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Assisted reproductive technology in Australia and New Zealand 2008

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Contents

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Abbreviations and symbols

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

Summary

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 Australia and New Zealand respectively.

This is the fourteenth annual report on the use of ART in Australia and New Zealand, and presents data on women who underwent ART treatments in 2008, and the resulting pregnancies and baby outcomes.

Increased use of ART treatments

There were 61,929 ART treatment cycles reported in Australia and New Zealand in 2008, a 9.0% increase on 2007 and a 47.8% increase on 2004. Of the cycles undertaken in 2008, 91.9% were from Australian fertility centres and 8.1% were from New Zealand fertility centres. Women used their own oocytes/embryos in about 95%of treatments, and over 36% of all cycles used frozen/thawed embryos.

Shift in practice to blastocyst culture

The use of blastocyst culture accounted for 38.6% of embryo transfer cycles in 2008, which is significantly higher than the percentage of cycles transferring blastocysts in 2004 (17.1%).

Women's age and parity

Almost one quarter (23.3%) of cycles were in women who had previously given birth. The average age of women undergoing ART treatment using their own oocytes was 35.7 years, slightly older than the average age (35.5 years) in 2007. One in four (26.6%) autologous fresh cycles undertaken in 2008 were in woman aged 40 years or older. The average age of women undergoing ART treatment using donor oocytes/embryos was 41 years.

Treatment outcomes and number of babies

Of the 61,929 treatment cycles, 22.6% resulted in a clinical pregnancy, and 17.2% resulted in a live delivery (the birth of at least one liveborn baby). There were 10,633 live deliveries resulting in 11,528 liveborn babies.

Multiple births

A clear trend in ART treatment over the last five years has been the reduction in the rate of multiple birth deliveries. The multiple delivery rate for ART treatment cycles undertaken in 2008 was 8.4% – compared to 10.0% in 2007 and 16.4% in 2004. This reduction is due to a voluntary shift in practice by clinicians and patients to single embryo transfer (SET), with the proportion of SET cycles increasing from 40.5% in 2004 to 67.8% in 2008. Importantly, this substantial decrease in the multiple delivery rate has been achieved while clinical pregnancy rates have remained stable at around 22% per cycle.

1 Introduction

A recent study undertaken for the Fertility Society of Australia found that approximately one in six Australian couples had taken longer than one year to conceive a planned pregnancy during their reproductive life (Labett 2006). Infertility is usually defined as the failure to conceive after one year of unprotected sex or the inability to carry a pregnancy to live birth, and tends to be attributed to males and females partners equally, or for the cause to be unexplained. However, infertility is not an absolute or irreversible condition, but rather a clinical continuum that in many cases can be successfully treated with medical or surgical techniques or lifestyle changes (Carr et al. 2005).

This year marks the 30th anniversary of the first assisted reproductive technology (ART) baby born in Australia, with the first New Zealand ART baby being born soon after in 1984. Over the last three decades more than 3.5 million children have been born worldwide following ART treatment (ESHRE 2008). Latest estimates indicate that 3.3% and 2.0% of babies born in Australia and New Zealand respectively are as a result of ART treatment (Laws & Sullivan 2009, Statistics New Zealand 2010).

The aim of any fertility treatment is the birth of a healthy baby. However ART and a number of other forms of fertility treatment predispose women to multiple gestation pregnancy, which increases the health risks to both mothers and babies. These risks include pregnancy and birthing complications, preterm delivery and low birthweight babies (Campbell and Templeton 2004, Kissin et al.2005). Through the voluntary reduction in the number of embryos transferred during ART treatment, Australian and New Zealand fertility clinics have substantially reduced the incidence of multiple gestation pregnancies over the last five years without compromising pregnancy rates.

Treatments covered in this report

ART is a group of procedures that involves the in vitro handling of human oocytes (eggs) and sperm or embryos for the purposes of establishing a pregnancy (Zegers-Hochschild et al. 2009). The most widely used ART is in vitro fertilisation (IVF) using a woman's own oocytes (autologous treatment). A typical fresh IVF treatment cycle involves five main steps:

- Controlled ovarian hyperstimulation where the female is treated with follicle stimulating hormone (FSH) over a number of days to induce the maturation of multiple oocytes.
- Oocyte pick-up (OPU) where mature oocytes are aspirated from ovarian follicles under light anaesthesia.
- Fertilisation of the collected oocytes by incubating them with sperm (the woman's partner or donated sperm) over a few hours in the laboratory.
- Embryo maturation where an embryo is cultured for 2–3 days to form a cleavage stage embryo (8 cells) or 5–6 days to create a blastocyst (100 cells).
- Transfer of one or more fresh embryos into the woman's uterus in order for a pregnancy to occur. To reduce the risk of multiple gestation pregnancies (twins or triplets) only one or two embryos are usually transferred.

Treatment may be discontinued at any stage during a treatment cycle due to a number of reasons including failed ovarian stimulation, excessive ovarian stimulation, failed fertilisation, inadequate embryo growth or patient choice.

Over the last three decades, ART has evolved to encompass complex ovarian hyperstimulation protocols and numerous variations to the typical fresh IVF treatment cycle just described. Some of these variations include:

- Intracytoplasmic sperm injection (ICSI), where a single sperm is injected directly into the oocyte to aid fertilisation.
- Gamete intrafallopian transfer (GIFT), where mature oocytes and sperm are placed directly into a woman's fallopian tubes so that in vivo fertilisation may take place. While once popular, this procedure now only accounts for a very small percentage of ART cycles.
- Preimplantation genetic diagnosis (PGD), where embryonic cells are removed and screened for chromosomal disorders or genetic diseases before embryo transfer.
- Donor/recipient arrangements, where donor oocytes are used to create embryos for transfer to a recipient woman.
- Cryopreservation (freezing) of embryos/thawed cycles, where embryos not transferred in the initial fresh treatment cycle are frozen and stored. Once thawed, the embryos can be transferred in subsequent treatments. With thaw cycles the efficiency of each OPU is improved.
- Surrogacy arrangements, where an embryo(s) is transferred into a woman (known as the gestational carrier) who agrees to carry a child for another person or couple (known as the commissioning parent(s)) with the intention that the child will be raised by the commissioning parents.

Along with ART, a number of other fertility treatments are undertaken in Australia and New Zealand. The use of artificial insemination using donated sperm from a man other than the woman's partner (donor sperm insemination (DI)) is one such treatment that warrants surveillance because of the use of donor sperm. Artificial insemination is a term that covers a range of techniques for placing sperm into the female genital tract, and can be used with controlled ovarian hyperstimulation or in unstimulated cycles.

ART treatment and DI are typically undertaken in fertility clinics, but DI may also be performed in hospitals and private clinics in Australia. There are different funding and regulatory arrangements for ART and DI in Australia and New Zealand.

Data used in this report

The data presented in this report are supplied by 36 fertility centres (comprising 70 fertility clinics in Australia and 7 fertility clinics in New Zealand), and compiled into the Australian and New Zealand Assisted Reproduction Database (ANZARD). ANZARD was established in 2002 as a joint initiative of the National Perinatal Statistics Unit (NPSU) and the Fertility Society of Australia (FSA), and supersedes the Assisted Conception Data Collection that ran from 1985 to 2001. ANZARD collects information on ART and DI treatments and their pregnancy and birth outcomes. ANZARD is a cycle-based data collection reflecting the year the treatment was undertaken and does not link successive cycles to a particular woman. Therefore it is possible for an individual woman to undergo more than one treatment cycle or experience more than one pregnancy in a year, but these events are not linked.

Assisted reproductive technology in Australia and New Zealand 2008 is the fourteenth annual report on the use of ART in Australia and New Zealand. This report provides information on ART and DI treatments and the resulting pregnancy and birth outcomes. Also included is an analysis of trends in ART treatments and outcomes in the five-year period from 2004 to 2008.

Purpose of this report

The main purpose of this report is to provide:

- information on ART and DI treatment cycles and the resulting pregnancy outcomes in Australia and New Zealand
- monitoring of ART treatment practices, success rates and perinatal outcomes
- information to inform standards for accreditation and monitoring of fertility centres
- information for national and international comparisons.

Structure of this report

This report has seven chapters, including this introductory chapter (Chapter 1).

Chapter 2 — 'Overview of ART treatment in 2008', provides an outline of the numbers and outcomes of all ART treatments undertaken in Australia and New Zealand.

Chapter 3 — 'Autologous and donation/recipient cycles in 2008', presents data on couples undergoing treatment, cycle types, and the outcomes of treatment in terms of discontinued treatment, clinical pregnancies and deliveries.

Chapter 4 — 'Pregnancy and birth outcomes following embryo transfer cycles in 2008', presents data on the outcomes of clinical pregnancies and deliveries following autologous and recipient cycles including a description of perinatal outcomes.

Chapter 5 — 'GIFT cycles, surrogacy cycles, other procedures and complications in 2008', includes information on cycles, procedures and complications that do not fit into the chapters already described.

Chapter 6 — 'Donor sperm insemination cycles in 2008', presents data on DI cycles and their outcomes, including a description of pregnancy and perinatal outcomes.

