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Assisted reproductive technology in Australia and New Zealand 2011

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The Fertility Society of Australia

Assisted reproductive technology in Australia and New Zealand 2011

Alan Macaldowie
Yueping A Wang
Georgina M Chambers
Elizabeth A Sullivan

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The University of New South Wales
Australia

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Any enquiries about or comments on this publication should be directed to:
National Perinatal Epidemiology and Statistics Unit
Level 2 McNevin Dickson Building
Gate 6 Avoca Street
Randwick Hospitals Campus
Randwick
NSW 2031
Australia
T +61 (2) 93821014
F +61 (2) 93821025
E npesu@unsw.edu.au

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Acknowledgments

The Australian and New Zealand Assisted Reproduction Database (ANZARD), funded by the Fertility Society of Australia (FSA), is a collaborative effort between the National Perinatal Epidemiology and Statistics Unit (NPESU) and fertility centres in Australia and New Zealand. The NPESU is a formally affiliated unit of the University of New South Wales (UNSW) within the School of Women's and Children's Health.

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Abbreviations and symbols

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 and Statistics Unit
OHSS	ovarian hyperstimulation syndrome
OPU	oocyte pick-up
PGD	preimplantation genetic diagnosis
SET	single embryo transfer
SLK	statistical linkage key
UNSW	University of New South Wales
WHO	World Health Organization

Symbols

–	not applicable

Summary

Use of assisted reproductive technology treatment

There were 66,347 assisted reproductive technology (ART) treatment cycles performed in Australia and New Zealand in 2011 (61,158 and 5,189 respectively), representing an increase of 8.3% for Australia and a decrease of 1.8% for New Zealand on 2010. Women used their own oocytes or embryos (autologous) in 95.1% of treatments, and 33.7% of all cycles used frozen/thawed embryos.

There were 34,490 women who undertook autologous ART treatment in Australia and New Zealand in 2011. On average, 1.9 cycles per woman were undertaken in Australia compared with 1.4 cycles per woman in New Zealand.

Women's age

The average age of women undergoing autologous cycles was 36, and ranged from 14 to 54. In contrast, the average age of women undergoing ART treatment using donor oocytes or embryos was approximately five years older (40.8, ranging from 20 to 54). The proportion of autologous cycles undertaken by women aged 40 or older continued to increase, with 26.5% in 2011 compared with 22.8% in 2007.

Treatment outcomes and number of babies

Of the 66,347 initiated cycles, 23.1% resulted in a clinical pregnancy, and 17.5% in a live delivery (the birth of at least one liveborn baby). There were 12,443 liveborn babies following ART treatments in 2011 (11,148 in Australia and 1,295 in New Zealand). Almost three-quarters of the liveborn babies (76.2%) were full-term singletons of normal birthweight.

There was a higher live delivery rate in younger women. For women aged under 30, the live delivery rate was 26.6% for autologous fresh cycles and 22.9% for autologous thaw cycles. For women aged over 44, the live delivery rate was 1.2% and 5.0% for autologous fresh and thaw cycles respectively.

Multiple births

A continuing trend in ART treatment in Australia and New Zealand has been the reduction in the rate of multiple deliveries, with a decrease from 10.0% in 2007 to 6.9% (7.1% for Australia and 5.8% for New Zealand) in 2011. This was achieved by clinicians and patients shifting to single embryo transfer, with the proportion increasing from 63.7% in 2007 to 73.2% in 2011. Importantly, this decrease in the multiple delivery rate was achieved while clinical pregnancy rates remained stable at about 23.0% per initiated cycle.

Cumulative success rates

Since 2009, the Australian and New Zealand Assisted Reproduction Database has included data items that make it possible to follow a woman from her first fresh ART treatment cycle through subsequent fresh and thaw cycles. For women who undertook their first autologous fresh cycle between 2009 and 2011, the cumulative live delivery rate was 21.1% after the first cycle, increasing to 31.1% after two cycles, 36.0% after three cycles, 38.6% after four cycles, and 40.0% after five cycles. The cumulative live delivery rate did not increase markedly with additional treatments after five cycles.

1 Introduction

It is estimated that about 9% of couples at any given time experience infertility, representing the source of much personal suffering to millions around the world (Boivin et al. 2007). The medical definition of 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). 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 5 million children worldwide (ICMART 2012). The most recent national estimates indicate that 4.1% of all women who gave birth in Australia in 2010 received some form of ART treatment (Li et al. 2012).

The purpose of this annual report is to inform clinicians, researchers, government and the community about ART treatment and the resulting pregnancy outcomes; to provide an ongoing mechanism for monitoring of ART treatment practices, success rates and perinatal outcomes; and to provide information for national and international comparisons.

The Fertility Society of Australia (FSA), in collaboration with the University of New South Wales (UNSW), is committed to providing informative annual statistics on ART treatments and is pleased to present the 2011 annual report on the use of ART in Australia and New Zealand.

Treatments covered in this report

ART is a group of procedures that involve 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 in vitro fertilisation (IVF) cycle, involves the following five steps:

1. Controlled ovarian hyperstimulation during which an ovarian stimulation regimen, typically follicle stimulating hormone (FSH) is administered to a woman over a number of days to induce the maturation of multiple oocytes.
2. Oocyte pick-up (OPU) where mature oocytes are aspirated from ovarian follicles.
3. Fertilisation of the collected oocytes by incubating them with sperm (from the woman's partner or donor) over a few hours in the laboratory.
4. 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 (60–100 cells).
5. 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

- assisted hatching, when the outer layer of the embryo, the zona pellucida, is either thinned or perforated in the laboratory to aid 'hatching' of the embryo
- gamete intrafallopian transfer (GIFT), when mature oocytes and sperm are placed directly into a woman's fallopian tubes so that fertilisation may take place in vivo (inside the body). While once popular, this procedure now accounts for only a very small percentage of ART cycles
- preimplantation genetic diagnosis (PGD), when one or more 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 and storage of embryos that are not transferred in the initial fresh treatment cycle. Once thawed or warmed, the embryos can be transferred in subsequent treatment cycles. Cryopreservation techniques include both the traditional slow freezing method and a newer technique called 'vitrification'. Vitrification can be used to cryopreserve gametes and embryos, and uses an ultra-rapid temperature change with exposure to higher concentrations of cryoprotectants
- 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 parent(s).

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 (for example, 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, also known as 'donor sperm insemination' (DI).

Data used in this report

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 years from 2007 to 2011.

As a joint initiative of the NPESU at UNSW and 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). A more detailed description of ANZARD2.0 can be found in Appendices B and C. The expanded treatment information in the collection includes data fields for oocyte/embryo vitrification, and duration of oocytes and embryos in storage. The upgrade to a woman-based data collection was achieved by introducing a statistical linkage key (SLK) that 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 across time to be reported. For the first time, the 2011 annual report presents cumulative success rates for women who started their first autologous fresh cycle during 2009 to 2011.

The 2011 data presented in this report were supplied by all 37 fertility centres (72 fertility clinics in Australia and 7 fertility clinics in New Zealand), and compiled into ANZARD2.0.

Note: The 2007 and 2008 ANZARD data have been updated to correct the previously reported misclassification error of cleavage and blastocyst transfer. In this report, the numbers and percentages of cleavage embryo and blastocyst transfer cycles for 2007 and 2008 are different from previous annual reports.

Structure of this report

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

Chapter 2—'Overview of ART treatment in 2011', 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 2011', presents data on the number of cycles, cycle types, and the outcomes of treatment in terms of discontinued treatment, clinical pregnancies and deliveries.

Chapter 4—' Pregnancy and birth outcomes following autologous and recipient embryo transfer cycles in 2011', presents data on the outcomes of clinical pregnancies and deliveries following autologous and recipient cycles including a description of perinatal outcomes.

Chapter 5—'Other cycle types, procedures and treatment complications in 2011', includes information on cycles, procedures and complications that do not fit into the chapters already described.

Chapter 6—'Donor sperm insemination cycles in 2011', presents data on DI cycles and their outcomes, including a description of pregnancy and perinatal outcomes.

Chapter 7—'Trends in ART treatment and outcomes: 2007–2011', 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 2011', presents information on the number of women undergoing ART treatment in 2011.

Chapter 9—'Cumulative success rates for women undertaking autologous treatment 2009-2011', presents information on the pregnancies and live deliveries per women for a cohort of women who undertook their first autologous fresh cycle during 2009 to 2011.

Appendices—Appendix A lists the contributing fertility clinics. Appendix B provides an overview of the ANZARD2.0 data collection that was used to prepare this report. Appendix C provides a detailed list of the data items in the collection.

2 Overview of ART treatment in 2011

There were 66,347 ART treatment cycles reported from Australian and New Zealand clinics in 2011 (Table 1). Of these, 92.2% (61,158) were from Australian clinics and 7.8% (5,189) were from New Zealand clinics. The number of ART treatment cycles in 2011 increased by 7.4% from the 61,774 cycles in 2010, with an 8.3% increase in Australia and 1.8% decrease in New Zealand. In 2011, the number of ART treatment cycles represented 12.9 cycles per 1,000 women of reproductive age (15–44 years) in Australia, compared with 5.7 cycles per 1,000 women of reproductive age in New Zealand (Australian Bureau of Statistics 2013; Statistics New Zealand 2012).

More than 95% of cycles in 2011 were autologous cycles (where a woman intended to use, or used her own oocytes or embryos). Of the 63,064 autologous cycles, 40,696 (64.5%) were fresh cycles and 22,368 (35.5%) were frozen/thaw cycles. Other treatment cycles accounted for small proportions: 2.7% were oocyte recipient cycles, 0.5% were embryo recipient cycles, 1.4% were oocyte donation cycles and 0.3% were surrogacy arrangement cycles (Table 1).

Of all ART treatments in 2011, 23.1% (15,319) resulted in a clinical pregnancy and 17.5% (11,640) in a live delivery (Table 1). Of these clinical pregnancies, 13,790 (90%) were from Australian clinics and 1,529 (10%) from New Zealand clinics. There were 12,623 babies born (including 12,443 liveborn) following ART treatment in 2011. Of these, 11,314 (89.6%) were from Australian clinics and 1,309 (10.4%) from New Zealand clinics. Of the liveborn babies, 76.2% (9,477) were singletons at term (gestational age of 37–41 weeks) with normal birthweight (≥ 2,500 grams). The multiple delivery rate was 6.9%.

Table 1: Number of initiated ART treatment cycles by treatment type, Australia and New Zealand, 2011

	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	63,064	95.1	14,747	11,219	11,992	9,162
Fresh	*40,696*	*61.3*	*9,100*	*6,928*	*7,417*	*5,606*
Thaw	*22,368*	*33.7*	*5,647*	*4,291*	*4,575*	*3,556*
Oocyte recipient	1,776	2.7	452	336	363	247
Embryo recipient	358	0.5	85	63	65	52
Oocyte donation	961	1.4	–	–	–	–
GIFT[(a)]	11	0.0	1	1	1	1
Surrogacy arrangement cycles	177	0.3	34	21	22	15
Intended parent cycles[(b)]	*46*	*0.1*	–	–	–	–
Gestational carrier cycles[(c)]	*131*	*0.2*	*34*	*21*	*22*	*15*
Total	**66,347**	**100.0**	**15,319**	**11,640**	**12,443**	**9,477**

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

(b) A cycle undertaken by a person or couple who intends to raise a child that will be, or is intended to be, carried by a gestational carrier during pregnancy.

(c) A cycle undertaken by a woman who carries, or intends to carry, a pregnancy on behalf of the intended parents with an agreement that the child will be raised by the intended parent(s).

3 Autologous and donation/recipient cycles in 2011

This chapter presents data on initiated autologous cycles, oocyte donation cycles and oocyte/embryo recipient cycles. Surrogacy cycles and GIFT 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 intended use of, 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. For women undergoing oocyte/embryo recipient cycles, the mean age was 40.8, five years older than for autologous cycles (35.9). Of all autologous and oocyte/embryo recipient cycles, one in four (26.5%) was undertaken by women aged 40 or older (Table 2). The average age of partners was 38.3, with one-third (35.3%) aged 40 or older. For 13.3% of oocyte/embryo cycles, the partner's age was not stated or no partner was involved (Table 3).

Table 2: Number of autologous and recipient cycles by women's age group and treatment type, Australia and New Zealand, 2011

Age group (years)[(a)]	Autologous				Oocyte/embryo recipient		All	
	Fresh		Thaw					
	Number	Per cent	Number	Per cent	Number	Per cent	Number	Per cent
< 30	4,262	10.5	2,458	11.0	78	3.7	6,798	10.4
30–34	10,285	25.3	6,844	30.6	200	9.4	17,329	26.6
35–39	14,641	36.0	8,673	38.8	461	21.6	23,775	36.5
40–44	10,599	26.0	4,071	18.2	850	39.8	15,520	23.8
≥ 45	909	2.2	322	1.4	545	25.5	1,776	2.7
Total	**40,696**	**100.0**	**22,368**	**100.0**	**2,134**	**100.0**	**65,198**	**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, 2011

Age group (years)[(a)]	Autologous				Oocyte /embryo recipient		All	
	Fresh		Thaw					
	Number	Per cent	Number	Per cent	Number	Per cent	Number	Per cent
< 30	2,443	6.0	1,267	5.7	63	3.0	3,773	5.8
30–34	8,540	21.0	5,224	23.4	211	9.9	13,975	21.4
35–39	12,139	29.8	7,308	32.7	500	23.4	19,947	30.6
40–44	8,825	21.7	4,645	20.8	557	26.1	14,027	21.5
≥ 45	5,837	14.3	2,643	11.8	519	24.3	8,999	13.8
Not stated	2,912	7.2	1,281	5.7	284	13.3	4,477	6.9
Total	**40,696**	**100.0**	**22,368**	**100.0**	**2134**	**100.0**	**65,198**	**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 is the number of previous pregnancies of 20 weeks or more gestation experienced by a woman. A woman who has had no previous pregnancies of 20 or more weeks gestation is called 'nulliparous'. A woman who has had at least one previous pregnancy of 20 weeks or more gestation is described as 'parous'.

Of the 65,198 initiated autologous and recipient cycles undertaken in 2011, 64.1% were undertaken by nulliparous women. Of autologous cycles (fresh and thaw), 63.9% were undertaken by nulliparous women, compared with 69.3% for oocyte/embryo recipient cycles (Table 4).

