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Assisted reproductive technology in Australia and New Zealand 2009

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Contents

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We acknowledge the fertility clinics in Australia and New Zealand and their directors who contributed data for this report. A complete list of all contributing fertility clinics can be found in Appendix 1.

We acknowledge the financial support from the Fertility Society of Australia for the compilation of ANZARD and the preparation of this report.

Abbreviations and symbols

AIHW	Australian Institute of Health and Welfare
ANZARD	Australian and New Zealand Assisted Reproduction Database
ART	assisted reproductive technology
DET	double embryo transfer
DI	donor sperm insemination
FSA	Fertility Society of Australia
FSH	follicle stimulating hormone
GIFT	gamete intrafallopian transfer
ICSI	intracytoplasmic sperm injection
IVF	in vitro fertilisation
NPESU	National Perinatal Epidemiology & Statistics Unit
OHSS	ovarian hyperstimulation syndrome
OPU	oocyte pick-up
PGD	preimplantation genetic diagnosis
PRERU	Perinatal & Reproductive Epidemiology Research Unit
RR	rate ratio
SET	single embryo transfer
SLK	statistical linkage key
UNSW	The University of New South Wales
WHO	World Health Organization

Symbols

. .	not applicable

Summary

This is the fifteenth annual report on the use of assisted reproductive technologies (ARTs) in Australia and New Zealand. The report presents data on ART treatment and donor insemination cycles undertaken in 2009, and the resulting pregnancies and baby outcomes.

Use of ART treatment cycles

There were 70,541 ART treatment cycles reported in Australia and New Zealand in 2009, a 13.9% increase on 2008 and a 48.0% increase on 2005. Of these, 92.4% were in Australian fertility centres and 7.6% were in New Zealand fertility centres. Women used their own oocytes/embryos in more than 95%of treatments (autologous), and 33.8% of all cycles used frozen/thawed embryos.

It is estimated that more than 35,000 women undertook autologous ART treatment in Australia and New Zealand in 2009. On average, 1.8 fresh and/or thaw cycles per woman were performed in 2009.

Treatment outcomes and number of babies

Of the 70,541 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 12,127 live deliveries resulting in 13,114 liveborn babies including 9,732 singletons at term of normal birthweight.

Women's age and parity

The average age of women undergoing autologous cycles was 35.8 years, about the same as the average age (35.7 years) in 2008. One in four (26.8%) autologous fresh cycles undertaken in 2009 was in women aged 40 years or older. The average age of women undergoing ART treatment using donor oocytes/embryos was 40.8 years. Almost one-quarter (24.5%) of cycles were undertaken by women who had previously given birth.

Advancing women's age is associated with the decrease in the live delivery rates. Of autologous fresh cycles, the live delivery rate per initiated cycle was 26.8% for cycles in women aged 30–34 years. It decreased to less than 1% for cycles in women aged over 44 years. Of autologous thaw cycles, the live delivery rate per initiated cycle fell from 20.1% of cycles in women aged 30–34 years to 2.4% of cycles in women aged over 44 years.

Transfer of cryopreserved embryos

Of the 22,472 frozen/thawed embryo transfer cycles, 18.3% involved the transfer of embryos that had been cryopreserved using an ultra-rapid method (vitrification). One-third of thaw cycles where a blastocyst (day 5–6 embryo) was transferred used vitrified blastocysts, compared to 1.7% of cycles where a cleavage embryo (day 2–3 embryo) was transferred.

Multiple births

A continuing trend in ART treatment has been the reduction in the rate of multiple birth deliveries from 14.1% in 2005 to 8.2% in 2009. This reduction was achieved by a shift in practice by clinicians and patients to single embryo transfer, with the proportion of single embryo transfer cycles increasing from 48.3% in 2005 to 69.7% in 2009. Importantly, this substantial decrease in the multiple delivery rate was achieved while clinical pregnancy rates remained stable at around 23% per cycle.

1 Introduction

It is estimated that 9.0% of couples at any given time experience infertility (Boivin et al. 2007). Infertility is usually defined as the failure to achieve a clinical pregnancy after 12 or more months of regular unprotected sexual intercourse (Zegers-Hochschild et al. 2009). Despite it being a common condition, infertility is increasingly being overcome through advancements in fertility treatment, in particular assisted reproductive technologies (ARTs). ARTs have evolved over the last three decades into a suite of mainstream medical interventions that have resulted in the birth of more than 4.3 million children worldwide (ESHRE 2010). In Australia and New Zealand, the numbers of ART treatment cycles and live deliveries have grown steadily each year, with the most recent estimates indicating that 3.2% and 2.0% of all women who gave birth in Australia and New Zealand in 2008 respectively received some form of ART treatment (Laws et al. 2010; 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 may increase the chance of 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 & Templeton 2004; Kissin et al. 2005). Through the 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 while limiting the impact on pregnancy rates.

Treatments covered in this report

ART is a group of procedures that involves the in vitro (outside of body) handling of human oocytes (eggs) and sperm or embryos for the purposes of establishing a pregnancy (Zegers-Hochschild et al. 2009). A typical fresh ART treatment cycle involves five main steps:

- Controlled ovarian hyperstimulation during which follicle stimulating hormone (FSH) is administered to the woman 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 anaesthesia.
- Fertilisation of the collected oocytes by incubating them with sperm (from the woman's partner or donor) over a few hours in the laboratory.
- Embryo maturation during which a fertilised oocyte is cultured for 2–3 days to form a cleavage embryo (6–8 cells) or 5–6 days to create a blastocyst (70–100 cells).
- Transfer of one or more fresh embryos into the uterus in order for a pregnancy to occur.

Treatment may be discontinued at any stage during a treatment cycle due to a number of reasons including inadequate or 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 described above. Some of these variations include:

- Intracytoplasmic sperm injection (ICSI), when a single sperm is injected directly into the oocyte to aid fertilisation.

- Gamete intrafallopian transfer (GIFT), when 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), when cells are removed from the embryo and analysed for chromosomal disorders or genetic diseases before embryo transfer.
- Donor/recipient arrangements, when donor oocytes from a woman are used to create embryos for transfer to another (recipient) woman.
- Cryopreservation of embryos/thawed cycles, when embryos not transferred in the initial fresh treatment cycle were cryopreserved and stored. Once thawed or warmed, the embryos can be transferred in subsequent treatments. Cryopreservation techniques include both traditional slow freezing method and vitrification, when oocytes or embryos are cryopreserved using an ultra-rapid method.
- Surrogacy arrangements, where a woman (known as the gestational carrier) agrees to carry a child for another person or couple (known as the intended parent(s)) with the intention that the child will be raised by the intended parents.

Along with ART, a number of other fertility treatments are undertaken in Australia and New Zealand. Artificial insemination is one such treatment by which sperm are placed into the female genital tract (e.g. intracervical or intrauterine), and can be used with controlled ovarian hyperstimulation or in natural cycles. Artificial insemination can be undertaken using a partner's sperm or donated sperm (donor sperm insemination (DI)).

Data used in this report

Assisted reproductive technology in Australia and New Zealand 2009 is the fifteenth 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 2005 to 2009.

As a joint initiative of the Perinatal & Reproductive Epidemiology Research Unit (PRERU) at The University of New South Wales (UNSW) and the Fertility Society of Australia (FSA), the Australian and New Zealand Assisted Reproduction Database (ANZARD) was upgraded in 2009 to accommodate new ART treatment types and to transform ANZARD from a cycle-based data collection to a woman-based data collection (ANZARD2.0). The expanded treatment information in ANZARD2.0 includes data fields for oocyte/embryo vitrification, oocyte freezing/thawing process and duration of thawed oocytes and embryos in storage. The upgrade to a woman-based data collection was achieved by introducing a statistical linkage key (SLK) which links successive treatment cycles undertaken by one woman. The SLK is a combination of the first two letters of a woman's first name, the first two letters of her surname and her date of birth. The SLK enables the number of women undergoing treatment in a particular treatment year to be reported.

The new ANZARD2.0 structure was implemented with the collection of 2009 treatment data. However, several clinics were unable to provide the SLK for women undergoing treatment in their clinics. Therefore, this report retains the cycle-based format used in previous reports for Chapters 2 to 7, and a new chapter, Chapter 8, presents information on the number of women who underwent ART treatment within clinics where the SLK is available.

The data presented in this report were supplied by all 37 fertility centres (77 fertility clinics in Australia and 7 fertility clinics in New Zealand), and compiled into ANZARD2.0.

Note: A data extraction error, where blastocyst transfer was incorrectly classified as cleavage embryo transfer, was identified for some clinics for treatment from 2002 to 2008. Therefore, the number of blastocyst transfers is underestimated in the trends analysis of this report for treatment years 2005 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 for national and international comparisons.

Structure of this report

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

Chapter 2—'Overview of ART treatment in 2009', 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 2009', presents data on women 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 2009', 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 2009', includes information on cycles, procedures and complications that do not fit into the chapters already described.

Chapter 6—'Donor sperm insemination cycles in 2009', presents data on DI cycles and their outcomes, including a description of pregnancy and perinatal outcomes.

Chapter 7—'Trends in ART treatment and outcomes: 2005–2009', presents trends in ART treatments during the last five years of data collection in Australia and New Zealand.

Chapter 8—'Women undertaking autologous treatment in 2009', presents information on the number of women undergoing ART treatment in 2009 and cumulative success rates.

Appendices—Appendix 1 lists the contributing fertility clinics. Appendix 2 describes the ANZARD2.0 data collection which was used to prepare this report. Appendix 3 presents the data items in the ANZARD2.0 collection.

Supplementary tables of this report are available on the AIHW website.

2 Overview of ART treatment in 2009

There were 70,541 ART treatment cycles reported from Australian and New Zealand clinics in 2009 (Table 1). Of these, 92.4% (65,202) were from Australian clinics and 7.6% (5,339) were from New Zealand clinics. In Australia there were 14.2 cycles per 1,000 women of reproductive age (15–44 years) compared with 5.9 cycles per 1,000 women of reproductive age in New Zealand.

Over 95% of cycles in 2009 were autologous cycles, that is where a woman intended to use, or used her own oocytes or embryos. Of the 67,229 autologous cycles, 43,352 (64.5%) were fresh cycles and 23,877 (35.5%) were frozen/thaw cycles. Other treatment cycles accounted for a small proportion of cycles, comprising 2.7% oocyte recipient cycles, 0.4% embryo recipient cycles, 1.5% oocyte donation cycles and 0.2% surrogacy cycles (Table 1).

Of all ART treatments in 2009, 22.6% (15,975) resulted in a clinical pregnancy and 17.2% (12,127) in a live delivery (Table 1). Of the 15,975 clinical pregnancies, 14,429 (90.3%) were from Australian clinics and 1,546 (9.7%) from New Zealand clinics. There were 13,303 babies born (including 13,114 liveborn) following ART treatment in 2009. Of the 13,303 ART babies born, 12,019 (90.3%) were from Australian clinics and 1,284 (9.7%) from New Zealand clinics. Of the liveborn babies, 74.2% (9,732) were singletons at term (gestational age of 37–41 weeks) with normal birthweight (≥ 2,500 grams).

Table 1: Number of initiated ART treatment cycles by treatment type, Australia and New Zealand, 2009

Treatment type	Number of initiated ART cycles	Per cent of treatment types	Number of clinical pregnancies	Number of live deliveries	Number of liveborn babies	Number of liveborn singletons at term with normal birthweight
Autologous	67,229	95.3	15,436	11,732	12,682	9,452
Fresh	*43,352*	*61.5*	*10,222*	*7,800*	*8,493*	*6,217*
Thaw	*23,877*	*33.8*	*5,214*	*3,932*	*4,189*	*3,235*
Oocyte recipient	1,884	2.7	464	340	373	240
Embryo recipient	251	0.4	51	36	38	25
Oocyte donation	1,037	1.5	. .	. .	. .	. .
GIFT[(a)]	14	0.0	1	1	2	0
Surrogacy arrangement cycles	126	0.2	23	18	19	15
Intended parent cycles	*35*	*0.0*	*. .*	*. .*	*. .*	*. .*
Gestational carrier cycles	*91*	*0.1*	*23*	*18*	*19*	*15*
Total	**70,541**	**100.0**	**15,975**	**12,127**	**13,114**	**9,732**

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

3 Autologous and donation/recipient cycles in 2009

This chapter presents data on initiated autologous cycles, oocyte donation cycles and oocyte/embryo recipient cycles. GIFT cycles and surrogacy cycles 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 influence 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 of, or intention to use, either fresh or frozen/thawed embryos.

3.1 Overview of autologous and recipient cycles

Age of women and their partners

The average age of women undergoing autologous and oocyte/embryo recipient cycles was 36.0 years. For women undergoing oocyte/embryo recipient cycles, the mean age was 40.8 years, five years older than for autologous cycles (35.8 years). Of all autologous and oocyte/embryo recipient cycles, one in four (25.0%) was undertaken by women aged 40 years or older (Table 2). The average age of partners was 38.2 years, with 35.2% aged 40 years or older. Of oocyte/embryo recipient cycles, 15.0% had partner's age not stated or no partner involved (Table 3).

Table 2: Number of autologous and recipient cycles by women's age group and treatment type, Australia and New Zealand, 2009

Age group (years)[(a)]	Autologous				Oocyte /embryo recipient		All	
	Fresh		Thaw					
	Number	Per cent	Number	Per cent	Number	Per cent	Number	Per cent
< 30	4,584	10.6	2,719	11.4	73	3.4	7,376	10.6
30–34	10,870	25.1	7,109	29.8	218	10.2	18,197	26.2
35–39	16,276	37.5	9,677	40.5	509	23.8	26,462	38.1
40–44	10,771	24.8	4,082	17.1	765	35.8	15,618	22.5
≥ 45	851	2.0	290	1.2	570	26.7	1,711	2.5
Total	**43,352**	**100.0**	**23,877**	**100.0**	**2,135**	**100.0**	**69,364**	**100.0**

(a) Age at start of a treatment cycle.

