 initiated autologous fresh cycles in 2008, 91.5% had oocyte pick-up (OPU) performed, 78.4% had embryos transferred, 23.5% resulted in a clinical pregnancy and 18.0% resulted in a live delivery. A live delivery is the delivery of one or more liveborn infants, with the birth of twins and triplets counted as one live delivery.

A treatment can be discontinued for a variety of reasons, including failure of ovaries to respond to drugs, excessive ovarian stimulation, failure to obtain oocytes, failure of oocyte fertilisation, inadequate embryo growth or patient choice.

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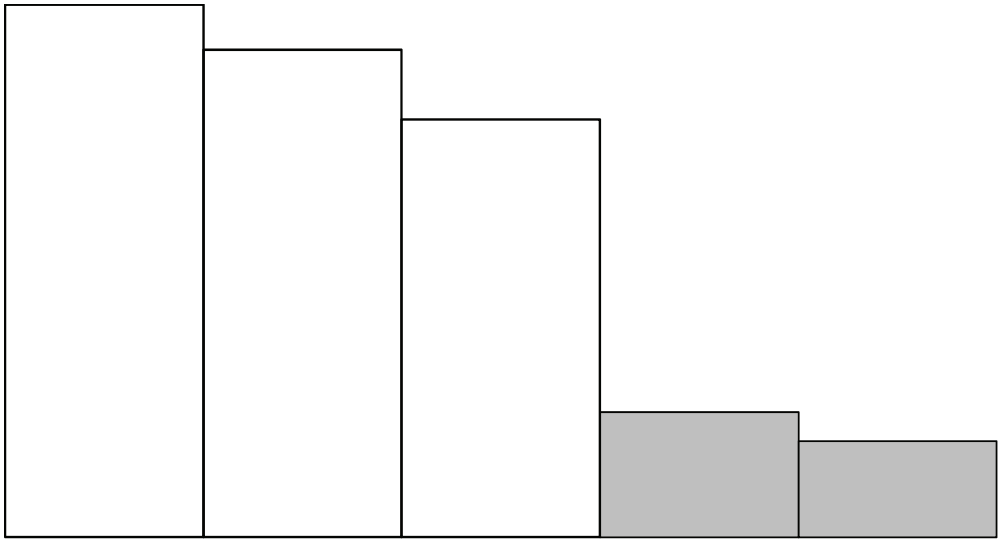
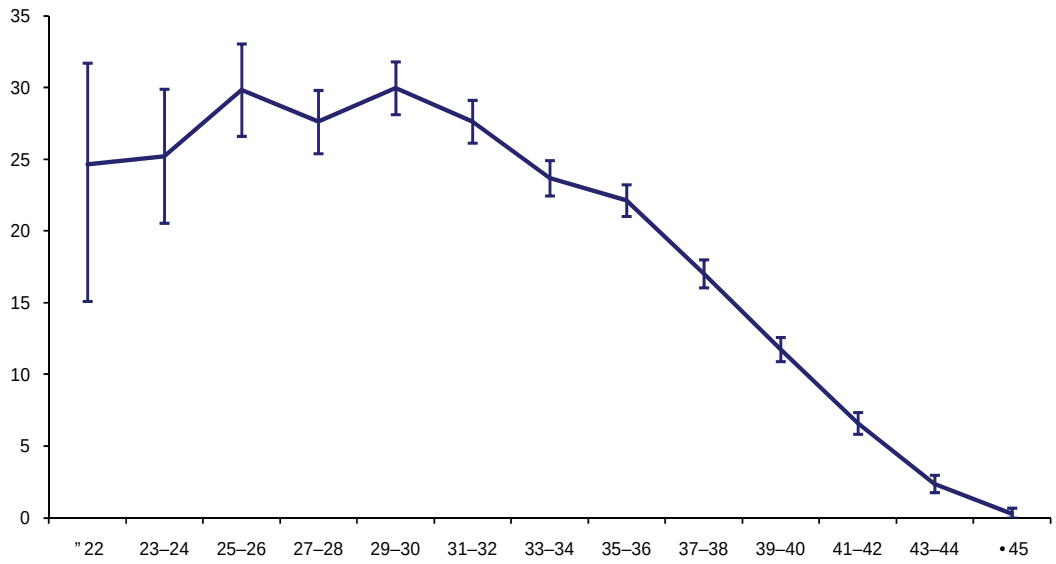


Maternal age is one of the key factors associated with the outcomes of autologous fresh cycles. The highest live delivery rate per embryo transfer cycle was in women aged less than 30 years (35.9%). The rate declined with advancing women's age, with the chance of having a liveborn baby being 9.0% of embryo transfer cycles in women aged 40–44 years, and 0.5% in

Figure 2 shows women's age-specific live delivery rates per initiated autologous fresh cycle by two-year age groups. The highest live delivery rates were for women aged between 25 and 30 years. The live delivery rate declined steadily for women older than 30 years. For women aged 45 years or older, less than one live delivery resulted from every 200 initiated cycles.

The lower live delivery rates in women in their early 20s possibly relate to concurrent underlying medical conditions.



Note: The bars on the graph represent the 95% confidence intervals of the live delivery rates, with the narrower bars representing more reliable estimates.

Figure 2: Live delivery rate per initiated autologous fresh cycle and 95% CI by women's age group, Australia and New Zealand, 2008

Cycles reported with male factor as the only cause of infertility had the highest rates of clinical pregnancy and live delivery, with 25.5% of initiated autologous fresh cycles resulting in a clinical pregnancy and 20.0% in a live delivery. Those with female factor infertility had lower rates of clinical pregnancy and live deli very per initiated cycle (22.3% and 16.9% respectively) (Table 9). The rate ratio (RR) oflive delivery was 1.19 for cycles with male factor only infertility to cycles with female factor only infertility (95% CI 1.12 to 1.25).

Table 9: Outcomes of autologous fresh cycles by cause of infertility, Australia and New Zealand, 2008

Male factor only	10,382	82.3	25.5	20.0
Female factor	11,943	75.4	22.3	16.9
Tubal disease only	2,257	79.7	21.9	16.3
Endometriosis only	2,164	80.4	25.0	19.4
Other female factor only	6,295	71.5	21.1	16.0
Combined female factor	1,227	79.1	24.4	17.9
Combined male—female factor	5,546	79.1	22.3	17.1
Unexplained	8,731	79.1	23.9	18.2
Not stated	712	57.2	18.3	13.5

Comparatively, the rates of clinical pregnancy and live delivery were higher in blastocyst transfer cycles than in cleavage stage embryo transfer cycles regardless of women's age (Table 11). Overall, the difference in live delivery rates for cleavage stage embryos and

There were 21,426 autologous thaw cycles reported in 2008. Of these, 92.0% (19,707) were from Australian clinics and 8.0% (1,719) from New Zealand clinics.