Table 4: Number of autologous and recipient cycles by parity and treatment type, Australia and New Zealand, 2011

	Autologous				Oocyte/embryo recipient		All	
	Fresh		Thaw					
Parity	Number	Per cent	Number	Per cent	Number	Per cent	Number	Per cent
Nulliparous	27,916	68.6	12,369	55.3	1,478	69.3	41,763	64.1
Parous	8,190	20.1	7,130	31.9	512	24.0	15,832	24.3
Not stated	4,590	11.3	2,869	12.8	144	6.7	7,603	11.7
Total	**40,696**	**100.0**	**22,368**	**100.0**	**2,134**	**100.0**	**65,198**	**100.0**

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

Cause of infertility

Causes of infertility may be known to relate to either the woman or her male partner, or both, or may 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 65,198 initiated autologous and recipient cycles, 22.5% reported male infertility factors as the only cause of infertility; 28.5% reported only female infertility factors; 14.3% reported combined male–female factors; 22.7% reported unexplained infertility; and 11.7% were not stated.

Intracytoplasmic sperm injection procedures

Of the 35,913 autologous fresh cycles where fertilisation was attempted, 67.8% used ICSI procedures and 32.2% used IVF procedures. Of fresh oocyte recipient cycles where fertilisation was attempted, 75.4% used ICSI procedures and 24.6% 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, 2011

	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	11,572	32.2	7,998	38.6	220	24.6	445	38.2
ICSI[(c)]	24,341	67.8	11,807	57.0	673	75.4	702	60.3
Not stated	–	–	905	4.4	–	–	18	1.5
Total	**35,913**	**100.0**	**20,710**	**100.0**	**893**	**100.0**	**1,165**	**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

Of the 53,688 fresh and thawed embryo transfer cycles, nearly three-quarters (73.2%) were single embryo transfer (SET) cycles and 26.1% were double embryo transfer (DET). In women aged under 35, 82.3% of embryo transfer cycles were SET cycles and 17.6% were DET cycles. In women aged 35 or older, two-thirds (67.5%) of cycles were SET cycles and 31.3% were DET cycles (Table 6).

Table 6: Number of fresh and thawed embryos transferred per cycle and women's age group, Australia and New Zealand, 2011

	Number of embryos transferred							
	One		Two		Three or more		All	
Age group (years)[(a)]	Number	Per cent	Number	Per cent	Number	Per cent	Number	Per cent
< 30	4,788	84.6	869	15.4	4	0.1	5,661	100.0
30–34	12,069	81.5	2,737	18.5	11	0.1	14,817	100.0
35–39	14,567	73.4	5,246	26.4	44	0.2	19,857	100.0
40–44	7,004	58.3	4,709	39.2	298	2.5	12,011	100.0
≥ 45	862	64.2	436	32.5	44	3.3	1,342	100.0
Total	**39,290**	**73.2**	**13,997**	**26.1**	**401**	**0.7**	**53,688**	**100.0**

(a) Age at start of a treatment cycle.

Stage of embryo development

Of the 53,688 embryo transfer cycles, 57.7% involved the transfer of day 5–6 embryos (blastocysts) with the remainder day 2–3 embryos (cleavage embryos). Of autologous cycles, blastocyst transfers made up 64.1% of thaw cycles compared with 53.5% of fresh cycles (Table 7).

Table 7: Number of embryo transfer cycles by treatment type and stage of embryo development, Australia and New Zealand, 2011

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	14,448	46.5	7,433	35.9	345	45.4	497	42.7
Blastocyst	16,605	53.5	13,277	64.1	415	54.6	668	57.3
Total	**31,053**	**100.0**	**20,710**	**100.0**	**760**	**100.0**	**1,165**	**100.0**

Transfer of cryopreserved embryos

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.

Of the 21,875 frozen/thawed embryo transfer cycles, almost half (49.2%) involved the transfer of vitrified embryos. Nearly three-quarters (73.1%) of frozen/thawed blastocyst transfer cycles had vitrified blastocysts transferred. By comparison, 7.2% of frozen/thawed cleavage embryo transfer cycles used vitrified embryos (Table 8).

Table 8: Number of embryo transfer cycles by freezing method and stage of embryo development, Australia and New Zealand, 2011

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	6,904	92.9	3,511	26.4	454	91.3	241	36.1
Vitrification[(a)]	529	7.1	9,766	73.6	41	8.2	425	63.6
Not stated	–	–	–	–	2	0.4	2	0.3
Total	**7,433**	**100.0**	**13,277**	**100.0**	**497**	**100.0**	**668**	**100.0**

(a) Ultra-rapid cryopreservation.

3.2 Autologous fresh cycles

In 2011, there were 40,696 initiated autologous fresh cycles, comprising 40,210 (98.8%) ovarian stimulated cycles and 486 (1.2%) unstimulated cycles. There were 116 cycles in which thawed oocytes were used.

Of the 40,696 initiated autologous fresh cycles, 92.1% (37,475) were in Australian clinics and 7.9% (3,221) were in 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 40,696 initiated autologous fresh cycles in 2011, 91.6% had OPU performed; 76.3% had embryos transferred; 22.4% resulted in a clinical pregnancy; and 17.0% 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.

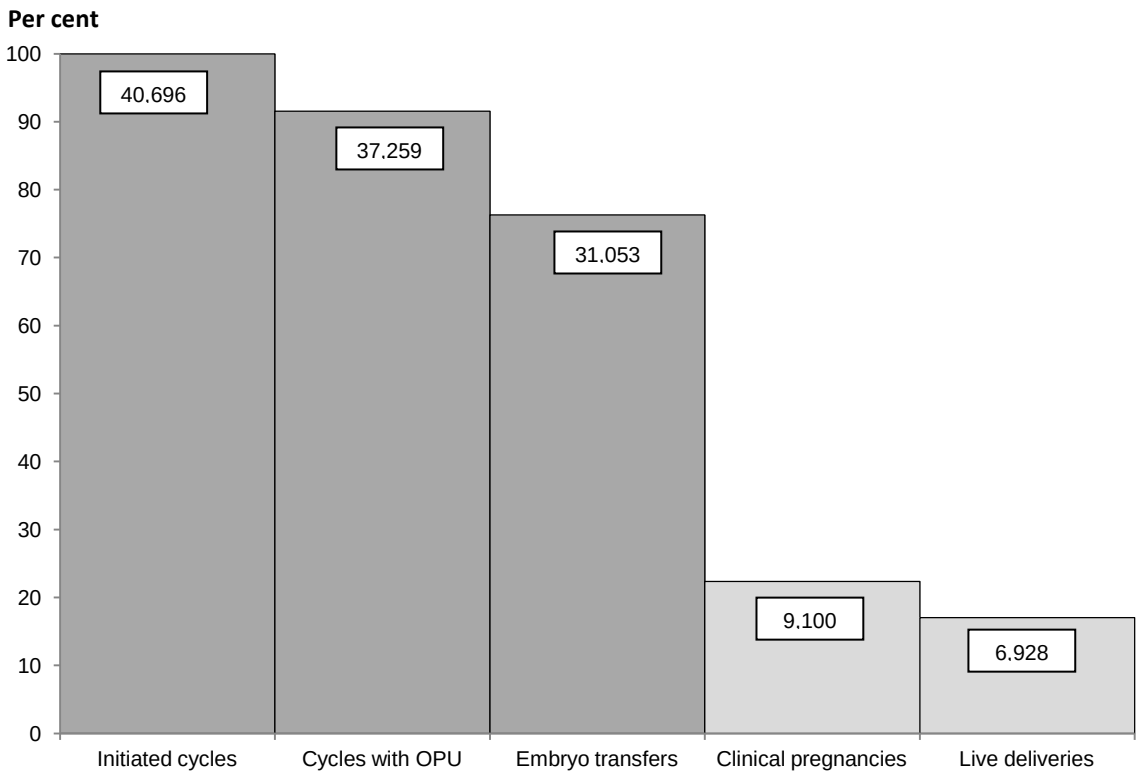

Figure 1: Progression of autologous fresh cycles, Australia and New Zealand, 2011

Clinical pregnancies and live deliveries 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 under 30 (34.6%). The rate declined with advancing women's age, with a rate of 9.3% for women aged 40–44 and 1.9% for women aged 45 or older (Table 9).

Table 9: Outcomes of autologous fresh cycles by women's age group, Australia and New Zealand, 2011

	Age group (years)[(a)]					
Stage/outcome of treatment	**< 30**	**30–34**	**35–39**	**40–44**	**≥ 45**	**All**
Initiated cycles	4,262	10,285	14,641	10,599	909	40,696
Cycles with OPU	3,934	9,577	13,508	9,448	792	37,259
Embryo transfer cycles	3,275	8,259	11,413	7,541	565	31,053
Clinical pregnancies	1,361	3,191	3,325	1,197	26	9,100
Live deliveries	1,133	2,607	2,478	699	11	6,928
Live deliveries per initiated cycle (%)	*26.6*	*25.3*	*16.9*	*6.6*	*1.2*	*17.0*
Live deliveries per embryo transfer cycle (%)	*34.6*	*31.6*	*21.7*	*9.3*	*1.9*	*22.3*
Live deliveries per clinical pregnancy (%)	*83.2*	*81.7*	*74.5*	*58.4*	*42.3*	*76.1*

(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 23 and 32. The live delivery rate declined steadily for women older than 30. For women aged 45 or older, only one delivery resulted from every 100 initiated cycles compared with 26 live deliveries from every 100 initiated cycles in women aged between 23 and 32.

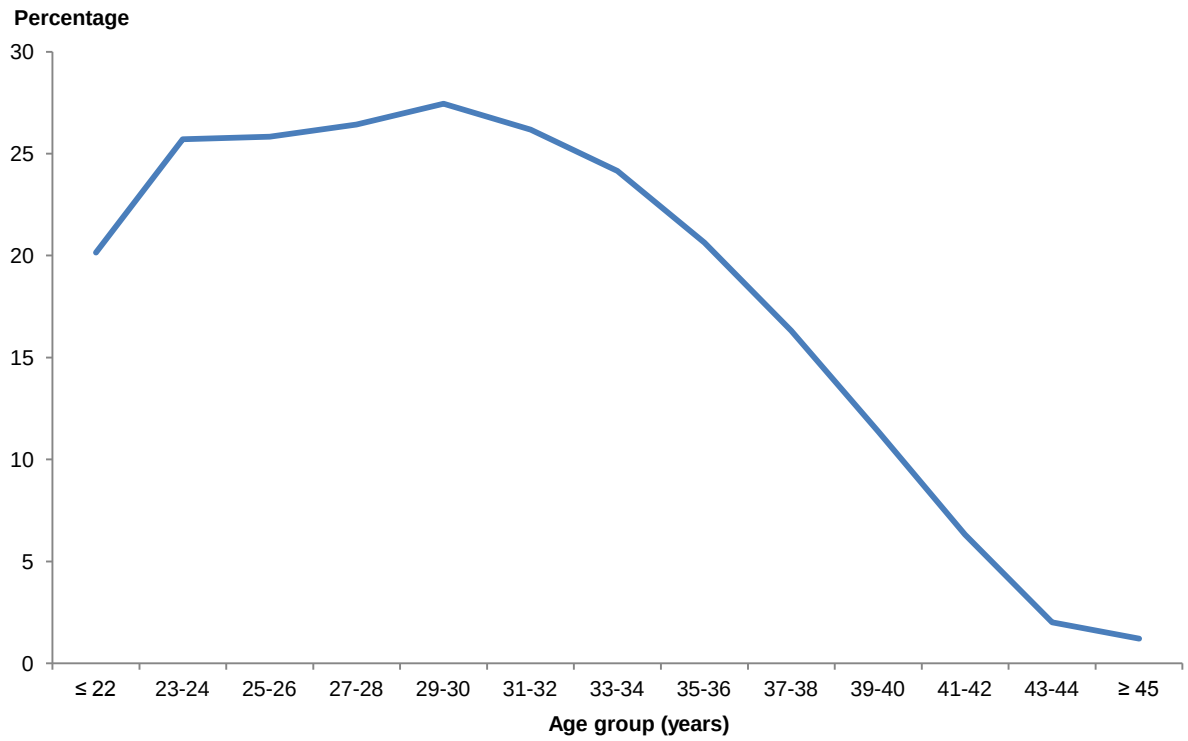

Figure 2: Live deliveries per initiated autologous fresh cycle by women's age at start of a treatment cycle, Australia and New Zealand, 2011

Clinical pregnancies and live deliveries 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-only infertility (Table 10).

Table 10: Outcomes of autologous fresh cycles by cause of infertility, Australia and New Zealand, 2011

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	9,252	80.6	25.0	19.5
Female factor	11,639	73.2	21.6	16.3
Tubal disease only	*1,678*	*79.2*	*22.3*	*17.1*
Endometriosis only	*2,327*	*79.8*	*23.7*	*18.1*
Other female factor only	*6,176*	*69.2*	*20.5*	*15.5*
Combined female factor	*1,458*	*72.5*	*21.7*	*16.0*
Combined male—female factors	6,205	75.4	23.3	18.2
Unexplained	9,201	78.1	22.6	17.2
Not stated	4,399	73.1	17.0	11.7
Total	**40,696**	**76.3**	**22.4**	**17.0**

Clinical pregnancies and live deliveries by number of embryos transferred

Overall, 68.7% of autologous fresh embryo transfer cycles were SET cycles, 30.3% were DET cycles and 1.0% had three or more embryos transferred. In women aged under 35, three or more embryos transferred accounted for less than 0.1% of embryo transfer cycles. This increased to 3.4% in women aged 40 or older.

Overall, the live delivery rate was 23.9% for SET cycles and 19.1% for DET cycles (Table 11). Of embryo transfer cycles in women aged under 35, the live delivery rate was slightly higher for SET cycles than DET cycles (32.9% and 30.3% respectively). Of embryo transfer cycles in women aged 35 or older, the live delivery rate was lower for SET cycles than DET cycles (21.6% and 22.1% respectively for women aged 35 to 39, and 7.5% and 10.1% respectively for women aged 40 or older).

Table 11: Outcomes of autologous fresh embryo transfer cycles by women's age and number of embryos transferred, Australia and New Zealand, 2011

	Age group (years)[a]							
	< 35		35–39		≥ 40		All	
Stage/outcome of treatment	SET[b]	DET[c]	SET[b]	DET[c]	SET[b]	DET[c]	SET[b]	DET[c]
Embryo transfer cycles	9,482	2,042	7,760	3,621	4,089	3,742	21,331	9,405
Clinical pregnancies	3,784	765	2,230	1,087	526	650	6,540	2,502
Live deliveries	3,120	618	1,674	800	306	378	5,100	1,796
Clinical pregnancies per embryo transfer cycle (%)	*39.9*	*37.5*	*28.7*	*30.0*	*12.9*	*17.4*	*30.7*	*26.6*
Live deliveries per embryo transfer cycle (%)	*32.9*	*30.3*	*21.6*	*22.1*	*7.5*	*10.1*	*23.9*	*19.1*

(a) Age at start of a treatment cycle.