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, 2009

Age group (years)[(a)]	Autologous				Oocyte /embryo recipient		All	
	Fresh		Thaw					
	Number	Per cent	Number	Per cent	Number	Per cent	Number	Per cent
< 30	2,652	6.1	1,363	5.7	55	2.6	4,070	5.9
30–34	9,119	21.0	5,349	22.4	210	9.8	14,678	21.2
35–39	13,555	31.3	8,219	34.4	533	25.0	22,307	32.2
40–44	9,248	21.3	4,769	20.0	525	24.6	14,542	21.0
≥ 45	6,283	14.5	3,050	12.8	492	23.0	9,825	14.2
Not stated	2,495	5.8	1,127	4.7	320	15.0	3,942	5.7
Total	**43,352**	**100.0**	**23,877**	**100.0**	**2,135**	**100.0**	**69,364**	**100.0**

(a) Age at start of a treatment cycle.

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

Parity

Parity describes a woman by 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 69,364 initiated autologous and recipient cycles undertaken in 2009, 61.2% were undertaken by nulliparous women. Of autologous cycles (fresh and thaw), 61.0% were undertaken by nulliparous women compared with 66.3% for oocyte/embryo recipient cycles (Table 4).

Table 4: Number of autologous and recipient cycles by parity and treatment type, Australia and New Zealand, 2009

	Autologous				Oocyte/embryo recipient		All	
	Fresh		Thaw					
Parity	Number	Per cent	Number	Per cent	Number	Per cent	Number	Per cent
Nulliparous	27,269	62.9	13,769	57.7	1,416	66.3	42,454	61.2
Parous	9,500	21.9	6,967	29.2	522	24.4	16,989	24.5
Not stated	6,583	15.2	3,141	13.2	197	9.2	9,921	14.3
Total	**43,352**	**100.0**	**23,877**	**100.0**	**2,135**	**100.0**	**69,364**	**100.0**

Cause of infertility

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

Of the 69,364 initiated autologous and recipient cycles, 20.7% reported male infertility factors as the only cause of infertility; 34.6% reported only female infertility factor(s); 12.0% reported combined male–female factors; 27.6% reported unexplained infertility; and 5.1% were not stated. Male infertility factors (alone and combined with female infertility factor) were reported for 32.6% of cycles.

ICSI procedures in autologous and recipient cycles

Of the 38,458 autologous fresh cycles where fertilisation was attempted, 65.6% used ICSI procedures and 34.4% used IVF procedures. In fresh oocyte recipient cycles where fertilisation was attempted, 73.3% used ICSI procedures and 26.7% used IVF procedures (Table 5).

Table 5: Number of autologous and recipient cycles with fertilisation attempted by treatment type and procedure, Australia and New Zealand, 2009

	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	13,212	34.4	9,522	44.6	256	26.7	500	45.4
ICSI[(c)]	25,246	65.6	10,843	50.7	702	73.3	602	54.6
Not stated	0	0.0	1,005	4.7	0	0.0	0	0.0
Total	**38,458**	**100.0**	**21,370**	**100.0**	**958**	**100.0**	**1,102**	**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 57,223 fresh and thawed embryo transfer cycles, 69.7% were single embryo transfer (SET) cycles and 29.6% were double embryo transfer (DET). In women aged less than 35 years, 79.4% of embryo transfer cycles were SET and 20.5% were DET. In women aged 35 years or older, 63.8% of cycles were SET and 35.1% were DET (Table 6).

Table 6: Number of fresh and thawed embryos transferred per cycle and women's age group, Australia and New Zealand, 2009

	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	5,096	82.9	1,049	17.1	5	0.1	6,150	100.0
30–34	12,196	78.0	3,426	21.9	10	0.1	15,632	100.0
35–39	15,341	69.3	6,762	30.5	38	0.2	22,141	100.0
40–44	6,542	54.2	5,238	43.4	297	2.5	12,077	100.0
≥ 45	737	60.3	448	36.6	38	3.1	1,223	100.0
Total	**39,912**	**69.7**	**16,923**	**29.6**	**388**	**0.7**	**57,223**	**100.0**

(a) Age at start of a treatment cycle.

Stage of embryo development in autologous and recipient cycles

Of the 57,223 embryo transfer cycles, 49.8% involved the transfer of day 5–6 embryos (blastocysts). Of autologous cycles, blastocyst transfers made up 53.2% of thaw cycles compared with 47.9% of fresh cycles (Table 7).

Table 7: Number of embryo transfer cycles by treatment type and stage of embryo development, Australia and New Zealand, 2009

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	17,663	52.1	10,009	46.8	483	56.8	585	53.1
Blastocyst	16,237	47.9	11,361	53.2	368	43.2	517	46.9
Total	**33,900**	**100.0**	**21,370**	**100.0**	**851**	**100.0**	**1,102**	**100.0**

Transfer of cryopreserved embryos in autologous and recipient cycles

Embryos created in a fresh cycle can be cryopreserved by either slow freezing or ultra-rapid (vitrification) methods. Slow frozen and vitrified embryos can be thawed/warmed, and then transferred in subsequent cycles. ANZARD2.0 data collection included information on oocyte/embryo cryopreservation methods in terms of slow freezing and vitrification. Due to the retrospective nature of the data collection, however, a few clinics were unable to distinguish between the two cryopreservation methods and reported all cryopreservation as a slow freezing method.

Of the 22,472 frozen/thawed embryo transfer cycles, 18.3% involved the transfer of vitrified embryos. Just over one-third of frozen/thawed blastocyst transfer cycles had vitrified blastocysts transferred. Only 1.7% of frozen/thawed day 2–3 embryo (cleavage embryo) transfer cycles had vitrified cleavage embryos transferred (Table 8).

Table 8: Number of embryo transfer cycles by freezing method and stage of embryo development, Australia and New Zealand, 2009

Type and procedure	Autologous				Oocyte/embryo recipient			
	Cleavage embryo		Blastocyst		Cleavage embryo		Blastocyst	
	Number	Per cent	Number	Per cent	Number	Per cent	Number	Per cent
Slow frozen	9,838	98.3	7,580	66.7	578	98.8	361	69.8
Vitrification[(a)]	171	1.7	3,781	33.3	7	1.2	156	30.2
Total	**10,009**	**100.0**	**11,361**	**100.0**	**585**	**100.0**	**517**	**100.0**

(a) Ultra-rapid cryopreservation.

3.2 Autologous fresh cycles

In 2009, there were 43,352 initiated autologous fresh cycles, comprising 42,853 (98.8%) ovarian stimulated cycles and 499 (1.2%) unstimulated cycles. There were 67 cycles in which thawed oocytes were used for fertilisation.

Of the 43,352 initiated autologous fresh cycles, 92.8% (40,213) were from Australian clinics and 7.2% (3,139) 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 43,352 initiated autologous fresh cycles in 2009, 91.5% had OPU performed, 78.2% had embryos transferred, 23.6% resulted in a clinical pregnancy and 18.0% resulted in a live delivery (Figure 1). 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 inadequate response of ovaries to medication, excessive ovarian stimulation, failure to obtain oocytes, failure of oocyte fertilisation, inadequate embryo growth or patient choice.

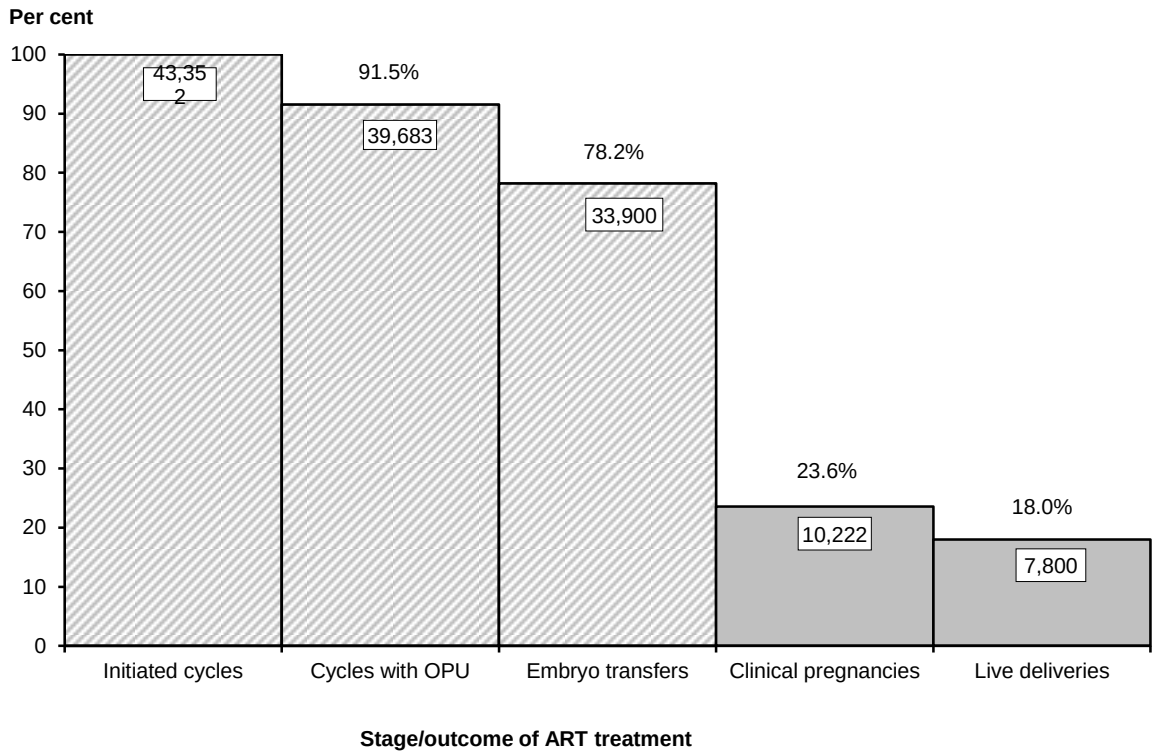

Figure 1: Progression of autologous fresh cycles, Australia and New Zealand, 2009

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 (34.0%). The rate declined with advancing women's age, with a rate of 9.4% for women aged 40–44 years and 0.8% for women aged 45 years or older (Table 9).

Table 9: Outcomes of autologous fresh cycles by women's age group, Australia and New Zealand, 2009

	Age group (years)[(a)]					
Stage/outcome of treatment	**< 30**	**30–34**	**35–39**	**40–44**	**≥ 45**	**All**
Initiated cycles	4,584	10,870	16,276	10,771	851	43,352
Cycles with OPU	4,226	10,155	14,952	9,629	721	39,683
Embryo transfer cycles	3,611	8,954	12,999	7,858	478	33,900
Clinical pregnancies	1,507	3,497	3,949	1,258	11	10,222
Live deliveries	1,227	2,910	2,922	737	4	7,800
Live deliveries per initiated cycle (%)	*26.8*	*26.8*	*18.0*	*6.8*	*0.5*	*18.0*
Live deliveries per embryo transfer cycle (%)	*34.0*	*32.5*	*22.5*	*9.4*	*0.8*	*23.0*
Live deliveries per clinical pregnancy (%)	*81.4*	*83.2*	*74.0*	*58.6*	*36.4*	*76.3*

(a) Age at start of a treatment cycle.

Figure 2 shows 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 32 years. The live delivery rate declined steadily for women older than 32 years. For women aged 45 years or older, only one live delivery resulted from every 200 initiated cycles compared with 54 live deliveries from every 200 initiated cycles in women aged between 25 and 34 years.

The lower live delivery rate in women in their early 20s is probably associated with greater levels of uncertainty in the estimates due to the small numbers of patients.

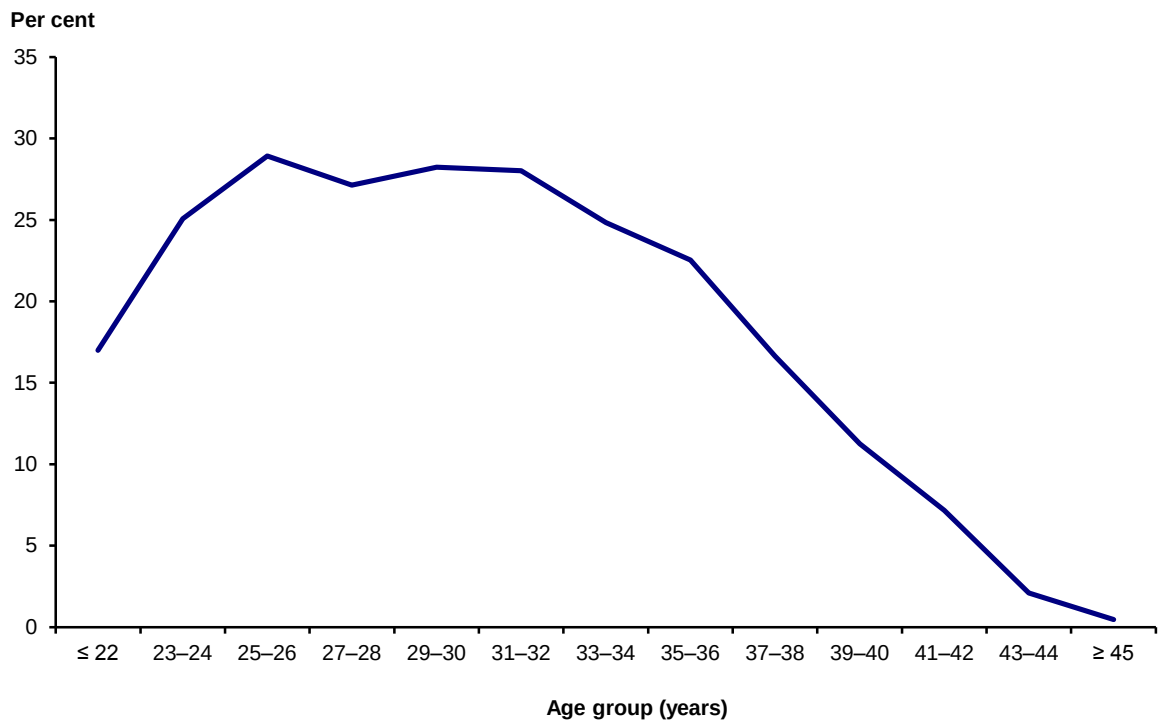

Figure 2: Live deliveries per initiated autologous fresh cycle by women's age at start of a treatment cycle, Australia and New Zealand, 2009

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 higher rates of clinical pregnancy and live delivery than cycles that reported female factor infertility (Table 10). The rate ratio (RR) of live delivery was 1.12 for cycles with male factor only infertility to cycles with female factor only infertility.