Chapter 7 — 'Trends in ART treatment and outcomes: 2004–2008', presents trends in ART treatments during the last five years of data collection in Australia and New Zealand.

Appendices — Appendix 1 describes the ANZARD data collection which was used to prepare this report. Appendix 2 presents the data items in the ANZARD collection.

This report is available in PDF format on the NPSU website <www.npsu.unsw.edu.au>. The website also includes supplementary tables (in PDF format).

2 Overview of ART treatment in 2008

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 accounted for only a small proportion of cycles, comprising 2.8% oocyte recipient cycles, 0.4% embryo recipient cycles, 1.6% oocyte donation cycles, 0.2% GIFT cycles and 0.2% surrogacy cycles (Table 1).

Of all ART treatments in 2008, 22.6% (13,983) resulted in a clinical pregnancy and 17.2% (10,633) resulted in a live delivery (Table 1). Of the 13,983 clinical pregnancies, 12,549 (89.7%) were from Australian clinics and 1,434 (10.3%) from New Zealand clinics. There were 11,711 babies (including 11,528 liveborn babies) born following ART treatment in 2008. Of all babies, 10,509 (89.7%) were reported from Australian clinics and 1,202 (10.3%) from New Zealand clinics.

The multiple delivery rate following ART treatment in 2008 was 8.4% (8.6% for Australia and 6.9% for New Zealand).

Table 1: Number of initiated ART treatment cycles by treatment type, Australia and New Zealand, 2008

Treatment type	Number of initiated ART cycles	Per cent of treatment types	Number of clinical pregnancies	Number of live deliveries	Number of liveborn babies
Autologous	58,740	94.9	13,457	10,257	11,098
Fresh	*37,314*	*60.3*	*8,764*	*6,729*	*7,306*
Thaw	*21,426*	*34.6*	*4,693*	*3,528*	*3,792*
Oocyte recipient	1,760	2.8	447	327	374
Embryo recipient	239	0.4	46	30	35
Oocyte donation	978	1.6	. .	. .	. .
GIFT[(a)]	98	0.2	17	11	13
Surrogacy arrangement cycles	114	0.2	16	8	8
Commissioning cycles	*34*	*0.1*	. .	. .	. .
Gestational carrier cycles	*80*	*0.1*	*16*	*8*	*8*
Total	**61,929**	**100.0**	**13,983**	**10,633**	**11,528**

(a) GIFT cycles were classified separately from autologous cycles.

3 Autologous and donation/recipient cycles in 2008

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 treatment cycle in which a woman intends to use, or uses her own oocytes.

A donation cycle is defined as an ART treatment cycle in which 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. The use of donor sperm does not alter the donor status of the cycle.

A recipient cycle is defined as an ART treatment cycle in which a woman receives oocytes or embryos from another woman.

Autologous and donor/recipient cycles can involve the use, or intention to use, either fresh or frozen/thawed embryos. In a small number of cycles undertaken in 2008 frozen/thawed oocytes were used in fertilisation.

3.1 Overview of autologous and recipient cycles

Women's age and partner's age of autologous and recipient cycles

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 for autologous 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

Age group (years)[(a)]	Autologous				Oocyte /embryo recipient		All	
	Fresh		Thaw					
	Number	Per cent	Number	Per cent	Number	Per cent	Number	Per cent
< 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
Total	**37,314**	**100.0**	**21,426**	**100.0**	**1,999**	**100.0**	**60,739**	**100.0**

(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

Age group (years)[(a)]	Autologous				Oocyte /embryo recipient		All	
	Fresh		Thaw					
	Number	Per cent	Number	Per cent	Number	Per cent	Number	Per cent
< 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
Total	**37,314**	**100.0**	**21,426**	**100.0**	**1,999**	**100.0**	**60,739**	**100.0**

(a) Age at time of treatment.

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

Parity of autologous and recipient cycles

Parity describes a woman in terms of the number of previous pregnancies experienced that reached 20 weeks or more gestation. Nulliparous refers to a woman who has never had a pregnancy of 20 weeks or more gestation. Parous refers to a woman who has had at least one previous pregnancy of 20 weeks or more gestation.

Of the 60,739 initiated autologous and recipient cycles undertaken in 2008, 68.4% were undertaken by nulliparous women. Of autologous cycles (fresh and thaw), 68.2% were undertaken by nulliparous women compared to 74.4% for oocyte/embryo recipient cycles (Table 4).

Table 4: Number of autologous and recipient cycles by parity and treatment type, Australia and New Zealand, 2008

	Autologous				Oocyte/embryo recipient		All	
	Fresh		Thaw					
Parity	Number	Per cent	Number	Per cent	Number	Per cent	Number	Per cent
Nulliparous	26,351	70.6	13,701	63.9	1,487	74.4	41,539	68.4
Parous	7,657	20.5	6,090	28.4	382	19.1	14,129	23.3
Not stated	3,306	8.9	1,635	7.6	130	6.5	5,071	8.3
Total	**37,314**	**100.0**	**21,426**	**100.0**	**1,999**	**100.0**	**60,739**	**100.0**

Cause of infertility of autologous and recipient cycles

Causes of infertility may be unexplained or relate to either the woman and/or her male partner. The reported cause of infertility are based on clinical diagnosis by the treating clinician, however, the diagnostic definitions may vary among fertility centres.

Of the 60,739 initiated autologous and recipient cycles, 27.3% reported male infertility factors as the only cause of infertility; 34.0% reported only female infertility factor(s); 14.4% reported combined male—female factors; and 22.2% reported unexplained infertility. Male infertility factors (alone and combined with female infertility factor) were reported for 41.7% of cycles.

ICSI procedures in autologous and recipient cycles

Of the 33,105 autologous fresh cycles where fertilisation was attempted, 63.2% used ICSI procedures and 36.8% used IVF procedures. In fresh oocyte recipient cycles where fertilisation was attempted, 69.2% used ICSI procedures and 30.8% used IVF procedures (Table 5).

Of thaw cycles where embryos were transferred, the proportion of ICSI was similar for both autologous and oocyte/embryo recipient cycles.

Table 5: Number of autologous and recipient cycles with fertilisation attempted by treatment type and procedure, Australia and New Zealand, 2008

	Autologous				Oocyte/embryo recipient			
	Fresh[(a)]		Thaw[(b)]		Fresh[(a)]		Thaw[(b)]	
Procedure	Number	Per cent	Number	Per cent	Number	Per cent	Number	Per cent
IVF	12,193	36.8	8,263	42.6	270	30.8	496	46.9
ICSI[(c)]	20,912	63.2	10,204	52.6	607	69.2	563	53.1
Not stated	0	0.0	935	4.8	0	0.0	0	0.0
Total	**33,105**	**100.0**	**19,402**	**100.0**	**877**	**100.0**	**1,059**	**100.0**

(a) Fresh cycles where fertilisation was attempted.

(b) Thaw cycles where embryos were transferred.

(c) Mixed IVF/ICSI cycles were classed as ICSI cycles.

Number of embryos transferred in autologous and recipient cycles

Of the 50,495 embryo transfer cycles, 67.8% were single embryo transfer (SET) cycles and 31.6% were double embryo transfer (DET) cycles. In women aged less than 35 years, 77.1% of cycles were SET cycles and 22.8% were DET cycles. In women aged 35 years or older, 61.9% of cycles were SET cycles and 37.1% were DET cycles (Table 6).

Table 6: Number of embryo transfer cycles by number of embryos transferred per cycle and women's age group, Australia and New Zealand, 2008

	Number of embryos transferred							
	One		Two		Three or more		All	
Age group (years)[(a)]	Number	Per cent	Number	Per cent	Number	Per cent	Number	Per cent
< 30	4,381	80.3	1,076	19.7	2	0.0	5,459	100.0
30–34	10,690	75.9	3,389	24.1	11	0.1	14,090	100.0
35–39	12,972	67.2	6,292	32.6	41	0.2	19,305	100.0
40–44	5,540	52.7	4,722	44.9	245	2.3	10,507	100.0
≥ 45	642	56.6	461	40.7	31	2.7	1,134	100.0
Total	**34,225**	**67.8**	**15,940**	**31.6**	**330**	**0.7**	**50,495**	**100.0**

(a) Age at time of treatment.

Stage of embryo development in autologous and recipient cycles

Of the 50,495 embryo transfer cycles, 38.6% involved the transfer of blastocysts. Of autologous cycles, blastocyst transfers made up 44.4% 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

Type and procedure	Autologous				Oocyte/embryo recipient			
	Fresh		Thaw		Fresh		Thaw	
	Number	Per cent	Number	Per cent	Number	Per cent	Number	Per cent
Cleavage embryo	18,988	64.9	10,789	55.6	550	70.7	687	64.9
Blastocyst	10,268	35.1	8,613	44.4	228	29.3	372	35.1
Total	**29,256**	**100.0**	**19,402**	**100.0**	**778**	**100.0**	**1,059**	**100.0**

3.2 Autologous fresh cycles

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.

Progression of autologous fresh cycles

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.