Figure 4 shows the main stages of autologous thaw cycles and the resulting treatment outcomes.

Of the 21,426 initiated autologous thaw cycles, 90.6% had embryos transferred, 21.9% resulted in a clinical pregnancy and 16.5% resulted in a live delivery (Figure 4). Almost one in eleven initiated autologous thaw cycles did not progress to embryo transfer, principally due to non-viability following thawing of cryopreserved (frozen) embryo(s).

The rate of live deliveries per initiated cycle was lower for autologous thaw cycles than for autologous fresh cycles in 2008 (16.5% and 18.0% respectively) (Figures 1 and 4).

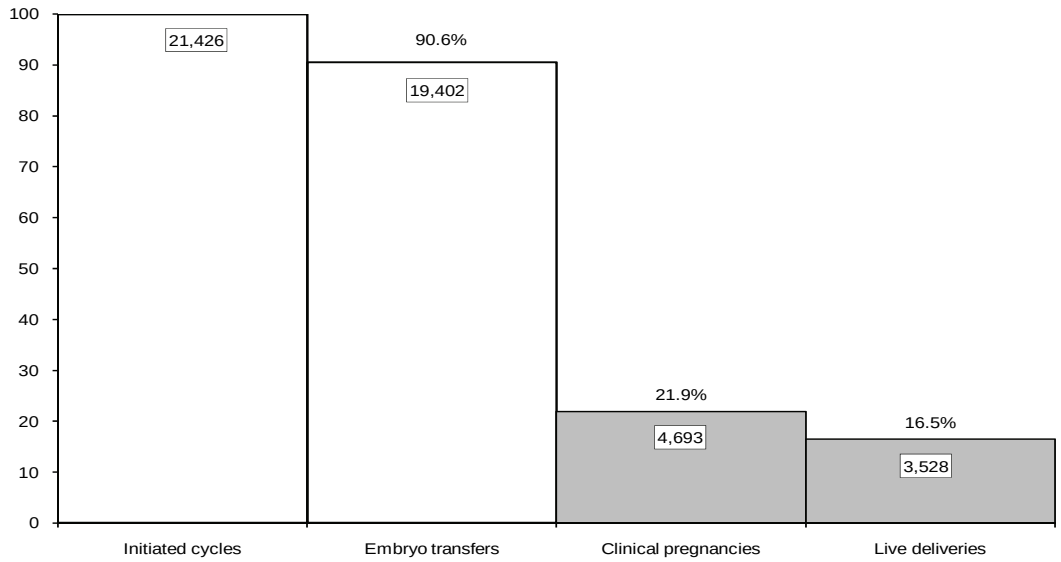


Figure 4: Progression of autologous thaw cycles, Australia and New Zealand, 2008

Similar to women undergoing autologous fresh cycles, the live delivery rate per thawed

The Figure 5 shows age specific live delivery rates per initiated autologous thaw cycle by two-year age groups. The highest live delivery rates were for women in their late 20s to early 30s. The live delivery rate declined steadily for women aged 34 years or older. For women aged 45 years or older, one in seventeen (5.9%, 95% CI 3.2% to 8.5%) initiated autologous thaw cycles resulted in a live delivery, which is significantly higher than the live delivery rate per initiated autologous fresh cycle in this age group (0.3%, 95% CI 0.0% to 0.7%) (Figures 2 and 5). The more favourable live delivery rate of thaw cycles relates to the fact that a woman's thawed embryos are frozen at the time of her initial autologous fresh cycle, and therefore are of a younger biological age.

The lower live delivery rates in women in their early 20s possibly relate to concurrent underlying medical conditions.

Cycles reported with male factor as the only cause of infertility had the highest rate of live delivery per initiated cycle (18.2%) (Table 14). The live delivery rate was significantly higher for cycles with male factor only infertility than for cycles with female factor only infertility (RR 1.21, 95% CI 1.12 to 1.30).

Table 14: Outcomes of autologous thaw cycles by cause of infertility, Australia and New Zealand, 2008

Male factor only	5,934	90.6	23.2	18.2
Female factor	7,657	91.9	20.8	15.1
Tubal disease only	1,514	91.7	20.7	14.8
Endometriosis only	1,403	91.7	21.2	16.7
Other female factor only	3,959	91.8	20.9	14.9
Combined female factor	781	93.1	20.0	13.8
Combined male—female factor	2,894	89.3	20.6	15.2
Unexplained	4,424	90.1	23.2	17.6
Not stated	517	80.9	18.8	13.7

The rates of clinical pregnancy and live delivery were lower for single embryo transfer (SET) than double embryo transfer (DET) regardless of a women's age. Overall, the difference in live delivery rates for SET and DET in autologous thaw cycles was 2.6 percentage points (17.5% and 20.1% respectively) (Table 15).

Table 15: Outcomes of autologous thaw embryo transfer cycles by women's age and number of embryos transferred, Australia and New Zealand, 2008

Embryo transfers	6,543	1,971	0	7,862	2,981	45	14,405	4,952	45
Clinical pregnancies	1,716	589	0	1,629	754	5	3,345	1,343	5
Live deliveries	1,358	464	0	1,169	532	5	2,527	996	5
Clinical pregnancies per embryo transfer cycle (%)	26.2	29.9	. .	20.7	25.3	11.1	23.2	27.1	11.1
Live deliveries per embryo transfer cycle (%)	20.8	23.5	. .	14.9	17.8	11.1	17.5	20.1	11.1

(a) Age at time of treatment.

The rates of clinical pregnancy and live delivery were higher for blastocyst transfer cycles than for cleavage stage embryo transfer cycles regardless of women's age. Overall, the difference in live delivery rates for cleavage stage embryos and blastocysts was 2.7 percentage points (17.0% and 19.7% respectively) (Table 16). The rate of live delivery for blastocyst transfer cycles was 1.2 times higher than that of cleavage stage embryo transfer cycles (RR 1.16, 95% CI 1.09 to 1.23).

