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Assisted reproductive technology in Australia and New Zealand 2007

Yueping Alex Wang
Georgina M Chambers
Mbathio Dieng
Elizabeth A Sullivan

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Australian Institute of Health and Welfare National Perinatal Statistics Unit
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Any enquiries about or comments on this publication should be directed to:

Yueping Alex Wang

Australian Institute of Health and Welfare, National Perinatal Statistics Unit

Level 2, McNevin Dickson Building, Randwick Hospital Campus, Randwick NSW 2031

Phone: (02) 9382 1014

Email: npsu@unsw.edu.au

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Contributors

Following is a list of the fertility clinics and their directors who contributed data for this report.

Australian Capital Territory

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

Sydney IVF Canberra, Deakin (Dr Mark Bowman)

New South Wales

Albury Reproductive Medicine Centre, Albury (Dr Scott Giltrap)

Fertility East, Bondi Junction (Dr Joel Berstein)

Fertility First, Hurstville (Dr Anne Clark)

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

IVF Australia

- Central Coast, Gosford (Dr Malcolm Tucker)
- Eastern Suburbs, Maroubra (Dr Graeme Hughes)
- North Shore, Greenwich (Dr Frank Quinn)
- Southern Sydney, Kogarah (Dr Andrew Kan)
- Western Sydney, Westmead (A/Prof. Peter Illingworth)

Next Generation Fertility, Parramatta (Dr Kim Mathews)

Royal Hospital for Women, Randwick (Dr Stephen Steigrad)

Sydney IVF

- Central Coast, North Gosford (Dr Mark Bowman)

City, Sydney (Dr Mark Bowman)

Coffs Harbour, Coffs Harbour (Dr Mark Bowman)

Illawarra, Wollongong (Dr Mark Bowman)

Lismore, Lismore (Dr Mark Bowman)

Liverpool, Liverpool (Dr Mark Bowman)

Newcastle, Merewether (Dr Mark Bowman)

Northwest, Baulkham Hills (Dr Mark Bowman)

Orange, Orange (Dr Mark Bowman)

Royal Prince Alfred Hospital, Camperdown (Dr Mark Bowman)

Westmead Fertility Centre, Westmead (Dr Howard Smith)

Northern Territory

REPROMED Darwin, Tiwi (Dr Richard Henshaw)

Queensland

City Fertility Centre

Brisbane (Dr Ashish Das)

Gold Coast, Tugun (Dr Ashish Das)

Coastal IVF, Maroochydore (Dr Paul Stokes)

Fertility Solutions Sunshine Coast, Nambour (Dr Kristen Small)

IVF Bundaberg, Bundaberg (Dr James Moir)

IVF Sunshine Coast, Birtinya (Dr James Moir)

Life Fertility Clinic, Brisbane (Dr Glenn Sterling)

Monash IVF

Gold Coast, Southport (Dr Irving Korman)

Queensland, Sunnybank (Dr Kevin Forbes)

Rockhampton, Rockhampton (Prof. Gab Kovacs)

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

Townsville, Townsville (Prof. Gab Kovacs)

QFG

Cairns, Cairns (Dr Robert Miller)

Gold Coast, Benowa (Dr Andrew Cary)

Mackay, North Mackay (Dr Lance Herron)

North West, Everton Park (Dr David Molloy)

Toowoomba IVF, Toowoomba (Dr John Esler)

Townsville, Hyde Park (Dr Ron Chang)

Queensland Fertility Group, Brisbane (Dr David Molloy)

South Australia

Flinders Reproductive Medicine, Bedford Park (Dr Enzo Lombardi)

REPROMED, Dulwich (Dr Richard Henshaw)

Tasmania

Sydney IVF Launceston, Launceston (Dr Mark Bowman)

TasIVF, Hobart (Dr Bill Watkins)

Victoria

Ballarat IVF, Wendouree (Dr Russell Dalton)

City Fertility Centre Melbourne, Melbourne (Dr David Wilkinson)

Melbourne Assisted Conception Centre, Heidelberg (Dr Mac Talbot)

Melbourne IVF, East Melbourne (Dr Lyndon Hale)

Monash IVF

- Bendigo, Bendigo (Dr Nick Lolatgis)
- Casterton, Casterton (Prof. David Healy)
- Epworth Hospital, Richmond (Dr Peter Lutjen)
- Geelong, Geelong (Prof. Gab Kovacs)
- Monash Surgical Private Hospital, Clayton (Dr Peter Lutjen)
- Northern, Broadmeadows (Dr Luk Rombauts)
- Sale, Sale (Dr Mac Talbot)

Reproductive Services, Carlton (Dr Lyndon Hale)

REPROMED Mildura, Mildura (Dr Richard Henshaw)

Western Australia

Concept Fertility Centre, Subiaco (Dr Rob Mazzucchelli)

Fertility North, Joondalup (Dr Vince Chapple)

Fertility Specialists 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)
- Hamilton, Hamilton (Dr Freddie Graham)
- Wellington, Wellington (Dr Andrew Murray)

Fertility Plus, Auckland (Dr Neil Johnson)

REPROMED Auckland, Auckland (Dr Guy Gudex)

REPROMED Christchurch, Christchurch (Dr Peter Benny)

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

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Abbreviations and symbols

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

Summary

Assisted reproductive technologies (ART) — such as in vitro fertilisation (IVF) — are a group of procedures used to assist women to become pregnant. ART usually involves removing oocytes (eggs) from a woman's ovaries, fertilising them in the laboratory and then transferring the resulting embryo(s) back into a woman's uterus. Over the last five years, the number of ART procedures has increased on average by over 10% per year in Australia and New Zealand. Latest estimates indicate that 3.1% and 1.8% of babies born in Australia and New Zealand respectively are as a result of ART treatment.

This is the thirteenth annual report on the use of ART in Australia and New Zealand, and presents data on women who underwent ART treatments in 2007, and the resulting pregnancies and baby outcomes.

Increased use of ART treatments

There were 56,817 ART treatment cycles reported in Australia and New Zealand in 2007. This represents a 12.5% increase in the number of cycles undertaken in 2006 and a 53.7% increase in the number of cycles undertaken in 2003. Of the 56,817 cycles, 22.6% resulted in a clinical pregnancy and 17.4% resulted in a live delivery (the birth of at least one liveborn baby). There were 10,856 liveborn babies born following ART treatment in 2007.

In 2007, 92.0% of cycles were from Australian fertility centres and 8.0% were from New Zealand fertility centres. Women used their own oocytes in about 95% of cycles, and over 38% of all cycles used frozen/thawed embryos.

Shift in practice to blastocyst culture

The use of blastocyst culture accounted for 30.6% of embryo transfer cycles in 2007, which is significantly higher than the percentage of cycles transferring blastocysts in 2003 (13.4%).

Women's age and parity

Almost one quarter (23.6%) of cycles were in women who had previously given birth. The average age of women undergoing ART treatment using their own oocytes was 35.5 years, slightly older than the average age (35.0 years) in 2003. In 2007, one in four (24.2%) fresh cycles in which women used their own oocytes were in woman aged 40 years or older. The average age of women undergoing ART treatment using donor oocytes/embryos was 40.5 years.

Better outcomes for mothers and babies

The most important trend in ART treatment over the last five years has been the reduction in the rate of multiple birth deliveries. The multiple delivery rate for ART treatment cycles undertaken in 2007 was 10.0% – compared to 12.0% in 2006, and 18.7% in 2003. This reduction is due to a voluntary shift in practice by clinicians and patients to single embryo transfer (SET), with the proportion of SET cycles increasing from 32.0% in 2003 to 63.7% in 2007. Importantly, this substantial decrease in the multiple delivery rate has been achieved while clinical pregnancy rates have remained stable around 22% per cycle.

1 Introduction

Having a child is not easily achieved for some, and this state of impaired fertility is a source of much personal suffering to millions of people around the world. A recent study undertaken for the Fertility Society of Australia found that approximately one in six Australian couples had taken longer than one year to conceive a planned pregnancy during their reproductive life (Labett 2006). Infertility is usually defined as the failure to conceive after one year of unprotected sex or the inability to carry a pregnancy to live birth. However, infertility is not an absolute or irreversible condition, but rather a clinical continuum that in many cases can be successfully treated with medical or surgical techniques or lifestyle changes (Carr et al. 2005).

In 1978, the treatment of infertility, and indeed the field of reproductive medicine, changed forever with the birth of Louise Brown in Manchester, England — the world's first assisted reproductive technology (ART) baby (Steptoe & Edwards 1978). The first Australian — and the world's third ART baby — was born in 1980 following treatment in 1979. The first New Zealand ART baby was born in 1984. Since the birth of Louise Brown, an estimated 3.5 million children have been born worldwide following ART treatment (ESHRE 2008). Latest estimates indicate that 3.1% and 1.8% of babies born in Australia and New Zealand respectively are as a result of ART treatment (Laws et al. 2008, Statistics New Zealand 2008).