Table 10: Outcomes of autologous fresh cycles by cause of infertility, Australia and New Zealand, 2009

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	9,116	79.6	24.9	19.7
Female factor	14,731	76.8	23.2	17.5
Tubal disease only	*2,285*	*79.8*	*23.5*	*17.0*
Endometriosis only	*2,271*	*77.8*	*25.7*	*19.8*
Other female factor only	*8,318*	*75.1*	*22.5*	*17.1*
Combined female factor	*1,857*	*79.4*	*23.2*	*17.1*
Combined male—female factors	5,450	79.5	24.1	17.8
Unexplained	11,950	80.1	23.7	18.0
Not stated	2,105	67.7	18.5	14.1
Total	**43,352**	**78.2**	**23.6**	**18.0**

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

Cycles with three or more embryos transferred accounted for less than 0.1% of embryo transfer cycles in women aged less than 35 years. This increased to 1.5% in women aged 35 years or older. Overall, 65.2% of embryo transfer cycles were SET cycles and 33.8% were DET cycles (Table 11).

For women aged less than 35 years, the difference in the live delivery rates of SET and DET cycles was 1.1 percentage points (33.2% and 32.1% respectively). For women aged 35 years and older, the difference in the live delivery rates of SET and DET cycles was 0.8 percentage points (17.6% and 16.8% respectively). Overall, the live delivery rate was 24.6% for SET and 20.3% for DET (Table 11).

Table 11: Outcomes of autologous fresh embryo transfer cycles by women's age and number of embryos transferred, Australia and New Zealand, 2009

	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 transfer cycles	9,961	2,595	9	12,158	8,858	319	22,119	11,453	328
Clinical pregnancies	3,975	1,028	1	2,987	2,168	63	6,962	3,196	64
Live deliveries	3,303	833	1	2,141	1,487	35	5,444	2,320	36
Clinical pregnancies per embryo transfer cycle (%)	*39.9*	*39.6*	*11.1*	*24.6*	*24.5*	*19.7*	*31.5*	*27.9*	*19.5*
Live deliveries per embryo transfer cycle (%)	*33.2*	*32.1*	*11.1*	*17.6*	*16.8*	*11.0*	*24.6*	*20.3*	*11.0*

(a) Age at start of a treatment cycle.

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 a woman's age (Table 12). Overall, the difference in live delivery rates for cleavage stage embryos and blastocysts was 9.2 percentage points (18.6% and 27.8% respectively). The live delivery rate for blastocyst transfer cycles was 50% higher than for cleavage stage embryo transfer cycles (RR 1.50).

Table 12: Outcomes of autologous fresh embryo transfer cycles by women's age and stage of embryo development, Australia and New Zealand, 2009

	Age group (years)[a]					
	< 35		≥ 35		All	
Stage/outcome of treatment	Cleavage stage embryo	Blastocyst	Cleavage stage embryo	Blastocyst	Cleavage stage embryo	Blastocyst
Embryo transfer cycles	5,741	6,824	11,922	9,413	17,663	16,237
Clinical pregnancies	1,982	3,022	2,438	2,780	4,420	5,802
Live deliveries	1,632	2,505	1,651	2,012	3,283	4,517
Clinical pregnancies per embryo transfer cycle (%)	*34.5*	*44.3*	*20.4*	*29.5*	*25.0*	*35.7*
Live deliveries per embryo transfer cycle (%)	*28.4*	*36.7*	*13.8*	*21.4*	*18.6*	*27.8*

(a) Age at start of a treatment cycle.

Live deliveries from autologous fresh cycles among fertility centres

The live delivery rate per initiated autologous fresh cycle varied among the 34 fertility centres that performed autologous fresh treatments in 2009. This variation is measured using quartiles which rank a centre's live delivery rate within the top and bottom 25% of centres.

The live delivery rate per initiated autologous fresh cycle ranged from 3.5% to 26.0% among fertility centres. The middle 50% of fertility centres (second and third quartiles) had live delivery rates between 13.7% and 20.6% (Table 13).

These data should be interpreted with caution because of the small number of patients who underwent autologous fresh treatments in some clinics and potential variation in patient characteristics which may influence the live delivery rate of an individual centre.

Table 13: Live delivery rate of autologous fresh cycles by women's age group among fertility centres, Australia and New Zealand, 2009

Age group (years)[a]	Live deliveries per initiated autologous fresh cycle (per cent)				
	Overall	First quartile	Second quartile	Third quartile	Fourth quartile
< 35	26.8	29.1–33.5	26.0–29.0	19.8–25.9	5.5–19.7
≥ 35	13.1	15.8–22.3	12.7–15.7	9.6–12.6	2.5–9.5
All	**18.0**	**20.7–26.0**	**18.2–20.6**	**13.7–18.1**	**3.5–13.6**

(a) Age at start of a treatment cycle.

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 the 34 fertility centres that performed autologous fresh cleavage embryo or blastocyst transfers. The rates were unadjusted for women's age and parity which may vary between centres.

These data should be interpreted with caution because of the small number of patients who underwent autologous fresh cleavage embryo or blastocyst transfers in some clinics and potential variation in patient characteristics which may influence the live delivery rate of an individual centre. A woman's age and embryo quality may influence whether one or two embryos are transferred, and whether embryos are transferred at the cleavage or blastocyst stage.

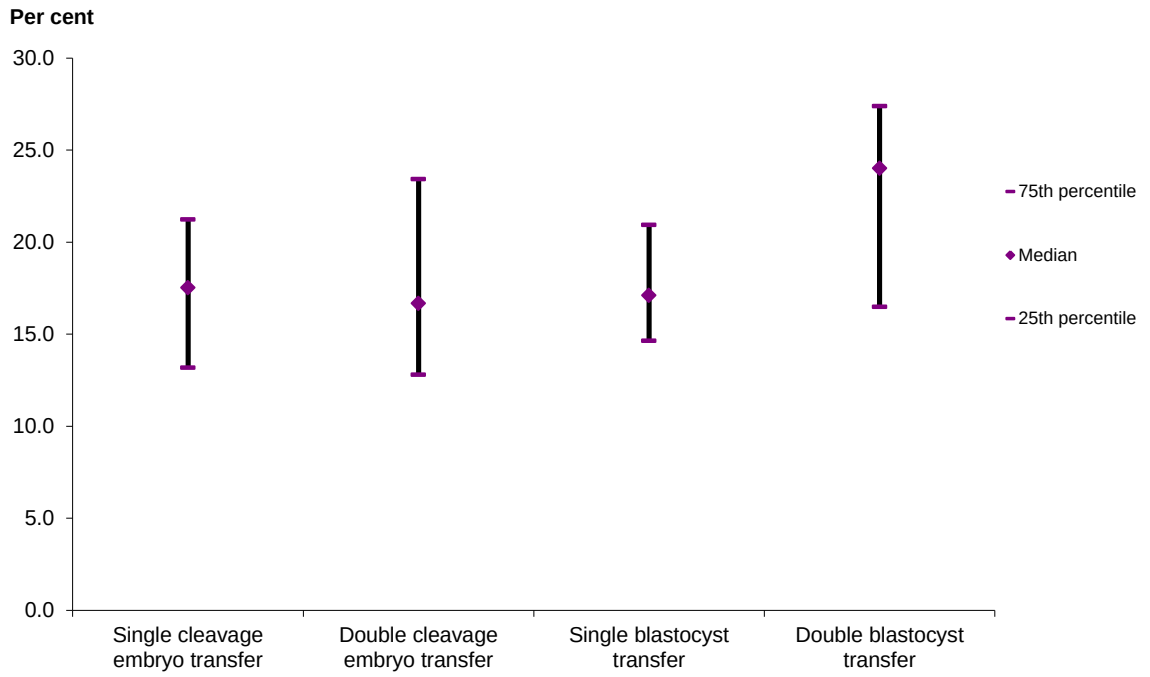

Figure 3: Live deliveries per autologous fresh embryo transfer cycle by number of embryos transferred and stage of embryo development among fertility centres, Australia and New Zealand, 2009

3.3 Autologous thaw cycles

There were 23,877 autologous thaw cycles reported in 2009. Of these, 92.6% (22,121) were from Australian clinics and 7.4% (1,756) 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 23,877 initiated autologous thaw cycles, 89.5% had embryos transferred, 21.8% resulted in a clinical pregnancy and 16.5% resulted in a live delivery (Figure 4). Almost one in 10 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 2009 (16.5% and 18.0% respectively) (Figures 1 and 4).

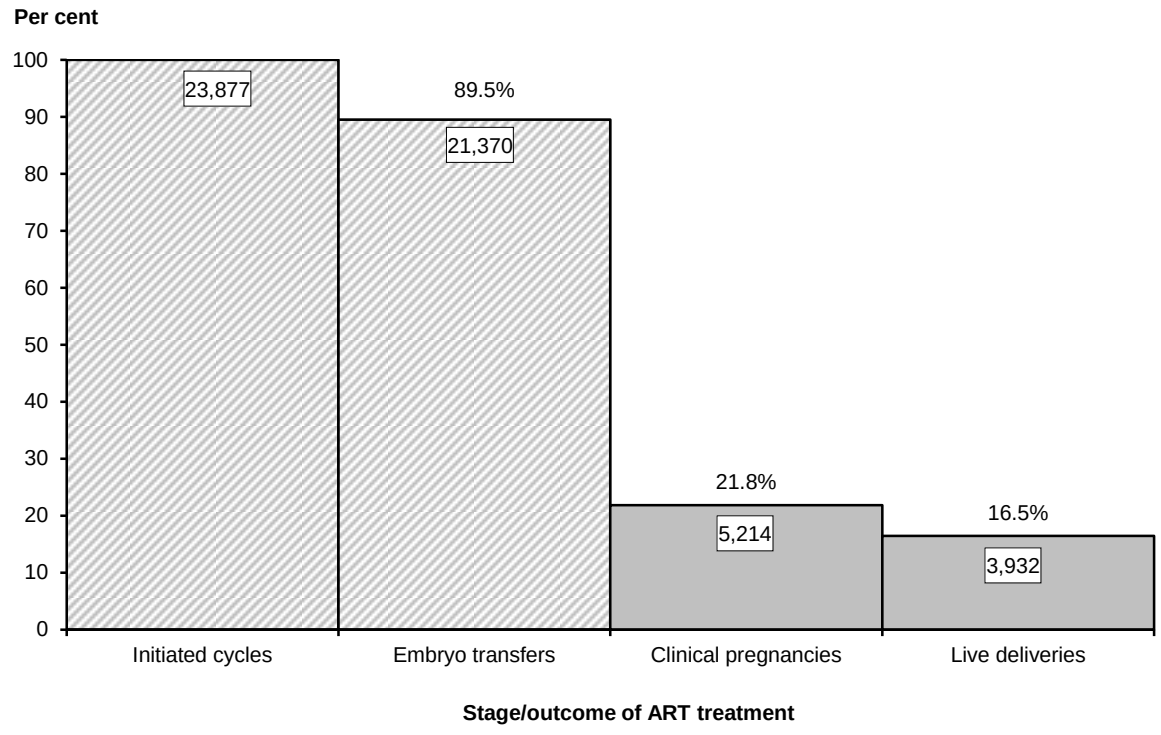

Figure 4: Progression of autologous thaw cycles, Australia and New Zealand, 2009

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

Similar to autologous fresh embryo transfer 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 30–34 years (Table 14). It is important to note that embryos thawed during a thaw cycle were created at an earlier initiated fresh cycle, therefore a woman's age at the start of a thaw cycle is older than her age at the start of the initiated fresh cycle.

Table 14: Outcomes of autologous thaw cycles by women's age group, Australia and New Zealand, 2009

	Age group (years)[(a)]					
Stage/outcome of treatment	**< 30**	**30–34**	**35–39**	**40–44**	**≥ 45**	**All**
Initiated cycles	2,719	7,109	9,677	4,082	290	23,877
Embryo transfer cycles	2,473	6,473	8,679	3,516	229	21,370
Clinical pregnancies	656	1,820	2,124	601	13	5,214
Live deliveries	510	1,427	1,592	396	7	3,932
Live deliveries per initiated cycle (%)	*18.8*	*20.1*	*16.5*	*9.7*	*2.4*	*16.5*
Live deliveries per embryo transfer cycle (%)	*20.6*	*22.0*	*18.3*	*11.3*	*3.1*	*18.4*
Live deliveries per clinical pregnancy (%)	*77.7*	*78.4*	*75.0*	*65.9*	*53.8*	*75.4*

(a) Age at start of a treatment cycle.

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 33 years and older. For women aged 45 years or older, 2.4%of initiated autologous thaw cycles resulted in a live delivery, which is higher than the live delivery rate per initiated autologous fresh cycle in this age group (0.5%) (Figures 2 and 5). The more favourable live delivery rate of thaw cycles probably 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 rate in women in their early 20s is probably associated with greater levels of uncertainty in the estimates, due to the small numbers of patients.

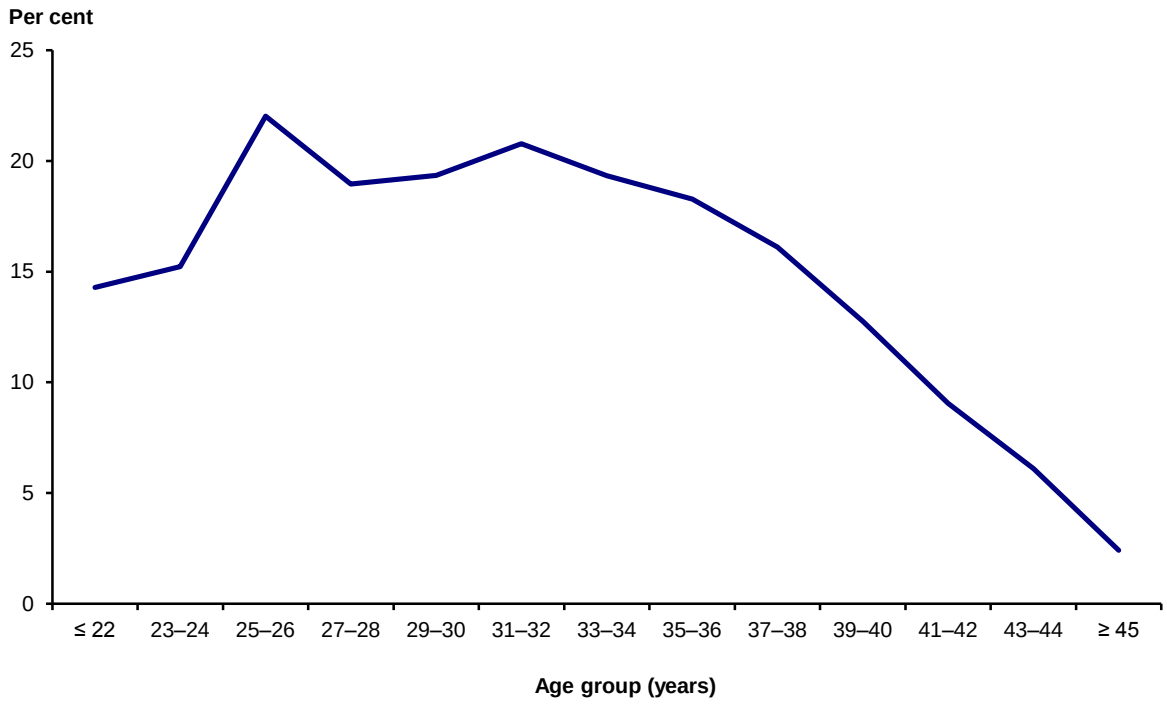

Figure 5: Live deliveries per initiated autologous thaw cycle by women's age at start of a treatment cycle, Australia and New Zealand, 2009

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 (17.8%) (Table 15). The live delivery rate was higher for cycles with male factor only infertility than for cycles with female factor only infertility (RR 1.16).