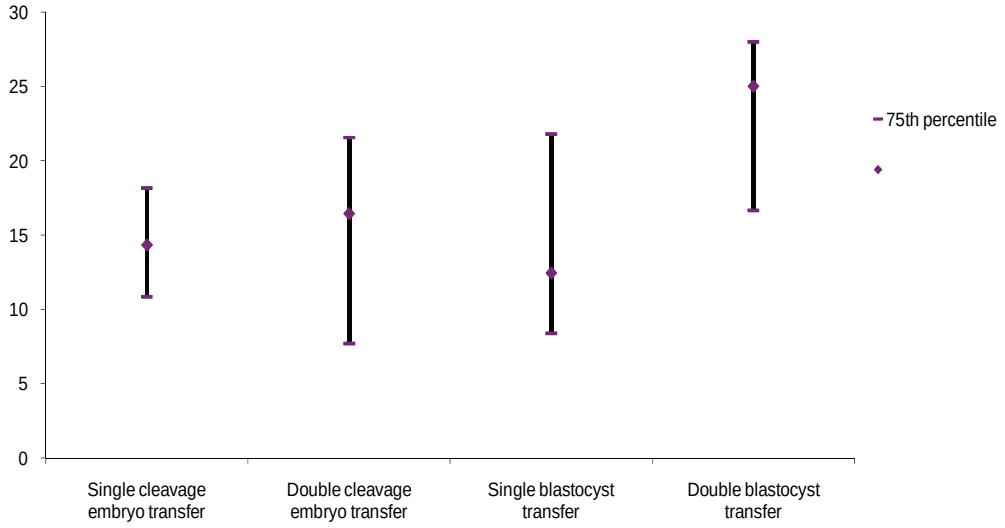
Table 16: Outcomes of autologous thaw embryo transfer cycles by women's age and stage of embryo development, Australia and New Zealand, 2008

Embryo transfers	4,513	4,001	6,276	4,612	10,789	8,613
Clinical pregnancies	1,180	1,125	1,215	1,173	2,395	2,298
Live deliveries	945	877	886	820	1,831	1,697
Clinical pregnancies per embryo transfer cycle (%)	26.1	28.1	19.4	25.4	22.2	26.7
Live deliveries per embryo transfer cycle (%)	20.9	21.9	14.1	17.8	17.0	19.7

(a) Age at time of treatment.

There was also variation in the outcomes of autologous thaw cycles by number and type of embryos transferred among the fertility centres. Figure 6 shows the median live delivery rate for autologous thaw embryo transfer cycles and the interquartile range by number of embryos transferred and stage of embryo development among the fertility centres that transfer these types of embryos. Double blastocyst transfers achieved the highest median live delivery rate (25.0%) followed by double cleavage stage embryo transfers (16.4%). The rates are unadjusted for the women's age and parity which may vary between centres.

These data should be interpreted with caution because of small numbers and potential variability of other factors which may influence the live delivery rate of an individual centre.



A donation cycle is defined as an ART treatment cycle where a woman intends to donate, or donates her oocytes to others. A donation cycle may result in the donation of either oocytes or embryos to a recipient woman. A recipient cycle is defined as an ART treatment cycle in which a woman receives oocytes or embryos from another woman. The use of donor sperm does not alter the donor status of the cycle.

In 2008, donation and recipient cycles accounted for 4.8% (2,977) of all treatment cycles in Australia and New Zealand. There were 978 cycles started where the intention was to donate oocytes, and there were 1,999 cycles started in women intending to receive donated oocytes or embryos (Table 1). All oocyte donation cycles were undertaken as fresh cycles.

In 2008, there were 978 cycles in Australia and New Zealand where the intention was to donate oocytes to a recipient. Fifty-one of these cycles were cancelled before oocyte pick-up (OPU).

Of the 978 oocyte donation cycles, 50.2% were in women aged 35 years or older. The average age of women donating oocytes was 33.6 years. Over 94% of the initiated oocyte donation cycles resulted in donations (Table 18).

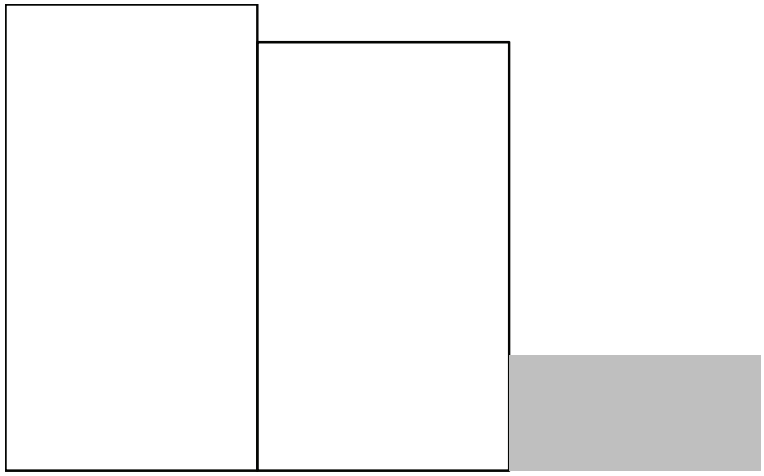
Table 18: Number of oocyte donation cycles by donor's age group, Australia and New Zealand, 2008

< 30	174	94.3	93.7	93.7
30–34	313	97.4	97.4	97.4
35–39	434	94.2	93.3	93.3
• 40	57	86.0	86.0	86.0

(a) Age at time of treatment.

There were 1,999 oocyte/embryo recipient cycles reported in 2008 (Table 1). The average age of women having an oocyte/embryo recipient cycle was 41.0 years. Of these 1,999 recipient cycles, 88.0% (1,760) were oocyte recipient cycles and 12.0% (239) were embryo recipient cycles. Of the 1,760 cycles where the embryos were derived from donated oocytes, 49.8% were thaw cycles (Table 19). All embryo recipient cycles were thaw cycles.

Figure 7 shows the main stages of oocyte/embryo recipient cycles and the resulting treatment outcomes. Of the 1,999 initiated oocyte/embryo recipient cycles undertaken in 2008, 24.7% resulted in a clinical pregnancy and 17.9% resulted in a live delivery.



Of the 883 fresh oocyte recipient cycles, 22.0% resulted in a live delivery, which is significantly higher than either the live delivery rate for thaw oocyte recipient cycles (15.2%) or embryo recipient cycles (12.6%) (Table 19).