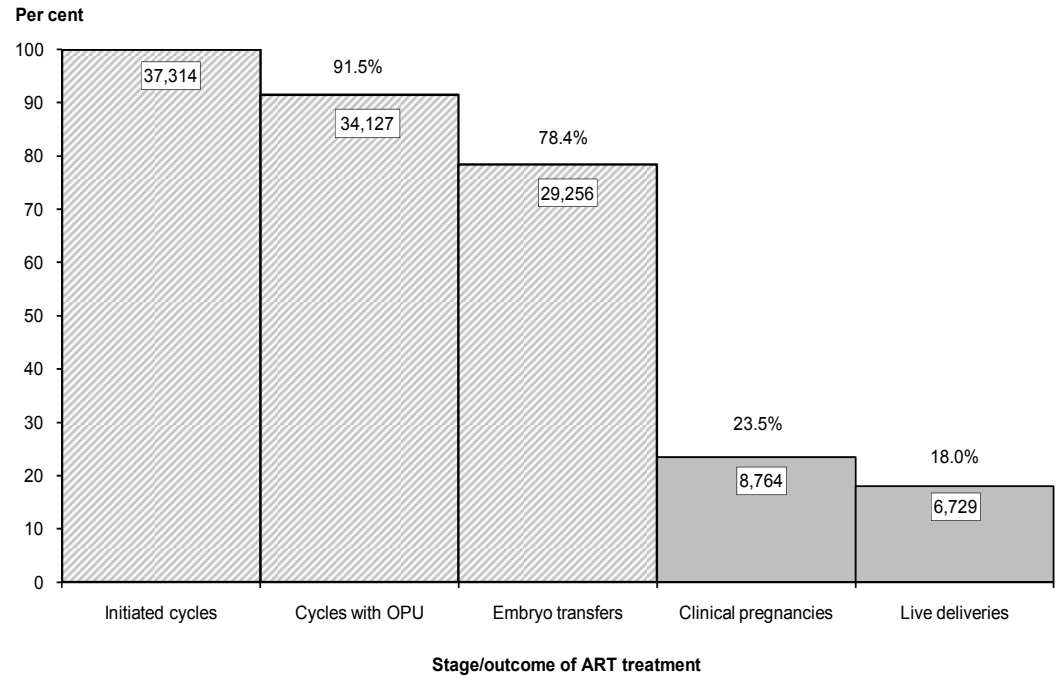


Figure 1: Progression of autologous fresh cycles, Australia and New Zealand, 2008

Clinical pregnancies and live deliveries from autologous fresh cycles by women's age

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 women aged 45 years or older (Table 8).

Table 8: Outcomes of autologous fresh cycles by women's age group, Australia and New Zealand, 2008

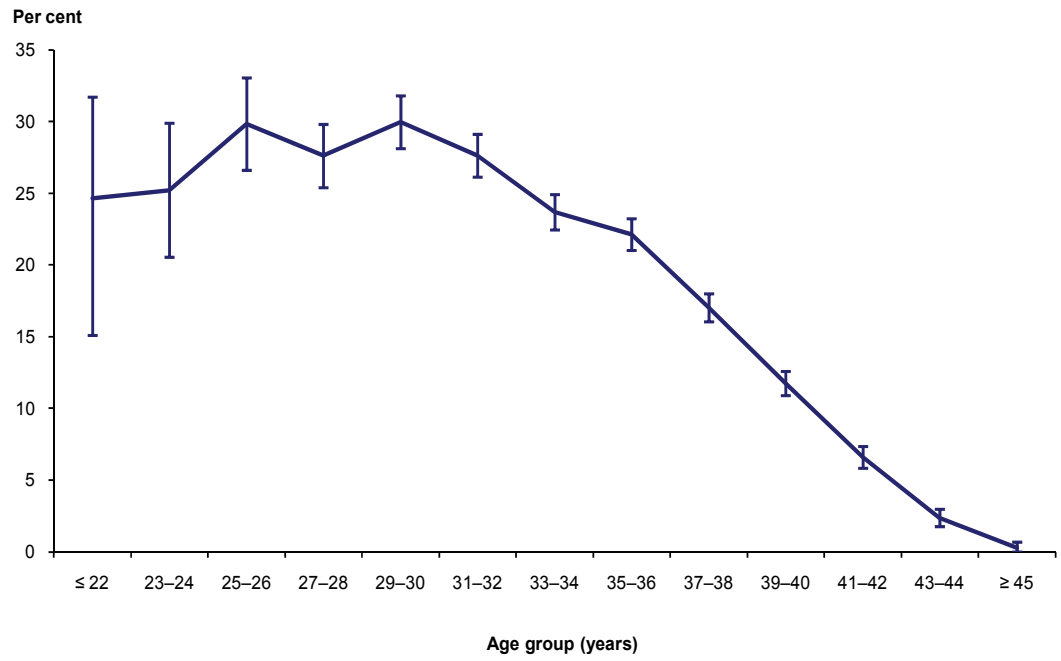
	Age group (years)[a]					
Stage/outcome of treatment	**< 30**	**30–34**	**35–39**	**40–44**	**≥ 45**	**All[b]**
Initiated cycles	3,895	9,369	14,120	9,258	671	37,314
Cycles with OPU	3,625	8,747	12,931	8,245	578	34,127
Embryo transfers	3,102	7,709	11,278	6,770	397	29,256
Clinical pregnancies	1,332	2,944	3,470	1,006	12	8,764
Live deliveries	1,115	2,428	2,575	609	2	6,729
Live deliveries per initiated cycle (%)	*28.6*	*25.9*	*18.2*	*6.6*	*0.3*	*18.0*
Live deliveries per embryo transfer cycle (%)	*35.9*	*31.5*	*22.8*	*9.0*	*0.5*	*23.0*
Live deliveries per clinical pregnancy (%)	*83.7*	*82.5*	*74.2*	*60.5*	*16.7*	*76.8*

(a) Age at time of treatment.

(b) Includes cycles in which women's age was not stated.

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

Clinical pregnancies and live deliveries from autologous fresh cycles by cause of infertility

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 delivery per initiated cycle (22.3% and 16.9% respectively) (Table 9). The rate ratio (RR) of live 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

Cause of infertility	Initiated cycles (number)	Embryo transfer cycles per initiated cycle (per cent)	Clinical pregnancies per initiated cycle (per cent)	Live deliveries per initiated cycle (per cent)
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
Total	**37,314**	**78.4**	**23.5**	**18.0**

Clinical pregnancies and live deliveries from autologous fresh cycles by number of embryos transferred

Cycles with three or more embryos transferred only accounted for 0.1% and 1.5% of embryo transfer cycles in women aged younger than 35 years and in women aged 35 years or older respectively. Overall, 63.9% of embryo transfer cycles were SET cycles and 35.1% were DET cycles.

For women aged less than 35 years the difference in the live delivery rates between SET and DET cycles was 0.8 percentage points (32.6% and 33.4% respectively). For women aged 35 years and older there was no difference in the live delivery rates between SET and DET cycles (17.4%). Overall, the live delivery rate was 24.2% for SET and 21.2% for DET (Table 10).

Table 10: Outcomes of autologous fresh embryo transfer cycles by women's age and number of embryos transferred, Australia and New Zealand, 2008

	Age group (years)[(a)]								
	< 35			≥ 35			All		
Stage/outcome of treatment	One embryo	Two embryos	Three or more embryos	One embryo	Two embryos	Three or more embryos	One embryo	Two embryos	Three or more embryos
Embryo transfers	8,366	2,432	13	10,324	7,851	270	18,690	10,283	283
Clinical pregnancies	3,295	976	5	2,472	1,973	43	5,767	2,949	48
Live deliveries	2,727	812	4	1,793	1,366	27	4,520	2,178	31
Clinical pregnancies per embryo transfer cycle (%)	*39.4*	*40.1*	*38.5*	*23.9*	*25.1*	*15.9*	*30.9*	*28.7*	*17.0*
Live deliveries per embryo transfer cycle (%)	*32.6*	*33.4*	*30.8*	*17.4*	*17.4*	*10.0*	*24.2*	*21.2*	*11.0*

(a) Age at time of treatment.

Clinical pregnancies and live deliveries from autologous fresh cycles by stage of embryo development

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 blastocysts was 5.5 percentage points (21.1% and 26.6% respectively). This is a 26% higher live delivery rate for blastocyst transfer cycles than for cleavage stage embryo transfer cycles (RR 1.26, 95% CI 1.21 to 1.32).

Table 11: Outcomes of autologous fresh embryo transfer cycles by women's age and stage of embryo development, Australia and New Zealand, 2008

	Age group (years)[a]					
	< 35		≥ 35		All	
Stage/outcome of treatment	Cleavage stage embryo	Blastocyst	Cleavage stage embryo	Blastocyst	Cleavage stage embryo	Blastocyst
Embryo transfers	6,570	4,241	12,418	6,027	18,988	10,268
Clinical pregnancies	2,431	1,845	2,779	1,709	5,210	3,554
Live deliveries	2,025	1,518	1,972	1,214	3,997	2,732
Clinical pregnancies per embryo transfer cycle (%)	*37.0*	*43.5*	*22.4*	*28.4*	*27.4*	*34.6*
Live deliveries per embryo transfer cycle (%)	*30.8*	*35.8*	*15.9*	*20.1*	*21.1*	*26.6*

(a) Age at time of treatment.