The aim of any fertility treatment is the birth of a healthy baby. However ART and a number of other forms of fertility treatment predispose women to multiple gestation pregnancy, which increases the health risks to both mothers and babies. These risks include pregnancy and birthing complications, preterm delivery and low birthweight babies. Through the voluntary reduction in the number of embryos transferred during ART treatment, Australian and New Zealand fertility clinics have substantially reduced the incidence of multiple gestation pregnancies over the last five years without compromising pregnancy rates. However, the challenge still remains to further reduce the incidence of multiple births, so that ART babies have the best possible start in life.

Treatments covered in this report

ART is a group of procedures that involves the in vitro handling of human oocytes (eggs) and sperm or embryos for the purposes of establishing a pregnancy (Zegers-Hochschild et al. 2006). The most widely used ART is in vitro fertilisation (IVF) using a woman's own oocytes (autologous treatment). A typical fresh IVF treatment cycle involves five main steps:

- Controlled ovarian hyperstimulation where the female is treated with follicle stimulating hormone (FSH) over a number of days to induce the maturation of multiple oocytes.
- Oocyte pick-up (OPU) where mature oocytes are aspirated from ovarian follicles under light anaesthesia.
- Fertilisation of the collected oocytes by incubating them with sperm (the woman's partner or donated sperm) over a few hours in the laboratory.
- Embryo maturation where an embryo is cultured for 2–3 days to form a cleavage stage embryo (8 cells) or 5–6 days to create a blastocyst (100 cells).

- Transfer of one or more fresh embryos into the woman's uterus in order for a pregnancy to occur. To reduce the risk of multiple gestation pregnancies (twins or triplets) only one or two embryos are usually transferred.

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

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

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

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

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

Data used in this report

The data presented in this report are supplied by 35 fertility centres (67 fertility clinics in Australia and 7 fertility clinics in New Zealand), and compiled into the Australian and New Zealand Assisted Reproduction Database (ANZARD). ANZARD was established in 2002, superseding the National Perinatal Statistics Unit (NPSU)—Fertility Society of Australia Assisted Conception Database that ran from 1985 to 2001. ANZARD collects information on ART and DI treatments and their pregnancy and birth outcomes. ANZARD is a cycle-based

data collection reflecting the year the treatment was undertaken and does not link successive cycles to a particular woman. Therefore it is possible for an individual woman to undergo more than one treatment cycle in a year or experience more than one pregnancy, but these events are not linked.

Assisted reproductive technology in Australia and New Zealand 2007 is the thirteenth annual report on the use of ART in Australia and New Zealand. This report provides information on ART and DI treatments and the resulting pregnancy and birth outcomes. Also included is an analysis of trends in ART treatments and outcomes in the five-year period from 2003 to 2007.

Purpose of this report

The main purpose of this report is to provide:

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

Structure of this report

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

Chapter 2 — 'Overview of ART treatment in 2007', 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 2007', presents data on couples undergoing treatment, cycle types, and the outcomes of treatment in terms of discontinued treatment, clinical pregnancies and deliveries.

Chapter 4 — 'Pregnancy and birth outcomes following embryo transfer cycles in 2007', presents data on the outcomes of clinical pregnancies and deliveries and describes perinatal outcomes of babies born following autologous and recipient cycles.

Chapter 5 — 'GIFT cycles, surrogacy cycles, other procedures and complications in 2007', includes information on cycles, procedures and complications that do not fit into the chapters already described.

Chapter 6 — 'Donor sperm insemination cycles in 2007', presents data on DI cycles and their outcomes, including a description of pregnancy and perinatal outcomes.

Chapter 7 — 'Trends in ART treatment and outcomes: 2003–2007', presents trends in ART treatments during the last five years of data collection in Australia and New Zealand.

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

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

2 Overview of ART treatment in 2007

There were 56,817 ART treatment cycles reported from Australian and New Zealand clinics in 2007 (Table 1). Of these, 92.0% (52,296) were from Australian clinics and 8.0% (4,521) were from New Zealand clinics. In Australia there were 11.7 cycles per 1,000 women of reproductive age (15–44 years) compared to 4.9 cycles per 1,000 women of reproductive age in New Zealand.

About 95% of cycles in 2007 were autologous cycles where a woman intended to use, or used her own oocytes or embryos. Of the 53,696 autologous cycles, 62.5% were fresh cycles and 37.5% were thaw cycles. Other treatment cycles accounted for only a small proportion of cycles, comprising 3.0% oocyte recipient cycles, 0.4% embryo recipient cycles, 1.7% oocyte donation cycles, 0.2% GIFT cycles and 0.1% surrogacy cycles (Table 1).

Of all ART treatments in 2007, 22.6% (12,815) resulted in a clinical pregnancy (Table 1). Of the 12,815 clinical pregnancies, 11,456 (89.4%) were from Australian clinics and 1,359 (10.6%) from New Zealand clinics. There were 10,994 babies (including 10,856 liveborn babies) born following ART treatment in 2007. Of all babies, 9,842 (89.5%) were reported from Australian clinics and 1,152 (10.5%) from New Zealand clinics.

The multiple delivery rate following ART treatment in 2007 was 10.0% (10.3% for Australia and 7.5% for New Zealand).

Table 1: Number of initiated ART treatment cycles by treatment type, Australia and New Zealand, 2007

Treatment type	Number of initiated ART cycles	Per cent of treatment types	Number of clinical pregnancies	Number of live deliveries	Number of liveborn babies
Autologous	53,696	94.8	12,331	9,528	10,468
Fresh	*33,575*	*59.3*	*8,081*	*6,305*	*6,957*
Thaw	*20,121*	*35.5*	*4,250*	*3,223*	*3,511*
Oocyte recipient	1,724	3.0	413	298	337
Embryo recipient	238	0.4	38	28	30
Oocyte donation	952	1.7	. .	. .	. .
GIFT[(a)]	133	0.2	19	13	14
Surrogacy	74	0.1	14	7	7
Total	**56,817**	**100.0**	**12,815**	**9,874**	**10,856**

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

3 Autologous and donation/recipient cycles in 2007

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

An autologous cycle is defined as an ART treatment cycle in which a woman intends to use, or uses her own oocytes or embryos.

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

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

Autologous and donor/recipient cycles can involve the use, or intention to use, either fresh or frozen/thawed embryos. In a small number of cycles undertaken in 2007 frozen/thawed oocytes were used in fertilisation.

3.1 Overview of autologous and recipient cycles

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

The average age of women undergoing autologous and oocyte/embryo recipient cycles in 2007 was 35.7 years. For women undergoing oocyte/embryo recipient cycles the mean age was 40.5 years, five years older than for autologous cycles (35.5 years). Over one in five cycles (22.8%) were undertaken by women aged 40 years or older (Table 2). The average age of partners was 38.1 years, with 35.7% in partners aged 40 years or older (Table 3).

Table 2: Number of autologous and recipient cycles by women's age group and treatment type, Australia and New Zealand, 2007

Age group (years)[(a)]	Autologous				Oocyte /embryo recipient		All	
	Fresh		Thaw					
	Number	Per cent	Number	Per cent	Number	Per cent	Number	Per cent
< 30	3,717	11.1	2,304	11.4	66	3.4	6,087	10.9
30–34	8,945	26.6	6,431	32.0	242	12.3	15,618	28.1
35–39	12,798	38.1	8,001	39.8	480	24.5	21,279	38.2
40–44	7,528	22.4	3,152	15.7	662	33.7	11,342	20.4
≥ 45	586	1.7	233	1.2	512	26.1	1,331	2.4
Not stated	1	0.0	0	0.0	0	0.0	1	0.0
Total	**33,575**	**100.0**	**20,121**	**100.0**	**1,962**	**100.0**	**55,658**	**100.0**

(a) Age at time of treatment.

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

Table 3: Number of autologous and recipient cycles by women's partners' age group and treatment type, Australia and New Zealand, 2007

Age group (years)[(a)]	Autologous				Oocyte /embryo recipient		All	
	Fresh		Thaw					
	Number	Per cent	Number	Per cent	Number	Per cent	Number	Per cent
< 30	2,217	6.6	1,174	5.8	37	1.9	3,428	6.1
30–34	7,273	21.7	4,743	23.6	243	12.4	12,259	22.0
35–39	10,652	31.7	7,067	35.1	469	23.9	18,188	32.7
40–44	7,441	22.2	4,112	20.4	504	25.7	12,057	21.7
≥ 45	4,847	14.4	2,499	12.4	468	23.9	7,814	14.0
Not stated	1,145	3.4	526	2.6	241	12.3	1,912	3.4
Total	**33,575**	**100.0**	**20,121**	**100.0**	**1,962**	**100.0**	**55,658**	**100.0**

(a) Age at time of treatment.