Table 15: Outcomes of autologous thaw cycles by cause of infertility, Australia and New Zealand, 2009

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	4,910	90.5	22.7	17.8
Female factor	8,415	89.2	20.6	15.3
Tubal disease only	*1,485*	*88.6*	*19.9*	*14.2*
Endometriosis only	*1,288*	*90.0*	*22.4*	*16.9*
Other female factor only	*4,681*	*89.6*	*20.5*	*15.3*
Combined female factor	*961*	*87.2*	*20.1*	*15.0*
Combined male–female factors	2,571	88.6	22.1	16.0
Unexplained	6,616	90.1	22.8	17.3
Not stated	1,365	86.5	20.8	15.7
Total	**23,877**	**89.5**	**21.8**	**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 SET than DET regardless of a woman's age. Overall, the difference in live delivery rates for SET and DET in autologous thaw cycles was 2.7 percentage points (17.8% and 20.5% respectively) (Table 16).

Table 16: Outcomes of autologous thaw embryo transfer cycles by women's age and number of embryos transferred, Australia and New Zealand, 2009

	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 transfer cycles	7,134	1,810	2	9,338	3,036	50	16,472	4,846	52
Clinical pregnancies	1,897	578	1	1,990	738	10	3,887	1,316	11
Live deliveries	1,476	460	1	1,457	534	4	2,933	994	5
Clinical pregnancies per embryo transfer cycle (%)	*26.6*	*31.9*	*50.0*	*21.3*	*24.3*	*20.0*	*23.6*	*27.2*	*21.2*
Live deliveries per embryo transfer cycle (%)	*20.7*	*25.4*	*50.0*	*15.6*	*17.6*	*8.0*	*17.8*	*20.5*	*9.6*

(a) Age at start of a treatment cycle.

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 a woman's age. Overall, the difference in live delivery rates for cleavage stage embryos and blastocysts was 3.4 percentage points (16.6% and 20.0% respectively) (Table 17). The rate of live delivery for blastocyst transfer cycles was 1.2 times higher than that of cleavage stage embryo transfer cycles (RR 1.20).

Table 17: Outcomes of autologous thaw embryo transfer cycles by women's age and stage of embryo development, Australia and New Zealand, 2009

	Age group (years)[a]					
	< 35		≥ 35		All	
Stage/outcome of treatment	Cleavage stage embryo	Blastocyst	Cleavage stage embryo	Blastocyst	Cleavage stage embryo	Blastocyst
Embryo transfer cycles	3,798	5,148	6,211	6,213	10,009	11,361
Clinical pregnancies	1,010	1,466	1,184	1,554	2,194	3,020
Live deliveries	813	1,124	852	1,143	1,665	2,267
Clinical pregnancies per embryo transfer cycle (%)	*26.6*	*28.5*	*19.1*	*25.0*	*21.9*	*26.6*
Live deliveries per embryo transfer cycle (%)	*21.4*	*21.8*	*13.7*	*18.4*	*16.6*	*20.0*

(a) Age at start of a treatment cycle.

Clinical pregnancies and live deliveries from autologous thaw cycles by embryo freezing methods

One-third of autologous thaw cycles where a blastocyst was transferred used vitrified embryos, compared with 1.7% of cycles where a cleavage embryo was transferred. The rates of clinical pregnancy and live delivery were higher for transfer of vitrified blastocysts than slow frozen blastocysts. The difference in live delivery rates between transfer of slow frozen blastocysts and transfer of vitrified blastocysts was 4.1 percentage points (18.6% and 22.7% respectively) (Table 18).

Table 18: Outcomes of autologous thaw embryo transfer cycles by stage of embryo development and embryo freezing methods, Australia and New Zealand, 2009

	Stage of embryo development					
	Cleavage embryo		Blastocyst		All	
Stage/outcome of treatment	Slow freezing	Vitrification[(a)]	Slow freezing	Vitrification[(a)]	Slow freezing	Vitrification[(a)]
Embryo transfer cycles	9,838	171	7,580	3,781	17,418	3,952
Clinical pregnancies	2,164	30	1,889	1,131	4,053	1,161
Live deliveries	1,646	19	1,409	858	3,055	877
Clinical pregnancies per embryo transfer cycle (%)	*22.0*	*17.5*	*24.9*	*29.9*	*23.3*	*29.4*
Live deliveries per embryo transfer cycle (%)	*16.7*	*11.1*	*18.6*	*22.7*	*17.5*	*22.2*

(a) Ultra-rapid cryopreservation.

Live deliveries from autologous thaw cycles among fertility centres

The live delivery rate per initiated autologous thaw cycle varied among the 33 fertility centres that performed autologous thaw cycles in 2009. 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 2.8% to 23.9% among fertility centres. The middle 50% of fertility centres (second and third quartiles) achieved rates between 10.4% and 17.8%.

Women aged less than 35 years (19.7%) had higher live delivery rates than those aged 35 years and older (14.2%). Overall the live delivery rate was 16.5% for autologous thaw cycles in all centres in Australia and New Zealand (Table 19).

These data should be interpreted with caution because of the small number of patients who underwent autologous thaw cycles in some clinics and potential variation in patient characteristics which may influence the live delivery rate of an individual centre.

Table 19: Live delivery rate of autologous thaw cycles by women's age group among fertility centres, Australia and New Zealand, 2009

Age group (years)[a]	Live deliveries per initiated autologous fresh cycle (per cent)				
	Overall	First quartile	Second quartile	Third quartile	Fourth quartile
< 35	19.7	22.5–28.6	17.4–22.4	12.2–17.3	4.4–12.1
≥ 35	14.2	16.1–21.4	12.2–16.0	9.9–12.1	0.0[b]–9.8
All	**16.5**	**17.9–23.9**	**14.7–17.8**	**10.4–14.6**	**2.8–10.3**

(a) Age at start of a treatment cycle.

(b) Less than 20 initiated cycles were undertaken in a clinic centre.

There was also variation among the 33 fertility centres in the outcomes of autologous thaw cycles by number and type of embryos transferred. 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. 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 the small number of patients who underwent autologous thaw cleavage embryo or blastocyst transfers in some clinics and potential variation in patient characteristics which may influence the live delivery rate of an individual centre.

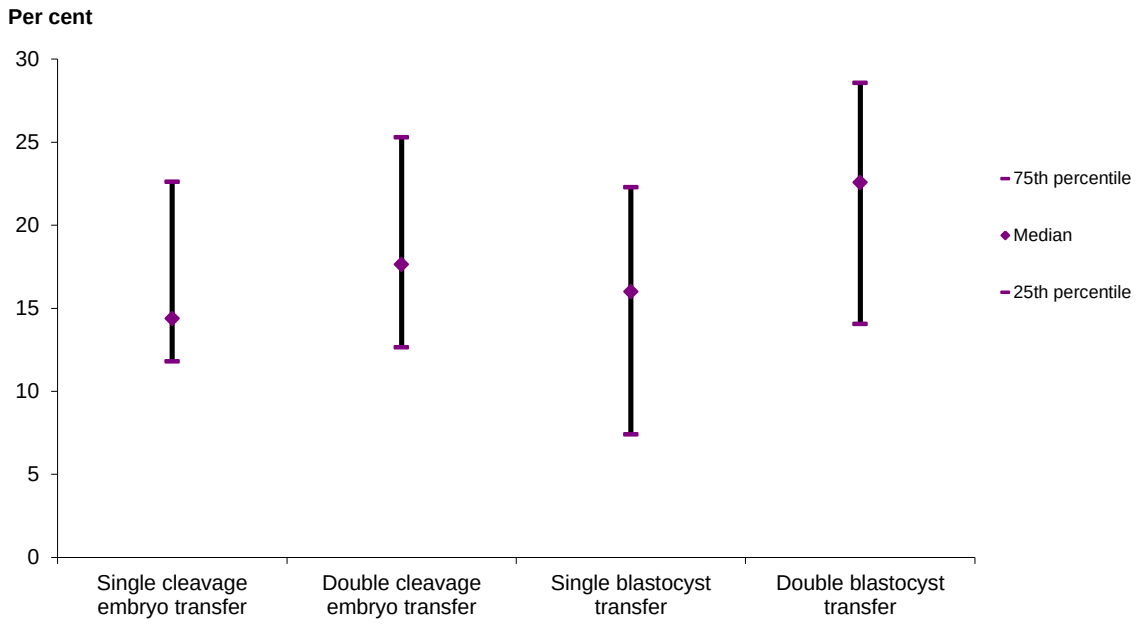

Figure 6: Live delivery rate of autologous thaw embryo transfer cycles by number of embryos transferred and stage of embryo development among fertility centres, Australia and New Zealand, 2009

3.4 Donation and recipient cycles

A donation cycle is defined as an ART treatment cycle in which a woman intends to donate, or donates her oocytes to another woman. 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 2009, donation and recipient cycles accounted for 4.1% (3,172) of all treatment cycles in Australia and New Zealand. There were 1,037 initiated cycles where the intention was to donate oocytes, consisting of 901 cycles from Australia and 136 from New Zealand. There were 2,135 cycles started for women where the intention was to receive donated oocytes or embryos (Table 1), including 1,868 cycles in Australia and 267 cycles in New Zealand.

Oocyte donation cycles

Of the 1,037 cycles in Australia and New Zealand where the intention was to donate oocytes to a recipient, 51 (4.9%) cycles were cancelled before OPU.

The average age of women donating oocytes was 33.4 years, with 48% of cycles in women aged 35 years or older. Just over 93% of the initiated oocyte donation cycles resulted in donations (Table 20).

Table 20: Number of oocyte donation cycles by donor's age group, Australia and New Zealand, 2009

Age group (years) [(a)]	Initiated cycles (number)	Cycles with OPU performed (number)	Cycles with OPU performed (per cent)	Cycles with oocytes donated (number)	Cycles with oocytes donated (per cent)
< 30	222	212	95.5	209	94.1
30–34	316	304	96.2	301	95.3
35–39	404	385	95.3	377	93.3
≥ 40	95	85	89.5	84	88.4
Total	**1,037**	**986**	**95.1**	**971**	**93.6**

(a) Age at start of a treatment cycle.

Oocyte/embryo recipient cycles

There were 2,135 oocyte/embryo recipient cycles in 2009 (Table 1). Of these, 88.2% (1,884) were oocyte recipient cycles and 11.8% (251) were embryo recipient cycles. Of the 1,884 cycles where the embryos were derived from donated oocytes, 48.8% were thaw cycles (Table 21).

Of the 965 fresh oocyte recipient cycles, 21.6% resulted in a live delivery, which is markedly higher than the live delivery rate for either thaw oocyte recipient (14.4%) or embryo recipient cycles (all classified as thaw cycles) (14.3%) (Table 21). The average age of women having an oocyte/embryo recipient cycle was 41.0 years.

Table 21: Outcomes of oocyte/embryo recipient cycles by treatment type, Australia and New Zealand, 2009

	Oocyte recipient			
Stage/outcome of treatment	Fresh	Thaw	Embryo recipient	All
Initiated cycles	965	919	251	2,135
Embryo transfer cycles	851	860	242	1,953
Clinical pregnancies	278	186	51	515
Live deliveries	208	132	36	376
Live deliveries per initiated cycle (%)	*21.6*	*14.4*	*14.3*	*17.6*
Live deliveries per embryo transfer cycle (%)	*24.4*	*15.3*	*14.9*	*19.3*
Live deliveries per clinical pregnancy (%)	*74.8*	*71.0*	*70.6*	*73.0*

Progression of oocyte/embryo recipient cycles

Figure 7 shows the main stages of fresh and thaw oocyte/embryo recipient cycles and the resulting treatment outcomes. Of the 2,135 initiated oocyte/embryo recipient cycles undertaken in 2009, 24.1% resulted in a clinical pregnancy and 17.6% in a live delivery.