Table 19: Outcomes of oocyte/embryo recipient cycles by treatment type, Australia and New Zealand, 2008

Initiated cycles	883	877	239	1,999
Embryo transfers	778	837	222	1,837
Clinical pregnancies	265	182	46	493
Live deliveries	194	133	30	357
Live deliveries per initiated cycle (%)	22.0	15.2	12.6	17.9
Live deliveries per embryo transfer cycle (%)	24.9	15.9	13.5	19.4
Live deliveries per clinical pregnancy (%)	73.2	73.1	65.2	72.4

The clinical pregnancy and live delivery rates of recipient cycles varied by recipient's age group. The overall live delivery rate per initiated cycle was 17.9% (Table 20).

Table 20: Outcomes of oocyte/embryo recipient cycles by recipient's age group, Australia and New Zealand, 2008

					•	
Initiated cycles	70	180	453	768	528	1,999
Embryo transfers	62	162	413	712	488	1,837
Clinical pregnancies	15	43	112	193	130	493
Live deliveries	11	35	76	142	93	357
Live deliveries per initiated cycle (%)	15.7	19.4	16.8	18.5	17.6	17.9
Live deliveries per embryo transfer cycle (%)	17.7	21.6	18.4	19.9	19.1	19.4
Live deliveries per clinical pregnancy (%)	73.3	81.4	67.9	73.6	71.5	72.4

(a) Age at time of treatment.

Of the 50,495 autologous and recipient embryo transfer cycles undertaken in Australian and New Zealand fertility centres, 13,950 resulted in a clinical pregnancy. Of these, 12,523 (89.8%) were from fertility centres in Australia and 1,42 7 (10.2%) from New Zealand centres. Clinical pregnancies that resulted from GIFT and surrogacy cycles are described in Chapter 5.

Almost four in five of the 13,950 clinical preg nancies (77.2%) resulted in a delivery and 20.9% resulted in early pregnancy loss (less than 20 weeks gestation and less than 400 grams birthweight). The outcomes of 270 (1.9%)

There were 2,916 early pregnancy losses (less than 20 weeks gestation and less than 400 grams birthweight) following embryo transfers in 2008, representing 20.9% of clinical pregnancies. The early pregnancy loss rate was 20.0% for autologous fresh cycles, 22.0% for autologous thaw cycles and 26.8% for oocyte/embryo recipient cycles.

Of the 2,916 early pregnancy losses, 91.0% were miscarriages, 6.0% were ectopic or heterotopic pregnancies and 3.0% were due to fetal reduction or termination of pregnancy (Table 24).

Table 24: Clinical pregnancies of < 20 weeks gestation by pregnancy outcome and treatment type, Australia and New Zealand, 2008

Miscarriage	1,574	89.8	957	92.7	122	92.4	2,653	91.0
Reduction or termination	60	3.4	22	2.1	5	3.8	87	3.0
Ectopic or heterotopic pregnancy	118	6.7	53	5.1	5	3.8	176	6.0

There were 10,762 women who gave birth to at least one baby of 20 weeks or more gestation or at least 400 grams birthweight following embryo transfer cycles in 2008. Of these, 98.6% (10,614) of the women gave birth to at least one liveborn baby (live delivery). The proportion of live deliveries among all deliveries was similar across all treatment types (Table 25).

Table 25: Deliveries by delivery outcome and treatment type, Australia and New Zealand, 2008

Live delivery	6,729	98.6	3,528	98.5	357	99.7	10,614	98.6
Fetal death[(a)]	76	1.1	40	1.1	1	0.3	117	1.1
Not stated	17	0.2	14	0.4	0	0.0	31	0.3

(a) Fetal death is reported by patients to fertility centre staff. These data are not official vital statistics.

Of the 10,762 women who gave birth following embryo transfer cycles in 2008, 8.4% had multiple gestation deliveries (Table 26). This proportion of multiple gestation deliveries was lower than in 2007 (10.0%) (Wang et al. 2009). By comparison, the proportion of all deliveries in Australia in 2007 that were multiple gestation deliveries was 1.6% (Laws & Sullivan 2009).

There were 877 women who had twin deliveries, accounting for 8.1% of women who gave birth following embryo transfer cycles in 2008. Eighty-two percent of twin deliveries were from DET cycles (720/877) and 17.2% (151/877) were from SET cycles. Of the 3,392 deliveries following DET, 21.2% were twins. This was significantly higher than the proportion of twin deliveries following SET (2.1%) (Table 26).

Table 26: Deliveries by gestation and number of embryos transferred, Australia and New Zealand, 2008

Singleton	7,180	97.9	2,652	78.2	29	78.4	9,861	91.6
Multiple	153	2.1	740	21.8	8	21.6	901	8.4

The average age of women at the time of delivery was 35.0 years. This is five years older than the average age (29.9 years) of women who gave birth in Australia in 2007 (Laws & Sullivan 2009).

Women aged less than 35 years had a marginally higher proportion of multiple gestation deliveries compared with women aged 35 years or older (8.6% and 8.2% respectively). Of deliveries following double embryo transfer, the proportion of multiple gestation deliveries was significantly higher for women aged less than 35 years compared to women aged 35 years or older (29.8% and 17.8%) (Table 27).

Table 27: Deliveries by gestation and maternal age group, Australia and New Zealand, 2008

Singleton	3,620	798	0	4,418	3,560	1,854	29	5,443
Multiple	77	338	3	418	76	402	5	483
Twin	76	329	2	407	75	391	4	470
Higher order multiple	1	9	1	11	1	11	1	13
Singleton	97.9	70.2	0.0	91.4	97.9	82.2	85.3	91.8
Multiple	2.1	29.8	100.0	8.6	2.1	17.8	14.7	8.2
Twin	2.1	29.0	66.7	8.4	2.1	17.3	11.8	7.9
Higher order multiple	0.0	0.8	33.3	0.2	0.0	0.5	2.9	0.2

(a) Age at time of delivery.

Almost half (49.1%, 95% CI 48.1% to 50.0%) of deliveries following embryo transfer cycles in 2008 were by caesarean section (Table 28). This is a markedly higher rate than for all deliveries in Australia in 2007 (30.9%) (Laws & Sullivan 2009).

The caesarean section rate increased with advancing women's age at delivery—39.5% of women aged less than 30 years had a caesarean section compared to 80.4% of women aged 45 years or older (Table 28).