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

Parity of autologous and recipient cycles

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

Of the 55,658 initiated cycles undertaken in 2007, 68.6% were undertaken by nulliparous women. Of autologous cycles, 68.3% were undertaken by nulliparous women compared to 77.2% for oocyte/embryo recipient cycles (Table 4).

Table 4: Number of autologous and recipient cycles by parity and treatment type, Australia and New Zealand, 2007

	Autologous				Oocyte/embryo recipient		All	
	Fresh		Thaw					
Parity	Number	Per cent	Number	Per cent	Number	Per cent	Number	Per cent
Nulliparous	23,842	71.0	12,823	63.7	1,514	77.2	38,179	68.6
Parous	7,083	21.1	5,632	28.0	394	20.1	13,109	23.6
Not stated	2,650	7.9	1,666	8.3	54	2.8	4,370	7.9
Total	**33,575**	**100.0**	**20,121**	**100.0**	**1,962**	**100.0**	**55,658**	**100.0**

Cause of infertility of autologous and recipient cycles

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

Of the 55,658 initiated cycles, 27.7% reported male infertility factors as the only cause of infertility; 33.6% reported only female infertility factor(s); 14.3% reported combined male—female factors; and 21.8% reported unexplained infertility. Male infertility factors (alone and combined with female infertility factor) were reported for 42.0% of cycles.

ICSI procedures in autologous and recipient cycles

Of the 29,618 autologous fresh cycles where fertilisation was attempted, 61.6% used ICSI procedures and 38.4% used IVF procedures. In fresh oocyte recipient cycles where fertilisation was attempted, 68.3% used ICSI procedures and 31.7% used IVF procedures (Table 5).

Of thaw cycles where IVF/ICSI procedures were stated, the proportion of ICSI was similar for both autologous and oocyte/embryo recipient cycles (approximately 53.0%).

Table 5: Number of autologous and recipient cycles with fertilisation attempted by treatment type and procedure, Australia and New Zealand, 2007

	Autologous				Oocyte/embryo recipient			
	Fresh		Thaw		Fresh		Thaw	
Procedure	Number	Per cent	Number	Per cent	Number	Per cent	Number	Per cent
IVF	11,385	38.4	8,684	47.4	279	31.7	504	47.3
ICSI	18,233	61.6	9,655	52.6	601	68.3	562	52.7
Total	**29,618**	**100.0**	**18,339**	**100.0**	**880**	**100.0**	**1,066**	**100.0**

Number of embryos transferred in autologous and recipient cycles

Of the 46,464 embryo transfer cycles, 63.7% were single embryo transfer (SET) cycles and 35.7% were double embryo transfer (DET) cycles. In women aged less than 35 years, 72.5% of cycles were SET cycles and 27.4% were DET cycles. In women aged 35 years or older, 57.8% of cycles were SET cycles and 41.2% were DET cycles (Table 6).

Table 6: Number of embryo transfer cycles by number of embryos transferred per cycle and women's age group, Australia and New Zealand, 2007

Age group (years)[(a)]	Number of embryos transferred							
	One		Two		Three or more		All	
	Number	Per cent	Number	Per cent	Number	Per cent	Number	Per cent
< 30	3,898	75.3	1,275	24.6	4	0.1	5,177	100.0
30–34	9,580	71.4	3,813	28.4	15	0.1	13,408	100.0
35–39	11,230	62.6	6,693	37.3	29	0.2	17,952	100.0
40–44	4,327	48.6	4,354	48.9	218	2.4	8,899	100.0
≥ 45	554	53.9	441	42.9	33	3.2	1,028	100.0
Total	**29,589**	**63.7**	**16,576**	**35.7**	**299**	**0.6**	**46,464**	**100.0**

(a) Age at time of treatment.

Stage of embryo development in autologous and recipient cycles

Of the 46,464 embryo transfer cycles, 30.6% involved the transfer of blastocysts. Of autologous thaw cycles, blastocyst transfers made up more than one-third (34.8 %) of embryo transfer cycles compared to 28.2% of autologous fresh cycles (Table 7).

Table 7: Number of embryo transfer cycles by treatment type and stage of embryo development, Australia and New Zealand, 2007

Type and procedure	Autologous				Oocyte/embryo recipient			
	Fresh		Thaw		Fresh		Thaw	
	Number	Per cent	Number	Per cent	Number	Per cent	Number	Per cent
Cleavage stage embryo	18,917	71.8	11,933	65.2	587	73.7	786	76.3
Blastocyst	7,420	28.2	6,368	34.8	209	26.3	244	23.7
Total	**26,337**	**100.0**	**18,301**	**100.0**	**796**	**100.0**	**1,030**	**100.0**

3.2 Autologous fresh cycles

In 2007, there were 33,575 initiated autologous fresh cycles, comprising 33,177 (98.8%) ovarian stimulated cycles and 398 (1.2%) unstimulated cycles. There were 36 cycles in which thawed oocytes were used for fertilisation.

Of the 33,575 initiated autologous fresh cycles, 92.0% (30,893) were from Australian clinics and 8.0% (2,682) were from New Zealand clinics.

Progression of autologous fresh cycles

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

Of the 33,575 initiated autologous fresh cycles in 2007, 90.8% had oocyte pick-up (OPU) performed, 78.4% had embryos transferred, 24.1% resulted in a clinical pregnancy and 18.8% resulted in a live delivery. A live delivery is the delivery of one or more live born infants, with the birth of twins and triplets counted as one live delivery.

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

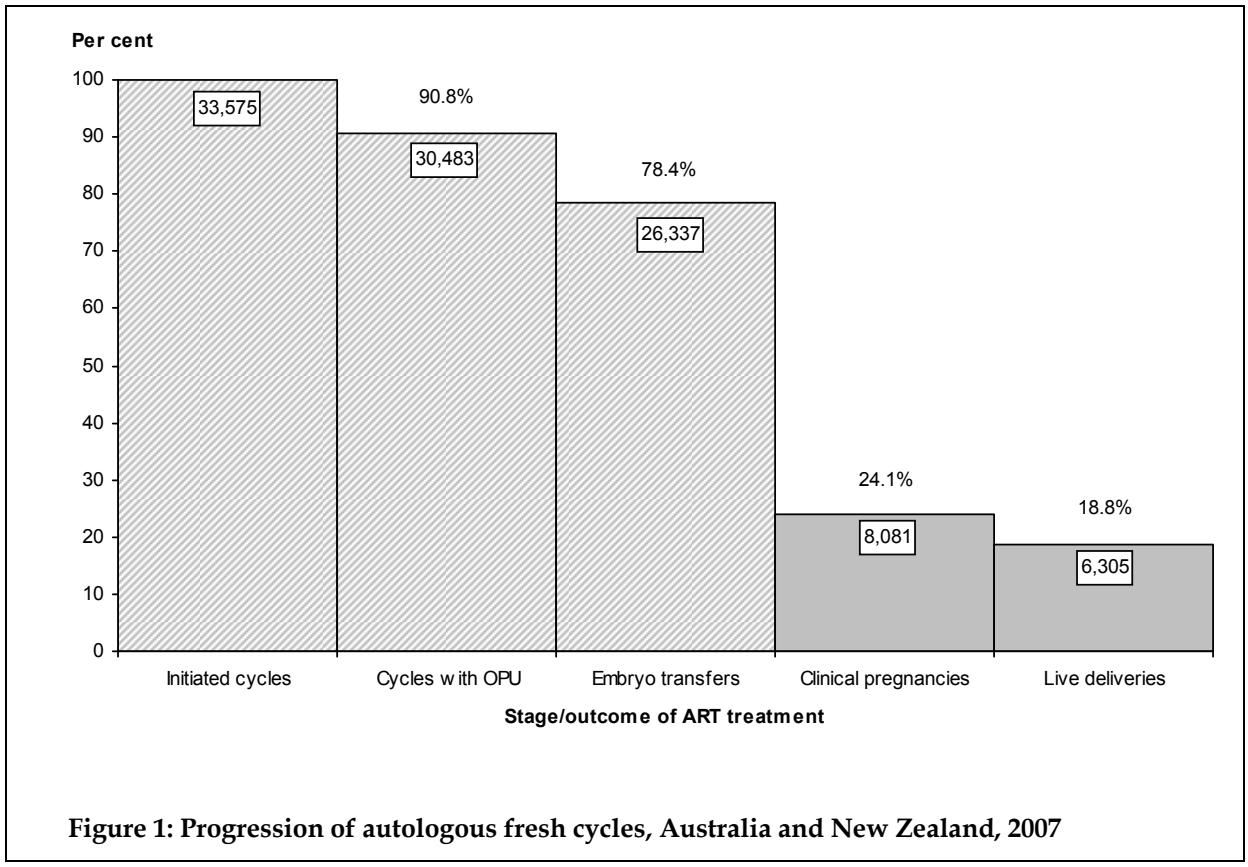


Figure 1: Progression of autologous fresh cycles, Australia and New Zealand, 2007

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

Maternal age is one of the key factors associated with the outcomes of autologous fresh cycles. The highest live delivery rate per embryo transfer cycle was in women aged less than 30 years (37.7%). The rate declined with advancing women's age, with the chance of having a liveborn baby being 9.9% of embryo transfer cycles in women aged 40–44 years, and 1.7% in women aged 45 years or older (Table 8).