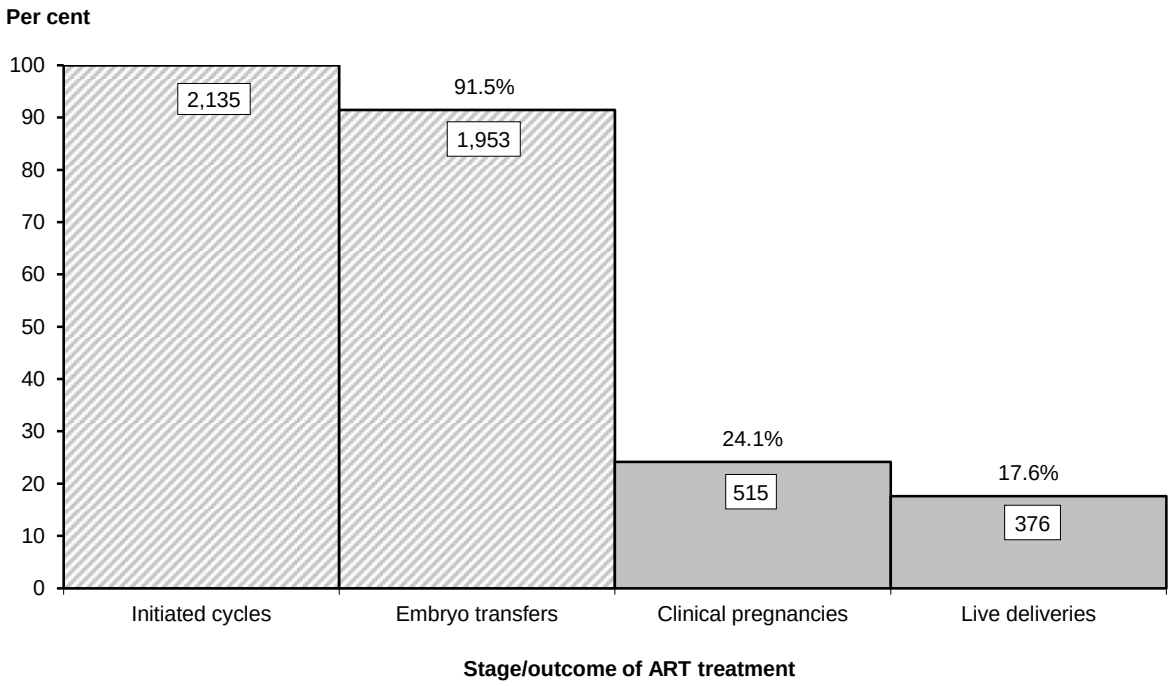

Figure 7: Progression of fresh and thaw oocyte/embryo recipient cycles following embryo transfers, Australia and New Zealand, 2009

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 17.6%. Of cycles in recipients aged ≥ 45 years, 14.7% of initiated cycles resulted in a live delivery, lower than for other age groups (Table 22). However, the live delivery rate of oocyte/embryo recipient cycles in recipients aged ≥ 45 years was markedly higher than the rate of autologous fresh cycles (0.5%) and the rate of autologous thaw cycles (2.4%) in women aged ≥ 45 years (Tables 9 and 14).

Table 22: Outcomes of oocyte/embryo recipient cycles by recipient's age group, Australia and New Zealand, 2009

	Age group (years)[a]					
Stage/outcome of treatment	**< 30**	**30–34**	**35–39**	**40–44**	**≥ 45**	**All**
Initiated cycles	73	218	509	765	570	2,135
Embryo transfer cycles	66	205	463	703	516	1,953
Clinical pregnancies	17	51	124	196	127	515
Live deliveries	14	41	92	145	84	376
Live deliveries per initiated cycle (%)	*19.2*	*18.8*	*18.1*	*19.0*	*14.7*	*17.6*
Live deliveries per embryo transfer cycle (%)	*21.2*	*20.0*	*19.9*	*20.6*	*16.3*	*19.3*
Live deliveries per clinical pregnancy (%)	*82.4*	*80.4*	*74.2*	*74.0*	*66.1*	*73.0*

(a) Age at start of a treatment cycle.

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

The clinical pregnancy and live delivery rates were higher for cycles where donors were in their late 20s to early 30s than for cycles with donors in all other age groups. Advancing donor's age was associated with a decrease in the live delivery rate from 22.2% of cycles with donors aged 25–29 years to 8.3% of cycles with donors aged ≥ 40 years (Table 23).

Table 23: Outcomes of oocyte/embryo recipient cycles by donor's age group, Australia and New Zealand, 2009

	Age group (years)[a]					
Stage/outcome of treatment	**< 25**	**25–29**	**30–34**	**35–39**	**≥ 40**	**All[b]**
Initiated cycles	115	311	695	790	181	2,135
Embryo transfer cycles	103	291	642	727	162	1,953
Clinical pregnancies	24	92	187	174	27	515
Live deliveries	16	69	144	124	15	376
Live deliveries per initiated cycle (%)	*13.9*	*22.2*	*20.7*	*15.7*	*8.3*	*17.6*
Live deliveries per embryo transfer cycle (%)	*15.5*	*23.7*	*22.4*	*17.1*	*9.3*	*19.3*
Live deliveries per clinical pregnancy (%)	*66.7*	*75.0*	*77.0*	*71.3*	*55.6*	*73.0*

(a) Age at start of a treatment cycle.

(b) Includes cycles where donor's age was not stated.

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

The live delivery rates per oocyte/embryo recipient cycle where embryos were transferred were similar for SET and DET cycles in recipients aged less than 35 years. However, DET resulted in a higher live delivery rate than SET in recipients aged 35 years or older (Table 24). Overall, the difference in the live delivery rate between SET cycles and DET cycles was 2.9 percentage points (18.3% and 21.2% respectively) (Table 24).

Table 24: Outcomes of oocyte/embryo recipient cycles by recipient's age and number of embryos transferred, Australia and New Zealand, 2009

	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 transfer cycles	197	70	4	1,124	554	4	1,321	624	8
Clinical pregnancies	51	17	0	284	161	2	335	178	2
Live deliveries	41	14	0	201	118	2	242	132	2
Clinical pregnancies per embryo transfer cycle (%)	*25.9*	*24.3*	*0.0*	*25.3*	*29.1*	*50.0*	*25.4*	*28.5*	*25.0*
Live deliveries per embryo transfer cycle (%)	*20.8*	*20.0*	*0.0*	*17.9*	*21.3*	*50.0*	*18.3*	*21.2*	*25.0*

(a) Age at start of a treatment cycle.

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

The live delivery rate per oocyte/embryo recipient cycle with embryos transferred showed some variation by women's age and stage of embryo development. Overall, the difference in live delivery rates for cleavage stage embryos and blastocysts was 3.0 percentage points (17.9% and 20.9% respectively) (Table 25).

Table 25: Outcomes of oocyte/embryo recipient cycles by recipient's age and stage of embryo development, Australia and New Zealand, 2009

	Age group (years)[a]					
	< 35		≥ 35		All	
Stage/outcome of treatment	Cleavage stage embryo	Blastocyst	Cleavage stage embryo	Blastocyst	Cleavage stage embryo	Blastocyst
Embryo transfer cycles	143	128	925	757	1,068	885
Clinical pregnancies	34	34	229	218	263	252
Live deliveries	30	25	161	160	191	185
Clinical pregnancies per embryo transfer cycle (%)	*23.8*	*26.6*	*24.8*	*28.8*	*24.6*	*28.5*
Live deliveries per embryo transfer cycle (%)	*21.0*	*19.5*	*17.4*	*21.1*	*17.9*	*20.9*

(a) Age at start of a treatment cycle.

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

Almost one-third of oocyte/embryo recipient thaw cycles where a blastocyst was transferred used vitrified embryos, compared with 1.2% of cycles where a cleavage embryo was transferred. Of oocyte/embryo recipient thaw cycles where blastocysts were transferred, the live delivery rates were similar for transfer of vitrified blastocysts and transfer of slow frozen blastocysts (16.0% and 15.5% respectively) (Table 26).

Table 26: Outcomes of oocyte/embryo recipient thaw cycles by stage of embryo development and embryo freezing methods, Australia and New Zealand, 2009

	Stage of embryo development					
	Cleavage embryo		Blastocyst		All	
Stage/outcome of treatment	Slow freezing	Vitrification	Slow freezing	Vitrification	Slow freezing	Vitrification
Embryo transfer cycles	578	7	361	156	939	163
Clinical pregnancies	122	0	80	35	202	35
Live deliveries	87	0	56	25	143	25
Clinical pregnancies per embryo transfer cycle (%)	*21.1*	*0.0*	*22.2*	*22.4*	*21.5*	*21.5*
Live deliveries per embryo transfer cycle (%)	*15.1*	*0.0*	*15.5*	*16.0*	*15.2*	*15.3*

4 Pregnancy and birth outcomes following embryo transfer cycles in 2009

4.1 Clinical pregnancies

Clinical pregnancies overview

Of the 57,223 autologous and recipient embryo transfer cycles undertaken in Australian and New Zealand fertility centres, 15,951 resulted in a clinical pregnancy. Of these, 14,413 (90.4%) were from fertility centres in Australia and 1,538 (9.6%) from New Zealand centres. Clinical pregnancies that resulted from GIFT and surrogacy cycles are described in Chapter 5.

Over three-quarters of the 15,951 clinical pregnancies (76.9%) resulted in a delivery and 21.3% resulted in early pregnancy loss (less than 20 weeks gestation and less than 400 grams birthweight). The outcomes of 297 (1.8%) clinical pregnancies were not known because women could not be followed up or contacted by fertility centres.

The majority of clinical pregnancies followed SET (70.1%) and DET (29.4%). Only 0.5% of clinical pregnancies followed the transfer of three or more embryos.

Fetal hearts by number of embryos transferred

Of the 15,951 clinical pregnancies, 79.3% had one fetal heart (single fetus) detected, 7.4% had multiple fetal hearts (multiple fetuses) detected and 8.2% had no fetal heart detected at the time of ultrasound (Table 27). Multiple gestation pregnancies are closely related to the number of embryos transferred in ART treatment. Two fetal hearts were detected in 19.4% of clinical pregnancies following DET cycles and in 2.1% of clinical pregnancies following SET cycles (Table 27). Multiple fetus pregnancies following SET are probably related to embryo splitting in which the transferred embryo split into two or more embryos.

Of the pregnancies achieved following SET of cleavage embryos, 1.6% had two fetal hearts detected. Of the pregnancies achieved following SET of blastocyst embryos, 2.3% had two fetal hearts detected.

Table 27: Clinical pregnancies by number of fetal hearts and number of embryos transferred, Australia and New Zealand, 2009

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)]	906	8.1	397	8.5	10	13.0	1,313	8.2
1	9,511	85.0	3,081	65.7	53	68.8	12,645	79.3
2	233	2.1	910	19.4	5	6.5	1,148	7.2
3 or 4	4	0.0	26	0.6	1	1.3	31	0.2
Not stated	530	4.7	276	5.9	8	10.4	814	5.1
Total	**11,184**	**100.0**	**4,690**	**100.0**	**77**	**100.0**	**15,951**	**100.0**

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

Early pregnancy loss

There were 3,395 early pregnancy losses (less than 20 weeks gestation and less than 400 grams birthweight) following embryo transfers, representing 21.3% of clinical pregnancies.

Of these early pregnancy losses, 90.1% were miscarriages, 3.3% were due to fetal reduction (aborting one or more fetuses in a multifetal pregnancy) or termination of pregnancy, and 6.6% were ectopic or heterotopic pregnancies (Table 28).

Table 28: Early pregnancy losses by pregnancy outcome and treatment type, Australia and New Zealand, 2009

Pregnancy outcome	Autologous				Oocyte /embryo recipient		All	
	Fresh		Thaw					
	Number	Per cent	Number	Per cent	Number	Per cent	Number	Per cent
Miscarriage	1,908	89.2	1034	91.4	116	92.8	3,058	90.1
Reduction or termination	74	3.5	37	3.3	1	0.8	112	3.3
Ectopic or heterotopic pregnancy	157	7.3	60	5.3	8	6.4	225	6.6
Total	**2,139**	**100.0**	**1,131**	**100.0**	**125**	**100.0**	**3,395**	**100.0**

4.2 Deliveries

There were 12,259 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. Of these, 98.8% (12,108) gave birth to at least one liveborn baby (live delivery). The proportion of term live deliveries among all deliveries was higher for autologous cycles than for oocyte/embryo recipient cycles (Table 29).

Table 29: Deliveries by delivery outcome and treatment type, Australia and New Zealand, 2009

Pregnancy outcome	Autologous				Oocyte /embryo recipient		All	
	Fresh		Thaw					
	Number	Per cent	Number	Per cent	Number	Per cent	Number	Per cent
Live delivery	7,800	98.9	3,932	98.7	376	97.9	12,108	98.8
< 37 weeks	*1,067*	*13.5*	*462*	*11.6*	*74*	*19.3*	*1,603*	*13.1*
≥ 37 weeks	*6,733*	*85.3*	*3470*	*87.1*	*302*	*78.6*	*10,505*	*85.7*
Fetal death (stillbirth)[(a)]	72	0.9	41	1.0	6	1.6	119	1.0
Not stated	18	0.2	12	0.3	2	0.5	32	0.3
Total	**7,890**	**100.0**	**3,985**	**100.0**	**384**	**100.0**	**12,259**	**100.0**

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

Deliveries by the number of embryos transferred

Of the 12,259 deliveries, 8.2% had multiple gestation deliveries (Table 29), a slightly lower proportion than in 2008 (8.4%) (Wang et al. 2010). By comparison, the proportion of multiple gestation deliveries in Australia from spontaneous conceptions as well as ART in 2008 was 1.6% (Laws et al. 2010).

Twin deliveries accounted for 8.0% of deliveries following embryo transfer cycles in 2009. Four out of five twin deliveries were from DET (767/985) and 21.7% (214/985) from SET cycles. Of the 3,494 deliveries following DET, 22.0% were twins, markedly higher than the proportion following SET (2.5%) (Table 30).

Table 30: Deliveries by gestation and number of embryos transferred, Australia and New Zealand, 2009

Gestation	One embryo		Two embryos		Three or more embryos		Total	
	Number	Per cent	Number	Per cent	Number	Per cent	Number	Per cent
Singleton	8,507	97.5	2,710	77.6	38	88.4	11,255	91.8
Multiple	*215*	*2.5*	*784*	*22.4*	*5*	*11.6*	*1,004*	*8.2*
Twin	214	2.5	767	22.0	4	9.3	985	8.0
Higher order multiple	1	0.0	17	0.5	1	2.3	19	0.2
Total	**8,722**	**100.0**	**3,494**	**100.0**	**43**	**100.0**	**12,259**	**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 2008 and in New Zealand in 2009 (29.6 years) (Laws et al. 2010; Statistics New Zealand 2011).

Women aged less than 35 years had a marginally lower proportion of multiple gestation deliveries compared with women aged 35 years or older (8.0% and 8.3% respectively). Of deliveries following DET, the proportion of multiple gestation deliveries was higher for women aged less than 35 years compared with women aged 35 years or older (28.4% and 19.6%) (Table 31).