Live deliveries from autologous fresh cycles among fertility centres

The live delivery rate per initiated autologous fresh cycle varied among the 33 fertility centres. This variation in live delivery rates is measured using quartiles which rank an individual centre's live delivery rate within the top and bottom 25% of centres.

The live delivery rate per initiated autologous fresh cycle ranged from 4.0% to 30.3% among fertility centres. The top 25% (first quartile) of fertility centres had live delivery rates between 19.4% and 30.3%. The bottom 25% (fourth quartile) of fertility centres had live delivery rates between 4.0% and 13.9%. The remaining 50% of fertility centres had live delivery rates between 14.0% and 19.3% (Table 12).

Table 12: Live delivery rate of autologous fresh cycles by women's age group among fertility centres, Australia and New Zealand, 2008

Age group (years)[a]	Live deliveries per initiated autologous fresh cycle (%)				
	Overall	First quartile	Second quartile	Third quartile	Fourth quartile
< 35	26.7	27.4–36.0	24.2–27.3	22.3–24.1	4.5–22.2
≥ 35	13.2	15.9–27.0	11.9–15.8	9.3–11.8	3.7–9.2
All[b]	**18.0**	**19.4–30.3**	**17.4–19.3**	**14.0–17.3**	**4.0–13.9**

(a) Age at time of treatment.

(b) Includes cycles in which women's age was not stated.

There was also variation in the outcomes of autologous fresh cycles by number of embryos transferred and stage of embryo development. Figure 3 shows the median live delivery rate and interquartile range among fertility centres. Single blastocyst transfers achieved the highest median rate of live deliveries per embryo transfer cycle (24.4%) amongst fertility centres. Half of the fertility centres that carried out single blastocyst transfers achieved a live delivery rate between 15.1% and 32.7%. Single cleavage stage transfers achieved a median live delivery rate of 18.8% per embryo transfer cycle, with half of the fertility centres that carried out single cleavage stage embryo transfers achieving a live delivery rate between 14.3% and 24.6%. The greatest variation in live delivery rates among fertility centres was in the transfer of blastocyst embryos. The rates were unadjusted for 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.

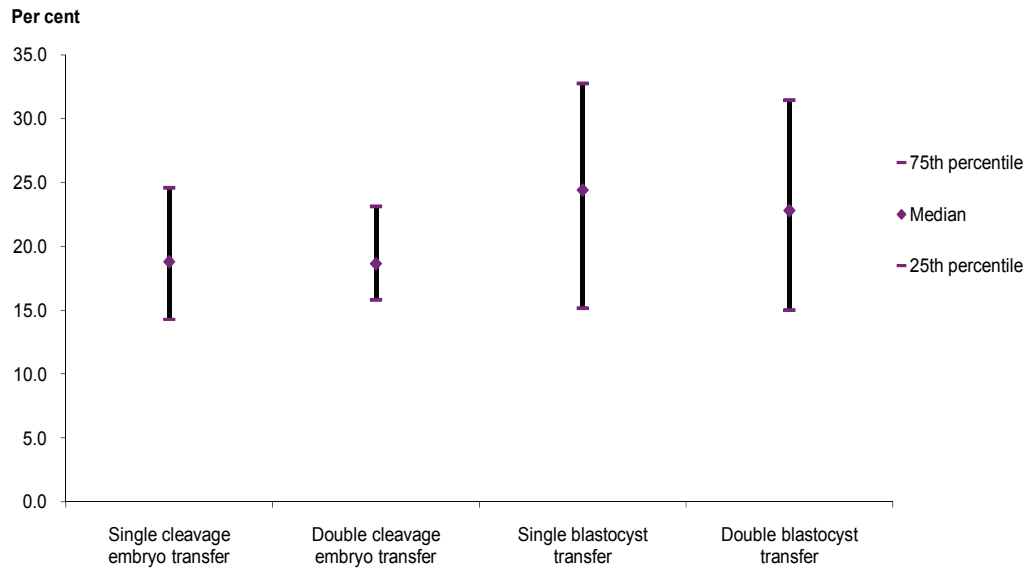


Figure 3: Live delivery rate of autologous fresh embryo transfer cycles by number of embryos transferred and stage of embryo development among fertility centres, Australia and New Zealand, 2008

3.3 Autologous thaw cycles

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.

Progression of autologous thaw cycles

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).

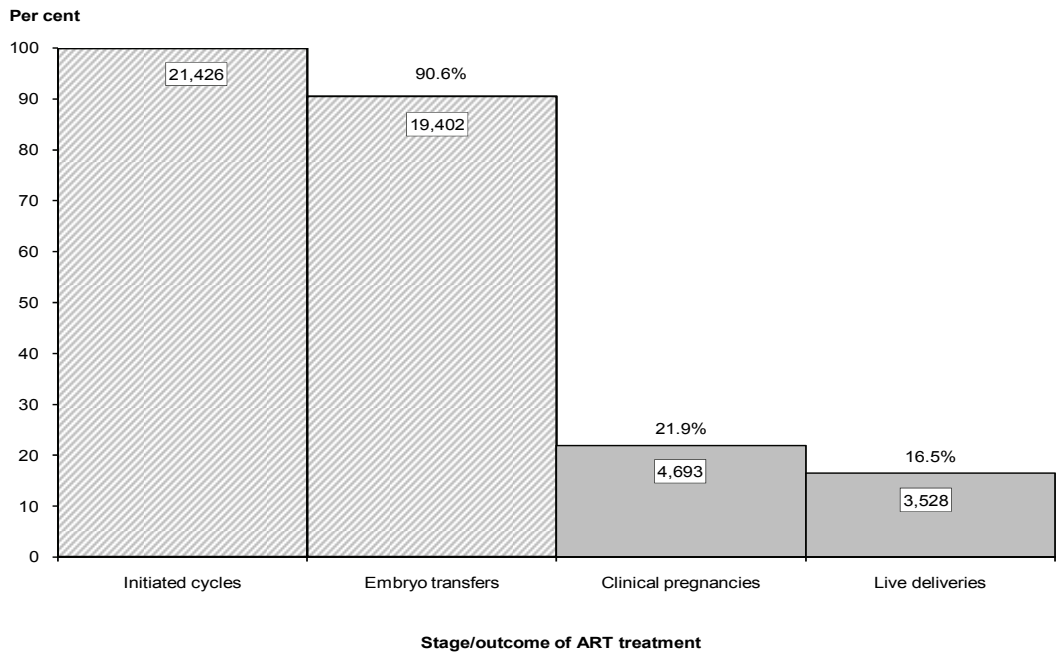


Figure 4: Progression of autologous thaw cycles, Australia and New Zealand, 2008

Clinical pregnancies and live deliveries from autologous thaw cycles by women's age

Similar to women undergoing autologous fresh cycles, the live delivery rate per thawed embryo transfer cycle declined with advancing women's age. The highest live delivery rate per embryo transfer cycle was in women aged less than 35 years (Table 13). However, the maternal age of the embryo relates to the age at which a women undertook her initial autologous fresh cycle, therefore the physiological age of the embryo may be younger than the age of the woman when she underwent her thaw cycle.

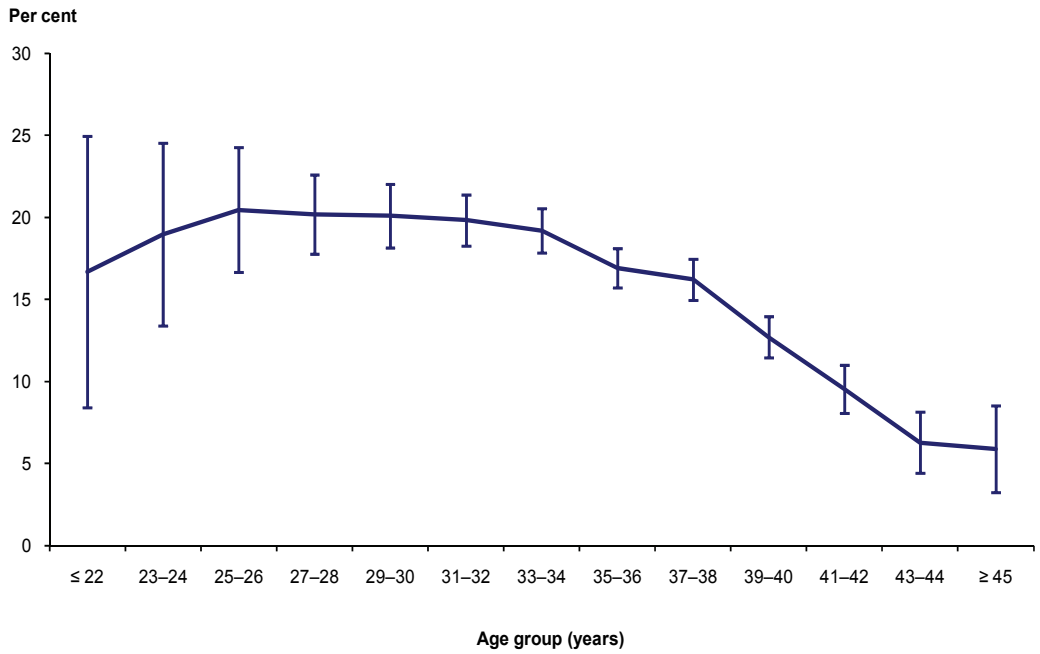
Table 13: Outcomes of autologous thaw cycles by women's age group, Australia and New Zealand, 2008