Table 8: Outcomes of autologous fresh cycles by women's age group, Australia and New Zealand, 2007

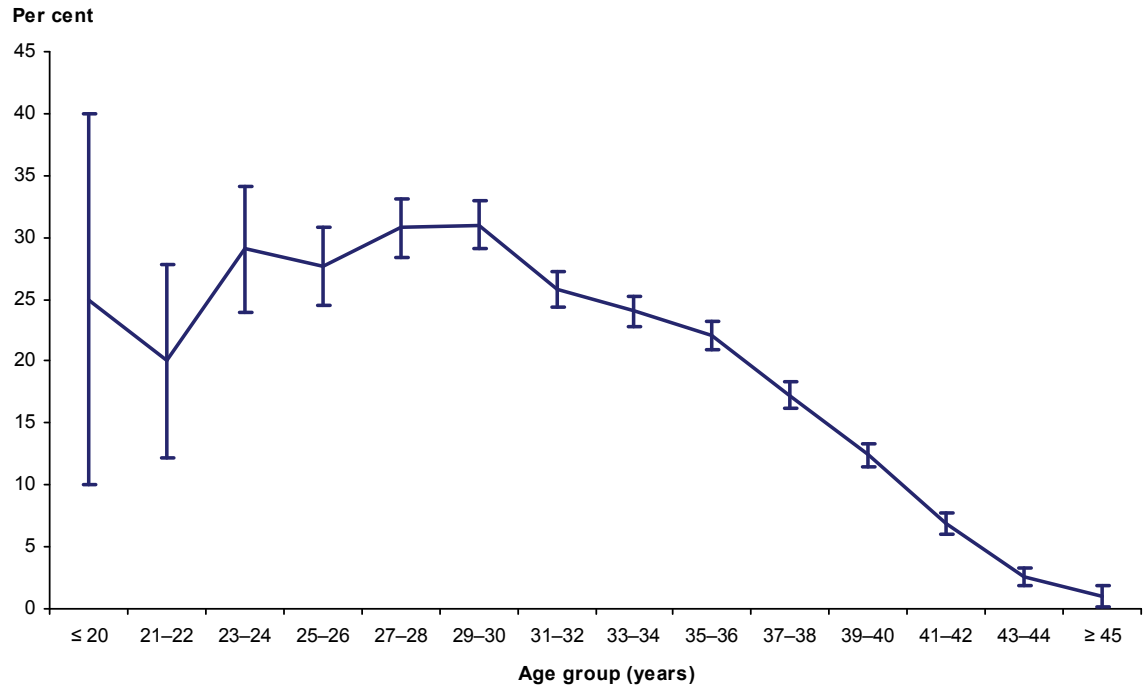
	Age group (years)[a]					
Stage/outcome of treatment	**< 30**	**30–34**	**35–39**	**40–44**	**≥ 45**	**All[b]**
Initiated cycles	3,717	8,945	12,798	7,528	586	33,575
Cycles with OPU	3,432	8,263	11,643	6,655	489	30,483
Embryo transfers	2,974	7,307	10,193	5,514	349	26,337
Clinical pregnancies	1,322	2,789	3,084	876	10	8,081
Live deliveries	1,120	2,281	2,352	546	6	6,305
Live deliveries per initiated cycle (%)	30.1	25.5	18.4	7.3	1.0	18.8
Live deliveries per embryo transfer cycle (%)	37.7	31.2	23.1	9.9	1.7	23.9
Live deliveries per clinical pregnancy (%)	84.7	81.8	76.3	62.3	60.0	78.0

(a) Age at time of treatment.

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

Figure 2 shows women's age-specific live delivery rates per initiated autologous fresh cycle by two-year age groups. The highest live delivery rates were for women aged between 23 and 30 years. The live delivery rate declined steadily for women older than 30 years. For women aged 45 years or older, only one live delivery resulted from every 100 initiated cycles (95% confidence intervals (CI): 0.2% to 1.8%).

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



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

Figure 2: Live delivery rate per initiated autologous fresh cycle and 95% CI by women's age group, Australia and New Zealand, 2007

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

Cycles reported with male factor as the only cause of infertility had the highest rates of clinical pregnancy and live delivery, with 26.7% of initiated autologous fresh cycles resulted in a clinical pregnancy and 21.3% in a live delivery. Those with female factor infertility had comparatively low rates of clinical pregnancy and live delivery per initiated cycle (21.9% and 16.6% respectively) (Table 9). The rate ratio (RR) of live delivery was 1.28 for cycles with male factor only infertility to cycles with female factor only infertility (95% CI 1.27 to 1.30).

Table 9: Outcomes of autologous fresh cycles by cause of infertility, Australia and New Zealand, 2007

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	9,394	82.6	26.7	21.3
Female factor	10,759	75.0	21.9	16.6
Tubal disease only	*2,334*	*80.3*	*22.4*	*17.1*
Endometriosis only	*2,123*	*78.6*	*24.5*	*19.5*
Other female factor only	*5,087*	*70.6*	*20.7*	*15.5*
Combined female factor	*1,215*	*77.0*	*21.1*	*15.6*
Combined male—female factor	4,969	78.4	23.5	18.2
Unexplained	7,755	79.6	24.5	19.2
Not stated	698	62.9	21.8	17.8
Total	**33,575**	**78.4**	**24.1**	**18.8**

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

Cycles with three or more embryos transferred only accounted for 0.1% and 1.4% of embryos transfer cycles in women aged younger than 35 years and in women aged 35 years or older respectively. Overall, 60.1% of embryo transfer cycles were SET cycles and 39.1% were DET cycles.

For women aged less than 35 years the difference in the live delivery rates between SET and DET cycles was 1.5 percentage points (32.7% and 34.2% respectively). For women aged 35 years and older the difference was only 0.4 percentage points (18.0% and 18.4% respectively). Overall, the live delivery rate was 25.0% for SET and 22.6% for DET (Table 10).

Table 10: Outcomes of autologous fresh embryo transfer cycles by women's age and number of embryos transferred, Australia and New Zealand, 2007

	Age group (years)[(a)]								
	< 35			≥ 35			All		
Stage/outcome of treatment	One embryo	Two embryos	Three or more embryos	One embryo	Two embryos	Three or more embryos	One embryo	Two embryos	Three or more embryos
Embryo transfers	7,558	2,712	11	8,259	7,572	225	15,817	10,284	236
Clinical pregnancies	2,997	1,108	6	2,017	1,912	41	5,014	3,020	47
Live deliveries	2,471	927	3	1,484	1,394	26	3,955	2,321	29
Clinical pregnancies per embryo transfer cycle (%)	*39.7*	*40.9*	*54.5*	*24.4*	*25.3*	*18.2*	*31.7*	*29.4*	*19.9*
Live deliveries per embryo transfer cycle (%)	*32.7*	*34.2*	*27.3*	*18.0*	*18.4*	*11.6*	*25.0*	*22.6*	*12.3*

(a) Age at time of treatment.

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

Comparatively, the rates of clinical pregnancy and live delivery were higher in blastocyst transfer cycles than in cleavage stage embryo transfer cycles regardless of women's age (Table 11). Overall, the difference in live delivery rates for cleavage stage embryos and blastocysts was almost 8 percentage points (21.7% and 29.6% respectively). This is a 1.4 times as high as the rate of live delivery for blastocyst transfer cycles than cleavage stage embryo transfer cycles (RR 1.37, 95% CI 1.31 to 1.43).