Table 31: Deliveries by gestation and maternal age group, Australia and New Zealand, 2009

	Age group (years)[(a)]							
	< 35				≥ 35			
Gestation	One embryo	Two embryos	Three embryos	All	One embryo	Two embryos	Three embryos	All
				Number				
Singleton	4,184	806	1	4,991	4,323	1,904	37	6,264
Multiple	*113*	*320*	*1*	*434*	*102*	*464*	*4*	*570*
Twin	112	312	1	425	102	455	3	560
Higher order multiple	1	8	0	9	0	9	1	10
Total	**4,297**	**1,126**	**2**	**5,425**	**4,425**	**2,368**	**41**	**6,834**
				Per cent				
Singleton	97.4	71.6	50.0	92.0	97.7	80.4	90.2	91.7
Multiple	*2.6*	*28.4*	*50.0*	*8.0*	*2.3*	*19.6*	*9.8*	*8.3*
Twin	2.6	27.7	50.0	7.8	2.3	19.2	7.3	8.2
Higher order multiple	0.0	0.7	0.0	0.2	0.0	0.4	2.4	0.1
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 (48.2%) of deliveries following embryo transfer cycles were by caesarean section (Table 32). This is a markedly higher rate than for all deliveries in Australia in 2008 (31.1%) (Laws et al. 2010). The higher rate of caesarean section following ART treatment may be related to the fact that women were five years older on average and that there were more multiple births following ART treatment.

The caesarean section rate increased with advancing women's age at delivery—37.8% of women aged less than 30 years had a caesarean section compared to 68.2% of women aged 45 years or older (Table 32).

The caesarean section rate varied by plurality, with 45.7% for singleton deliveries, 79.1% for twin deliveries and 89.5% for triplet deliveries.

Table 32: Deliveries by method of delivery and maternal age group, Australia and New Zealand, 2009

Method of delivery	Age group (years)[(a)]					
	< 30	30–34	35–39	40–44	≥ 45	Total
			Number			
Caesarean section	520	1,713	2,560	1,022	90	5,905
Other	848	2,311	2,383	695	40	6,277
Not stated	9	24	27	15	2	77
Total	**1,377**	**4,048**	**4,970**	**1,732**	**132**	**12,259**
			Per cent			
Caesarean section	37.8	42.3	51.5	59.0	68.2	48.2
Other	61.6	57.1	47.9	40.1	30.3	51.2
Not stated	0.7	0.6	0.5	0.9	1.5	0.6
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 born 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 13,282 babies born to women who had embryo transfer cycles— 90.4% (12,003) were from fertility centres in Australia and 9.6% (1,279) from fertility centres in New Zealand. Of these, 84.7% were singletons, 14.8% twins and 0.4% triplets. There were 13,093 liveborn babies (98.6%). The birth status was not reported for 36 (0.3%) babies.

Sex distribution in liveborn babies

There were 6,814 (52.0%) liveborn male babies, 6,256 (47.8%) liveborn female babies and 23 (0.2%) liveborn babies where sex was not stated. For the 13,093 liveborn babies, the sex ratio was 108.9 male for every 100 female babies, significantly higher than the ratio for all Australian liveborn babies born in 2008 (105.6, $p<0.05$) (Laws et al. 2010).

Liveborn babies following cleavage embryo transfers had a sex ratio of 99.9 male babies for every 100 female babies. In comparison, liveborn babies following blastocyst transfers had a sex ratio of 116.3 male for every 100 female babies.

Gestational age of babies

The average gestational age of all babies born following embryo transfer cycles was 37.8 weeks (Table 33). This is lower than the average gestational age of 38.8 weeks for all babies born in Australia in 2008 (Laws et al. 2010).

Nearly one in six babies (17.6%) were preterm (less than 37 weeks gestation), which was markedly higher than the proportion of preterm babies (8.2%) born in Australia in 2008 (Laws et al. 2010). The average gestational age of singletons was 38.4 weeks, lower than the average gestational age of 38.9 weeks for all singletons born in Australian in 2008. In contrast, the average gestational age for ART twins was 34.9 weeks, similar to the average gestational age of 35.1 weeks for all twins born in Australia in 2008 (Laws et al., 2010).

Table 33: Babies by gestational age and plurality, Australia and New Zealand, 2009

Gestational age (weeks)	Singletons		Twins		Higher order multiples		Total	
	Number	Per cent	Number	Per cent	Number	Per cent	Number	Per cent
Mean	*38.4*		*34.9*		*31.0*		*37.8*	
≤ 27	160	1.4	106	5.4	9	15.8	275	2.1
28–31	118	1.0	136	6.9	9	15.8	263	2.0
32–36	840	7.5	914	46.4	39	68.4	1,793	13.5
≥ 37	10,137	90.1	814	41.3	0	0.0	10,951	82.4
Total	**11,255**	**100.0**	**1,970**	**100.0**	**57**	**100.0**	**13,282**	**100.0**
≤ 36	*1,118*	*9.9*	*1,156*	*58.7*	*57*	*100.0*	*2,331*	*17.6*

Figure 8 shows the distribution of gestational age for singletons and twins born to women who had embryo transfer cycles in 2009. Singletons following SET had a lower proportion of preterm birth (9.5%) than singletons following DET (11.1%). The overall proportions of preterm singletons (9.9%) and twins (58.7%) born to women who had embryo transfer cycles in 2009 were higher than the proportions of preterm singletons and twins born in Australia in 2008 (6.6% and 56.7% respectively) (Laws et al. 2010).

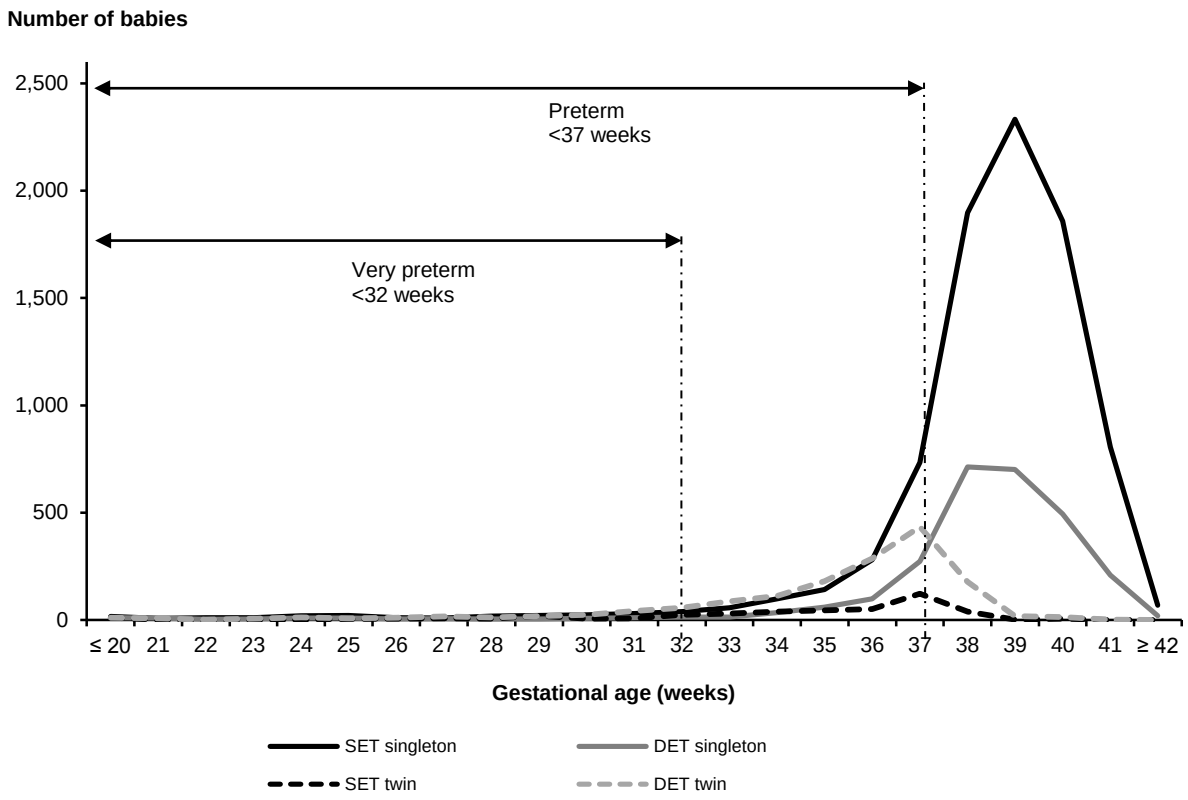

Figure 8: Number of babies born following embryo transfer cycles by gestational age, Australia and New Zealand, 2009

Birthweight of liveborn babies

The average birthweight for liveborn babies to women who had embryo transfer cycles was 3,183 grams. Just over 13% of these babies were low birthweight (< 2,500 grams) (Table 34). The high proportion of low birthweight babies mainly reflects the high proportion of multiple births among babies conceived after ART treatment.

The average birthweight was 3,332 grams for liveborn ART singletons and 2,368 grams for twins. These were lower than the mean birthweight of all liveborn singletons (3,409 grams) and twins (2,402 grams) in Australia in 2008 (Laws et al. 2010). Low birthweight was reported for 6.4% of ART singletons (Table 34), which is markedly higher than the proportion of low birthweight singletons (4.7%) born in Australia in 2008 (Laws et al. 2010). Of ART twins, 50.8% were low birthweight, which is similar to the proportion of low birthweight twins (50.2%) born in Australia in 2008 (Laws et al. 2010).

Table 34: Liveborn babies by birthweight group and plurality, Australia and New Zealand, 2009

	Singletons		Twins		Higher order multiples		Total	
Birthweight (g)	**Number**	**Per cent**	**Number**	**Per cent**	**Number**	**Per cent**	**Number**	**Per cent**
Mean	*3,332*		*2,368*		*1,609*		*3,183*	
< 1,000	62	0.6	77	4.0	6	10.7	145	1.1
1,000–1,499	87	0.8	103	5.4	13	23.2	203	1.6
1,500–1,999	133	1.2	240	12.5	24	42.9	397	3.0
2,000–2,499	429	3.9	555	28.9	13	23.2	997	7.6
2,500–2,999	1,721	15.5	667	34.7	0	0.0	2,388	18.2
3,000–3,499	4,212	37.9	230	12.0	0	0.0	4,442	33.9
3,500–3,999	3,126	28.1	20	1.0	0	0.0	3,146	24.0
≥ 4,000	1,216	10.9	3	0.2	0	0.0	1,219	9.3
Not stated	131	1.2	25	1.3	0	0.0	156	1.2
Total	**11,117**	**100.0**	**1,920**	**100.0**	**56**	**100.0**	**13,093**	**100.0**
< 2,500	*711*	*6.4*	*975*	*50.8*	*56*	*100.0*	*1,742*	*13.3*

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 203 reported perinatal deaths, representing 1.5% of all babies born following embryo transfer cycles. Of these, 153 were fetal deaths and 50 were neonatal deaths. The perinatal mortality rate in 2009 was 15.3 deaths per 1,000 births (Table 35), which was lower than the rate of 16.2 deaths per 1,000 ART births in 2008 (Wang et al. 2010), and higher than the rate of 10.2 per 1,000 births to all women who gave birth in Australia in 2008 (Laws et al. 2010). Singletons had a lower perinatal mortality rate (12.3 deaths per 1,000 births) compared to multiples (32.1 deaths per 1,000 births) (Table 35).

These data should be interpreted with caution because of the small numbers and potential variability in case reporting, which is compounded by the self-reported nature of ART birth outcome data. In 2009, information relating to birth outcomes was not stated for 1.8% of clinical pregnancies.

Table 35: Perinatal mortality of babies by type of death and plurality, Australia and New Zealand, 2009

Birth outcome	Singletons	Multiples	Total
		Number	
Fetal death (stillbirth)	109	44	153
Neonatal death	29	21	50
Perinatal death[(a)]	138	65	203
All birth	**11,255**	**2,027**	**13,282**
All live birth	**11,117**	**1,976**	**13,093**
		Rate[(b)]	
Fetal deaths per 1,000 births	9.7	21.7	11.5
Neonatal deaths per 1,000 live births	2.6	10.6	3.8
Perinatal deaths per 1,000 births	12.3	32.1	15.3

(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 36 babies.

5 GIFT cycles, surrogacy cycles, other procedures and complications in 2009

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. The use of GIFT has been declining in Australia and New Zealand in recent years. In 2009, there were 14 GIFT cycles which resulted in one clinical pregnancy and a live delivery of twins.

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 intended parent(s)) with the intention that the child will be raised by the intended parents. The oocytes and/or sperm used to create the embryo(s) in the surrogacy cycle can be either from the intended parents or from a donor(s).

There were 126 surrogacy cycles in 2009, including 91 gestational carrier cycles and 35 cycles undertaken by intended parents. Among the 91 gestational carrier cycles, 23 (25.3%) resulted in a clinical pregnancy and 18 (19.8%) resulted in a delivery. All 19 babies born to gestational carriers were liveborn and included one set of twins.

5.3 Preimplantation genetic diagnosis

Preimplantation genetic diagnosis (PGD) is a procedure in which cells from the embryo are removed and analysed for chromosomal disorders or genetic diseases before embryo transfer. In 2009, PGD was performed in 1,044 cycles, representing 1.7% of cycles in which embryos were created or thawed. Most PGD cycles (928/1044) were fresh cycles (Table 36).

Table 36: Number of cycles with PGD by type of embryo, Australia and New Zealand, 2009

	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	37,588	928	2.5
Thaw	24,468	116	0.5
Total	**62,056**	**1,044**	**1.7**

5.4 Ovarian hyperstimulation syndrome

Morbidity information that is specifically related to ART treatment was collected in ANZARD2.0. Ovarian hyperstimulation syndrome (OHSS) is a complication of controlled ovarian hyperstimulation, where excessive follicles are produced with high levels of oestrogen secretion.

Cases of OHSS that require hospitalisation are reported by patients and clinicians, and validated against 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 266 OHSS cases reported in 2009 that were admitted to hospital. Of these, 259 had OPU performed. Overall, hospital-admitted OHSS occurred in 0.6% of OPU cycles. A higher number of oocytes retrieved at OPU is associated with increased risk of OHSS. The incidence of OHSS was less than 0.1% of OPU cycles where 1–4 oocytes were retrieved. It increased to 1.6% of OPU cycles where 15–19 oocytes were retrieved and 4.4% of OPU cycles where ≥ 20 oocytes were retrieved (Table 37).