(b) SET: single embryo transfer.

(c) DET: double embryo transfer.

Clinical pregnancies and live deliveries by stage of embryo development

Overall, 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). The live delivery rate for blastocyst transfer cycles was 10.5 percentage points higher than for cleavage stage embryo transfer cycles.

Table 12: Outcomes of autologous fresh embryo transfer cycles by women's age and stage of embryo development, Australia and New Zealand, 2011

	Age group (years)[a]							
	< 35		35–39		≥ 40		All	
Stage/outcome of treatment	CL[b]	BL[c]	CL[b]	BL[c]	CL[b]	BL[c]	CL[b]	BL[c]
Embryo transfer cycles	4,479	7,055	5,279	6,134	4,690	3,416	14,448	16,605
Clinical pregnancies	1,440	3,112	1,253	2,072	585	638	3,278	5,822
Live deliveries	1,163	2,577	916	1,562	334	376	2,413	4,515
Clinical pregnancies per embryo transfer cycle (%)	*32.2*	*44.1*	*23.7*	*33.8*	*12.5*	*18.7*	*22.7*	*35.1*
Live deliveries per embryo transfer cycle (%)	*26.0*	*36.5*	*17.4*	*25.5*	*7.1*	*11.0*	*16.7*	*27.2*

(a) Age at start of a treatment cycle.
(b) CL: cleavage embryo.
(c) BL: blastocyst.

Live deliveries among fertility centres

The live delivery rate per initiated autologous fresh cycle varied among the 35 fertility centres that performed at least 30 autologous fresh treatment cycles in 2011. This variation is measured using quartiles that rank a centre's live delivery rate within the top and bottom 25% or the middle 50% of centres. There were eight or nine centres in each quartile.

The live delivery rate per initiated autologous fresh cycle ranged from 3.6% to 25.9% among fertility centres. The middle 50% of fertility centres (second and third quartiles) had live delivery rates between 14.5% and 20.5% (Table 13).

These data should be interpreted with caution because of the small number of women who underwent autologous fresh treatments in some centres coupled with potential variation in patient characteristics that 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, 2011

	Live deliveries per initiated autologous fresh cycle (per cent)				
Age group (years)[(a)]	**Overall**	**First quartile**	**Second quartile**	**Third quartile**	**Fourth quartile**
< 35	25.7%	29.7–36.8	24.0–29.6	19.7–23.9	4.8–19.6
35–39	16.9%	21.6–25.7	17.2–21.5	14.0–17.1	3.7–13.9
≥ 40	6.2%	8.0–13.0	6.0–7.9	4.3–5.9	0.0–4.2
All	**17.0%**	**20.6–25.9**	**17.2–20.5**	**14.5–17.1**	**3.6–14.4**

(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 35 fertility centres that performed autologous fresh cleavage stage embryo or blastocyst transfers. For example, 50% of the clinics that performed single blastocyst transfers achieved a live delivery rate between 22.0% and 34.3%.

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 centres coupled with potential variation in patient characteristics which may influence the live delivery rate of an individual centre. A woman's age, parity, cause of infertility and embryo quality may influence whether one or two embryos are transferred, and whether embryos are transferred at the cleavage or blastocyst stage.

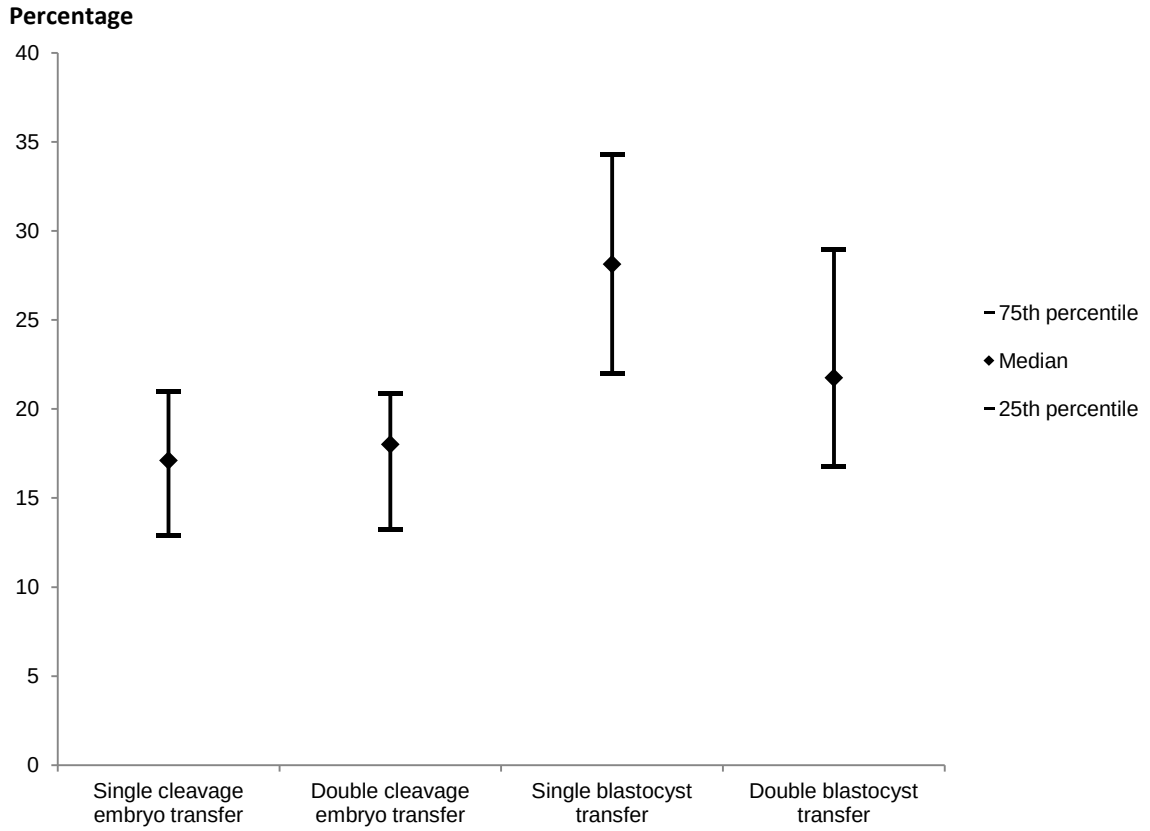

Figure 3: Live deliveries per autologous fresh embryo transfer cycle by number of embryos transferred and stage of embryo development among fertility centres, Australia and New Zealand, 2011

3.3 Autologous thaw cycles

There were 22,368 autologous thaw cycles reported in 2011 (Figure 4). Of these, 93% (20,805) were in Australian clinics and 7% (1,563) in 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 22,368 initiated autologous thaw cycles, 92.6% had embryos transferred, 25.2% resulted in a clinical pregnancy and 19.2% resulted in a live delivery (Figure 4). Almost 1 in 13 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 higher for autologous thaw cycles than for autologous fresh cycles in 2011 (19.2% and 17.0% respectively) (Figures 1 and 4).

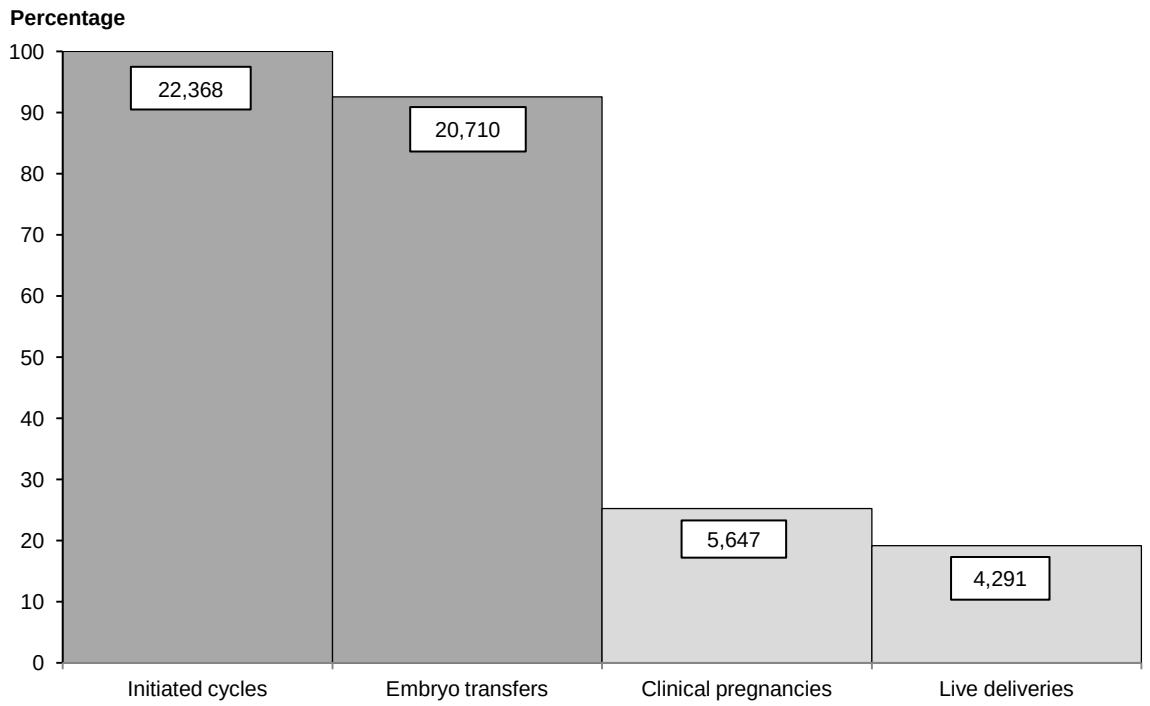

Figure 4: Progression of autologous thaw cycles, Australia and New Zealand, 2011

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 (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, 2011

	Age group (years)[a]					
Stage/outcome of treatment	**< 30**	**30–34**	**35–39**	**40–44**	**≥ 45**	**All**
Initiated cycles	2,458	6,844	8,673	4,071	322	22,368
Embryo transfer cycles	2,317	6,377	8,048	3,700	268	20,710
Clinical pregnancies	719	1,988	2,199	712	29	5,647
Live deliveries	562	1,570	1,692	451	16	4,291
Live deliveries per initiated cycle (%)	*22.9*	*22.9*	*19.5*	*11.1*	*5.0*	*19.2*
Live deliveries per embryo transfer cycle (%)	*24.3*	*24.6*	*21.0*	*12.2*	*6.0*	*20.7*
Live deliveries per clinical pregnancy (%)	*78.2*	*79.0*	*76.9*	*63.3*	*55.2*	*76.0*

(a) Age at start of the thaw 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 mid-20s to mid-30s. The live delivery rate declined steadily for women aged 35 and older. For women aged 45 or older, 5% 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 (1.2%) (Figures 2 and 5).

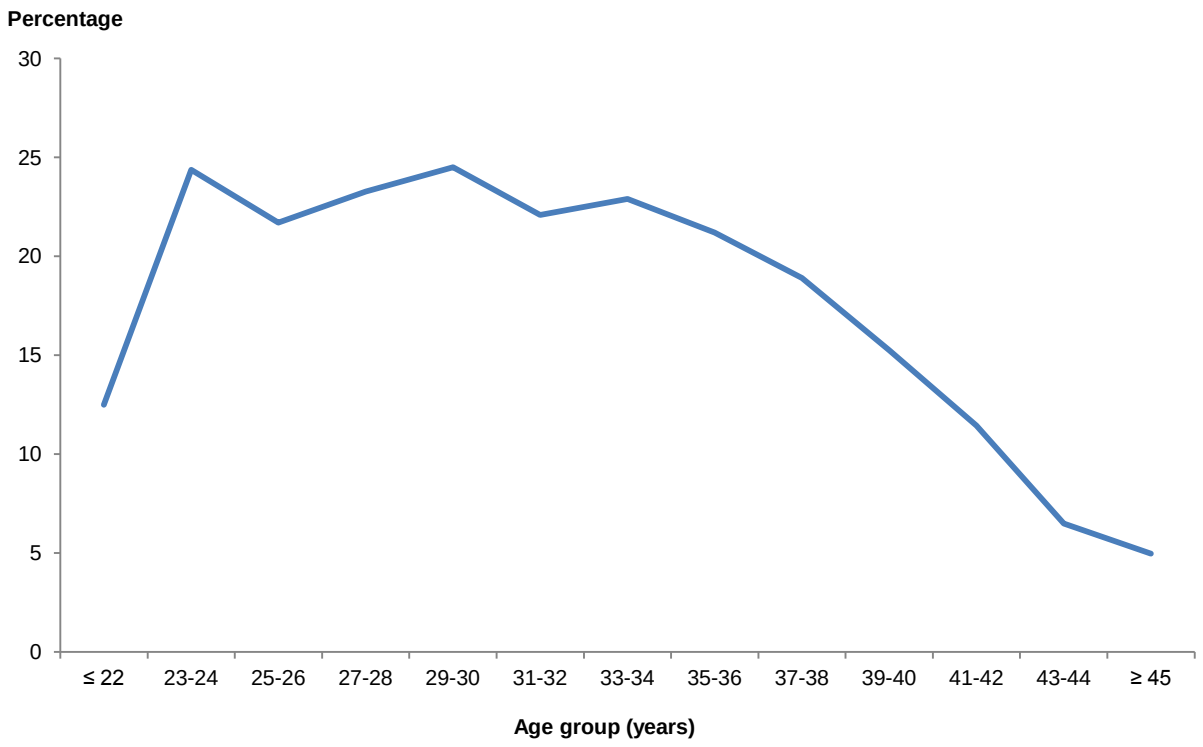

Figure 5: Live deliveries per initiated autologous thaw cycle by women's age at start of the thaw treatment cycle, Australia and New Zealand, 2011

Clinical pregnancies and live deliveries by cause of infertility

Cycles reported with male factor as the only cause of infertility had a higher rate of live delivery per initiated cycle (20.5%) than those with female factor-only infertility (18.5%) (Table 15).