There was also a significant difference in the caesarean section rate for singleton deliveries (46.6%) compared with twin deliveries (78.1%) and triplet deliveries (82.6%).

Table 28: Deliveries by method of delivery and maternal age group, Australia and New Zealand, 2008

The babies described in this section were those born at 20 weeks or more gestational age or at least 400 grams birthweight following embryo transfer cycles. The outcomes of babies born from GIFT and surrogacy cycles are described in Chapter 5.

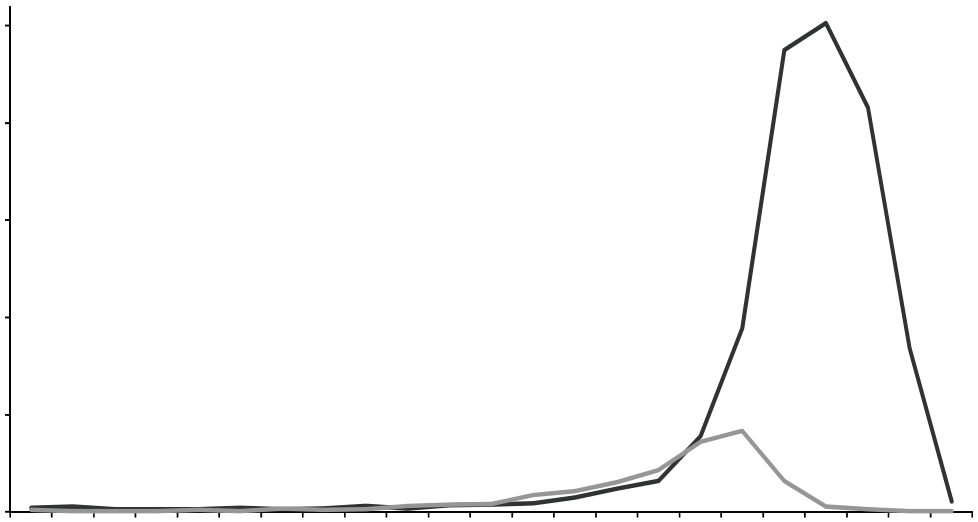
There were 11,688 babies born to women who had embryo transfer cycles in 2008 — 89.8% (10,490) were from fertility centres in Australia and 10.2% (1,198) were from fertility centres in New Zealand. Of the 11,688 babies, 84.4% were singletons, 15.0% were twins and 0.6% were higher order multiples. There were 11,507 liveborn babies, representing 98.5% of all babies. The birth status was not reported for 32 babies.

There were 5,952 (50.9%) male babies, 5,661 (48.4%) female babies and 75 (0.6%) babies where gender was not stated. For the 11,507 liveborn babies the secondary sex ratio was 105.6 male babies for every 100 female babies, which was the same for all Australian liveborn babies born in 2007 (105.6) (Laws & Sullivan 2009).

The average gestational age of all babies born following embryo transfer cycles was 37.7 weeks (Table 29). This is less than the average gestational age of 38.8 weeks for all babies born in Australia in 2007 (Laws & Sullivan 2009).

Nearly one in five babies (19.3%) were preterm (less than 37 weeks gestation), which was markedly higher than the proportion of preterm babies (8.1%) born in Australia in 2007 (Laws & Sullivan 2009). The high proportion of ART babies born preterm is mainly related to the higher proportion of multiple births among women who had ART treatment. The average gestational age of singletons was 38.3 weeks, with 10.7% of singletons being born preterm. This contrasts with the average gestational age for ART twins of 34.9 weeks, with 64.1% of twins being born preterm. All ART higher order multiples were born preterm (Table 29).

Figure 8 shows the distribution of gestational age for singletons and twins born to women who had embryo transfer cycles in 2008. The proportions of preterm singletons (10.7%) and twins (64.1%) born to women who had embryo transfer cycles in 2008 were higher than the proportions of preterm singletons and twins born in Australia in 2007 (6.6% and 53.7% respectively) (Laws & Sullivan 2009).



The average birthweight for liveborn babies to women who had embryo transfer cycles in 2008 was 3,183 grams. Just over 14% of these babies were low birthweight (< 2,500 grams) (Table 30).

As with gestational age, the high proportion of low birthweight babies mainly reflects the high proportion of multiple births among babies conceived after ART treatment.

Singletons had an average birthweight of 3,334 grams, compared with 2,380 grams for twins. Seven per cent of ART singletons were low birthweight (Table 30), which is markedly higher than the proportion of low birthweight singletons (4.7%) born in Australia in 2007 (Laws & Sullivan 2009). Of ART twins, 52.7% were low birthweight, which is similar to the proportion of low birthweight twins (49.6%) born in Australia in 2007 (Laws & Sullivan 2009).

Table 30: Liveborn babies by birthweight group and plurality, Australia and New Zealand, 2008

Mean (g)	3,334		2,380		1,479		3,183	
< 1,000	64	0.7	54	3.1	13	20.0	131	1.1
1,000–1,499	81	0.8	103	6.0	16	24.6	200	1.7
1,500–1,999	126	1.3	220	12.8	27	41.5	373	3.2
2,000–2,499	406	4.2	529	30.8	8	12.3	943	8.2
2,500–2,999	1,503	15.5	541	31.5	1	1.5	2,045	17.8
3,000–3,499	3,618	37.2	199	11.6	0	0.0	3,817	33.2
3,500–3,999	2,817	29.0	36	2.1	0	0.0	2,853	24.8
• 4,000	1,051	10.8	7	0.4	0	0.0	1,058	9.2
Not stated	57	0.6	30	1.7	0	0.0	87	0.8
< 2,500	677	7.0	906	52.7	64	98.5	1,647	14.3

Perinatal mortality is a summary measure of fetal deaths (stillbirths) and neonatal deaths (defined as the death of liveborn infants within 28 days of birth).

There were 189 reported perinatal deaths, representing 1.6% of all babies born following embryo transfer cycles in 2008. Of these, 149 were fetal deaths and 40 were neonatal deaths. The perinatal mortality rate in 2008 was 16.2 deaths per 1,000 births (Table 31), which was slightly higher than the rate of 14.5 deaths per 1,000 ART births reported in 2007 (Wang et al. 2009), and higher than the rate of 10.3 per 1,000 births to all women who gave birth in Australia 2007 (Laws & Sullivan 2009).

Singletons had a lower perinatal mortality rate of 12.8 deaths per 1,000 births compared to multiple birth babies (34.8 deaths per 1,000 births) (Table 31).