Table 37: Number of cycles with OPU performed and OHSS by number of oocytes collected, Australia and New Zealand, 2009

	Number of oocytes collected						
	None	1–4	5–9	10–14	15–19	≥ 20	All
Cycles with OHSS	0	3	26	54	67	109	259
Cycles with OPU	723	9,705	14,367	9,360	4,162	2,487	40,804
OHSS per OPU cycle (%)	*0.0*	*0.0*	*0.2*	*0.6*	*1.6*	*4.4*	*0.6*

6 Donor sperm insemination cycles in 2009

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 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 2009, there were 2,556 DI cycles reported, which included 23.0% (589) undertaken with controlled ovarian hyperstimulation and 71.0% (1,815) undertaken in unstimulated cycles. In 5.9% (152) of DI cycles, ovarian stimulation status was not stated. Of all DI cycles, 13.7% resulted in a clinical pregnancy and 10.6% resulted in a live delivery (Table 38).

The average age of women who had a DI cycle was 35.3 years. In general, the clinical pregnancy rate and live delivery rate decreased with advancing women's age. Over 16% of DI cycles in women aged 30–34 years resulted in a live delivery, compared with 2.7% of DI cycles in women aged 40 years or older (Table 38).

Table 38: Outcomes of DI cycles by women's age group, Australia and New Zealand, 2009

	Age group (years)[(a)]				
Stage/outcome of treatment	< 30	30–34	35–39	≥ 40	Total
DI cycles	345	634	1,089	488	2,556
Clinical pregnancies	58	119	146	26	349
Live deliveries	48	102	109	13	272
Clinical pregnancies per DI cycle (%)	*16.8*	*18.8*	*13.4*	*5.3*	*13.7*
Live deliveries per DI cycle (%)	*13.9*	*16.1*	*10.0*	*2.7*	*10.6*
Live deliveries per clinical pregnancy (%)	*82.8*	*85.7*	*74.7*	*50.0*	*77.9*

(a) Age at start of a treatment cycle.

Clinical pregnancies following DI cycles

Of the 349 clinical pregnancies following DI cycles, 0.3% were ectopic/heterotopic pregnancies and 1.4% were terminations/reductions. Over 78% of clinical pregnancies (273/349) resulted in a delivery. Of the 273 deliveries, 263 (96.3%) were singleton deliveries and 10 (3.7%) were twin deliveries.

Perinatal outcomes of babies

There were 283 babies born to women who had DI treatment, including 282 liveborn babies and one birth status unknown. Of these, 36 (12.7%) were born preterm (< 37 weeks gestation). The mean birthweight of liveborn babies following DI treatment was 3,312 grams. This was higher than the mean birthweight (3,183 grams) of liveborn babies following embryo transfer cycles. Twenty-seven liveborn babies (9.6%) were born with low birthweight (< 2,500 grams).

7 Trends in ART treatment and outcomes: 2005–2009

This section includes autologous cycles, donation/recipient cycles, GIFT cycles and surrogacy cycles undertaken in Australia and New Zealand from 2005 to 2009. It does not include DI cycles.

ART treatment and outcomes

In 2009, 70,541 initiated ART treatment cycles were undertaken in Australia and New Zealand. This is an increase of 13.9% on 2008 and an increase of 48.0% on 2005 (Table 39). The proportion of initiated thaw cycles has remained at approximately 37% for each year.

The increase in treatment cycles has resulted in a similar parallel increase in the number of clinical pregnancies and live deliveries resulting from ART treatment between 2005 and 2009. This increase resulted mainly from the increase in the number of ART treatments undertaken. In 2009, there were 12,127 live deliveries, 1.5 times the 8,166 live deliveries in 2005 (Table 39). This increase represents an average growth of 1,323 clinical pregnancies per year ($p<0.01$) and 955 live deliveries per year ($p<0.01$) between 2005 and 2009.

Between 2005 and 2009, the pregnancy and live delivery rates per initiated cycle ranged from 22.0% to 23.2% and from 17.1% to 17.8% respectively (Table 39). During this period there was a shift in clinical practice to SET in Australia and New Zealand, with the proportion of SET cycles increasing from 48.3% in 2005 to 69.7% in 2009 (Table 43).

Table 39: Number of ART treatment cycles by stage/outcome of treatment, Australia and New Zealand, 2005 to 2009

Stage/outcome of treatment	2005	2006	2007	2008	2009
Initiated cycles[(a)]	47,661	50,521	56,817	61,929	70,541
Embryo transfers[(b)]	39,121	41,447	46,620	50,645	57,320
Clinical pregnancies	10,492	11,720	12,815	13,983	15,975
Live deliveries	8,166	8,999	9,874	10,633	12,127
Clinical pregnancies per initiated cycle (%)	*22.0*	*23.2*	*22.6*	*22.6*	*22.6*
Live deliveries per initiated cycle (%)	*17.1*	*17.8*	*17.4*	*17.2*	*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

The decline in multiple gestation deliveries resulting from ART treatment continued in 2009. The proportion of multiple deliveries significantly decreased from 14.1% in 2005 to 8.2% in 2009 ($p<0.01$) (Table 40). The decline is primarily the result of increasing uptake of SET (Figure 9).

Table 40: Number of deliveries following ART treatment by gestation, Australia and New Zealand, 2005 to 2009

	2005		2006		2007		2008		2009	
Gestation	**Number**	**Per cent**	**Number**	**Per cent**	**Number**	**Per cent**	**Number**	**Per cent**	**Number**	**Per cent**
Singleton	7,085	85.9	8,016	88	8,990	90	9,880	91.6	11,272	91.8
Multiple	*1,161*	*14.1*	*1,093*	*12.0*	*994*	*10.0*	*903*	*8.4*	*1,006*	*8.2*
Twin	1,134	13.8	1,070	11.7	978	9.8	879	8.2	987	8.0
Higher order multiple	27	0.3	23	0.3	16	0.2	24	0.2	19	0.2
Total[(a)]	**8,246**	**100.0**	**9,109**	**100.0**	**9,984**	**100.0**	**10,783**	**100.0**	**12,278**	**100.0**

(a) Includes cycles in which gestation was unknown.

Women's age of autologous cycles

While the majority of fresh and thaw autologous cycles undertaken between 2005 and 2009 were in women aged 30 to 40 years, the proportion of autologous cycles in women aged 40 years and older increased from 19.6% in 2005 to 23.8% in 2009. The average age of women having autologous cycles increased from 35.3 years in 2005 to 35.8 years in 2009 (Analysis of Variance, $p<0.01$) (Table 41).

Table 41: Number of autologous cycles by women's age group, Australia and New Zealand, 2005 to 2009

	2005		2006		2007		2008		2009	
Age group (years)[(a)]	**Number**	**Per cent**	**Number**	**Per cent**	**Number**	**Per cent**	**Number**	**Per cent**	**Number**	**Per cent**
Mean	*35.3*		*35.4*		*35.5*		*35.7*		*35.8*	
< 30	5,144	11.5	5,539	11.6	6,021	11.2	6,373	10.8	7,303	10.9
30–34	14,499	32.4	14,312	30	15,376	28.6	16,154	27.5	17,979	26.7
35–39	16,328	36.5	17,947	37.7	20,799	38.7	22,572	38.4	25,953	38.6
40–44	8,158	18.2	9,153	19.2	10,680	19.9	12,663	21.6	14,853	22.1
≥ 45	634	1.4	688	1.4	819	1.5	977	1.7	1,141	1.7
Not stated	0	0	4	0	1	0	1	0	0	0.0
Total	**44,763**	**100.0**	**47,643**	**100.0**	**53,696**	**100.0**	**58,740**	**100.0**	**67,229**	**100.0**

(a) Age at start of a treatment cycle.

Types of ART treatment and stage of embryo development

In Australia and New Zealand, the proportion of ART treatment cycles that used ICSI continued to increase slightly, from 54.9% of cycles in 2005 to 60.2% in 2009 (Table 42).

The number and proportion of blastocyst transfer cycles increased significantly from 2005 to 2009. For embryo transfer cycles, the proportion of blastocyst transfer cycles increased from 22.4% in 2005 to 49.8% in 2009 ($p<0.01$) (Table 42).

This increase in blastocyst transfer cycles from 2005 to 2009 must be interpreted with caution as a data extraction error where blastocyst transfer was misclassified as cleavage embryo transfer was identified from some clinics for treatment years from 2002 to 2008. Therefore, the number of blastocyst transfers is under-estimated in the trends analysis of this report for treatment years 2005 to 2008.

Table 42: Number of embryo transfer cycles by treatment type, Australia and New Zealand, 2005 to 2009

	2005		2006		2007		2008		2009	
Treatment type/procedure	Number	Per cent	Number	Per cent	Number	Per cent	Number	Per cent	Number	Per cent
Fertilisation procedure										
IVF	16,959	43.5	17,625	42.7	18,774	40.4	19,761	39.1	21,790	38.0
ICSI	21,420	54.9	22,890	55.4	26,611	57.2	29,864	59.0	34,489	60.2
Not stated	619	1.6	809	2.0	1,128	2.4	944	1.9	1,028	1.8
Stage of embryo development										
Cleavage stage	30,243	77.6	30,145	72.9	32,261	69.4	31,066	61.4	28,780	50.2
Blastocyst	8,755	22.4	11,179	27.1	14,252	30.6	19,503	38.6	28,527	49.8

Number of embryos transferred per embryo transfer cycle

There has been a significant shift in ART practice to an increase in the number of SET cycles in Australia and New Zealand. In 2005, the proportion of SET cycles accounted for 48.3% of embryo transfer cycles and by 2009 this proportion had increased to 69.7% ($p<0.01$) (Table 43). There was also a significant decline in the proportion of cycles in which three or more embryos were transferred, from 1.9% in 2005 to 0.7% in 2009 ($p<0.01$).

Table 43: Proportion of embryo transfer cycles by number of embryos transferred, Australia and New Zealand, 2005 to 2009

Number of embryos transferred	2005	2006	2007	2008	2009
One embryo	48.3	56.9	63.7	67.8	69.7
Two embryos	49.8	42.2	35.7	31.6	29.6
Three or more embryos	1.9	1.0	0.6	0.6	0.7

8 Women undertaking autologous treatment in 2009

ANZARD was transformed from a cycle-based data collection to a woman-based data collection for treatments undertaken from 2009 onwards (ANZARD2.0). This allows reporting of the number of women undergoing treatment and number of cycles per woman in a treatment year.

This section presents the number of women who underwent autologous ART treatment in 2009. The number of cycles undertaken by a woman included both fresh and thaw cycles. For some women, if their fresh cycles were undertaken in previous years, only thaw cycles were reported and presented. Of the 67,229 autologous ART treatment cycles in 2009, 4,375 (6.5%) cycles were excluded due to lack of data, leaving 62,840 autologous cycles to be reported in this section.

Women who undertook autologous treatment

There were 34,806 women who undertook 62,840 autologous fresh and/or thaw cycles in Australia and New Zealand in 2009. Of these women, 31,323 had treatment in Australia and 3,491 in New Zealand. Eight had treatment in both Australia and New Zealand.

On average, 1.8 fresh and/or thaw cycles per woman were undertaken in 2009, with more cycles per woman in Australia (1.8 cycles per woman) than in New Zealand (1.4 cycles per woman). Just over half of the women in Australia had one autologous treatment cycle and almost 10% had four or more cycles. In comparison, 70.4% of women in New Zealand had one autologous treatment cycle and only 1.9% had four or more cycles (Table 44).

Table 44: Women undertaking autologous fresh and/or thaw cycles by number of cycles, Australia and New Zealand, 2009

	Australia		New Zealand		All	
Number of cycles	**Number**	**Per cent**	**Number**	**Per cent**	**Number**	**Per cent**
One	16,136	51.5	2,456	70.4	18,583	53.4
Two	8,201	26.2	745	21.3	8,945	25.7
Three	4,084	13.0	223	6.4	4,307	12.4
Four or more	2,902	9.3	67	1.9	2,971	8.5
Total	**31,323**	**100.0**	**3,491**	**100.0**	**34,806**	**100.0**

Women who undertook autologous fresh cycles

There were 40,319 fresh cycles undertaken by 28,044 women in Australia and New Zealand in 2009, an average of 1.4 fresh cycles per woman. The average age of women at their first autologous fresh cycle was 35.6 years. Younger women had fewer fresh cycles with about 75% of women aged younger than 35 years having only one autologous fresh cycle. This partly reflects the higher success rate per initiated fresh autologous cycle among younger women. Less than 1% of women aged less than 30 years had four or more cycles. This proportion increased to 5.3% for women aged 40–44 years and 7.1% for women aged 45 years or older (Table 45).

Table 45: Women undertaking autologous fresh cycles by number of cycles, Australia and New Zealand, 2009

	Age group (years)[a]					
Number of cycles	**< 30**	**30–34**	**35–39**	**40–44**	**≥ 45**	**All**
			Number			
One	2,556	5,715	7,358	3,507	253	19,389
Two	617	1,452	2,329	1,561	96	6,055
Three	120	363	750	583	42	1,858
Four or more	31	106	258	317	30	742
Total	**3,324**	**7,636**	**10,695**	**5,968**	**421**	**28,044**
			Per cent			
One	76.9	74.8	68.8	58.8	60.1	69.1
Two	18.6	19.0	21.8	26.2	22.8	21.6
Three	3.6	4.8	7.0	9.8	10.0	6.6
Four or more	0.9	1.4	2.4	5.3	7.1	2.6
Total	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**

(a) Age at start of first autologous fresh cycle in 2009.

Women who undertook autologous thaw cycles

There were 22,521 thaw cycles undertaken by 15,277 women in Australia and New Zealand in 2009, representing an average of 1.5 thaw cycles per woman. The average age of women at their first autologous thaw cycle was 35.4 years.

The proportion of women who had only one thaw cycle varied from 64.7% for women aged 30–34 years to 81.8% for women aged 45 years or older (Table 46). A higher proportion of younger women had two or more thaw cycles, while a higher proportion of older women underwent two or more fresh cycles (Tables 45 and 46).