	Age group (years)[a]					
Stage/outcome of treatment	**< 30**	**30–34**	**35–39**	**40–44**	**≥ 45**	**All**
Initiated cycles	2,478	6,785	8,452	3,405	306	21,426
Embryo transfers	2,295	6,219	7,614	3,025	249	19,402
Clinical pregnancies	620	1,685	1,856	503	29	4,693
Live deliveries	488	1,334	1,353	335	18	3,528
Live deliveries per initiated cycle (%)	*19.7*	*19.7*	*16.0*	*9.8*	*5.9*	*16.5*
Live deliveries per embryo transfer cycle (%)	*21.3*	*21.5*	*17.8*	*11.1*	*7.2*	*18.2*
Live deliveries per clinical pregnancy (%)	*78.7*	*79.2*	*72.9*	*66.6*	*62.1*	*75.2*

(a) Age at time of treatment.

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.



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

Clinical pregnancies and live deliveries from autologous thaw cycles by cause of infertility

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

Cause of infertility	Initiated cycles (number)	Embryo transfer cycles per initiated cycle (per cent)	Clinical pregnancies per initiated cycle (per cent)	Live deliveries per initiated cycle (per cent)
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
Total	**21,426**	**90.6**	**21.9**	**16.5**

Clinical pregnancies and live deliveries from autologous thaw cycles by number of embryos transferred

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

	Age group (years)[a]								
	< 35			≥ 35			All		
Stage/outcome of treatment	One embryo	Two embryos	Three or more embryos	One embryo	Two embryos	Three or more embryos	One embryo	Two embryos	Three or more embryos
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.

Clinical pregnancies and live deliveries from autologous thaw cycles by stage of embryo development

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

	Age group (years)[(a)]					
	< 35		≥ 35		All	
Stage/outcome of treatment	Cleavage stage embryo	Blastocyst	Cleavage stage embryo	Blastocyst	Cleavage stage embryo	Blastocyst
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.

Live deliveries from autologous thaw cycles among fertility centres

The live delivery rate per initiated autologous thaw cycle varied among 33 fertility centres in Australia and New Zealand. This variation in live delivery rates is measured using quartiles which rank an individual centre's live delivery rate within the top and bottom 25% of centres.

The live delivery rates per initiated autologous thaw cycle ranged from 4.3% to 26.5% among fertility centres. The top 25% (first quartile) of fertility centres had live delivery rates from 19.7% to 26.5%. The bottom 25% (fourth quartile) of fertility centres had live delivery rates between 4.3% and 10.8%. The remaining 50% of fertility centres achieved rates between 10.9% and 19.6%. Overall the live delivery rate was 16.5% for autologous thaw cycles in all centres in Australia and New Zealand. Women aged less than 35 years (19.7%) had higher rates than those aged 35 years and older (14.0%) (Table 17).

Table 17: Live delivery rate of autologous thaw cycles by women's age group among fertility centres, Australia and New Zealand, 2008

Age group (years)[(a)]	Live deliveries per initiated autologous fresh cycle (%)				
	Overall	First quartile	Second quartile	Third quartile	Fourth quartile
< 35	19.7	22.4–31.5	18.5–22.3	13.0–18.4	4.5–12.9
≥ 35	14.0	16.3–23.5	12.6–16.2	8.4–12.5	0.0[(b)]–8.3
All	**16.5**	**19.7–26.5**	**14.6–19.6**	**10.9–14.5**	**4.3–10.8**

(a) Age at time of treatment.

(b) Less than 10 initiated cycles were undertaken in a small number of centres.

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.

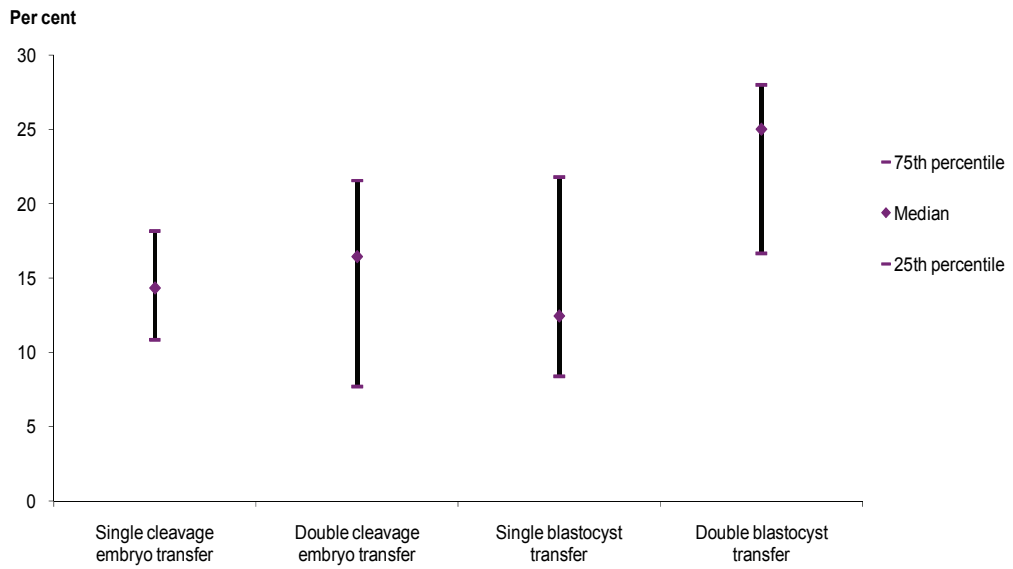


Figure 6: Live delivery rate of autologous thaw embryo transfer cycles by number of embryos transferred and stage of embryo development among fertility centres, Australia and New Zealand, 2008

3.4 Donation and recipient cycles

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.

Oocyte donation 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

Age group (years) [(a)]	Initiated cycles (number)	Cycles with OPU performed (per cent)	Cycles with oocyte collected (per cent)	Cycles with oocyte donated (per cent)
< 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
Total	**978**	**94.8**	**94.3**	**94.3**

(a) Age at time of treatment.

Oocyte/embryo recipient cycles

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.

Progression of oocyte/embryo recipient 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.

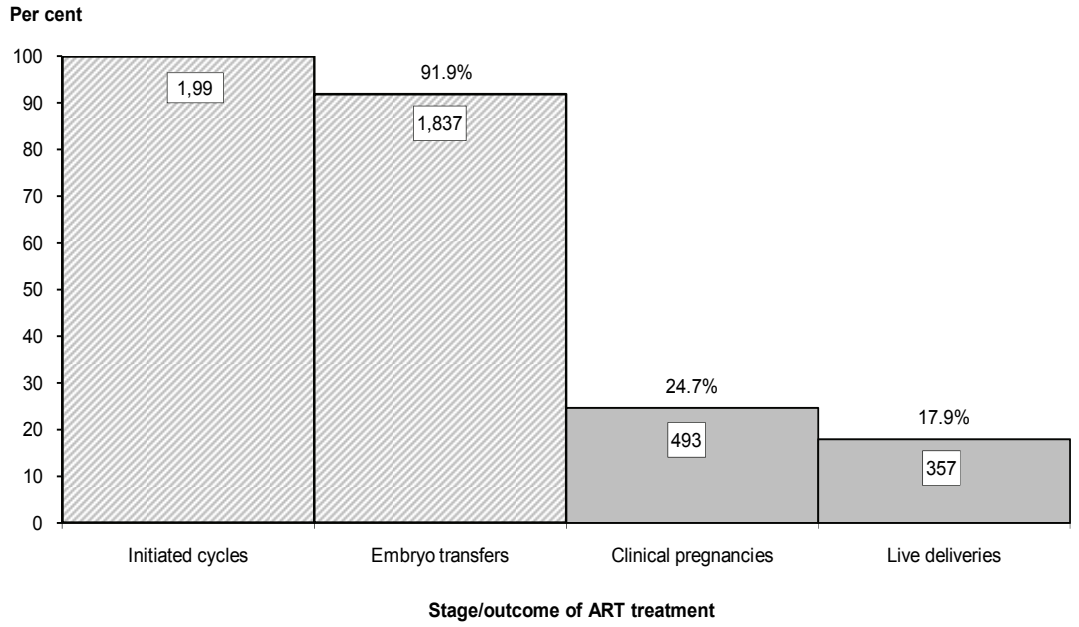


Figure 7: Progression of oocyte/embryo recipient cycles following embryo transfers, Australia and New Zealand, 2008

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

	Oocyte recipient			
Stage/outcome of treatment	Fresh	Thaw	Embryo recipient	All
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*

Clinical pregnancies and live deliveries from oocyte/embryo recipient cycles by recipient's age

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

	Age group (years)[(a)]					
Stage/outcome of treatment	< 30	30–34	35–39	40–44	≥ 45	All
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.