Table 15: Outcomes of autologous thaw cycles by cause of infertility, Australia and New Zealand, 2011

Cause of infertility	Initiated cycles (number)	Embryo transfer cycles per initiated cycle (per cent)	Clinical pregnancies per initiated cycle (per cent)	Live deliveries per initiated cycle (per cent)
Male factor only	5,200	92.5	26.3	20.5
Female factor	5,949	91.7	24.9	18.5
Tubal disease only	*1,012*	*92.1*	*25.3*	*19.6*
Endometriosis only	*1,161*	*92.7*	*25.3*	*18.9*
Other female factor only	*3,102*	*91.6*	*24.9*	*17.9*
Combined female factor	*674*	*90.4*	*23.9*	*18.8*
Combined male–female factors	2,761	93.2	25.7	19.7
Unexplained	5,275	93.1	27.4	20.9
Not stated	3,183	93.0	20.0	15.0
Total	**22,368**	**92.6**	**25.2**	**19.2**

Clinical pregnancies and live deliveries by number of embryos transferred

Overall, of the 20,710 embryo transfer cycles, 80.0% were SET cycles, 19.6% were DET cycles and 0.4% transferred three or more embryos. In women aged under 40, three or more frozen/thawed embryos were transferred in less than 0.1% of embryo transfer cycles, compared with 1.5% in women aged 40 or older.

The overall live delivery rates for SET and DET in autologous thaw cycles were 20.7% and 21.1% respectively. For cycles in women aged under 40, the live delivery rate was higher for DET than for SET. For cycles in women aged ≥ 40, the live delivery rate was slightly lower for DET than for SET (Table 16).

Table 16: Outcomes of autologous thaw embryo transfer cycles by women's age and number of embryos transferred, Australia and New Zealand, 2011

	Age group (years)[a]							
	< 35		35–39		≥ 40		All	
Stage/outcome of treatment	SET[b]	DET[c]	SET[b]	DET[c]	SET[b]	DET[c]	SET[b]	DET[c]
Embryo transfer cycles	7,182	1,507	6,533	1,503	2,852	1,057	16,567	4,067
Clinical pregnancies	2,181	525	1,754	443	528	201	4,463	1,169
Live deliveries	1,722	409	1,361	330	341	120	3,424	859
Clinical pregnancies per embryo transfer cycle (%)	*30.4*	*34.8*	*26.8*	*29.5*	*18.5*	*19.0*	*26.9*	*28.7*
Live deliveries per embryo transfer cycle (%)	*24.0*	*27.1*	*20.8*	*22.0*	*12.0*	*11.4*	*20.7*	*21.1*

(a) Age at start of a treatment cycle.

(b) SET: single embryo transfer.

(c) DET: double embryo transfer.

Clinical pregnancies and live deliveries by stage of embryo development

The rates of clinical pregnancy and live delivery were higher for blastocyst transfer cycles than for cleavage embryo transfer cycles, regardless of a woman's age (Table 17). The rate of live delivery for blastocyst transfer cycles was 59.3% higher than for cleavage stage embryo transfer cycles.

Table 17: Outcomes of autologous thaw embryo transfer cycles by women's age and stage of embryo development, Australia and New Zealand, 2011

	Age group (years)[a]							
	< 35		35–39		≥ 40		All	
Stage/outcome of treatment	CL[b]	BL[c]	CL[b]	BL[c]	CL[b]	BL[c]	CL[b]	BL[c]
Embryo transfer cycles	2,728	5,966	2,902	5,146	1,803	2,165	7,433	13,277
Clinical pregnancies	638	2,069	613	1,586	228	513	1,479	4,168
Live deliveries	522	1,610	464	1,228	131	336	1,117	3,174
Clinical pregnancies per embryo transfer cycle (%)	*23.4*	*34.7*	*21.1*	*30.8*	*12.6*	*23.7*	*19.9*	*31.4*
Live deliveries per embryo transfer cycle (%)	*19.1*	*27.0*	*16.0*	*23.9*	*7.3*	*15.5*	*15.0*	*23.9*

(a) Age at start of a treatment cycle.

(b) CL: cleavage embryo.

(c) BL: blastocyst.

Clinical pregnancies and live deliveries by embryo freezing methods

Almost three-quarters (73.6%) of autologous thaw cycles where a blastocyst was transferred used vitrified embryos, compared with 7.1% of cycles where a cleavage embryo was transferred. The rates of clinical pregnancy and live delivery were higher for the transfer of vitrified blastocysts than slow frozen blastocysts. In contrast, the rates of clinical pregnancy and live delivery were higher for slow frozen cleavage stage embryos than vitrified cleavage stage embryos (Table 18).

Table 18: Outcomes of autologous thaw embryo transfer cycles by stage of embryo development and embryo freezing methods, Australia and New Zealand, 2011

	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	6,904	529	3,511	9,766	10,415	10,295
Clinical pregnancies	1,389	90	917	3,251	2,306	3,341
Live deliveries	1,057	60	689	2,485	1,746	2,545
Clinical pregnancies per embryo transfer cycle (%)	*20.1*	*17.0*	*26.1*	*33.3*	*22.1*	*32.5*
Live deliveries per embryo transfer cycle (%)	*15.3*	*11.3*	*19.6*	*25.4*	*16.8*	*24.7*

(a) Ultra-rapid cryopreservation.

Live deliveries from autologous thaw cycles among fertility centres

The live delivery rate per initiated autologous thaw cycle ranged from 3.5% to 29.4% among the 35 fertility centres that performed at least 30 autologous thaw cycles in 2011. The middle 50% of fertility centres (second and third quartiles) achieved rates between 13.5% and 20.7% (Table 19).

These data should be interpreted with caution because of the small number of patients who underwent autologous thaw cycles in some centres 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, 2011

	Live deliveries per initiated autologous thaw cycle (per cent)				
Age group (years)[(a)]	**Overall**	**First quartile**	**Second quartile**	**Third quartile**	**Fourth quartile**
< 35	22.9	25.3–34.9	19.0–25.2	16.1–18.9	5.4–16.0
35–39	19.5	21.6–30.2	17.8–21.5	12.3–17.7	0.0–12.2
≥ 40	10.6	14.5–23.7	9.1–14.4	7.4–9.0	0.0–7.3
All	**19.2**	**20.8–29.4**	**16.1–20.7**	**13.5–16.0**	**3.5–13.4**

(a) Age at start of the thaw treatment cycle.

There was also variation among the 36 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. For example, 50% of the clinics who performed single frozen/thawed blastocyst transfers achieved a live delivery rate of between 15.2% and 24.6%.

These data should be interpreted with caution because of the small number of patients who underwent autologous thaw cleavage stage embryo or blastocyst transfers in some centres, and potential variation in patient characteristics which may influence the live delivery rate of an individual centre.

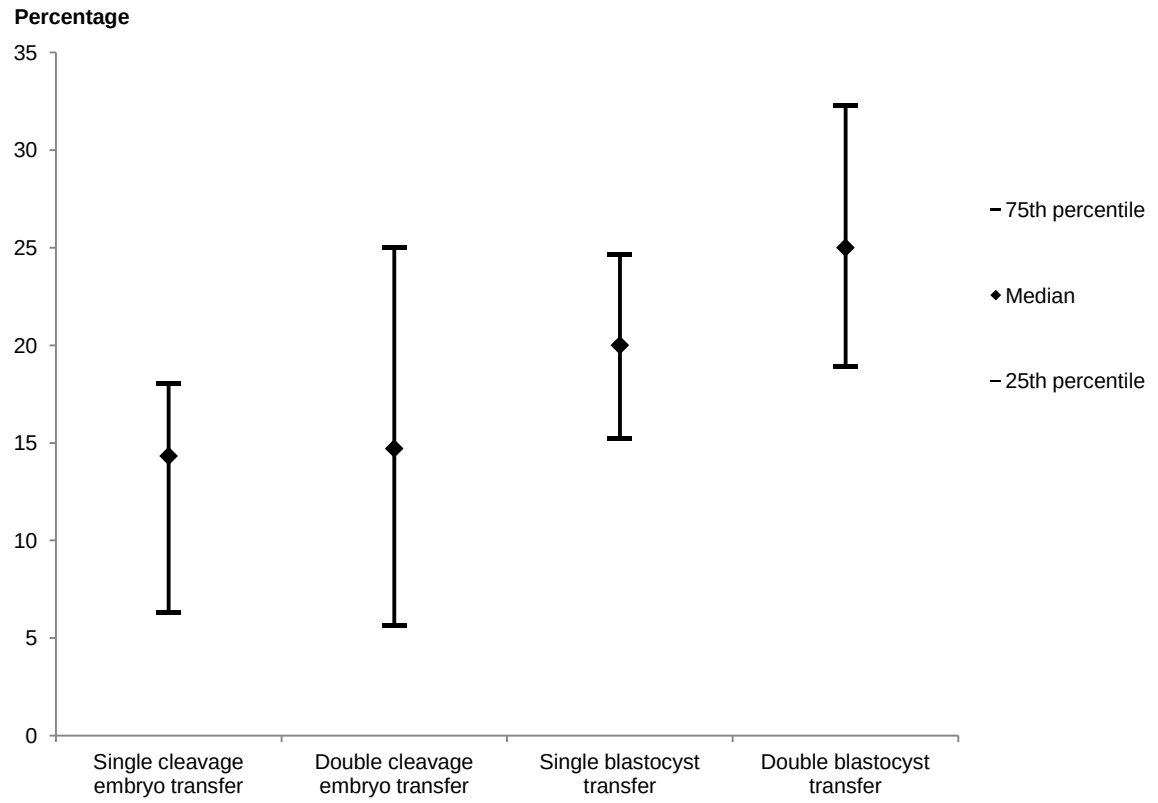

Figure 6: Live delivery rate of autologous thaw embryo transfer cycles by number of embryos transferred and stage of embryo development among fertility centres, Australia and New Zealand, 2011

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 either oocytes or embryos being donated to a recipient woman. A recipient cycle is defined as an ART treatment cycle in which a woman receives oocytes or embryos. The use of donor sperm does not alter the donor status of the cycle.

In 2011, donation and recipient cycles accounted for 4.7% (3,095) of all treatment cycles in Australia and New Zealand. There were 961 initiated cycles where the intention was to donate oocytes, consisting of 831 (86.5%) cycles in Australia and 130 (13.5%) in New Zealand. There were 2,134 oocyte/embryo recipient cycles (Table 1), including 1,907 cycles in Australia and 227 cycles in New Zealand.

Oocyte donation cycles

Of the 961 cycles in Australia and New Zealand where the intention was to donate oocytes to a recipient, 40 (4.1%) cycles were cancelled before OPU, and a further 13 did not result in oocytes being donated.

The average age of women donating oocytes was 32.9 years, with 42.8% of cycles in women aged 35 or older (Table 20).

Table 20: Number of oocyte donation cycles by donor's age group, Australia and New Zealand, 2011

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	239	225	94.1	224	93.7
30–34	311	303	97.4	294	94.5
35–39	343	330	96.2	327	95.3
≥ 40	68	63	92.6	63	92.6
Total	**961**	**921**	**95.8**	**908**	**94.5**

(a) Donor's age at start of a treatment cycle.

Oocyte/embryo recipient cycles

There were 2,134 oocyte/embryo recipient cycles in 2011. Of these, 83.2% (1,776) were oocyte recipient cycles and 16.8% (358) were embryo recipient cycles (Table 1). The average age of women having an oocyte/embryo recipient cycle was 40.8 years.

Progression of oocyte/embryo recipient cycles

Figure 7 shows the main stages of oocyte/embryo recipient cycles and the treatment outcomes. Of the 2,134 initiated oocyte/embryo recipient cycles undertaken in 2011, 25.2% resulted in a clinical pregnancy and 18.7% in a live delivery.

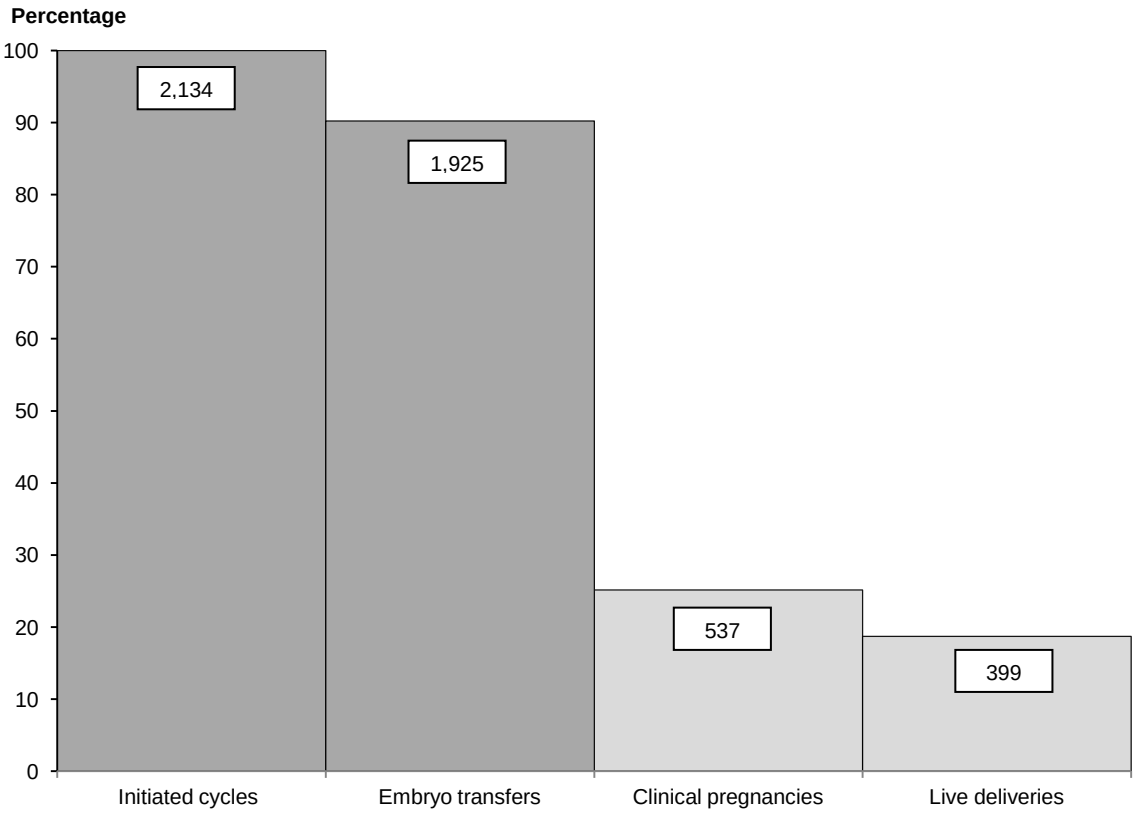

Figure 7: Progression of fresh and thaw oocyte/embryo recipient cycles, Australia and New Zealand, 2011

Clinical pregnancies and live deliveries from oocyte/embryo recipient cycles by type of recipient cycle

Of the 1,776 oocyte recipient cycles, 50.9% were fresh cycles and 49.1% were thaw cycles. The live delivery rate was 20.4% for fresh oocyte recipient cycles, higher than for thawed oocyte recipient cycles (17.4%).