These data should be interpreted with caution because of the small numbers and potential variability in case reporting. Data are limited by the self-reported nature of the information, especially on pregnancy complications and infant morbidity and mortality. In 2008, information relating to birth outcomes was not stated for 1.9% of clinical pregnancies.

Table 31: Perinatal mortality of babies by type of death and plurality, Australia and New Zealand, 2008

Fetal deaths	108	41	149
Neonatal deaths	18	22	40
Fetal deaths per 1,000 births	11.0	22.4	12.7
Neonatal deaths per 1,000 live births	1.9	12.6	3.5
Perinatal deaths per 1,000 births[(b)]	12.8	34.8	16.2

(a) Perinatal deaths are reported by patients to fertility centre staff. These data are not official vital statistics.

(b) Fetal and perinatal mortality rates were calculated using all births (live births and fetal deaths) as the denominator. The neonatal mortality rate was calculated using live births as the denominator.

Note: The birth status was not reported for 32 babies.

Preimplantation genetic diagnosis (PGD) is a procedure whereby embryonic cells are removed and screened for chromosomal disorders or genetic diseases before embryo transfer. In 2008, PGD was performed in 971 cycles, representing 1.8% of cycles in which embryos were created or thawed. Most PGD cycles (795/971) were fresh cycles (Table 32).

Of the 971 PGD cycles, 72.0% (699) had embryos transferred, 23.8% (231) resulted in a clinical pregnancy and 18.3% (178) resulted in a live delivery.

Table 32: Number of cycles with PGD by type of embryo, Australia and New Zealand, 2008

Fresh	32,384	795	2.5
Thaw	22,237	176	0.8

Donor sperm insemination (DI) covers a range of techniques of placing sperm into the female genital tract using donated sperm from a man other than the woman's partner. The information reported to ANZARD and presented in this section only describes DI cycles undertaken in fertility centre s in Australia and New Zealand, and does not include DI undertaken outside of this setting.

In 2008, there were 2,390 DI cycles reported to ANZARD, which included 24.1% (575) undertaken with controlled ovarian hypersti mulation and 75.9% (1,815) undertaken in unstimulated cycles. Of all DI cycles, 14.5%resulted in a clinical pregnancy and 11.1% resulted in a live delivery (Table 34).

There were 347 clinical pregnancies following DI cycles in 2008 (Table 34). Of these, 0.3% were ectopic/heterotopic pregnancies and 0.9% were terminations/reductions. Almost 78% of clinical pregnancies (270 of 347) resulted ina delivery. Of the 270 deliveries, 94.8% (256) were singleton deliveries and 5.2% (14) were twin deliveries.

There were 284 babies born to women who had DI treatment. Of these babies, 10.2% (29) were born preterm (<37 weeks gestation). Themean birthweight of liveborn babies following DI treatment was 3,401 grams. Seventeen liveborn babies (6.1%) were born with low birthweight (<2,500 grams). The perinatal mortality rate (fetal deaths plus neonatal deaths) was 10.6 per 1,000 births to women who had DI in 2008.

This section includes autologous cycles, donation/recipient cycles, GIFT cycles and surrogacy cycles undertaken in Australia and New Zealand from 2004 to 2008.

In 2008, 61,929 initiated ART treatment cycles were undertaken in Australia and New Zealand. This is an increase of 9.0% in ART treatment cycles undertaken in 2007 and an increase of 47.8% in ART treatment cycles undertaken in 2004 (Table 35). The proportion of initiated cycles that were thaw cycles has remained at approximately 37% for each year.

There was also a steady increase in the number of clinical pregnancies and live deliveries resulting from ART treatment between 2004 and 2008. This increase resulted mainly from the increase in the number of ART treatments undertaken. In 2008, there were 10,633 live deliveries, 1.6 times the 6,792 live deliveries in 2004 (Table 35). This increase represents an average growth of 1,270 clinical pregnancies per year ($p<0.01$) and 939 live deliveries per year ($p<0.01$) between 2004 and 2008.

Between 2004 and 2008, the live delivery rate per initiated cycle ranged from 16.2% to 17.8% (Table 35). During this period there was a voluntary shift in clinical practice to SET in Australia and New Zealand, with the proportion of SET cycles increasing from 40.5% to 67.8% (Figure 9). During the same period there was a fall in the multiple delivery rate from 16.4% to 8.4% (Table 36).

Table 35: Number of ART treatment cycles by stage/outcome of treatment, Australia and New Zealand, 2004 to 2008

Initiated cycles[(a)]	41,904	47,661	50,521	56,817	61,929
Embryo transfers[(b)]	34,232	39,121	41,447	46,620	50,645
Clinical pregnancies	8,794	10,492	11,720	12,815	13,983
Live deliveries	6,792	8,166	8,999	9,874	10,633
Clinical pregnancies per initiated cycle (%)	21.0	22.0	23.2	22.6	22.6
Live deliveries per initiated cycle (%)	16.2	17.1	17.8	17.4	17.2

(a) Includes all ART treatment (autologous cycles, oocyte donation cycles, oocyte/embryo recipient cycles, GIFT cycles, surrogacy cycles and unclassified cycles).

(b) Includes GIFT cycles that reached oocyte transfer.

Between 2004 and 2008, there was a decrease in multiple gestation deliveries resulting from ART treatment. The proportion of multiples de liveries significantly decreased from 16.4% in 2004 to 8.4% in 2008 ($p<0.01$). The proportion of twin deliveries was 8.2% — the lowest since ANZARD was established (Table 36).

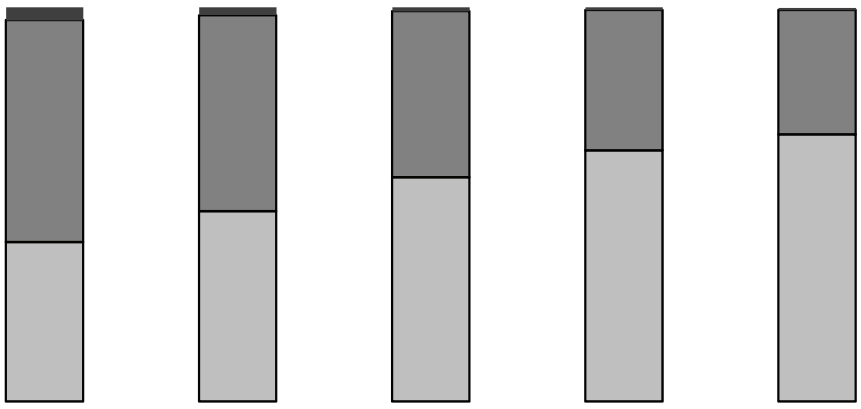
Table 36: Number of deliveries following ART treatment by gestation, Australia and New Zealand, 2004 to 2008

The number and proportion of blastocyst transfer cycles have increased significantly over the five-year period from 2004 to 2008. For fresh and thaw embryo transfer cycles the proportion of blastocyst transfer cycles increased from 17.1% in 2004 to 38.6% in 2008 (p<0.01) (Table 38).