Clinical pregnancies and live deliveries from oocyte/embryo recipient cycles by number of embryos transferred

Regardless of women's age, the live delivery rate per oocyte/embryo recipient cycle with embryos transferred was lower for SET cycles than for DET cycles. Overall, the difference in the live delivery rate between SET cycles and DET cycles was 7.9 percentage points (16.4% and 24.3% respectively) (Table 21).

Table 21: Outcomes of oocyte/embryo recipient cycles by recipient's age and number of embryos transferred, Australia and New Zealand, 2008

	Age group (years)[(a)]								
	< 35			≥ 35			All		
Stage/outcome of treatment	One embryo	Two embryos	Three or more embryos	One embryo	Two embryos	Three or more embryos	One embryo	Two embryos	Three or more embryos
Embryo transfers	162	62	0	968	643	2	1,130	705	2
Clinical pregnancies	32	26	0	236	198	1	268	224	1
Live deliveries	25	21	0	160	150	1	185	171	1
Clinical pregnancies per embryo transfer cycle (%)	*19.8*	*41.9*	*. .*	*24.4*	*30.8*	*50.0*	*23.7*	*31.8*	*50.0*
Live deliveries per embryo transfer cycle (%)	*15.4*	*33.9*	*. .*	*16.5*	*23.3*	*50.0*	*16.4*	*24.3*	*50.0*

(a) Age at time of treatment.

Clinical pregnancies and live deliveries from oocyte/embryo recipient cycles by stage of embryo development

Regardless of women's age, the live delivery rate per oocyte/embryo recipient cycle with embryos transferred was similar for cleavage stage embryo transfer cycles and blastocyst transfer cycles. Overall, the difference in live delivery rates for cleavage stage embryos and blastocysts was only 0.9 percentage points (19.7% and 18.8% respectively) (Table 22).

Table 22: Outcomes of oocyte/embryo recipient cycles by recipient's age and stage of embryo development, Australia and New Zealand, 2008

	Age group (years)[(a)]					
	< 35		≥ 35		All	
Stage/outcome of treatment	Cleavage stage embryo	Blastocyst	Cleavage stage embryo	Blastocyst	Cleavage stage embryo	Blastocyst
Embryo transfers	145	79	1,092	521	1,237	600
Clinical pregnancies	38	20	297	138	335	158
Live deliveries	29	17	215	96	244	113
Clinical pregnancies per embryo transfer cycle (%)	*26.2*	*25.3*	*27.2*	*26.5*	*27.1*	*26.3*
Live deliveries per embryo transfer cycle (%)	*20.0*	*21.5*	*19.7*	*18.4*	*19.7*	*18.8*

(a) Age at time of treatment.

4 Pregnancy and birth outcomes following embryo transfer cycles in 2008

4.1 Clinical pregnancies

Clinical pregnancies overview

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 1,427 (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 pregnancies (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%) clinical pregnancies were not known because women were unable to be followed up or contacted by fertility centres.

The majority of clinical pregnancies followed SET (67.2%) and DET (32.4%). Only 0.4% of clinical pregnancies followed the transfer of more than two embryos.

Fetal hearts by number of embryos transferred

Multiple gestation pregnancies are closely related to the number of embryos transferred in ART treatment. Two fetal hearts were detected in 19.3% of clinical pregnancies following DET cycles and in 1.9% of clinical pregnancies following SET cycles (Table 23).

Table 23: Clinical pregnancies by number of fetal hearts and number of embryos transferred, Australia and New Zealand, 2008

Number of fetal hearts	One embryo		Two embryos		Three or more embryos		Total	
	Number	Per cent	Number	Per cent	Number	Per cent	Number	Per cent
0[(a)]	665	7.1	358	7.9	6	11.1	1,029	7.4
1	8,172	87.1	3,067	67.9	31	57.4	11,270	80.8
2	180	1.9	870	19.3	8	14.8	1,058	7.6
3 or 4	6	0.1	28	0.6	3	5.6	37	0.3
Not stated	357	3.8	193	4.3	6	11.1	556	4.0
Total	**9,380**	**100.0**	**4,516**	**100.0**	**54**	**100.0**	**13,950**	**100.0**

(a) No fetal heart detected at the time of ultrasound.

Early pregnancy loss

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

Pregnancy outcome	Autologous				Oocyte /embryo recipient		All	
	Fresh		Thaw					
	Number	Per cent	Number	Per cent	Number	Per cent	Number	Per cent
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
Total	**1,752**	**100.0**	**1,032**	**100.0**	**132**	**100.0**	**2,916**	**100.0**

4.2 Deliveries

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

Pregnancy outcome	Autologous				Oocyte /embryo recipient		All	
	Fresh		Thaw					
	Number	Per cent	Number	Per cent	Number	Per cent	Number	Per cent
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
Total	**6,822**	**100.0**	**3,582**	**100.0**	**358**	**100.0**	**10,762**	**100.0**

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

Deliveries by the number of embryos transferred

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

Gestation	One embryo		Two embryos		Three or more embryos		Total	
	Number	Per cent	Number	Per cent	Number	Per cent	Number	Per cent
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*
Twin	151	2.1	720	21.2	6	16.2	877	8.1
Higher order multiple	2	0.0	20	0.6	2	5.4	24	0.2
Total	**7,333**	**100.0**	**3,392**	**100.0**	**37**	**100.0**	**10,762**	**100.0**

Deliveries by maternal age

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

	Age group (years)[(a)]							
	< 35				≥ 35			
Gestation	One embryo	Two embryos	Three embryos	All	One embryo	Two embryos	Three embryos	All
				Number				
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
Total	**3,697**	**1,136**	**3**	**4,836**	**3,636**	**2,256**	**34**	**5,926**
				Per cent				
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
Total	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**

(a) Age at time of delivery.

Caesarean section

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

Method of delivery	Age group (years)[(a)]					
	< 30	30–34	35–39	40–44	≥ 45	Total
			Number			
Caesarean section	512	1,530	2,217	897	123	5,279
Other	773	1,994	2,046	598	28	5,439
Not stated	10	17	13	2	2	44
Total	**1,295**	**3,541**	**4,276**	**1,497**	**153**	**10,762**
			Per cent			
Caesarean section	39.5	43.2	51.8	59.9	80.4	49.1
Other	59.7	56.3	47.8	39.9	18.3	50.5
Not stated	0.8	0.5	0.3	0.1	1.3	0.4
Total	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**

(a) Age at time of delivery.

4.3 Perinatal outcomes of babies conceived following embryo transfer cycles

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.

Sex distribution in 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).

Gestational age of babies

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).

Table 29: Babies by gestational age and plurality, Australia and New Zealand, 2008

Gestational age (weeks)	Singletons		Twins		Higher order multiples		Total	
	Number	Per cent	Number	Per cent	Number	Per cent	Number	Per cent
Mean	*38.3*		*34.9*		*30.0*		*37.7*	
≤ 27	145	1.5	76	4.3	15	20.5	236	2.0
28–31	121	1.2	126	7.2	25	34.2	272	2.3
32–36	787	8.0	922	52.6	33	45.2	1,742	14.9
≥ 37	8,808	89.3	630	35.9	0	0.0	9,438	80.7
Total	**9,861**	**100.0**	**1,754**	**100.0**	**73**	**100.0**	**11,688**	**100.0**
≤ 36	*1,053*	*10.7*	*1,124*	*64.1*	*73*	*100.0*	*2,250*	*19.3*

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).