Of the 358 embryo recipient cycles, only one was a fresh cycle. The overall live delivery rate was 17.6% for embryo recipient cycles (Table 21).

Table 21: Outcomes of oocyte/embryo recipient cycles by treatment type, Australia and New Zealand, 2011

	Oocyte recipient			
Stage/outcome of treatment	Fresh	Thaw	Embryo recipient	All
Initiated cycles	904	872	358	2,134
Embryo transfer cycles	759	837	329	1,925
Clinical pregnancies	240	212	85	537
Live deliveries	184	152	63	399
Live deliveries per initiated cycle (%)	*20.4*	*17.4*	*17.6*	*18.7*
Live deliveries per embryo transfer cycle (%)	*24.2*	*18.2*	*19.1*	*20.7*
Live deliveries per clinical pregnancy (%)	*76.7*	*71.7*	*74.1*	*74.3*

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 18.7%, varying between 17.4% and 20.5% by recipient's age (Table 22). However, the live delivery rate of oocyte/embryo recipient cycles in recipients aged ≥ 45 (17.8%) was markedly higher than the rate for autologous fresh cycles (1.2%) and the rate of autologous thaw cycles (5.0%) in women aged ≥ 45 (Tables 9 and 14).

Table 22: Outcomes of oocyte/embryo recipient cycles by recipient's age group, Australia and New Zealand, 2011

	Recipient's age group (years)[(a)]					
Stage/outcome of treatment	< 30	30–34	35–39	40–44	≥ 45	All
Initiated cycles	78	200	461	850	545	2,134
Embryo transfer cycles	69	181	396	770	509	1,925
Clinical pregnancies	16	56	110	223	132	537
Live deliveries	14	41	80	167	97	399
Live deliveries per initiated cycle (%)	*17.9*	*20.5*	*17.4*	*19.6*	*17.8*	*18.7*
Live deliveries per embryo transfer cycle (%)	*20.3*	*22.7*	*20.2*	*21.7*	*19.1*	*20.7*
Live deliveries per clinical pregnancy (%)	*87.5*	*73.2*	*72.7*	*74.9*	*73.5*	*74.3*

(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 recipient cycles where donors were in their 20s and 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 (Table 23). The live delivery rate for cycles in donors aged under 40 was 19.4% compared to 4.9% for cycles in donors aged ≥ 40 (Table 23).

Table 23: Outcomes of oocyte/embryo recipient cycles by donor's age group, Australia and New Zealand, 2011

	Donor's age group (years)[a]				
Stage/outcome of treatment	**< 30**	**30–34**	**35–39**	**≥ 40**	**All[b]**
Initiated cycles	463	686	656	122	2,134
Embryo transfer cycles	409	633	572	106	1,925
Clinical pregnancies	126	191	149	13	537
Live deliveries	92	146	113	6	399
Live deliveries per initiated cycle (%)	*19.9*	*21.3*	*17.2*	*4.9*	*18.7*
Live deliveries per embryo transfer cycle (%)	*22.5*	*23.1*	*19.8*	*5.7*	*20.7*
Live deliveries per clinical pregnancy (%)	*73.0*	*76.4*	*75.8*	*46.2*	*74.3*

(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

Of the 1,925 oocyte/embryo recipient cycles where embryos were transferred, 72.3% were SET, 27.3% were DET and 8 cycles (0.4%) transferred three or more embryos.

The overall live delivery rate per oocyte/embryo recipient cycle where embryos were transferred was 27.4% for SET cycles and 29.7% for DET cycles. For cycles in recipients aged under 40, the live delivery rate was similar for SET and DET cycles. For cycles in recipients aged ≥ 40, the live delivery rate was higher for DET cycles compared to SET cycles (23.1% and 19.9% respectively) (Table 24).

Table 24: Outcomes of oocyte/embryo recipient cycles by recipient's age and number of embryos transferred, Australia and New Zealand, 2011

	Age group (years)[a]							
	< 35		35–39		≥ 40		All	
Stage/outcome of treatment	SET[b]	DET[c]	SET[b]	DET[c]	SET[b]	DET[c]	SET[b]	DET[c]
Embryo transfer cycles	193	57	274	122	925	346	1,392	525
Clinical pregnancies	54	18	71	39	256	99	381	156
Live deliveries	42	13	56	24	184	80	282	117
Clinical pregnancies per embryo transfer cycle (%)	*28.0*	*31.6*	*25.9*	*32.0*	*27.7*	*28.6*	*27.4*	*29.7*
Live deliveries per embryo transfer cycle (%)	*21.8*	*22.8*	*20.4*	*19.7*	*19.9*	*23.1*	*20.3*	*22.3*

(a) Age at start of a treatment cycle.

(b) SET: single embryo transfer.

(c) DET: double embryo transfer.

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 was higher for blastocyst transfer cycles than cleavage embryo transfer cycles regardless of recipient's age. Overall, the difference in live delivery rates for cleavage stage embryo and blastocyst transfer cycles was 7.1 percentage points (16.7% and 23.8% respectively) (Table 25).

Table 25: Outcomes of oocyte/embryo recipient cycles by recipient's age and stage of embryo development, Australia and New Zealand, 2011

	Age group (years)[a]							
	< 35		35–39		≥ 40		All	
Stage/outcome of treatment	CL[b]	BL[c]	CL[b]	BL[c]	CL[b]	BL[c]	CL[b]	BL[c]
Embryo transfer cycles	106	144	176	220	560	719	842	1,083
Clinical pregnancies	18	54	43	67	133	222	194	343
Live deliveries	16	39	30	50	95	169	141	258
Clinical pregnancies per embryo transfer cycle (%)	*17.0*	*37.5*	*24.4*	*30.5*	*23.8*	*30.9*	*23.0*	*31.7*
Live deliveries per embryo transfer cycle (%)	*15.1*	*27.1*	*17.0*	*22.7*	*17.0*	*23.5*	*16.7*	*23.8*

(a) Age at start of a treatment cycle.

(b) CL: cleavage embryo.

(c) BL: blastocyst.

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

Almost two-thirds of oocyte/embryo recipient thaw cycles where a blastocyst was transferred used vitrified embryos, compared with just over 8% of cycles where a cleavage embryo was transferred. Overall, the difference in the live delivery rate of oocyte/embryo recipient thaw cycles was 8.1 percentage points for slow frozen and vitrified embryos (15.3% and 23.4% 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, 2011

	Stage of embryo development					
	Cleavage embryo		Blastocyst		All	
Stage/outcome of treatment	Slow freezing	Vitrification	Slow freezing	Vitrification	Slow freezing	Vitrification
Embryo transfer cycles	454	41	241	425	695	466
Clinical pregnancies	93	12	55	137	148	149
Live deliveries	69	7	37	102	106	109
Clinical pregnancies per embryo transfer cycle (%)	*20.5*	*29.3*	*22.8*	*32.2*	*21.3*	*32.0*
Live deliveries per embryo transfer cycle (%)	*15.2*	*17.1*	*15.4*	*24.0*	*15.3*	*23.4*

4 Pregnancy and birth outcomes following autologous and recipient embryo transfer cycles in 2011

4.1 Clinical pregnancies

Clinical pregnancies overview

Of the 53,688 autologous and recipient embryo transfer cycles undertaken in Australian and New Zealand fertility centres, 15,284 resulted in a clinical pregnancy. Of these, 13,760 (90.0%) were reported from fertility centres in Australia and 1,524 (10.0%) from New Zealand centres. Clinical pregnancies that resulted from other cycles are described in Chapter 5.

Of the 15,284 clinical pregnancies, over three-quarters (77.0%) resulted in a delivery and 22.1% resulted in early pregnancy loss (less than 20 weeks gestation and less than 400 grams birthweight). The outcomes of 135 (0.9%) clinical pregnancies were not known because women could not be followed up or contacted by fertility centres.

Nearly three-quarters (74.5%) of clinical pregnancies followed SET, while one-quarter followed DET (25.0%). Just 0.5% of clinical pregnancies followed the transfer of three or more embryos.

Fetal hearts by number of embryos transferred

Of the 15,284 clinical pregnancies, 81.1% had one fetal heart (single fetus) detected, 6.6% had multiple fetal hearts (multiple fetuses) detected and 10.4% had no fetal heart detected at the time of ultrasound (Table 27). Multiple fetuses are closely related to the number of embryos transferred in ART treatment. Two fetal hearts were detected in 18.6% of clinical pregnancies following DET cycles and in 2.3% of clinical pregnancies following SET cycles (Table 27).

Table 27: Clinical pregnancies by number of fetal hearts and number of embryos transferred, Australia and New Zealand, 2011

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)]	1,128	9.9	452	11.8	13	17.8	1,593	10.4
1	9,776	85.9	2,564	67.0	53	72.6	12,393	81.1
2	258	2.3	711	18.6	5	6.8	974	6.4
3 or 4	6	0.1	23	0.6	0	0.0	29	0.2
Not stated	216	1.9	77	2.0	2	2.7	295	1.9
Total	**11,384**	**100.0**	**3,827**	**100.0**	**73**	**100.0**	**15,284**	**100.0**

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

Early pregnancy loss

There were 3,380 early pregnancy losses (less than 20 weeks gestation and less than 400 grams birthweight) following embryo transfers, representing 22.1% of clinical pregnancies (Table 28).

Pregnancies following SET result in a lower rate of early pregnancy loss (20.8%) and higher delivery rate (78.3%) than pregnancies following DET and three or more embryos (Table 28).

Table 28: Early pregnancy losses by pregnancy outcome and number of embryos transferred, Australia and New Zealand, 2011

Pregnancy outcome	Number of embryos transferred							
	One		Two		Three or more		All	
	Number	Per cent	Number	Per cent	Number	Per cent	Number	Per cent
Early pregnancy loss	2,373	20.8	974	25.5	33	45.2	3,380	22.1
Miscarriage	*2,170*	*19.1*	*867*	*22.7*	*30*	*41.1*	*3,067*	*20.1*
Termination	*72*	*0.6*	*27*	*0.7*	*0*	*0.0*	*99*	*0.6*
Ectopic	*131*	*1.2*	*80*	*2.1*	*3*	*4.1*	*214*	*1.4*
Delivery	8,914	78.3	2,815	73.6	40	54.8	11,769	77.0
Not stated	97	0.9	38	1.0	0	0.0	135	0.9
Total	**11,384**	**100.0**	**3,827**	**100.0**	**73**	**100.0**	**15,284**	**100.0**

4.2 Deliveries

There were 11,769 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, 98.7% (11,618) 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, 2011

Pregnancy outcome	Autologous				Oocyte /embryo recipient		All	
	Fresh		Thaw					
	Number	Per cent	Number	Per cent	Number	Per cent	Number	Per cent
Live delivery	6,928	98.6	4,291	99.0	399	98.8	11,618	98.7
< 37 weeks	*923*	*13.1*	*501*	*11.6*	*83*	*20.5*	*1,507*	*12.8*
≥ 37 weeks	*6,005*	*85.4*	*3,790*	*87.4*	*316*	*78.2*	*10,111*	*85.9*
Fetal death (stillbirth)[(a)]	77	1.1	34	0.8	5	1.2	116	1.0
Not stated	24	0.3	11	0.3	0	0.0	35	0.3
Total	**7,029**	**100.0**	**4,336**	**100.0**	**404**	**100.0**	**11,769**	**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 11,769 deliveries, 6.9% had multiple deliveries (Table 30), a lower proportion than in 2010 (7.9%) (Macaldowie et al. 2012). By comparison, the proportion of multiple deliveries in Australia from all conceptions in 2010 was 1.6% (Li et al. 2012).

Twin deliveries accounted for 6.8% of deliveries following embryo transfer cycles in 2011. Of twin deliveries, three-quarters were from DET (593/798) and one-quarter were from SET cycles (201/798). Of the 2,815 deliveries following DET cycles, 21.1% were twins, markedly higher than the proportion following SET cycles (2.3%) (Table 30).

Table 30: Deliveries by gestation and number of embryos transferred, Australia and New Zealand, 2011

Gestation	One embryo		Two embryos		Three or more embryos		Total	
	Number	Per cent	Number	Per cent	Number	Per cent	Number	Per cent
Singleton	8,709	97.7	2,210	78.5	36	90.0	10,955	93.1
Multiple	*205*	*2.3*	*605*	*21.5*	*4*	*10.0*	*814*	*6.9*
Twin	201	2.3	593	21.1	4	10.0	798	6.8
Higher order multiple	4	0.0	12	0.4	0	0.0	16	0.1
Total	**8,914**	**100.0**	**2,815**	**100.0**	**40**	**100.0**	**11,769**	**100.0**

Deliveries by maternal age

The average age of women at the time of delivery was 35.1. This is five years older than the average age (30) of women who gave birth in Australia in 2010 (Li et al. 2012).

Women aged 40 or older had a lower proportion (5.1%) of multiple deliveries compared with women aged under 35 (7.3%) and women aged 35–39 (7.2%). Of deliveries following DET, the proportion of multiple deliveries was higher for women aged under 35 (29.6%) compared with women aged 35–39 (22.4%) and women aged 40 or older (10.5%) (Table 31).

Table 31: Deliveries by gestation and maternal age group, Australia and New Zealand, 2011

	Age group (years)[a]								
	< 35			35–39			≥ 40		
Gestation	**SET[b]**	**DET[c]**	**All[d]**	**SET[b]**	**DET[c]**	**All[d]**	**SET[b]**	**DET[c]**	**All[d]**
					Number				
Singleton	4,248	642	4,892	3,314	878	4,197	1,147	690	1,866
Multiple	*117*	*270*	*388*	*71*	*254*	*325*	*17*	*81*	*101*
Twin	114	265	380	70	249	319	17	79	99
Higher order multiple	3	5	8	1	5	6	0	2	2
Total	**4,365**	**912**	**5,280**	**3,385**	**1,132**	**4,522**	**1,164**	**771**	**1,967**
					Per cent				
Singleton	97.3	70.4	92.7	97.9	77.6	92.8	98.5	89.5	94.9
Multiple	*2.7*	*29.6*	*7.3*	*2.1*	*22.4*	*7.2*	*1.5*	*10.5*	*5.1*
Twin	2.6	29.1	7.2	2.1	22.0	7.1	1.5	10.2	5.0
Higher order multiple	0.1	0.5	0.2	0.0	0.4	0.1	0.0	0.3	0.1
Total	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**

(a) Age at time of delivery.
(b) SET: single embryo transfer.
(c) DET: double embryo transfer.
(d) Included three or more embryos.