Table 11: Outcomes of autologous fresh embryo transfer cycles by women's age and stage of embryo development, Australia and New Zealand, 2007

	Age group (years)[a]					
	< 35		≥ 35		All	
Stage/outcome of treatment	Cleavage stage embryo	Blastocyst	Cleavage stage embryo	Blastocyst	Cleavage stage embryo	Blastocyst
Embryo transfers	7,024	3,257	11,893	4,163	18,917	7,420
Clinical pregnancies	2,618	1,493	2,662	1,308	5,280	2,801
Live deliveries	2,173	1,228	1,932	972	4,105	2,200
Clinical pregnancies per embryo transfer cycle (%)	*37.3*	*45.8*	*22.4*	*31.4*	*27.9*	*37.7*
Live deliveries per embryo transfer cycle (%)	*30.9*	*37.7*	*16.2*	*23.3*	*21.7*	*29.6*

(a) Age at time of treatment.

Live deliveries from autologous fresh cycles among fertility centres

The live delivery rate per initiated autologous fresh cycle varied among 32 fertility centres. This variation in live delivery rates is measured using quartiles which rank an individual centre's live delivery rate within the top and bottom 25% of centres.

The live delivery rate per initiated autologous fresh cycle ranged from 2.2% to 26.9% among fertility centres. The top 25% (first quartile) of fertility centres had live delivery rates between 23.0% and 26.9%. The bottom 25% (fourth quartile) of fertility centres had live delivery rates between 2.2% and 12.8%. The remaining 50% of fertility centres had live delivery rates between 12.9% and 22.9% (Table 12).

Table 12: Live delivery rate of autologous fresh cycles by women's age group among fertility centres, Australia and New Zealand, 2007

Age group (years)[a]	Live deliveries per initiated autologous fresh cycle (%)				
	Mean	First quartile	Second quartile	Third quartile	Fourth quartile
< 35	26.9	28.6–33.5	26.0–28.5	20.1–25.9	0.0[b]–20.0
≥ 35	13.9	18.3–27.4	12.4–18.2	8.6–12.3	0.0[b]–8.5
All[c]	18.8	23.0–26.9	18.2–22.9	12.9–18.1	2.2–12.8

(a) Age at time of treatment.

(b) Less than 15 initiated cycles were undertaken in a small number of centres.

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

There was also variation in the outcomes of autologous fresh cycles by number of embryos transferred and stage of embryo development. Figure 3 shows the average live delivery rate and interquartile range among fertility centres. Single blastocyst transfers achieved the highest rate (30.8%) of live deliveries per embryo transfer cycle. Half of the fertility centres that carried out single blastocyst transfers achieved a live delivery rate between 16.7% and 36.8%. Single cleavage stage transfers achieved a live delivery rate of 19.2% per embryo transfer cycle, with half of the fertility centres that carried out single cleavage stage embryo transfers achieving a live delivery rate between 13.5% and 24.0%. The greatest variation in live delivery rates among fertility centres was in the transfer of blastocyst embryos. The rates are unadjusted for women's age and parity which may vary between centres.

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

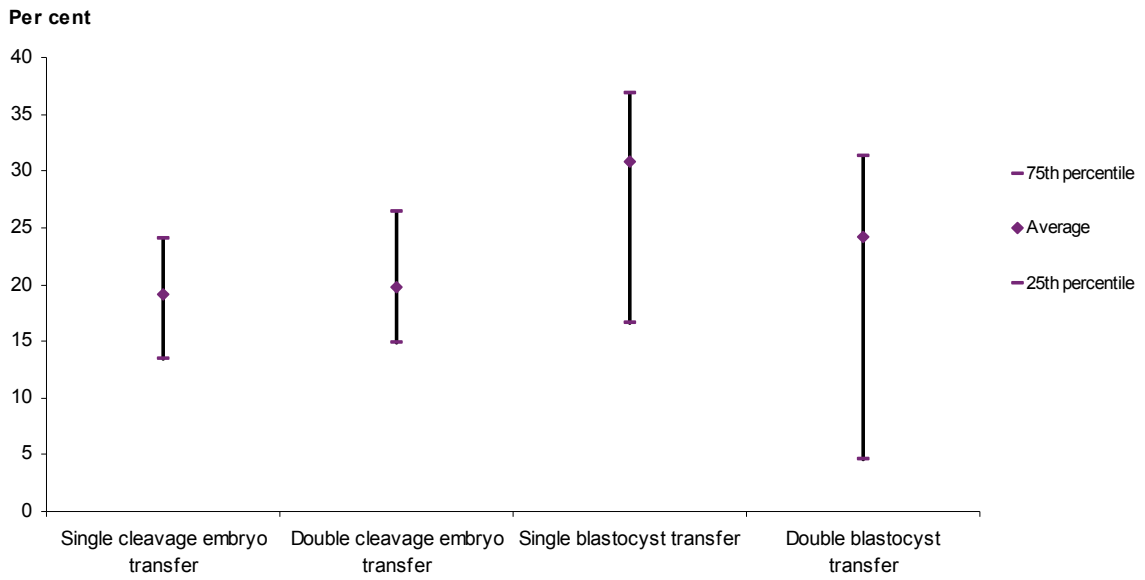


Figure 3: Live delivery rate of autologous fresh embryo transfer cycles by number of embryos transferred and stage of embryo development among fertility centres, Australia and New Zealand, 2007

3.3 Autologous thaw cycles

There were 12,121 autologous thaw cycles reported in 2007. Of these, 92.5% (18,606) were from Australian clinics and 7.5% (1,515) from New Zealand clinics.

Progression of autologous thaw cycles

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

Of the 20,121 initiated thaw cycles, 91.0% had embryos transferred, 21.1% resulted in a clinical pregnancy and 16.0% resulted in a live delivery (Figure 4). Almost one in eleven initiated autologous thaw cycles did not progress to embryo transfer, principally due to non-viability following thawing of cryopreserved (frozen) embryo(s).

The rate of live deliveries per initiated cycle was lower for autologous thaw cycles than for autologous fresh cycles in 2007 (16.0% and 18.8% respectively) (Figures 1 and 4).

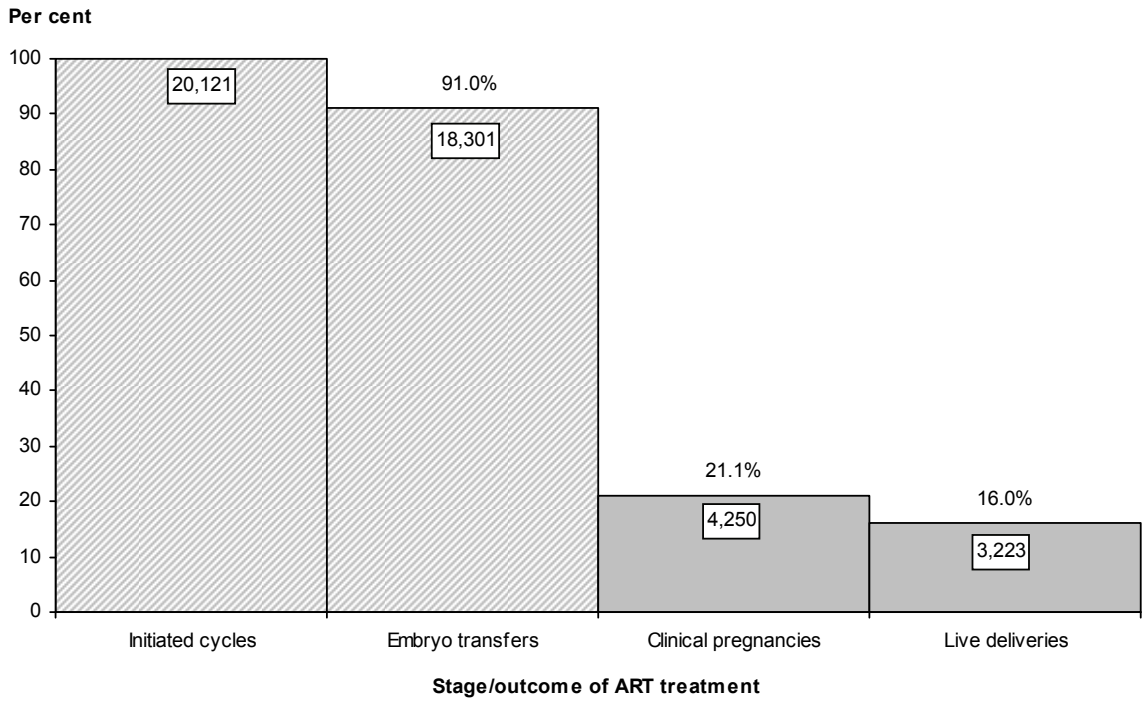


Figure 4: Progression of autologous thaw cycles, Australia and New Zealand, 2007

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

Similar to women undergoing autologous fresh cycles, the live delivery rate per embryo transfer cycle declined with advancing women's age. The highest live delivery rate per embryo transfer cycle was in women aged 30–34 years (Table 13). However, the maternal age of the embryo relates to the age at which a women undertook her initial autologous fresh cycle, therefore the physiological age of the embryo may be younger than the age of the woman when she underwent her thaw cycle.