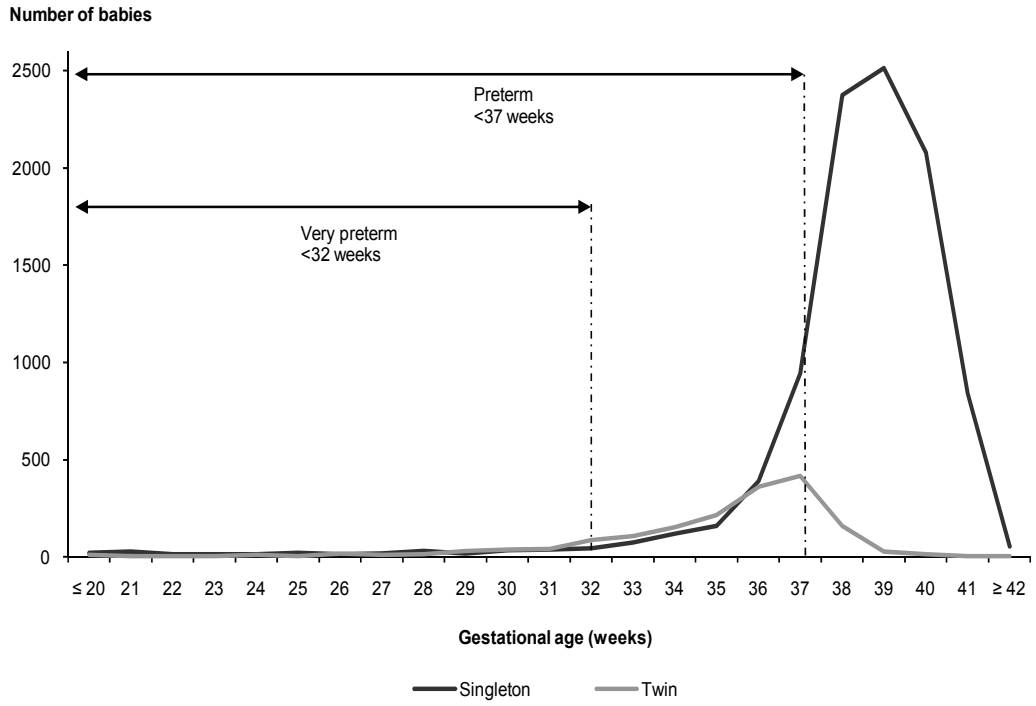


Figure 8: Number of babies by gestational age, Australia and New Zealand, 2008

Birthweight of liveborn babies

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

	Singletons		Twins		Higher order multiples		Total	
Birthweight (g)	**Number**	**Per cent**	**Number**	**Per cent**	**Number**	**Per cent**	**Number**	**Per cent**
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
Total	**9,723**	**100.0**	**1,719**	**100.0**	**65**	**100.0**	**11,507**	**100.0**
< 2,500	*677*	*7.0*	*906*	*52.7*	*64*	*98.5*	*1,647*	*14.3*

Perinatal mortality

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

Type of death	Singletons	Multiples	Total
		Number	
Fetal deaths	108	41	149
Neonatal deaths	18	22	40
Perinatal deaths[(a)]	**126**	**63**	**189**
		Rate (per 1,000 births)	
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.

5 GIFT cycles, surrogacy cycles, other procedures and complications in 2008

5.1 GIFT cycles

Gamete intrafallopian transfer (GIFT) is 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. The use of GIFT has been declining in Australia and New Zealand in recent years. In 2008, there were 98 GIFT cycles or intended GIFT cycles reported to ANZARD. Of these cycles, 76 (77.6%) had oocytes transferred, 17 (17.3%) resulted in a clinical pregnancy, and 11 (11.2%) resulted in a delivery (including two twin deliveries). All deliveries following GIFT cycles were live deliveries.

Of the 13 babies born to women who had GIFT cycles in 2008, 53.8% were born preterm (<37 weeks gestation) and 46.2% were low birthweight (<2,500 grams).

5.2 Surrogacy cycles

Surrogacy is 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 raised by the 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).

There were 114 surrogacy cycles reported to ANZARD in 2008, including 80 gestational carrier cycles and 34 commissioning parent cycles. Among the 80 gestational carrier cycles, 16 (20.0%) resulted in a clinical pregnancy and 10 (12.5%) resulted in a delivery. All ten babies born to gestational carriers in 2008 were singletons including eight liveborn singletons.

5.3 Preimplantation genetic diagnosis

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

	Stage of treatment		
Type of embryo	Number of cycles with embryo fertilised/thawed	Number of cycles with PGD	PGD per cycle with embryo fertilised/thawed (%)
Fresh	32,384	795	2.5
Thaw	22,237	176	0.8
Total	**54,621**	**971**	**1.8**

5.4 Ovarian hyperstimulation syndrome

ANZARD includes morbidity information that is specifically related to ART treatment. Ovarian hyperstimulation syndrome (OHSS) is a complication of controlled ovarian hyperstimulation, where excessive follicles are produced with high levels of oestrogen secretion.

OHSS and other morbidity data are reported by patients and clinicians, and validated with hospital records by fertility centre staff. It is possible this information is under-reported as there is no nationally-agreed definition for OHSS.

There were 198 OHSS cases reported in 2008 that were admitted to hospital. Of these, 196 had OPU performed. Overall, hospital-admitted OHSS occurred in 0.6% of cycles that involved an OPU with the incidence of OHSS increasing with the number of oocytes collected (Table 33).

Table 33: Number of cycles with OPU performed and OHSS by number of oocytes collected, Australia and New Zealand, 2008

	Number of oocytes collected						
	None	1–4	5–9	10–14	15–19	≥ 20	All
Cycles with OHSS	1	4	20	45	44	82	196
Cycles with OPU	643	8,258	12,282	7,947	3,690	2,328	35,148
OHSS per OPU cycle (%)	*0.2*	*0.0*	*0.2*	*0.6*	*1.2*	*3.5*	*0.6*

6 Donor sperm insemination cycles in 2008

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 centres in Australia and New Zealand, and does not include DI undertaken outside of this setting.

Number and outcomes of DI cycles

In 2008, there were 2,390 DI cycles reported to ANZARD, which included 24.1% (575) undertaken with controlled ovarian hyperstimulation 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).

The average age of women who had a DI cycle in 2008 was 35.3 years. The clinical pregnancy rate and live delivery rate decreased with advancing women's age. About 17% of DI cycles in women aged less than 30 years resulted in a live delivery, compared to only 3.9% of DI cycles in women aged 40 years or older (Table 34).

Table 34: Outcomes of DI cycles by women's age group, Australia and New Zealand, 2008

	Age group (years)[(a)]				
Stage/outcome of treatment	< 30	30–34	35–39	≥ 40	Total
DI cycles	299	703	904	484	2,390
Clinical pregnancies	58	125	134	30	347
Live deliveries	50	104	93	19	266
Clinical pregnancies per DI cycle (%)	*19.4*	*17.8*	*14.8*	*6.2*	*14.5*
Live deliveries per DI cycle (%)	*16.7*	*14.8*	*10.3*	*3.9*	*11.1*
Live deliveries per clinical pregnancy (%)	*86.2*	*83.2*	*69.4*	*63.3*	*76.7*

(a) Age at time of treatment.

Clinical pregnancies following DI cycles

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 in a delivery. Of the 270 deliveries, 94.8% (256) were singleton deliveries and 5.2% (14) were twin deliveries.

Perinatal outcomes of babies

There were 284 babies born to women who had DI treatment. Of these babies, 10.2% (29) were born preterm (<37 weeks gestation). The mean 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.

7 Trends in ART treatment and outcomes: 2004–2008

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

ART treatment and outcomes

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

Stage/outcome of treatment	2004	2005	2006	2007	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.

Multiple gestation deliveries

Between 2004 and 2008, there was a decrease in multiple gestation deliveries resulting from ART treatment. The proportion of multiples deliveries 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

	2004		2005		2006		2007		2008	
Gestation	Number	Per cent	Number	Per cent	Number	Per cent	Number	Per cent	Number	Per cent
Singleton	5,740	82.8	7,085	85.9	8,016	88.0	8,990	90.0	9,880	91.6
Multiple	*1,137*	*16.4*	*1,161*	*14.1*	*1,093*	*12.0*	*994*	*10.0*	*903*	*8.4*
Twin	1,114	16.1	1,134	13.8	1,070	11.7	978	9.8	879	8.2
Higher order multiple	23	0.3	27	0.3	23	0.3	16	0.2	24	0.2
Total[(a)]	**6,932**	**100.0**	**8,246**	**100.0**	**9,109**	**100.0**	**9,984**	**100.0**	**10,783**	**100.0**

(a) Includes cycles in which gestation was unknown.

Women's age of autologous cycles

The majority of fresh and thaw autologous cycles were in women aged 30 to 40 years. The proportion of autologous cycles in women aged 40 years and older increased from 19.1% in 2004 to 23.3% in 2008. The average age of women having autologous cycles increased from 35.1 years in 2004 to 35.7 years in 2008 (Analysis of Variance, $p<0.01$) (Table 37).

Table 37: Number of autologous cycles by women's age group, Australia and New Zealand, 2004 to 2008

	2004		2005		2006		2007		2008	
Age group (years)[(a)]	Number	Per cent	Number	Per cent	Number	Per cent	Number	Per cent	Number	Per cent
Mean (years)	*35.1*		*35.3*		*35.4*		*35.5*		*35.7*	
< 30	4,680	12.0	5,144	11.5	5,539	11.6	6,021	11.2	6,373	10.8
30–34	12,970	33.2	14,499	32.4	14,312	30.0	15,376	28.6	16,154	27.5
35–39	13,937	35.7	16,328	36.5	17,947	37.7	20,799	38.7	22,572	38.4
40–44	6,928	17.7	8,158	18.2	9,153	19.2	10,680	19.9	12,663	21.6
≥ 45	557	1.4	634	1.4	688	1.4	819	1.5	977	1.7
Not stated	0	0.0	0	0.0	4	0.0	1	0.0	1	0.0
Total	**39,072**	**100.0**	**44,763**	**100.0**	**47,643**	**100.0**	**53,696**	**100.0**	**58,740**	**100.0**

(a) Age at time of treatment.

Types of ART treatment and stage of embryo development

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

	2004		2005		2006		2007		2008	
Treatment type/procedure	Number	Per cent	Number	Per cent	Number	Per cent	Number	Per cent	Number	Per cent
					Fresh					
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
					Thaw					
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

Number of embryos transferred per embryo transfer cycle

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).