Caesarean section

Almost half (49.5%) 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 2010 (31.6%) (Li et al. 2012). 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: 38.8% of women aged less than 30 years had a caesarean section compared with 76.3% of women aged 45 years or older (Table 32).

The caesarean section rate varied by plurality, with 47.3% for singleton deliveries, 78.8% for twin deliveries and 100% for triplet deliveries.

Table 32: Deliveries by method of delivery and maternal age group, Australia and New Zealand, 2011

	Age group (years)[a]					
Method of delivery	**< 30**	**30–34**	**35–39**	**40–44**	**≥ 45**	**Total**
			Number			
Caesarean section	517	1,745	2,299	1,128	135	5,824
Other	812	2,188	2,198	651	42	5,891
Not stated	4	14	25	11	0	54
Total	**1,333**	**3,947**	**4,522**	**1,790**	**177**	**11,769**
			Per cent			
Caesarean section	38.8	44.2	50.8	63.0	76.3	49.5
Other	60.9	55.4	48.6	36.4	23.7	50.1
Not stated	0.3	0.4	0.6	0.6	0.0	0.5
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

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

There were 12,599 babies born to women who had autologous and recipient embryo transfer cycles— 89.6% (11,294) were reported from fertility centres in Australia and 10.4% (1,305) from fertility centres in New Zealand. Of the 12,599 babies, 87.0% were singletons, 12.7% were twins and 0.4% were triplets. There were 12,420 liveborn babies (98.6%). The birth status was not reported for 0.3% of babies.

Sex distribution in liveborn babies

There were 6,446 (51.9%) liveborn male babies, 5,936 (47.8%) liveborn female babies and 38 (0.3%) liveborn babies where sex was not stated. For the 12,382 liveborn babies where the baby's sex was stated, the sex ratio was 108.6 male babies for every 100 female babies, higher than the ratio for all Australian liveborn babies born in 2010 (104.8) (Li et al. 2012). The difference in sex ratio between ART liveborn babies and all Australian liveborn babies is likely related to the ART procedures as sex selection is not permitted in Australia.

Liveborn babies following cleavage embryo transfers had a sex ratio of 96.8 male babies for every 100 female babies. In comparison, liveborn babies following blastocyst transfers had a sex ratio of 114.6 male babies for every 100 female babies. In comparison, in 2010, liveborn babies following cleavage embryo transfers had a sex ratio of 100.1 male babies for every 100 female babies, and liveborn babies following blastocyst transfers had a sex ratio of 114.3 male babies for every 100 female babies (Macaldowie et al. 2012).

Gestational age of babies

The average gestational age of babies born following autologous and recipient embryo transfer cycles was 37.9 weeks (Table 33). This is lower than the average gestational age of 38.7 weeks for all babies born in Australia in 2010 (Li et al. 2012).

Over 17% of babies were preterm (less than 37 weeks gestation), which was markedly higher than the proportion of preterm babies (8.3%) born in Australia in 2010 (Li et al. 2012). The average gestational age of ART singletons was 38.4 weeks, marginally shorter than the average gestational age of 38.9 weeks for all singletons born in Australia in 2010 (Li et al. 2012). The average gestational age for ART twins was 34.7 weeks, marginally less than the average gestational age of 35.1 weeks for all twins born in Australia in 2010 (Li et al. 2012).

Table 33: Babies by gestational age and plurality, Australia and New Zealand, 2011

Gestational age (weeks)	Singletons		Twins		Higher order multiples		Total	
	Number	Per cent	Number	Per cent	Number	Per cent	Number	Per cent
Mean	38.4		34.7		31.9		37.9	
≤ 27	149	1.4	94	5.9	0	0.0	243	1.9
28–31	107	1.0	126	7.9	21	43.8	254	2.0
32–36	828	7.6	822	51.5	27	56.3	1,677	13.3
≥ 37	9,871	90.1	554	34.7	0	0.0	10,425	82.7
Total	**10,955**	**100.0**	**1,596**	**100.0**	**48**	**100.0**	**12,599**	**100.0**
≤ 36	1,084	9.9	1,042	65.3	48	100.0	2,174	17.3

Figure 8 shows the distribution of gestational age for singletons and twins born to women who had autologous and recipient embryo transfer cycles in 2011. Singletons following SET cycles had a lower proportion of preterm birth (9.4%) than singletons following DET cycles (11.7%). The overall proportions of preterm singletons (9.9%) and twins (65.3%) born to women who had embryo transfer cycles in 2011 were higher than the overall proportions of preterm singletons and twins born in Australia in 2010 (6.7% and 56.7% respectively) (Li et al. 2012).

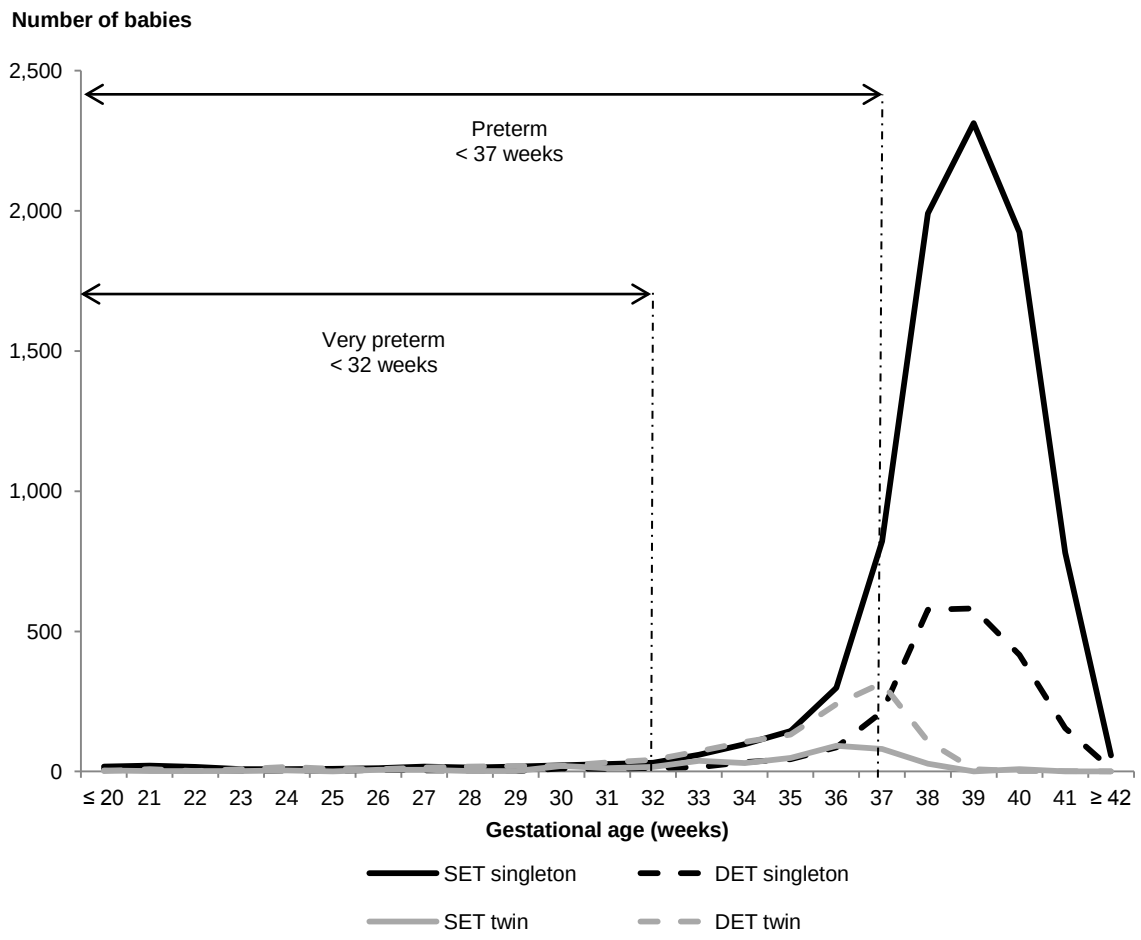

Figure 8: Number of babies born following embryo transfer cycles by gestational age, Australia and New Zealand, 2011

Birthweight of liveborn babies

The average birthweight for liveborn babies to women who had autologous and recipient embryo transfer cycles was 3,207 grams. More than 13% of these babies were low birthweight (less than 2,500 grams) (Table 34).

The average birthweight was 3,342 grams and 2,316 grams for liveborn ART singletons and twins respectively. These were lower than the mean birthweight of all liveborn singletons (3,401 grams) and twins (2,390 grams) in Australia in 2010 (Li et al. 2012). Low birthweight was reported for 6.1% of liveborn singletons following SET, lower than the 7.9% of those following DET.

Table 34: Liveborn babies by birthweight group and plurality, Australia and New Zealand, 2011

	Singletons				
Birthweight (grams)	SET[(a)]	DET[(b)]	Twins	Higher order multiples	Total[(c)]
			Number		
< 1,000	47	12	54	2	115
1,000–1,499	40	20	111	19	190
1,500–1,999	97	36	208	12	355
2,000–2,499	338	104	505	11	961
2,500–2,999	1,350	366	489	2	2,215
3,000–3,499	3,122	780	142	0	4,051
3,500–3,999	2,559	598	21	0	3,190
≥ 4,000	962	225	2	0	1,193
Not stated	91	32	27	0	150
Total	**8,606**	**2,173**	**1,559**	**46**	**12,420**
< 2,500	*522*	*172*	*878*	*44*	*1,621*
			Per cent		
< 1,000	0.5	0.6	3.5	4.3	0.9
1,000–1,499	0.5	0.9	7.1	41.3	1.5
1,500–1,999	1.1	1.7	13.3	26.1	2.9
2,000–2,499	3.9	4.8	32.4	23.9	7.7
2,500–2,999	15.7	16.8	31.4	4.3	17.8
3,000–3,499	36.3	35.9	9.1	0.0	32.6
3,500–3,999	29.7	27.5	1.3	0.0	25.7
≥ 4,000	11.2	10.4	0.1	0.0	9.6
Not stated	1.1	1.5	1.7	0.0	1.2
Total	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**
< 2,500	*6.1*	*7.9*	*56.3*	*95.7*	*13.1*

(a) SET: single embryo transfer.

(b) DET: double embryo transfer.

(c) Included singletons following transfer of three or more embryos.

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 182 reported perinatal deaths, including 143 fetal deaths and 39 neonatal deaths. The perinatal mortality rate in 2011 was 14.4 deaths per 1,000 births (Table 35), which was higher than the rate of 9.3 per 1,000 births for all births in Australia in 2010 (Li et al. 2012). Singletons had a lower perinatal mortality rate (12.0 deaths per 1,000 births) compared with multiples (30.4 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 2011, information relating to pregnancy outcomes was not stated for 0.9% of clinical pregnancies.

Table 35: Perinatal mortality of babies by type of death and plurality, Australia and New Zealand, 2011

Birth outcome	Singletons	Multiples	Total
		Number	
Fetal death (stillbirth)	106	37	143
Neonatal death	26	13	39
Perinatal death[(a)]	132	50	182
All births	**10,955**	**1,644**	**12,599**
All live births	**10,815**	**1,605**	**12,420**
		Rate[(b)]	
Fetal deaths per 1,000 births	*9.7*	*22.5*	*11.4*
Neonatal deaths per 1,000 live births	*2.4*	*8.1*	*3.1*
Perinatal deaths per 1,000 births	*12.0*	*30.4*	*14.4*

(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 Other cycle types, procedures and treatment complications in 2011

5.1 Gestational surrogacy cycles

Gestational 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 parent(s). 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 177 gestational surrogacy cycles in 2011, including 131 gestational carrier cycles and 46 cycles undertaken by intended parents. Among the 131 gestational carrier cycles, 34 (26.0%) resulted in a clinical pregnancy and 21 (16.0%) resulted in a delivery. Of all 23 babies born to gestational carriers (21 singletons and one set of twins), 22 were liveborn and one singleton's outcome was unknown.

5.2 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 2011, there were 11 GIFT cycles that resulted in one singleton pregnancy and one liveborn baby.

5.3 Assisted hatching

Assisted hatching is an ART procedure where the outer layer of the embryo, the zona pellucida, is either thinned or perforated in the laboratory to aid 'hatching' of the embryo.

There were 2,733 assisted hatching cycles reported in 2011. Of these, 2,475 (90.6%) had embryos transferred, resulting in 719 (26.3%) clinical pregnancies and 539 (19.7%) live deliveries. There were 585 births following assisted hatching cycles, including 504 singletons, 78 twins and 3 triplets.

5.4 Preimplantation genetic diagnosis

Preimplantation genetic diagnosis (PGD) is a procedure in which one or more cells are removed from the embryo and analysed for chromosomal disorders or genetic diseases before embryo transfer. In 2011, PGD was performed in 1,182 cycles, representing 2.0% of cycles in which embryos were created or thawed. Most PGD cycles (908/1,182) were fresh cycles (Table 36).

Of the 1,182 PGD cycles, 65.7% (777) had embryos transferred and resulted in 262 (22.2%) clinical pregnancies and 210 (17.8%) live deliveries.

Table 36: Number of cycles with PGD by type of embryo, Australia and New Zealand, 2011

	Stage of treatment		
Type of embryo	Number of cycles with embryo created/thawed	Number of cycles with PGD	PGD per cycle with embryo fertilised/thawed (%)
Fresh	35,077	908	2.6
Thawed	23,200	274	1.2
Total	**58,277**	**1,182**	**2.0**

5.5 Ovarian hyperstimulation syndrome

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. There were 229 OHSS cases reported in 2011 that were admitted to hospital. It is possible this information is under-reported as there is no nationally agreed definition for OHSS.

A higher number of oocytes retrieved at OPU is associated with OHSS (Table 37).