Table 38: Number of embryo transfer cycles by treatment type, Australia and New Zealand, 2004 to 2008

Cleavage stage	16,381	82.1	17,452	77.0	17,773	73.4	19,504	71.9	19,540	65.1
Blastocyst	3,571	17.9	5,222	23.0	6,428	26.6	7,629	28.1	10,496	34.9
Cleavage stage	11,875	84.0	12,791	78.4	12,372	72.3	12,757	65.8	11,526	56.1
Blastocyst	2,266	16.0	3,533	21.6	4,751	27.7	6,623	34.2	9,007	43.9

There has been a significant decline in the number of cycles in which three or more embryos were transferred, from 3.2% in 2004 to 0.6% in 2008 (p<0.01). There has also been a significant shift in practice to SET, with the proportion of SET cycles increasing from 40.5% in 2004 to 67.8% in 2008 (p<0.01) in Australia and New Zealand (Figure 9).



The data presented in this report are supplied by 36 fertility centres in Australia and New Zealand and are compiled into ANZARD. ANZARD includes information about the ART treatment procedures of IVF and GIFT. It also includes information about ART treatment using fresh and cryopreserved/thawed embryos, treatment involving donated oocytes or embryos, and treatment involving surrogacy arrangements. ANZARD collects data on the use of ART techniques such as ICSI, assisted hatching, PGD and blastocyst culture. In addition to ART procedures, ANZARD also collects data from fertility centres about artificial insemination cycles using donated sperm (donor insemination (DI)). The outcomes of pregnancies, deliveries and babies born following ART and DI treatments are also maintained in ANZARD. This includes the method of birth, birth status, birthweight, gestational age, plurality, perinatal mortality and selected information on maternal morbidity.

This report presents information on ART and DI treatment cycles that took place in fertility clinics in Australia and New Zealand in 2008, and the resulting pregnancies and births. The babies included in this report were conceived through treatment cycles undertaken in 2008, and were born in either 2008 or 2009.

Most fertility centres have computerised data information management systems and are able to provide the NPSU with high quality data. All data processed by NPSU undergo a validation process, with data queries being followed up with fertility centre staff. In 2008, information relating to pregnancy and birth outcomes was not provided for 1.9% of clinical pregnancies. The Reproductive Technology Accreditation Committee of the Fertility Society of Australia also plays a role in ensuring the quality of ANZARD data by validating selected records against clinic files in their annual inspections.

Data presented are for treatment cycles and not patients. It is possible for an individual woman to undergo more than one treatment cycle in a year or experience more than one pregnancy. This means that information reported about patient characteristics, such as age, parity and cause of infertility, is based on calculations in which individuals may be counted more than once.

The rates of clinical pregnancy and live delivery were measured per initiated cycle. Where the number of initiated cycles was not available, for example using blastocysts or cleavage stage embryos, the rates were measured per embryo transfer cycle.

Where applicable, percentages in tables have been calculated including the ‘Not stated’ category. Throughout the report, for totals, percentages may not add up to 100.0 and, for subtotals, they may not add up to the sum of the percentages

Variable	Data domain
Unit identifier	3-digit code for clinics provided by NPSU.
Site of main treatment	For centres with multiple sites, this identifies location of most significant part of the treatment.
Unit patient ID/medical record number	Unique ID for patient.
Woman's date of birth	Day/month/year.
Husband/male partner DOB	Day/month/year.
Oocyte/embryo donor's age	Completed years at time of donation.
Previous Medicare item 13200s	The number of billed Australian Medicare item 13200. New Zealand units leave this field blank.
Cause of infertility: tubal disease	Yes—in the opinion of the treating clinician or clinic there is significant tubal disease present. No—other.
Cause of infertility: endometriosis	Yes—in the opinion of the treating clinician or clinic there is significant endometriosis contributing to this couple's subfertility. No—other.
Cause of infertility: male factor	Yes—in the opinion of the treating clinician or clinic there is a significant male factor problem. No—other.

Variable	Data domain
Maternal complications of pregnancy	Describes morbidity related to pregnancy.
Number of babies delivered	Include all liveborn and stillborn babies.
Caesarean delivery	Yes—delivery by planned or emergency caesarean section. No—other.
Baby 1 outcome	Liveborn, stillborn or neonatal death.
Baby 1 sex	Male or female.
Baby 1 birthweight	Weight in grams.
Baby 1 abnormality	Describes any known congenital malformation.
Baby 1 date of neonatal death	Date of neonatal death.
Baby 2 outcome	Liveborn, stillborn or neonatal death.
Baby 2 sex	Male or female.
Baby 2 weight	Weight in grams.
Baby 2 abnormality	Describes any known congenital malformation.
Baby 2 date of neonatal death	Date of neonatal death.
Baby 3 outcome	Liveborn, stillborn or neonatal death.
Baby 3 sex	Male or female.
Baby 3 weight	Weight in grams.
Baby 3 abnormality	Describes any known congenital malformation.
Baby 3 date of neonatal death	Date of neonatal death.
Baby 4 outcome	Liveborn, stillborn or neonatal death.
Baby 4 sex	Male or female.
Baby 4 weight	Weight in grams.
Baby 4 abnormality	Describes any known congenital malformation.
Baby 4 date of neonatal death	Date of neonatal death.
Admitted with ART morbidity	Yes—woman is admitted to hospital with any condition (excluding any pregnancy-related issues, such as ectopic pregnancy) that could be in any way related to fertility treatment.
OHSS	Yes—admission to hospital is due to symptoms of OHSS.
Morbidity detail	Describes symptoms of treatment-related morbidity.

This report categorises ART treatments according to whether a woman used her own oocytes or embryos, or oocytes/embryos were donated by another woman/couple, and whether the embryos were transferred soon after fertilisation or following cryopreservation.