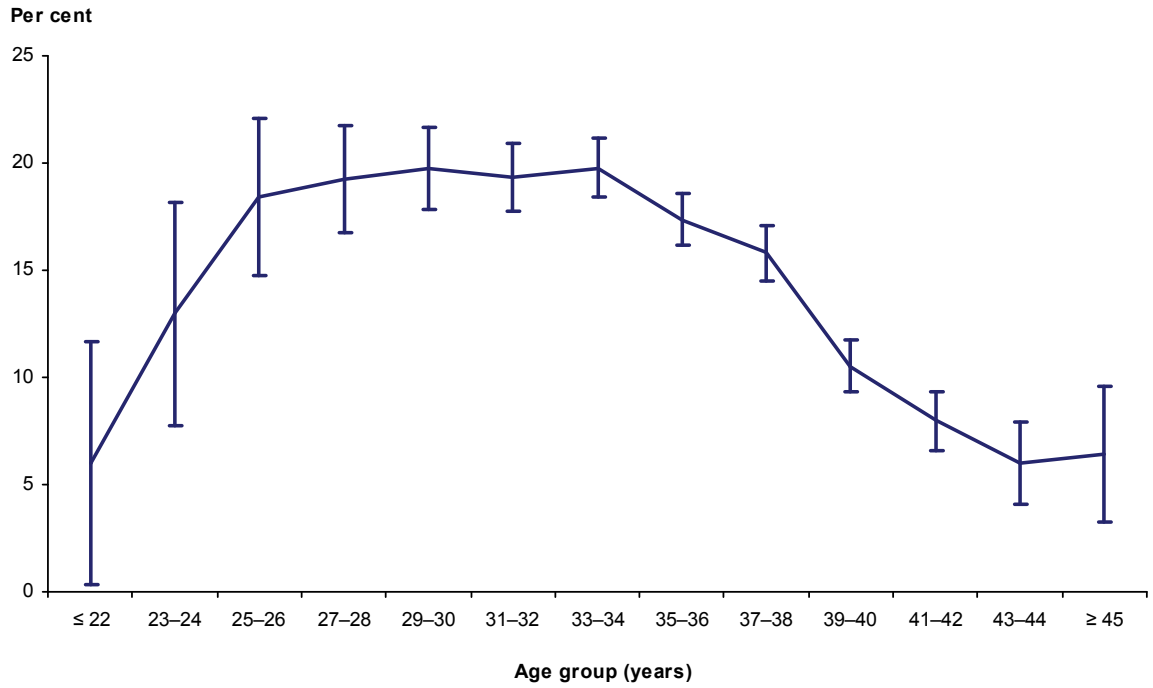
Table 13: Outcomes of autologous thaw cycles by women's age group, Australia and New Zealand, 2007

	Age group (years)[(a)]					
Stage/outcome of treatment	**< 30**	**30–34**	**35–39**	**40–44**	**≥ 45**	**All**
Initiated cycles	2,304	6,431	8,001	3,152	233	20,121
Embryo transfers	2,142	5,873	7,307	2,781	198	18,301
Clinical pregnancies	555	1,568	1,694	407	26	4,250
Live deliveries	421	1,264	1,271	252	15	3,223
Live deliveries per initiated cycle (%)	18.3	19.7	15.9	8.0	6.4	16.0
Live deliveries per embryo transfer cycle (%)	19.7	21.5	17.4	9.1	7.6	17.6
Live deliveries per clinical pregnancy (%)	75.9	80.6	75.0	61.9	57.7	75.8

(a) Age at time of treatment.

The Figure 5 shows age specific live delivery rates per initiated autologous thaw cycle by 2 year age groups. The highest live delivery rates were for women in there late 20s to early 30s. The live delivery rate declined steadily for women aged 34 years or older. For women aged 45 years or older, over one in fifteen (6.4%, 95% CI 3.3% to 9.6%) initiated autologous thaw cycles resulted in a live delivery, which is significantly higher than the live delivery rate per initiated autologous fresh cycle in this age group (1.0%, 95% CI 0.2% to 1.8%) (Figures 2 and 5).

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



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

Figure 5: Live delivery rate per initiated autologous thaw cycle and 95% CI by women's age group, Australia and New Zealand, 2007

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

Cycles reported with male factor as the only cause of infertility had the highest rates of clinical pregnancies and live deliveries per initiated cycle (24.9% and 17.7% respectively) (Table 14). The live delivery rate was significantly higher for cycles with male factor only infertility than for cycles with female factor only infertility (RR 1.18, 95% CI 1.09 to 1.28).

Table 14: Outcomes of autologous thaw cycles by cause of infertility, Australia and New Zealand, 2007

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	5,743	91.5	24.9	17.7
Female factor	7,028	91.6	22.0	15.0
Tubal disease only	*1,625*	*90.6*	*20.8*	*13.2*
Endometriosis only	*1,406*	*92.5*	*21.6*	*15.4*
Other female factor only	*3,265*	*92.0*	*22.2*	*15.6*
Combined female factor	*732*	*90.2*	*23.9*	*15.4*
Combined male—female factor	2,736	90.1	22.4	15.1
Unexplained	4,046	90.2	23.5	15.8
Not stated	568	88.2	23.4	17.6
Total	**20,121**	**91.0**	**23.2**	**16.0**

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

The rates of clinical pregnancy and live delivery were lower for single embryo transfer (SET) than double embryo transfer (DET) regardless of a women's age. Overall, the difference in live delivery rates for SET and DET in autologous thaw cycles was 3.4 percentage points (16.6% and 20.0% respectively) (Table 15).

Table 15: Outcomes of autologous thaw embryo transfer cycles by women's age and number of embryos transferred, Australia and New Zealand, 2007

	Age group (years)[a]								
	< 35			≥ 35			All		
Stage/outcome of treatment	One embryo	Two embryos	Three or more embryos	One embryo	Two embryos	Three or more embryos	One embryo	Two embryos	Three or more embryos
Embryo transfers	5,751	2,256	8	6,992	3,247	47	12,743	5,503	55
Clinical pregnancies	1,450	671	2	1,304	811	12	2,754	1,482	14
Live deliveries	1,142	541	2	969	561	8	2,111	1,102	10
Clinical pregnancies per embryo transfer cycle (%)	*25.2*	*29.7*	*25.0*	*18.6*	*25.0*	*25.5*	*21.6*	*26.9*	*25.5*
Live deliveries per embryo transfer cycle (%)	*19.9*	*24.0*	*25.0*	*13.9*	*17.3*	*17.0*	*16.6*	*20.0*	*18.2*

(a) Age at time of treatment.

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

The rates of clinical pregnancy and live delivery were slightly higher for blastocyst transfer cycles than for cleavage stage embryo transfer cycles regardless of women's age (Table 16). Overall, the difference in live delivery rates for cleavage stage embryos and blastocysts was 1.4 percentage points (17.1% and 18.5% respectively). Blastocyst transfer cycles had 1.1 times as high as the rate of live delivery than cleavage stage embryo transfer cycles (RR 1.08, 95% CI 1.01 to 1.15).

Table 16: Outcomes of autologous thaw embryo transfer cycles by women's age and stage of embryo development, Australia and New Zealand, 2007

	Age group (years)[(a)]					
	< 35		≥ 35		All	
Stage/outcome of treatment	Cleavage stage embryo	Blastocyst	Cleavage stage embryo	Blastocyst	Cleavage stage embryo	Blastocyst
Embryo transfers	5,057	2,958	6,876	3,410	11,933	6,368
Clinical pregnancies	1,313	810	1,369	758	2,682	1,568
Live deliveries	1,046	639	999	539	2,045	1,178
Clinical pregnancies per embryo transfer cycle (%)	*26.0*	*27.4*	*19.9*	*22.2*	*22.5*	*24.6*
Live deliveries per embryo transfer cycle (%)	*20.7*	*21.6*	*14.5*	*15.8*	*17.1*	*18.5*

(a) Age at time of treatment.

Live deliveries from autologous thaw cycles among fertility centres

The live delivery rate per initiated autologous thaw cycle varied among 31 fertility centres in Australia and New Zealand. This variation in live delivery rates is measured using quartiles which rank an individual centre's live delivery rate.

The live delivery rates per initiated autologous thaw cycle ranged from 5.7% to 33.3% among fertility centres. The top 25% (first quartile) of fertility centres had live delivery rates from 19.1% to 33.3%. The bottom 25% (fourth quartile) of fertility centres had live delivery rates between 5.7% and 13.4%. The remaining 50% of fertility centres achieved rates between 13.5% and 19.0%. Overall the live delivery rate was 16.0% for autologous thaw cycles in all centres in Australia and New Zealand. Women aged less than 35 years (19.3%) had higher rates than those aged 35 years and older (13.5%) (Table 17).