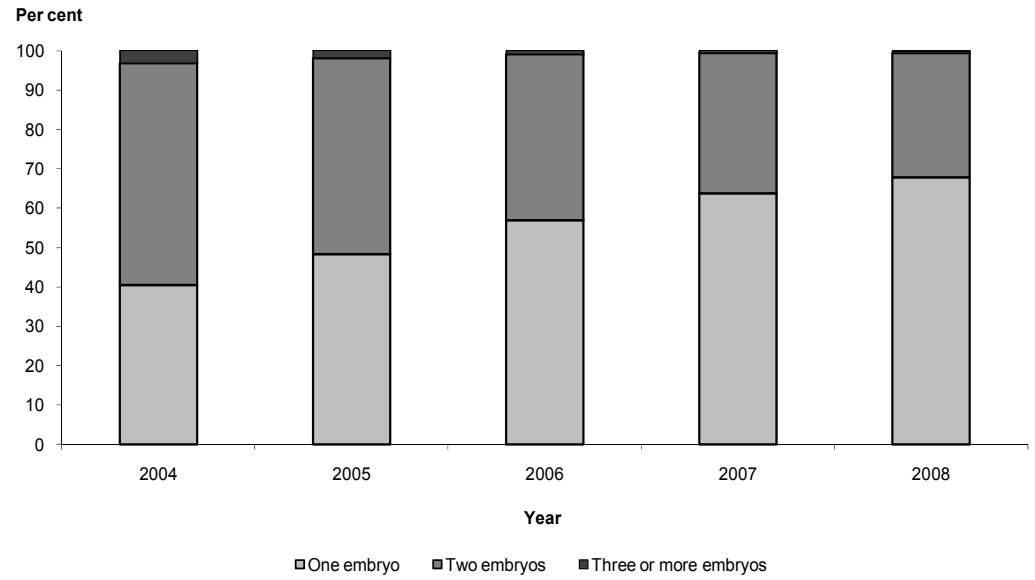


Figure 9: Proportion of embryo transfer cycles by number of embryos transferred, Australia and New Zealand, 2004 to 2008

Appendix 1: Data used in this report

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.

Data validation

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 presentation

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 for the categories. This is due to rounding error.

Data limitations

Follow-up of pregnancy and birth outcomes is limited because the ongoing care of pregnant patients is often carried out by non-ART practitioners. The method of follow-up varies by fertility centre and includes follow-up with the patient or clinician or the use of routine data sourced from a health department. 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. Fertility centre staff invest significant effort in validating such information by obtaining medical records from clinicians or hospitals. Data about previous ART treatment and history of pregnancies are, in some cases, reported by patients.

Appendix 2: ANZARD data items

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.
Cause of infertility: other factors	Yes—in the opinion of the treating clinician or clinic there is subfertility due to any other factors apart from female age, tubal disease, male factor or endometriosis. Possible examples are fibroids, ovulation disorders or premature ovarian failure. There is no clinical subfertility (e.g. egg donor, preimplantation genetic diagnosis or other non-fertility reason for ART). No—other.
Cause of infertility: idiopathic	Yes—in the opinion of the treating clinician or clinic there is clinical subfertility without any apparent explanation. No—other, including case of PGD for genetic disease.
Previous pregnancies < 20 weeks	Number of known pregnancies less than 20 weeks in the female partner regardless of whether by ART or by a different partner.
Previous pregnancies ≥ 20 weeks	Number of known pregnancies reaching 20 weeks or more in the female partner regardless of whether by ART or by a different partner.
Cycle ID	Unique cycle identifier.
Cycle date	For treatment cycles this is according to the Medicare definition and is the date of LMP for unstimulated cycles or, where FSH is used, the first day of FSH administration. For cycles where the only process is movement or disposal of embryos, this is the date of embryo movement. This date defines the year in which a cycle is reported to NPSU.
Surrogacy	Yes—the procedure is part of a surrogate arrangement. No—the procedure is not part of a surrogate arrangement.
Injectable FSH stimulation given	Yes—FSH administered. Does not include clomiphene or hCG alone unless FSH was also given. No—other.
DI date	Date of first insemination with donor sperm.
OPU date	Date of oocyte retrieval.
Number of eggs retrieved	Number of eggs retrieved at OPU. Include any immature oocytes that are identified.
Number of eggs donated	Number of eggs donated to someone else.
Number of eggs received	Number of eggs received from someone else.
Number of eggs GIFT	Number of eggs replaced in a GIFT procedure.

Variable	*Data domain*
Number of eggs IVF	Number of eggs treated with IVF.
Number of eggs ICSI	Number of eggs treated with ICSI.
Site of sperm used	Site of sperm extraction: ejaculated, epididymal (whether by open biopsy or by PESA), testicular or other.
Person from which sperm derives	Husband/partner (h), known donor (k), anonymous donor (a), embryo received or embryo transferred is a donated embryo (e).
Number of eggs fertilised normally	Number of eggs fertilised normally.
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.
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.
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 to be received from donation (recipient cycle); or 2. Records the number of embryos to be imported into the current unit from another unit.
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.
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	Embryo transfer date.
Number of early embryos transferred	Number of zygote or cleavage stage embryos (i.e. up to 4 days since fertilisation) transferred.
Number of blastocysts transferred	Number of blastocyst embryos (i.e. > 4 days since fertilisation) transferred.
Any embryos ICSI?	Yes—any embryos transferred were fertilised by ICSI. No—no transferred embryos were fertilised by ICSI.
Number of zygotes/cleavage stage embryos frozen	Number of zygote or cleavage stage embryos (i.e. up to 4 days since fertilisation) frozen.
Number of blastocysts frozen	Number of blastocyst embryos (i.e. > 4 days since fertilisation) frozen.
Number of embryos donated to someone else or exported from the unit of treatment	To minimise the number of required fields in the data collection, this field serves two purposes: 1. Records the number of embryos to be donated to someone else (donor cycle); or 2. Records the number of embryos to be exported from the current unit to another unit.
Number of potentially usable frozen embryos discarded	Potentially usable embryos disposed of in accordance with patient or government request.
Clinical pregnancy	A pregnancy that fulfils one of the following criteria: 1. Known to be ongoing at 20 weeks; 2. Evidence by ultrasound of an intrauterine sac (with or without a fetal heart); 3. Examination of products of conception reveal chorionic villi; or 4. A definite ectopic pregnancy that has been diagnosed laparoscopically or by ultrasound.
Date pregnancy ended	Date on which delivery, miscarriage or termination takes place.
Number of fetal hearts	Number of fetal hearts seen on first ultrasound (intrauterine only).
Ectopic pregnancy	Yes—pregnancy is an ectopic pregnancy, or a combined ectopic and uterine (heterotopic) pregnancy. No—pregnancy not ectopic or heterotopic.
Elective termination of pregnancy	Yes—pregnancy is terminated. No—pregnancy not terminated.
Selective reduction performed	Yes—selective reduction was performed owing to fetal abnormality. No—selective reduction not performed.
Fetal abnormality in a pregnancy ending < 20 weeks or in a fetus removed by selective reduction	Details of elective terminations of pregnancy and fetal reductions due to fetal abnormality.

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.

Terminology used in this report

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.

Cleavage stage embryo: an embryo comprising approximately 8 cells usually developed by 2 or 3 days after fertilisation.

Clinical pregnancy: a pregnancy in which at least one of the following criteria is met:

- known to be ongoing at 20 weeks
- evidence by ultrasound of an intrauterine sac (with or without a fetal heart)
- examination of products of conception reveal chorionic villi, or
- an ectopic pregnancy has been diagnosed by laparoscope or by ultrasound.

Controlled ovarian hyperstimulation: medical treatment to induce the development of multiple ovarian follicles in order to obtain multiple oocytes at oocyte pick-up (OPU).

Cryopreservation: freezing embryos for potential future ART treatment.

Delivery: a birth event in which one or more babies of 20 weeks or more gestation or of 400 grams or more birthweight are born.

DI (donor insemination) cycle: an artificial insemination cycle in which sperm not from the woman's partner (donor sperm) is used.

Discontinued cycle: an ART cycle that does not proceed to oocyte pick-up (OPU) or embryo transfer.

Donation cycle: 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. The use of donor sperm does not alter the donor status of the cycle.

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

Embryo: an egg that has been fertilised by a sperm and has undergone one or more divisions.

Embryo transfer: a procedure whereby embryo(s) are placed in the uterus or fallopian tube. The embryo(s) can be fresh or thawed following cryopreservation, and may include the transfer of cleavage stage embryos or blastocysts.

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 and screened for chromosomal disorders or genetic diseases before embryo transfer.

Nulliparous: refers to a woman who has never had a pregnancy of 20 weeks or more gestation.

Perinatal death: a fetal death (stillbirth) or neonatal death of at least 20 weeks gestation or at least 400 grams birthweight.

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 raised 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 cryopreserved 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, the terminology used in this report may differ from that in the ICMART glossary.

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List of tables

Supplementary tables

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

List of figures