Artificial insemination : a range of techniques of placing sperm into the female genital tract, and can be used with controlled ovarian hyperstimulation or in unstimulated cycles. These techniques are referred to as donor insemination (DI) in this report.

ART (assisted reproductive technology): treatments or procedures that involve the in vitro handling of human oocytes (eggs) and sperm or embryos for the purposes of establishing a pregnancy. ART does not include artificial insemination.

Autologous cycle: an ART treatment cycle in which a woman intends to use, or uses her own oocytes or embryos. GIFT cycles are classified separately from autologous cycles.

Blastocyst: an embryo comprising approximately 100 cells usually developed by 5 or 6 days after fertilisation.

Caesarean section: an operative delivery by surgical incision through the abdominal wall and uterus.

Fetal death (stillbirth): the birth of an infant after 20 or more weeks gestation or 400 grams or more birthweight that shows no signs of life.

Fresh cycle: an ART treatment cycle which intends to use, or uses embryo(s) that have not been cryopreserved (frozen).

Gestational age: the completed weeks of gestation of the fetus. This is calculated as follows:

- Cycles with embryos transferred: (pregnancy end date – embryo transfer date + 16 days) for transfer of cleavage stage embryos and (pregnancy end date – embryo transfer date + 19 days) for transfer of blastocysts.
- GIFT cycles: (pregnancy end date – OPU date) + 14 days.
- DI cycles: (pregnancy end date – date of insemination) + 14 days.

GIFT (gamete intrafallopian transfer): an ART treatment where mature oocytes and sperm are placed directly into a woman's fallopian tubes so that in vivo fertilisation may take place. GIFT cycles are classified separately from autologous cycles.

Heterotopic pregnancy: a double gestation pregnancy in which implantation takes place both inside and outside the uterine cavity.

ICSI (intracytoplasmic sperm injection): a procedure whereby a single sperm is injected directly into the oocyte to aid fertilisation. If an embryo transfer cycle involves the transfer of at least one embryo created using ICSI, it is counted as an ICSI cycle.

Live birth: according to the World Health Organization (WHO) definition, a live birth is defined as the complete expulsion or extraction from its mother of a product of conception irrespective of the duration of the pregnancy, after such separation, breathes or shows any other evidence of life, such as beating of the heart, pulsation of the umbilical cord, or definite movement of the voluntary muscles, whether or not the umbilical cord has been cut or the placenta is attached; each product of such a birth is considered liveborn. In this report, live births are included if they meet the WHO definition and if they are of 20 weeks or more gestation or 400 grams or more birthweight.

Live delivery: a live delivery is the delivery of one or more liveborn infants, with the birth of twins, triplets or more counted as one live delivery.

Low birthweight: a birthweight of less than 2,500 grams.

OHSS (ovarian hyperstimulation syndrome): the complication of ovulation stimulation therapy, which involves the administration of follicle stimulating hormone (FSH). OHSS symptoms include abdominal pain and fluid retention.

Oocyte (egg): a female reproductive cell.

OPU (oocyte pick-up): the procedure to collect oocytes from ovaries, usually by ultrasound guided transvaginal aspiration and rarely by laparoscopic surgery.

Parity: a classification of a woman in terms of the number of previous pregnancies experienced that reached 20 weeks or more gestation.

Parous: refers to a woman who has had at least one previous pregnancy of 20 weeks or more gestation.

PGD (preimplantation genetic diagnosis): a procedure where embryonic cells are removed

Preterm: a gestation of less than 37 weeks.

Recipient cycle: an ART treatment cycle in which a woman receives oocytes or embryos from another woman.

Secondary sex ratio: the number of male liveborn babies per 100 female liveborn babies.

Surrogacy arrangement: an arrangement where a woman (known as the gestational carrier) agrees to carry a child for another person or couple (known as the commissioning parent(s)) with the intention that the child will be rais ed by those commissioning parents. The oocytes and/or sperm used to create the embryo(s) in the surrogacy cycle can be either from the commissioning parents or from a donor(s).

Thaw cycle: an ART treatment cycle in which cryopr eserved embryos are thawed with the intention of performing embryo transfer.

Thawed embryo: an embryo thawed after cryopreservation. It is used in thaw cycles.

Note: The International Committee Monitoring of Assisted Reproductive Technologies (ICMART) has published an ART glossary for the terms used in ART data collections (Zegers-Hochschild et al. 2009). However, theterminology used in this report may differ from that in the ICMART glossary.

Campbell DM, Templeton A. Maternal complications of twin pregnancy. Int J Gynaecol Obstet 2004;84:71-73.

Carr BR, Black EB & Azziz R 2005. Essential reproductive medicine. New York: McGraw-Hill Companies, Inc.

ESHRE (European Society of Human Reproduction and Embryology) 2008. From strength to strength in Barcelona. Focus on Reproduction September 2008. Grimbergen, Belgium.

Kissin DM, Schieve LA, Reynolds MA. Multiple-birth risk associated with IVF and extended embryo culture: USA, 2001. Hum Reprod 2005;20:2215-2223.

Labett Research and Marketing 2006. Fertility study: attitudes, experiences and behaviours of Australian general public, Report for the Fertility Society of Australia. Lower Hutt. New Zealand.

Laws PJ & Sullivan EA 2009. Australia's mothers and babies 2007. Perinatal statistics series no. 23. Cat. no. PER 48. Sydney: AIHW National Perinatal Statistics Unit.

Statistics New Zealand 2010.National Population Estimates at 30 June. Viewed 8 June 2010, <http://www.stats.govt.nz/publications/populationstatistics/demographic-trends-2009.aspx>

Wang YA, Chambers GM, Dieng M & Sullivan EA 2009. Assisted reproduction technology in Australia and New Zealand 2007. Assisted reproductive technology series no. 13. Cat. no. PER 47. Canberra: AIHW.

Zegers-Hochschild F, Adamson GD, de Mouzon J, Ishihara O, Mansour R, Nygren K, Sullivan E, van der Poel S on behalf ofICMART and WHO 2009. The International Committee for Monitoring Assisted Reproductive Technology (ICMART) and the World Health Organization (WHO) revised glossary on ART terminology, 2009. Human Reproduction 24(11):2683-87.

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The supplementary tables are available on the Internet at <www.aihw.gov.au/publications> and <www. npsu.unsw.edu.au>.