Table 37: Number of cycles with OPU performed and OHSS by number of oocytes collected, Australia and New Zealand, 2011

	Number of oocytes collected						
	None	1–4	5–9	10–14	15–19	≥ 20	All
Cycles with OHSS	0	3	27	40	56	103	229
Cycles with OPU	756	9,142	13,655	8,507	3,895	2,390	38,345
OHSS per OPU cycle (%)	0.0	0.0	0.2	0.5	1.4	4.3	0.6

6 Donor sperm insemination cycles in 2011

Donor sperm insemination (DI) covers a range of techniques of placing sperm into the female genital tract using donated sperm from a man who is not 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 2011, there were 2,538 DI cycles reported, which included 27.7% (703) undertaken with controlled ovarian hyperstimulation and 72.3% (1,835) undertaken in unstimulated cycles. Of all DI cycles, 14.3% resulted in a clinical pregnancy and 11.5% resulted in a live delivery (Table 38).

The average age of women who had a DI cycle was 35.2. The clinical pregnancy rate and live delivery rate decreased with advancing women's age. Of the DI cycles in women aged under 30, 16.8% resulted in a live delivery, compared with 3.7% of DI cycles in women aged 40 or older (Table 38).

Table 38: Outcomes of DI cycles by women's age group, Australia and New Zealand, 2011

	Age group (years)[(a)]				
Stage/outcome of treatment	**< 30**	**30–34**	**35–39**	**≥ 40**	**Total**
DI cycles	380	698	972	488	2,538
Clinical pregnancies	73	122	138	31	364
Live deliveries	64	102	107	18	291
Clinical pregnancies per DI cycle (%)	19.2	17.5	14.2	6.4	14.3
Live deliveries per DI cycle (%)	16.8	14.6	11.0	3.7	11.5
Live deliveries per clinical pregnancy (%)	87.7	83.6	77.5	58.1	79.9

(a) Age at start of a treatment cycle.

Clinical pregnancies following DI cycles

Of the 364 clinical pregnancies following DI cycles, 81.0% resulted in a delivery, 17.6% ended in early pregnancy loss (including 17.0% miscarriages, 0.3% ectopic/heterotopic pregnancies and 0.3% terminations/reductions), and 1.4% were unknown pregnancy outcomes. Of the 295 deliveries, 279 (94.6%) were singleton deliveries and 16 (5.4%) were multiple deliveries including one set of triplets.

Perinatal outcomes of babies

There were 312 babies born to women who had DI treatment, including 307 liveborn babies and five stillborn babies. Of these liveborn babies, 43 (14.0%) were born preterm (less than 37 weeks gestation). The mean birthweight of liveborn babies following DI treatment was 3,290 grams. This was higher than the mean birthweight (3,207 grams) of liveborn babies following embryo transfer cycles. Thirty liveborn babies (9.8%) were born with low birthweight (less than 2,500 grams).

7 Trends in ART treatment and outcomes: 2007–2011

This section includes autologous cycles, donation/recipient cycles, surrogacy cycles and GIFT cycles undertaken in Australia and New Zealand from 2007 to 2011. It does not include DI cycles.

ART treatment and outcomes

In 2011, 42,629 initiated fresh ART treatment cycles were undertaken in Australia and New Zealand. This is an increase of 9.8% on 2010 and an increase of 19.9% on 2007 (Table 39). Between 2007 and 2011, the pregnancy and live delivery rates per initiated fresh cycle ranged from 21.9% to 23.8% and from 16.7% to 18.3% respectively (Table 39).

Table 39: Number of fresh cycles by stage/outcome of treatment, Australia and New Zealand, 2007 to 2011

Stage/outcome of treatment	2007	2008	2009	2010	2011
Initiated cycles[(a)]	35,566	39,309	45,400	38,796	42,629
Embryo transfers	27,240	30,112	34,765	29,775	31,837
Clinical pregnancies	8,355	9,047	10,501	9,236	9,346
Live deliveries	6,498	6,935	8,009	7,014	7,117
Clinical pregnancies per initiated cycle (%)	23.5	23.0	23.1	23.8	21.9
Live deliveries per initiated cycle (%)	18.3	17.6	17.6	18.1	16.7

(a) Included autologous cycles, oocyte donation cycles, oocyte/embryo recipient cycles, GIFT cycles, and surrogacy cycles.

In comparison, 23,718 autologous thaw cycles was reported in 2011, an increase of 3.2% on 2010 and an increase of 11.6% on 2007 (Table 40). The live delivery rate following thaw cycles have increased from 15.9% in 2007 to 19.1% in 2011 (Table 40).

Table 40: Number of thaw cycles by stage/outcome of treatment, Australia and New Zealand, 2007 to 2011

Stage/outcome of treatment	2007	2008	2009	2010	2011
Initiated cycles[(a)]	21,251	22,620	25,141	22,978	23,718
Embryo transfers	19,380	20,533	22,555	20,805	21,974
Clinical pregnancies	4,460	4,936	5,474	5,516	5,973
Live deliveries	3,376	3,698	4,118	4,155	4,523
Clinical pregnancies per initiated cycle (%)	21.0	21.8	21.8	24.0	25.2
Live deliveries per initiated cycle (%)	15.9	16.3	16.4	18.1	19.1

(a) Included autologous cycles, oocyte/embryo recipient cycles, and surrogacy cycles.

Multiple gestation deliveries

The decline in multiple gestation deliveries resulting from ART treatment continued in 2011. The proportion of multiple deliveries decreased from 10.0% in 2007 to 6.9% in 2011 (Table 41). The decline is primarily the result of increasing uptake of SET (Table 44).

Table 41: Number of deliveries following ART treatment by gestation, Australia and New Zealand, 2007 to 2011

	2007		2008		2009		2010		2011	
Gestation	Number	Per cent	Number	Per cent	Number	Per cent	Number	Per cent	Number	Per cent
Singleton	8,990	90	9,880	91.6	11,272	91.8	10,382	92.1	10,977	93.1
Multiple	*994*	*10.0*	*903*	*8.4*	*1,006*	*8.2*	*890*	*7.9*	*815*	*6.9*
Twin	978	9.8	879	8.2	987	8	874	7.8	799	6.8
Higher order multiple	16	0.2	24	0.2	19	0.2	16	0.1	16	0.1
Total[(a)]	9,984	100	10,783	100	12,278	100	11,272	100	11,792	100

(a) Includes cycles in which gestation was unknown.

Women's age for autologous cycles

While the majority of autologous cycles undertaken between 2007 and 2011 were in women aged 30 to 40, the proportion of autologous cycles in women aged 40 and older increased from 21.4% in 2007 to 25.3% in 2011. The average age of women having autologous cycles increased from 35.5 in 2007 to 35.9 in 2011 (Table 42).

Table 42: Number of fresh and thaw autologous cycles by women's age group, Australia and New Zealand, 2007 to 2011

	2007		2008		2009		2010		2011	
Age group (years)[(a)]	Number	Per cent	Number	Per cent	Number	Per cent	Number	Per cent	Number	Per cent
Mean	35.5		35.7		35.8		35.8		35.9	
< 30	6,021	11.2	6,373	10.8	7,303	10.9	6,469	11	6,720	10.7
30–34	15,376	28.6	16,154	27.5	17,979	26.7	15,641	26.7	17,129	27.2
35–39	20,799	38.7	22,572	38.4	25,953	38.6	22,224	37.9	23,314	37.0
40–44	10,680	19.9	12,663	21.6	14,853	22.1	13,194	22.5	14,670	23.3
≥ 45	819	1.5	977	1.7	1,141	1.7	1,046	1.8	1,231	2.0
Not stated	1	0	1	0	0	0	0	0	0	0.0
Total	**53,696**	**100**	**58,740**	**100**	**67,229**	**100**	**58,574**	**100**	**63,064**	**100**

(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, from 57.2% of cycles in 2007 to 63.2% in 2011 (Table 43). The number and proportion of blastocyst transfer cycles increased from 33.7% in 2007 to 57.7% in 2011 (Table 43).

Table 43: Number of embryo transfer cycles by treatment type, Australia and New Zealand, 2007 to 2011

	2007		2008		2009		2010		2011	
Treatment type/procedure	Number	Per cent	Number	Per cent	Number	Per cent	Number	Per cent	Number	Per cent
Fertilisation procedure										
IVF	18,774	40.4	19,761	39.1	21,790	38	18,237	36.1	18,873	35.1
ICSI	26,611	57.2	29,864	59	34,489	60.2	31,564	62.4	34,006	63.2
Not stated	1,128	2.4	944	1.9	1,028	1.8	769	1.5	922	1.7
Stage of embryo development										
Cleavage stage	30,846	66.3	29,352	58.0	28,780	50.2	24,200	47.9	22,760	42.3
Blastocyst	15,667	33.7	21,217	42.0	28,527	49.8	26,370	52.1	31,041	57.7

Note: The 2007 and 2008 ANZARD data have been updated to correct the previously reported misclassification error of cleavage and blastocyst transfer. The numbers and percentages of cleavage embryo and blastocyst transfer cycles for 2007 and 2008 are different from previous annual reports.

Number of embryos transferred per embryo transfer cycle

There has been an ongoing shift in ART practice to SET cycles in Australia and New Zealand. In 2007, the proportion of SET cycles accounted for 63.7% of embryo transfer cycles and by 2011 this proportion had increased to 73.2% (Table 44).

Table 44: Proportion of embryo transfer cycles by number of embryos transferred, Australia and New Zealand, 2007 to 2011

Number of embryos transferred	2007	2008	2009	2010	2011
One embryo	63.7	67.8	69.7	69.6	73.2
Two embryos	35.7	31.6	29.6	29.5	26.0
Three or more embryos	0.6	0.6	0.7	0.8	0.7

8 Women undertaking autologous treatment in 2011

ANZARD was upgraded 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 over time.

This section presents the number of women who underwent autologous ART treatment in 2011. 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.

Women who undertook autologous treatment

There were 34,490 women who undertook 63,064 autologous fresh and/or thaw cycles in Australia and New Zealand in 2011. Of these women, 31,111 had treatment in Australia, 3,390 in New Zealand, and 11 had treatment in both Australia and New Zealand.

On average, 1.8 fresh and/or thaw cycles per woman were undertaken in 2011, with more cycles per woman in Australia (1.9 cycles per woman) than in New Zealand (1.4 cycles per woman). More than half (50.7%) of the women in Australia had one autologous treatment cycle compared with 68.9% of women in New Zealand. In line with this, 9.6% of women in Australia had four or more cycles in 2011 compared with 1.8% of women in New Zealand (Table 45).

Table 45: Women undertaking autologous fresh and/or thaw cycles by number of cycles, Australia and New Zealand, 2011

	Australia		New Zealand		All	
Number of cycles	**Number**	**Per cent**	**Number**	**Per cent**	**Number**	**Per cent**
One	15,781	50.7	2,337	68.9	18,100	52.5
Two	8,320	26.7	791	23.3	9,115	26.4
Three	4,028	12.9	202	6.0	4,233	12.3
Four or more	2,982	9.6	60	1.8	3,042	8.8
Total	**31,111**	**100.0**	**3,390**	**100.0**	**34,490**	**100.0**

Note: Only women who undertook cycles in 2011 are included.

Women who undertook autologous fresh cycles

There were 40,696 fresh cycles undertaken by 28,053 women in Australia and New Zealand in 2011, an average of 1.5 fresh cycles per woman. Younger women had fewer fresh cycles with about 78% of women aged under 30 having only one autologous fresh cycle. This partly reflects the higher success rate per initiated fresh autologous cycle among younger women, and the fact that younger women tend to have more cryopreserved embryos available for subsequent thaw cycles. Less than 1% of women aged under 30 had four or more cycles. This proportion increased to 5.6% for women aged 40 to 44 and 7.4% for women aged 45 or older (Table 46).

Table 46: Women undertaking autologous fresh cycles by number of cycles, Australia and New Zealand, 2011

	Age group (years)[a]					
Number of cycles	**< 30**	**30–34**	**35–39**	**40–44**	**≥ 45**	**All**
			Number			
One	2,676	5,728	6,852	3,658	280	19,194
Two	630	1,555	2,317	1,590	108	6,200
Three	112	362	706	637	48	1,865
Four or more	18	117	277	347	35	794
Total	**3,436**	**7,762**	**10,152**	**6,232**	**471**	**28,053**
			Per cent			
One	77.9	73.8	67.5	58.7	59.4	68.4
Two	18.3	20.0	22.8	25.5	22.9	22.1
Three	3.3	4.7	7.0	10.2	10.2	6.6
Four or more	0.5	1.5	2.7	5.6	7.4	2.8
Total	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**

(a) Age at start of first autologous fresh cycle in 2011.

Women who undertook autologous thaw cycles

There were 22,368 thaw cycles undertaken by 15,063 women in Australia and New Zealand in 2011, representing an average of 1.5 thaw cycles per woman. The proportion of women who had only one thaw cycle increased from 65.4% for women aged under 30 to 81.5% in women aged 45 or older (Table 47). 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 46 and 47).

Table 47: Women undertaking autologous thaw cycles by number of cycles, Australia and New Zealand, 2011

	Age group (years)[(a)]					
Number of cycles	**< 30**	**30–34**	**35–39**	**40–44**	**≥ 45**	**All**
			Number			
One	1,101	3,018	3,799	1,965	203	10,086
Two	396	1,082	1,338	542	33	3,391
Three	127	323	440	171	11	1,072
Four or more	60	175	189	88	2	514
Total	**1,684**	**4,598**	**5,766**	**2,766**	**249**	**15,063**
			Per cent			
One	65.4	65.6	65.9	71.0	81.5	67.0
Two	23.5	23.5	23.2	19.6	13.3	22.5
Three	7.5	7.0	7.6	6.2	4.4	7.1
Four or more	3.6	3.8	3.3	3.2	0.8	3.4
Total	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**

(a) Age at start of first autologous thaw cycle in 2011.

9 Cumulative success rates for women undertaking autologous treatment 2009–2011

Previous chapters in this report have measured the outcomes of ART treatment on a per cycle basis. A limitation of this measurement is that it does not account for the potential need for multiple ART cycles to achieve a live birth. In contrast, cumulative success (clinical pregnancy and live delivery) rates are a longitudinal measure of ART treatment outcomes over a number of treatment cycles or over a specific time period, and provide more comprehensive information on the efficacy of ART treatment than cycle-based measures.