Table 46: Women undertaking autologous thaw cycles by number of cycles, Australia and New Zealand, 2009

	Age group (years)[(a)]					
Number of cycles	**< 30**	**30–34**	**35–39**	**40–44**	**≥ 45**	**All**
			Number			
One	1,127	2,886	4,121	1,879	166	10,179
Two	421	1,068	1,468	566	26	3,549
Three	132	344	458	161	8	1,103
Four or more	56	161	168	58	3	446
Total	**1,736**	**4,459**	**6,215**	**2,664**	**203**	**15,277**
			Per cent			
One	64.9	64.7	66.3	70.5	81.8	66.6
Two	24.3	24.0	23.6	21.2	12.8	23.2
Three	7.6	7.7	7.4	6.0	3.9	7.2
Four or more	3.2	3.6	2.7	2.2	1.5	2.9
Total	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**

(a) Age at start of first autologous thaw cycle in 2009.

Appendix 1: Contributing Fertility Clinics

Australian Capital Territory

Canberra Fertility Centre, Deakin (Dr Martyn Stafford-Bell)

ISIS Fertility, Barton (Dr Nicole Sides)

Sydney IVF — Canberra, Deakin (Dr Mark Bowman)

New South Wales

Albury Reproductive Medicine Centre, Albury (Dr Scott Giltrap)

Demeter Laboratories, Liverpool (Dr David Knight)

Fertility East, Bondi Junction (Dr Joel Bernstein)

Fertility First, Hurstville (Dr Anne Clark)

Hunter IVF (Monash), New Lambton Heights (Dr Steven Raymond, Dr Andrew Hedges)

IVF Australia — Central Coast, Gosford (Dr Malcolm Tucker)

IVF Australia — Eastern Suburbs, Maroubra (Dr Graeme Hughes)

IVF Australia — North Shore, Greenwich (Dr Frank Quinn)

IVF Australia — Southern Sydney, Kogarah (Dr Andrew Kan)

IVF Australia — Western Sydney, Westmead (A/Prof. Peter Illingworth)

Next Generation Fertility, Parramatta (Dr Kim Matthews)

Royal Hospital for Women, Randwick (Dr Stephen Steigrad)

Sydney IVF, Sydney (Dr Mark Bowman)

Sydney IVF — Coffs Harbour, Coffs Harbour (Dr Mark Bowman)

Sydney IVF — Illawarra, Wollongong (Dr Mark Bowman)

Sydney IVF — Lismore, Lismore (Dr Mark Bowman)

Sydney IVF — Liverpool, Liverpool (Dr Mark Bowman)

Sydney IVF — Newcastle, Merewether (Dr Mark Bowman)

Sydney IVF — Northwest, Baulkham Hills (Dr Mark Bowman)

Sydney IVF — Orange, Orange (Dr Mark Bowman)

Sydney IVF — RPAH, Camperdown (Dr Mark Bowman)

Westmead Fertility Centre, Westmead (Dr Howard Smith)

Northern Territory

Repromed Darwin, Tiwi (Dr Richard Henshaw)

Queensland

Assisted Conception Australia, Greenslopes (Dr Clare Boothroyd)

City Fertility Centre, Brisbane (Dr Ashish Das)

City Fertility Centre Gold Coast, Robina (Dr Ashish Das)

Coastal IVF, Maroochydore (Dr Paul Stokes)

Fertility Solutions Sunshine Coast, Nambour (Dr Kristen Small)

Fertility Solutions Sunshine Coast, Bundaberg (Dr Kristen Small)

IVF Caboolture, Caboolture (Dr James Moir)

IVF Sunshine Coast, Birtinya (Dr James Moir)

Life Fertility Clinic, Brisbane (Dr Glenn Sterling)

Monash IVF Gold Coast, Southport (Dr Irving Korman)

Monash IVF Queensland, Sunnybank (Dr Kevin Forbes)

Monash IVF Rockhampton, Rockhampton (Prof. Gab Kovacs)

Monash IVF Townsville, Townsville (Prof. Gab Kovacs)

QFG Cairns, Cairns (Dr Robert Miller)

QFG Gold Coast, Benowa (Dr Andrew Cary)

QFG Mackay, North Mackay (Dr Lance Herron)

QFG Toowoomba IVF, Toowoomba (Dr John Esler)

QFG Townsville, Hyde Park (Dr Ron Chang)

Queensland Fertility Group, Brisbane (Dr David Molloy)

The Wesley/Monash IVF Services, Auchenflower (Dr John Allan)

South Australia

Fertility SA, Adelaide (Dr Jodie Semmler)

Flinders Reproductive Medicine, Bedford Park (Dr Enzo Lombardi)

Repromed, Dulwich (Dr Richard Henshaw)

Tasmania

Sydney IVF – Launceston, Launceston (Dr Mark Bowman)

TasIVF, Hobart (Dr Bill Watkins)

Victoria

Ballarat IVF, Wendouree (Dr Russell Dalton)

City Fertility Centre Melbourne, Melbourne (Dr David Wilkinson)

Melbourne IVF, East Melbourne (Dr Lyndon Hale)

Monash IVF, Epworth Hospital, Richmond (Dr Peter Lutjen)

Monash IVF, Monash Surgical Private Hospital, Clayton (Dr Peter Lutjen)

Monash IVF, Bendigo (Dr Mark Jalland)

Monash IVF Casterton, Casterton (Prof David Healy)

Monash IVF Geelong, Geelong (Prof. Gab Kovacs)

Monash IVF Sale, Sale (Dr Mac Talbot)

Monash IVF Sunshine, St Albans (Dr Mac Talbot)

Reproductive Services, Carlton (Dr Lyndon Hale)

Repromed Mildura, Mildura (Dr Richard Henshaw)

Western Australia

Concept Fertility Centre, Subiaco (Dr Rob Mazzucchelli)

Fertility North, Joondalup (Dr Vince Chapple)

Fertility Specialists South, Attadale (Prof Roger Hart)

Fertility Specialists WA, Claremont (Prof Roger Hart)

Hollywood Fertility Centre, Hollywood (Dr Simon Turner)

PIVET Medical Centre, Leederville (Dr John Yovich)

The Keogh Institute for Medical Research, Nedlands (Dr Bronwyn Stuckey)

New Zealand

Fertility Associates, Auckland (Dr Mary Birdsall)

Fertility Associates Hamilton, Hamilton (Dr Freddie Graham)

Fertility Associates Wellington, Wellington (Dr Andrew Murray)

Fertility Plus, Auckland (Dr Neil Johnson)

Repromed Auckland, Auckland (Dr Guy Gudex)

Repromed Christchurch, Christchurch (Dr Peter Benny)

The Otago Fertility Services, Dunedin (A/Prof. Wayne Gillett)

Appendix 2: Data used in this report

The data presented in this report are supplied by 37 fertility centres in Australia and New Zealand and are compiled into ANZARD2.0. ANZARD2.0 includes autologous treatment cycles, treatment involving donated oocytes or embryos and treatment involving surrogacy arrangements. ANZARD2.0 collects data on the use of ART techniques such as ICSI, oocyte/embryo freezing methods, PGD and cleavage/blastocyst transfers. In addition to ART procedures, ANZARD2.0 also collects data from fertility centres about artificial insemination cycles using donated sperm. The outcomes of pregnancies, deliveries and babies born following ART and DI treatments are also maintained in ANZARD2.0. 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 2009, and the resulting pregnancies and births. The babies included in this report were conceived through treatment cycles undertaken in 2009, and were born in either 2009 or 2010.

Data validation

Most fertility centres have computerised data information management systems and are able to provide the NPESU with high quality data. All data processed by NPESU undergo a validation process, with data queries being followed up with fertility centre staff. In 2009, information relating to pregnancy and birth outcomes was not provided for 1.8% of clinical pregnancies. The Reproductive Technology Accreditation Committee of the Fertility Society of Australia also plays a role in ensuring the quality of ANZARD2.0 data by validating selected records against clinic files in their annual inspections.

Data presentation

Data presented in Chapters 2 to 7 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 in Chapters 2 to 7 were measured per initiated cycle. Where the number of initiated cycles was not available, 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 3: ANZARD2.0 data items

Variable	*Data domain*
Unit identifier	3-digit code for clinics provided by NPESU.
Site of the unit	Where the cycle was initiated.
Unit patient ID/medical record number	Unique ID for patient.
First two letters of first name	First two letters of female patient first name.
First two letters of surname	First two letters of female patient surname.
Female patient date of birth	DD/MM/YYYY.
Husband/male partner date of birth	DD/MM/YYYY.
Age of oocyte/embryo donor	Completed age at time of OPU.
Cause of infertility: tubal disease	Yes–in the opinion of the treating clinician or clinic there is subfertility due to tubal disease. No–other.
Cause of infertility: endometriosis	Yes–in the opinion of the treating clinician or clinic there is subfertility due to endometriosis. No–other.
Cause of infertility: other female factors	Yes–in the opinion of the treating clinician or clinic there is subfertility due to other female factors apart from tubal disease and endometriosis. Possible examples could include fibroids, ovulation disorders or premature ovarian failure. 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: unexplained	Yes–in the opinion of the clinic or clinician there is subfertility without any apparent explanation. No–if yes answered to any of the previous cause of infertility fields.
Any pregnancies ≥ 20 weeks	Yes–if the female patient has had a pregnancy of 20 complete weeks or more by ART or by a different partner. No–if the female patient has had no previous pregnancy of 20 complete weeks or more.
Cycle ID	Unique cycle identifier.
Cycle date	Cycle date is coded by 1. The first date where FSH/stimulation drug is administered, 2. The date of LMP for unstimulated cycles (including natural fresh cycles and thaw cycles), 3. The date of embryos disposed for embryo disposal cycles, 4. The date of oocytes/embryos imported or exported for oocyte/embryo import/export cycles, 5. The date of embryos donated for frozen embryos donation cycles, or 6. The date of embryos received for non-transfer embryo recipient cycles.
Surrogacy arrangement	Yes–if surrogacy arrangement is involved in this cycle. No–if surrogacy arrangement is not involved in this cycle.
Ovarian stimulation	Yes–FSH administered. Does not include clomiphene or hCG alone unless FSH was also given. No–other.
First ever FSH stimulated cycle for OPU	Yes–if the current cycle is the first ever FSH stimulated cycle with the intention of OPU. No–other.
Date of intrauterine insemination	DD/MM/YYYY.
Date of cancellation for cancelled OPU	Date of the last day FSH is administered in a cancelled cycle. DD/MM/YYYY.
OPU date	Date of oocyte pickup.
Number of eggs retrieved	Number of eggs retrieved at OPU.
Number of eggs donated	Number of eggs donated to someone else.

Variable	*Data domain*
Number of eggs received	Number of eggs received from someone else.
Number of eggs imported	Records number of oocytes imported into the current unit from another unit.
Number of eggs exported	Records number of oocytes exported from the current unit into another unit.
Number of oocytes slow frozen	Number of oocytes frozen by slow freezing method in this cycle.
Number of oocytes vitrified	Number of oocytes frozen by vitrification in this cycle.
Number of slow frozen oocytes thawed	Number of slow frozen oocytes thawed in this cycle.
Number of vitrified oocytes warmed	Number of vitrified oocytes warmed in this cycle.
Freezing date of thawed/warmed oocytes	DD/MM/YYYY.
Number of eggs GIFT	Number of eggs replaced in a GIFT procedure.
Number of eggs IVF	Number of eggs treated (inseminated) 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 who provided sperm	Husband/partner (h), known donor (k), anonymous donor (a), unknown (u).
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 imported from another clinic	Records number of embryos imported into the unit from another unit.
Number of embryos received from another patient/ clinic	Records the number of embryos that a patient/couple received from another patient/couple.
Number of slow frozen cleavage embryos thawed	Number of slow frozen cleavage embryos thawed with the intention of performing an embryo transfer.
Number of vitrified cleavage embryos warmed	Number of vitrified cleavage embryos warmed with the intention of performing an embryo transfer.
Number of slow frozen blastocysts thawed	Number of slow frozen blastocysts thawed with the intention of performing an embryo transfer.
Number of vitrified blastocysts warmed	Number of vitrified blastocyst embryos warmed with the intention of performing an embryo transfer.
Freezing date of thawed/warmed embryos	Freezing date of thawed/warmed embryos.
Thawed/warmed embryos originally from oocyte donor or embryo donor	o–embryo from donated oocyte. e–donated embryo.
ET date	Embryo transfer date.
Number of cleavage embryos transferred	Number of cleavage stage embryos transferred.
Number of blastocyst transferred	Number of blastocyst stage embryos transferred.
Any embryos ICSI?	Yes–any embryos transferred were fertilised by ICSI. No–no transferred embryos were fertilised by ICSI.
Number of cleavage embryos slow frozen	Number of cleavage embryos frozen by slow freezing method in this cycle.
Number of cleavage embryos vitrified	Number of cleavage embryos frozen by vitrification in this cycle.
Number of blastocysts slow frozen	Number of blastocysts frozen by slow freezing method in this cycle.

Variable	*Data domain*
Number of blastocysts vitrified	Number of blastocysts frozen by vitrification method in this cycle.
Number of embryos exported	Number of embryos exported from the current unit to another unit.
Number of embryos donated	Number of embryos donated to another patient.
Number of potentially usable frozen embryos discarded	Frozen embryos disposed in accordance with patient's request or Government regulation.
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	If this pregnancy is an ectopic pregnancy, or a combined ectopic and uterine pregnancy (heterotopic). n–No e–Ectopic h–Heterotopic
Elective termination of pregnancy	Yes–pregnancy is terminated. No–pregnancy not terminated.
Selective reduction performed	Yes–If selective reduction has been performed due to fetal abnormality/other reasons. No–If no selective reduction has been performed.
Fetal abnormality in a pregnancy ending < 20 weeks or by selective reduction	Fetal abnormality in a pregnancy ending < 20 weeks or by selective reduction.
Maternal complications of pregnancy	Maternal complications of pregnancy.
Number of babies delivered	Include all liveborn and stillborn babies after 20 weeks gestation or at least 400 grams birthweight.
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.

Variable	*Data domain*
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.
Postcode	Postcode of patient residential area.
Comments	Any comments on this cycle.

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 intended parent(s)) with the intention that the child will be raised by those intended parents. The oocytes and/or sperm used to create the embryo(s) in the surrogacy cycle can be either from the intended 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.

Vitrification: an ultra-rapid cryopreservation method that prevents ice formation within the suspension which is converted to a glass-like solid.

Note: The International Committee Monitoring 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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Supplementary tables

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

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