Table 17: Live delivery rate of autologous thaw cycles by women's age group among fertility centres, Australia and New Zealand, 2007

Age group (years)[(a)]	Live deliveries per initiated autologous fresh cycle (%)				
	Mean	First quartile	Second quartile	Third quartile	Fourth quartile
< 35	19.3	22.2–100.0[(b)]	17.5–22.1	14.2–17.4	4.7–14.1
≥ 35	13.5	16.3–21.1	12.6–16.2	10.9–12.5	0.0[(b)]–10.9
All[(c)]	**16.0**	**19.1–33.3**	**15.4–19.0**	**13.5–15.3**	**5.7–13.4**

(a) Age at time of treatment.

(b) Less than 5 initiated cycles were undertaken in a small number of centres.

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

There was also variation in the outcomes of autologous thaw cycles by number and type of embryos transferred among the fertility centres. Figure 6 shows the average live delivery rate for autologous thaw embryo transfer cycles and the interquartile range by number of embryos transferred and stage of embryo development among fertility centres. Double blastocyst transfers achieved the highest live delivery rate (20.9%) followed by double cleavage stage embryo transfers (19.7%). The rates are unadjusted for the women's age and parity which may vary between centres.

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

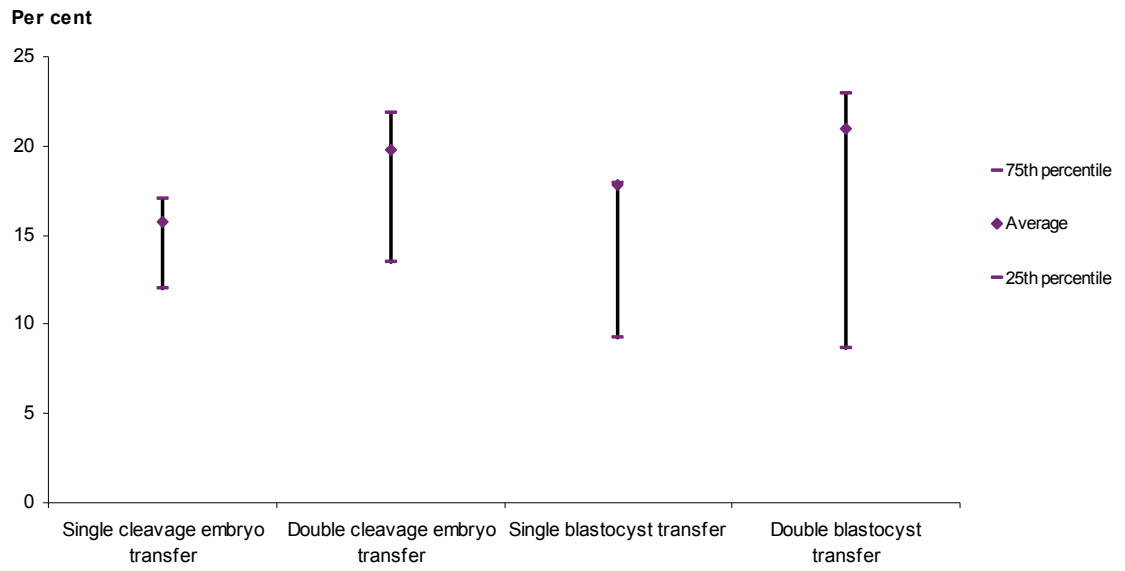


Figure 6: Live delivery rate of autologous thaw embryo transfer cycles by number of embryos transferred and stage of embryo development among fertility centres, Australia and New Zealand, 2007

3.4 Donation and recipient cycles

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

In 2007, donation and recipient cycles accounted for 5.1% (2,914) of all treatment cycles in Australia and New Zealand, including 952 (32.7%) oocyte donation cycles and 1,962 (67.3%) oocyte/embryo recipient cycles (Table 1). All oocyte donation cycles were undertaken as fresh cycles.

3.4.1 Oocyte donation cycles

In 2007, there were 952 cycles in Australia and New Zealand where the intention was to donate fresh oocytes to a recipient. Forty-nine of these cycles were cancelled before oocyte pick-up (OPU).

Of the 952 oocyte donation cycles, 47.5% were in women aged 35 years or older. The average age of women donating oocytes was 33.6 years. Nearly 94% of the initiated oocyte donation cycles resulted in donations (Table 18).

Table 18: Number of oocyte donation cycles by donor's age group, Australia and New Zealand, 2007

Age group (years) [(a)]	Initiated cycles (number)	Cycles with OPU performed (per cent)	Cycles with oocyte collected (per cent)	Cycles with oocyte donated (per cent)
< 30	157	95.5	94.3	94.3
30–34	343	94.2	93.6	93.3
35–39	388	95.4	94.1	93.8
≥ 40	64	93.8	93.8	93.8
Total[(b)]	**952**	**94.9**	**93.9**	**93.7**

(a) Age at time of treatment.

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

3.4.2 Oocyte/embryo recipient cycles

There were 1,962 oocyte/embryo recipient cycles reported in 2007 (Table 1). The average age of women having an oocyte/embryo recipient cycle was 40.5 years. Of these 1,962 recipient cycles, 87.9% (1,724) were oocyte recipient cycles and 12.1% (238) were embryo recipient cycles. About half (48.7%) of the 1,724 oocytes recipient cycles were thaw cycles (Table 19). All embryo recipient cycles were thaw cycles.

Progression of oocyte/embryo recipient cycles

Figure 7 shows the main stages of oocyte/recipient cycles and the resulting treatment outcomes. Of the 1,962 initiated oocyte/embryo recipient cycles undertaken in 2007, 23.0% resulted in a clinical pregnancy and 16.6% resulted in a live delivery.

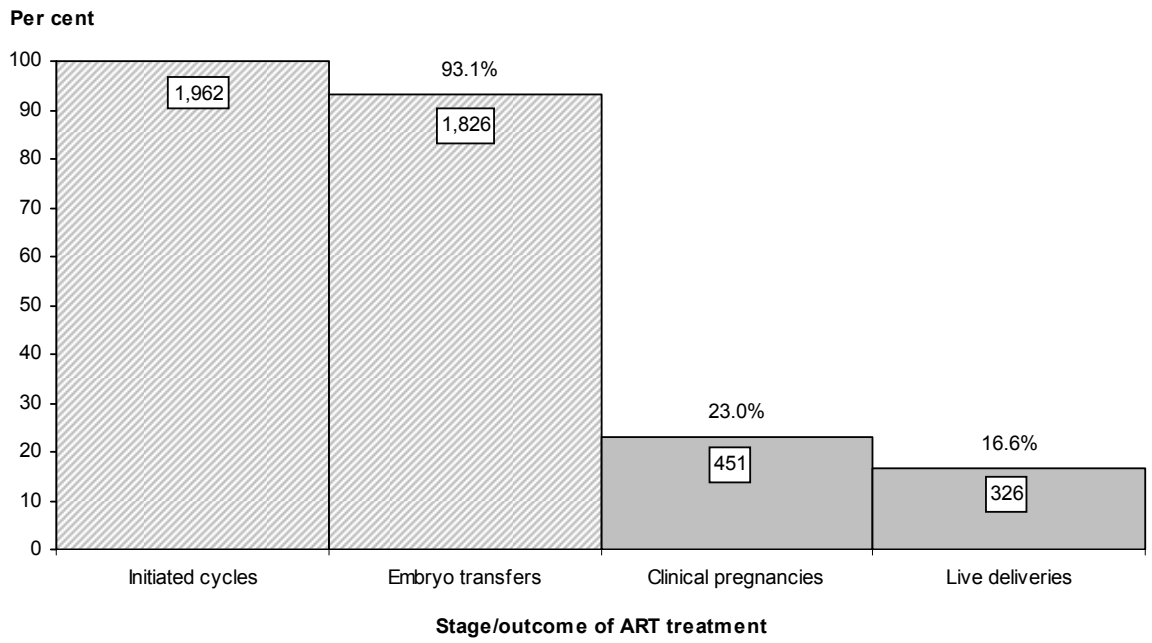


Figure 7: Progression of oocyte/embryo recipient cycles following embryo transfers, Australia and New Zealand, 2007

Of the 884 fresh oocyte recipient cycles, 20.4% resulted in a live delivery, which is significantly higher than either the live delivery rate for thaw oocyte recipient cycles (14.0%) or embryo recipient cycles (11.8%) ($p<0.01$, Chi-square test) (Table 19).