This chapter presents the cumulative success rates for a cohort of women who started their first autologous fresh ART treatment cycle during 2009–2011. Women in this cohort were followed from the start of their first fresh cycle through subsequent fresh and thaw cycles until 31 December 2011 or delivery of a liveborn baby before 31 October 2012. Women without a live delivery following an ART treatment cycle during 2009–2011 might or might not have returned for subsequent treatment cycles during this period. These women might have had additional treatment cycles after 2011 and their treatment information and resulting outcomes will be captured in subsequent annual reports. Therefore, in this dynamic cohort of women undergoing their first autologous fresh ART treatment during 2009–2011, the cumulative success rates may increase over time as more women return for treatment at a later date

The cumulative clinical pregnancy rate was calculated using total number of clinical pregnancies following fresh and frozen/thawed embryo transfer cycles divided by total number of women. The cumulative live delivery rate was calculated using total number of live deliveries following either fresh or frozen/thawed embryo transfer cycles divided by total number of women.

The following example demonstrates how the cumulative live delivery rate is calculated.

- There are 120 women who undertake their first fresh cycle. Of these, 36 women have live delivery and 84 women do not. The cumulative live delivery rate after the first cycle is 30.0% (36/120).
- If 80 of the remaining 84 women undertake their second fresh or thaw cycle, and 12 women have a live delivery and 68 women do not, the cumulative live delivery rate after two cycles is 40.0% ((36+12)/120).
- If 60 of the remaining 68 women undertake their third fresh or thaw cycle, and 8 women have a live delivery and 52 women do not, the cumulative live delivery rate after three cycles is 46.7% ((36+12+8)/120).
- If 45 of the remaining 52 women undertake their fourth fresh or thaw cycle, and 5 women have a live delivery and 40 women do not, the cumulative live delivery rate after four cycles is 50.8% ((36+12+8+5)/120).

Continuing the above calculation, the cumulative live delivery rate can be measured after five, six or even ten cycles. Note, that the above example only considers live deliveries following ART treatment. It does not include live deliveries following other fertility

treatment or spontaneous conception. For example, women who did not return for ART treatment and may then have conceived spontaneously and had a live delivery will not be captured in this data.

Number of cycles by women's age group

For cycles where the SLK was available during 2009–2011, 44,668 women in Australia and New Zealand undertook their first autologous fresh cycle (Table 48). By the end of 2011, 100,820 cycles were undertaken by these women, giving an average of 2.3 cycles per woman. It is important to note that these only included cycles undertaken during 2009–2011.

More than 90% of women had less than five cycles during the three year period.

Table 48: Number of cycles by women's age group, Australia and New Zealand, 2009–2011

	Age group (years)[(a)]					
Number of cycles	**< 30**	**30–34**	**35–39**	**40–44**	**≥ 45**	**All**
			Number			
One	3,280	6,339	6,698	3,165	288	19,770
Two	1,722	3,315	4,046	2,019	127	11,229
Three	844	1,731	2,244	1,207	51	6,077
Four	461	947	1,253	669	38	3,368
Five	240	482	679	397	16	1,814
Six	130	258	388	219	10	1,005
Seven	61	160	212	140	5	578
Eight	42	107	112	88	4	353
Nine	23	51	78	56	2	210
Ten or more	24	48	102	88	2	264
Total	**6,827**	**13,438**	**15,812**	**8,048**	**543**	**44,668**
			Per cent			
One	48.0	47.2	42.4	39.3	53.0	44.3
Two	25.2	24.7	25.6	25.1	23.4	25.1
Three	12.4	12.9	14.2	15.0	9.4	13.6
Four	6.8	7.0	7.9	8.3	7.0	7.5
Five	3.5	3.6	4.3	4.9	2.9	4.1
Six	1.9	1.9	2.5	2.7	1.8	2.2
Seven	0.9	1.2	1.3	1.7	0.9	1.3
Eight	0.6	0.8	0.7	1.1	0.7	0.8
Nine	0.3	0.4	0.5	0.7	0.4	0.5
Ten or more	0.4	0.4	0.6	1.1	0.4	0.6
Total	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**

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

Note: Some women may return for additional treatments after 2011, so the number of subsequent treatment cycles may increase over time.

Cumulative pregnancy and live delivery rates

The overall cumulative pregnancy rate was 54.5% (Table 49). Women aged less than 30 and 30–34 had higher cumulative pregnancy rates (64.3% and 66.1% respectively) than older women. For women aged 45 or older, the cumulative pregnancy rate was 3.5%.

Similarly, the cumulative live delivery rate decreased with advancing women's age from over 50% for women aged less than 35, to 40.7% for women aged 35–39, 16.4% for women aged 40–44 and 1.7% for women aged 45 or older (Table 49).

Table 49: Cumulative pregnancy and live delivery rates by women's age group, Australia and New Zealand, 2009–2011

	Age group (years)[(a)]					
Number of cycles	**< 30**	**30–34**	**35–39**	**40–44**	**≥ 45**	**All**
Number of women	6,827	13,438	15,812	8,048	543	44,668
Number of pregnancies	4,391	8,883	8,676	2,363	19	24,332
By fresh embryo transfer	*3,139*	*6,514*	*6,438*	*1,843*	*18*	*17,952*
By thawed embryo transfer	*1,252*	*2,369*	*2,238*	*520*	*1*	*6,380*
Number of live deliveries	3,582	7,222	6,443	1,323	9	18,579
By fresh embryo transfer	*2,598*	*5,349*	*4,786*	*1,036*	*8*	*13,777*
By thawed embryo transfer	*984*	*1,873*	*1,657*	*287*	*1*	*4,802*
Cumulative pregnancy rate	*64.3*	*66.1*	*54.9*	*29.4*	*3.5*	*54.5*
Cumulative live delivery rate	*52.5*	*53.7*	*40.7*	*16.4*	*1.7*	*41.6*

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

Note: Some women may return for subsequent treatment after 2011, so the cumulative pregnancy and live delivery rates may increase over time.

Cumulative live delivery rate by number of cycles

The cumulative live delivery rate was 21.1% after the first cycle, and increased to 31.1% after two cycles, 36.0% after three cycles, 38.6% after four cycles, and 40% after five cycles (Table 50). The cumulative live delivery rate did not increase markedly with additional treatments after five cycles.

Table 50: Cumulative live delivery rate by women's age group and number of cycles, Australia and New Zealand, 2009-2011

	Age group (years)[(a)]					
	< 30	**30–34**	**35–39**	**40–44**	**≥ 45**	**All**
Number of women	6,827	13,438	15,812	8,048	543	44,668
			Number of live deliveries			
After one cycle	1,880	3,824	3,120	604	8	9,436
After two cycles	2,742	5,518	4,703	935	8	13,906
After three cycles	3,149	6,322	5,508	1,115	8	16,102
After four cycles	3,357	6,730	5,946	1,204	8	17,245
After five cycles	3,457	6,945	6,183	1,263	8	17,856
After six cycles	3,517	7,066	6,302	1,287	9	18,181
After seven cycles	3,549	7,146	6,370	1,306	9	18,380
After eight cycles	3,568	7,188	6,407	1,310	9	18,482
After nine cycles	3,575	7,207	6,424	1,317	9	18,532
After ten or more cycles	3,582	7,222	6,443	1,323	9	18,579
			Cumulative live delivery rate			
After one cycle	27.5	28.5	19.7	7.5	1.5	21.1
After two cycles	40.2	41.1	29.7	11.6	1.5	31.1
After three cycles	46.1	47.0	34.8	13.9	1.5	36.0
After four cycles	49.2	50.1	37.6	15.0	1.5	38.6
After five cycles	50.6	51.7	39.1	15.7	1.5	40.0
After six cycles	51.5	52.6	39.9	16.0	1.7	40.7
After seven cycles	52.0	53.2	40.3	16.2	1.7	41.1
After eight cycles	52.3	53.5	40.5	16.3	1.7	41.4
After nine cycles	52.4	53.6	40.6	16.4	1.7	41.5
After ten or more cycles	52.5	53.7	40.7	16.4	1.7	41.6

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

Note: Some women may return for additional treatments after 2011, so the cumulative live delivery rate may increase over time.

Appendix A: Contributing fertility clinics

Australian Capital Territory

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

ISIS Fertility, Barton (Dr Nicole Sides)

Genea—Canberra, Deakin (Associate Professor Mark Bowman)

New South Wales

Demeter Laboratories, Liverpool (Dr David Knight)

Fertility East, Bondi Junction (Dr Joel Bernstein)

Fertility First, Hurstville (Dr Anne Clark)

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

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

IVF Australia—East, Maroubra (Dr Graeme Hughes)

IVF Australia—North, Greenwich (Dr Frank Quinn)

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

IVF Australia—West, Westmead (Associate Professor Peter Illingworth)

Next Generation Fertility, Parramatta (Dr Kim Matthews)

Reproductive Medicine Albury, Albury (Dr Scott Giltrap)

Royal Hospital for Women, Randwick (Dr Stephen Steigrad)

Genea, Sydney (Associate Professor Mark Bowman)

Genea—Coffs Harbour, Coffs Harbour (Associate Professor Mark Bowman)

Genea—Illawarra, Wollongong (Associate Professor Mark Bowman

Genea—Lismore, Lismore (Associate Professor Mark Bowman)

Genea—Liverpool, Liverpool (Associate Professor Mark Bowman)

Genea—Newcastle, Merewether (Associate Professor Mark Bowman)

Genea—Northwest, Baulkham Hills (Associate Professor Mark Bowman)

Genea—Orange, Orange (Associate Professor Mark Bowman)

Genea—RPAH, Camperdown (Associate Professor 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)

Cairns Fertility Centre, Cairns (Dr John Yovich)

City Fertility Centre, Brisbane (Dr Ashish Das)

City Fertility Centre Southside, Robina (Dr Ashish Das)

City Fertility Centre Southside, Sunnybank (Dr Ashish Das)

Coastal IVF, Maroochydore (Dr Paul Stokes)

Fertility Solutions Sunshine Coast, Nambour (Dr James Orford)

Fertility Solutions Bundaberg, Bundaberg (Dr James Orford)

IVF Caboolture, Caboolture (Dr James Moir)

IVF Sunshine Coast, Birtinya (Dr James Moir)

Life Fertility Centre, Spring Hill (Dr Glenn Sterling)

Monash IVF Gold Coast, Southport (Dr Irving Korman)

Monash IVF Queensland, Sunnybank (Dr Bruce Dunphy)

Monash IVF Rockhampton, Rockhampton (Professor Gab Kovacs)

Monash IVF Townsville, Townsville (Professor 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

City Fertility Centre Adelaide, Henly Beach (Dr Marcin Stankiewicz)

Fertility SA, Adelaide (Dr Jodie Semmler)

Flinders Reproductive Medicine, Bedford Park (Dr Enzo Lombardi)

Repromed, Dulwich (Associate Professor Kelton Tremellen)

Tasmania

Genea—Launceston, Launceston (Associate Professor 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 Hawthorn, Hawthorn Hospital, Richmond (Dr Peter Lutjen)

Monash IVF, Bendigo (Dr Mark Jalland)

Monash IVF Clayton, Clayton (Dr Peter Lutjen)

Monash IVF Casterton, Casterton (Professor David Healy)

Monash IVF Geelong, Geelong (Professor Gab Kovacs)

Monash IVF Sale, Sale (Associate Professor Luk Rombauts)

Monash IVF Sunshine, St Albans (Dr Gareth Weston)

Reproductive Services, Parkville (Dr Lyndon Hale)

Western Australia

Concept Fertility Centre, Subiaco (Dr Rob Mazzucchelli)

Fertility North, Joondalup (Dr Vince Chapple)

Fertility Specialists South, Attadale (Dr Roger Hart)

Fertility Specialists WA, Claremont (Dr 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 VP Singh)

Fertility Associates Wellington, Wellington (Dr Andrew Murray)

Fertility Plus, Auckland (Dr Barry Lowe)

Repromed Auckland, Auckland (Dr Guy Gudex)

Repromed Christchurch, Christchurch (Dr Greg Phillipson)

The Otago Fertility Services, Dunedin (Associate Professor Wayne Gillett)

Appendix B: 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 on artificial insemination cycles using donated sperm from fertility centres. 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 2011, and the resulting pregnancies and births. The babies included in this report were conceived through treatment cycles undertaken in 2011, and were born in either 2011 or 2012.

Data validation

Most fertility centres have computerised data information management systems and are able to provide 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 2011, information relating to pregnancy and birth outcomes was not provided for 0.9% of clinical pregnancies.

The Reproductive Technology Accreditation Committee of FSA 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 women. 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 in Chapters 2 to 7, 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 calculated 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 centres 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. Fertility centre staff invest great effort in validating such information by obtaining medical records from clinicians or hospitals.

Appendix C: 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 sub-fertility due to tubal disease. No–other.
Cause of infertility: endometriosis	Yes–in the opinion of the treating clinician or clinic there is sub-fertility due to endometriosis. No–other.
Cause of infertility: other female factors	Yes–in the opinion of the treating clinician or clinic there is sub-fertility 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 sub-fertility 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 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.

Variable	*Data domain*
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.
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	Number of cleavage embryos frozen by slow freezing method in this cycle.

Variable	*Data domain*
frozen	
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.
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 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.

Variable	*Data domain*
Baby 3 abnormality	Describes any known congenital malformation.
Baby 3 date of neonatal death	Date of neonatal death.
Baby 4 outcome	Liveborn, stillborn or neonatal death.
Baby 4 sex	Male or female.
Baby 4 weight	Weight in grams.
Baby 4 abnormality	Describes any known congenital malformation.
Baby 4 date of neonatal death	Date of neonatal death.
Admitted with ART morbidity	Yes–woman is admitted to hospital with any condition (excluding any pregnancy-related issues, such as ectopic pregnancy) that could be in any way related to fertility treatment.
OHSS	Yes–admission to hospital is due to symptoms of OHSS.
Morbidity detail	Describes symptoms of treatment-related morbidity.
Postcode	Postcode of patient residential area.
Comments	Any comments on this cycle.

Glossary

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.

Assisted hatching: when the outer layer of the embryo, the zona pellucida, is either thinned or perforated in the laboratory to aid 'hatching' of the embryo, the aim being to potentially improve the chance of implantation in the uterus.

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 about 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 about 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 that 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.

IVF (in vitro fertilisation): an ART procedure that involves extracorporeal fertilisation.

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 the intended parent(s). 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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In 2011, there were 66,347 assisted reproductive technology (ART) treatment cycles performed in Australia and New Zealand. Of these, 23.1% resulted in a clinical pregnancy and 17.5% in a live delivery (the birth of at least one liveborn baby). There were 12,443 liveborn babies following ART treatment in 2011.