Table 19: Outcomes of oocyte/embryo recipient cycles by treatment type, Australia and New Zealand, 2007

	Oocyte recipient			
Stage/outcome of treatment	**Fresh**	**Thaw**	**Embryo recipient**	**All**
Initiated cycles	884	840	238	1,962
Embryo transfers	796	802	228	1,826
Clinical pregnancies	255	158	38	451
Live deliveries	180	118	28	326
Live deliveries per initiated cycle (%)	*20.4*	*14.0*	*11.8*	*16.6*
Live deliveries per embryo transfer cycle (%)	*22.6*	*14.7*	*12.3*	*17.9*
Live deliveries per clinical pregnancy (%)	*70.6*	*74.7*	*73.7*	*72.3*

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. Cycles in recipients aged 40–44 years had a higher live delivery rate than other ages groups (Table 20).

Table 20: Outcomes of oocyte/embryo recipient cycles by recipient's age group, Australia and New Zealand, 2007

	Age group (years)[(a)]					
Stage/outcome of treatment	**< 30**	**30–34**	**35–39**	**40–44**	**≥ 45**	**All**
Initiated cycles	66	242	480	662	512	1,962
Embryo transfers	61	228	452	604	481	1,826
Clinical pregnancies	15	55	112	158	111	451
Live deliveries	9	39	83	116	79	326
Live deliveries per initiated cycle (%)	*13.6*	*16.1*	*17.3*	*17.5*	*15.4*	*16.6*
Live deliveries per embryo transfer cycle (%)	*14.8*	*17.1*	*18.4*	*19.2*	*16.4*	*17.9*
Live deliveries per clinical pregnancy (%)	*60.0*	*70.9*	*74.1*	*73.4*	*71.2*	*72.3*

(a) Age at time of treatment.

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

Regardless of women's age, the live delivery rate per oocyte/embryo recipient cycle with embryos transferred was lower for SET cycles than for DET cycles. Overall, the difference in the live delivery rate between SET cycles and DET cycles was 4.6 percentage points (15.9% and 20.5% respectively) (Table 21).

Table 21: Outcomes of oocyte/embryo recipient cycles by recipient's age and number of embryos transferred, Australia and New Zealand, 2007

	Age group (years)[a]								
	< 35			≥ 35			All		
Stage/outcome of treatment	One embryo	Two embryos	Three or more embryos	One embryo	Two embryos	Three or more embryos	One embryo	Two embryos	Three or more embryos
Embryo transfers	169	120	0	860	669	8	1,029	789	8
Clinical pregnancies	41	29	0	197	183	1	238	212	1
Live deliveries	24	24	0	140	138	0	164	162	0
Clinical pregnancies per embryo transfer cycle (%)	*24.3*	*24.2*	*. .*	*22.9*	*27.4*	*12.5*	*23.1*	*26.9*	*12.5*
Live deliveries per embryo transfer cycle (%)	*14.2*	*20.0*	*. .*	*16.3*	*20.6*	*0.0*	*15.9*	*20.5*	*0.0*

(a) Age at time of treatment.

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

Regardless of women's age, the live delivery rate per oocyte/embryo recipient cycle with embryos transferred was similar between cleavage stage embryo transfer cycles and blastocyst transfer cycles. Overall, the difference in live delivery rates for cleavage stage embryos and blastocysts was only 0.2 percentage points (17.9% and 17.7% respectively) (p=0.90, Chi-square test) (Table 22).

Table 22: Outcomes of oocyte/embryo recipient cycles by recipient's age and stage of embryo development, Australia and New Zealand, 2007

	Age group (years)[(a)]					
	< 35		≥ 35		All	
Stage/outcome of treatment	Cleavage stage embryo	Blastocyst	Cleavage stage embryo	Blastocyst	Cleavage stage embryo	Blastocyst
Embryo transfers	223	66	1,150	387	1,373	453
Clinical pregnancies	53	17	288	93	341	110
Live deliveries	37	11	209	69	246	80
Clinical pregnancies per embryo transfer cycle (%)	*23.8*	*25.8*	*25.0*	*24.0*	*24.8*	*24.3*
Live deliveries per embryo transfer cycle (%)	*16.6*	*16.7*	*18.2*	*17.8*	*17.9*	*17.7*

(a) Age at time of treatment.

4 Pregnancy and birth outcomes following embryo transfer cycles in 2007

4.1 Clinical pregnancies

Clinical pregnancies overview

Of the 46,464 autologous and recipient embryo transfer cycles undertaken in Australian and New Zealand fertility centres, 12,782 resulted in a clinical pregnancy. Of these, 11,430 (89.4%) were from fertility centres in Australia and 1,352 (10.6%) from New Zealand centres. The 33 clinical pregnancies that resulted from GIFT and surrogacy cycles are described in Chapter 5.

Almost four in five clinical pregnancies (78.0%) resulted in a delivery and 20.3% resulted in early pregnancy loss (less than 20 weeks gestation and less than 400 grams birthweight). The outcomes of 223 (1.7%) clinical pregnancies were not known because women were unable to be followed up or contacted by fertility centres.

The majority of clinical pregnancies followed SET (62.6%) and DET (36.9%). Only 0.5% of clinical pregnancies followed the transfer of more than two embryos.

Fetal hearts by number of embryos transferred

Multiple gestation pregnancies are closely related to the number of embryos transferred in ART treatment. Two fetal hearts were detected in 20.9% of clinical pregnancies following DET cycles and in 1.9% of clinical pregnancies following SET cycles (Table 23).

Table 23: Clinical pregnancies by number of fetal hearts and number of embryos transferred, Australia and New Zealand, 2007

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)]	532	6.6	322	6.8	4	6.5	858	6.7
1	6,935	86.6	3,117	66.1	41	66.1	10,093	79.0
2	154	1.9	986	20.9	10	16.1	1,150	9.0
3 or 4	5	0.1	24	0.5	1	1.6	30	0.2
Not stated	380	4.7	265	5.6	6	9.7	651	5.1
Total	**8,006**	**100.0**	**4,714**	**100.0**	**62**	**100.0**	**12,782**	**100.0**

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

Early pregnancy loss

There were 2,596 early pregnancy losses (less than 20 weeks gestation and less than 400 grams birthweight) following embryo transfers in 2007, representing 20.3% of clinical pregnancies. Of these, 89.6% were miscarriages, 6.6% were ectopic or heterotopic pregnancies and 3.8% were due to fetal reduction or termination of pregnancy (Table 24).

Table 24: Clinical pregnancies of < 20 weeks gestation by pregnancy outcome and treatment type, Australia and New Zealand, 2007

Pregnancy outcome	Autologous				Oocyte /embryo recipient		All	
	Fresh		Thaw					
	Number	Per cent	Number	Per cent	Number	Per cent	Number	Per cent
Miscarriage	1,399	90.2	827	88.9	100	87.0	2,326	89.6
Reduction or termination	62	4.0	34	3.7	2	1.7	98	3.8
Ectopic or heterotopic pregnancy	90	5.8	69	7.4	13	11.3	172	6.6
Total	**1,551**	**100.0**	**930**	**100.0**	**115**	**100.0**	**2,596**	**100.0**

4.2 Deliveries

There were 9,963 women who gave birth to at least one baby of 20 weeks or more gestation or at least 400 grams birth weight following embryo transfer cycles in 2007. Of these, 98.9% of the women gave birth to at least one liveborn baby (live delivery). The proportion of live deliveries among all deliveries was similar across all treatment types (Table 25).

Table 25: Deliveries by delivery outcome and treatment type, Australia and New Zealand, 2007

Pregnancy outcome	Autologous				Oocyte /embryo recipient		All	
	Fresh		Thaw					
	Number	Per cent	Number	Per cent	Number	Per cent	Number	Per cent
Live delivery	6,305	98.8	3,223	99.1	326	98.8	9,854	98.9
Fetal death[(a)]	67	1.1	29	0.9	4	1.2	100	1.0
Not stated	8	0.1	1	0.0	0	0.0	9	0.1
Total	**6,380**	**100.0**	**3,253**	**100.0**	**330**	**100.0**	**9,963**	**100.0**

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

Deliveries by the number of embryos transferred

Of the 9,963 women who gave birth following embryo transfer cycles in 2007, 10.0% had multiple gestation deliveries (Table 26). This proportion of multiple gestation deliveries was lower than in 2006 (12.0%) (Wang et al. 2008). By comparison, the proportion of all deliveries in Australia in 2006 that were multiple gestation deliveries was 1.7% (Laws et al. 2008).

There were 977 women who had twin deliveries, accounting for 9.8% of women who gave birth following embryo transfer cycles in 2007. Eighty–six percent of twin deliveries were from DET cycles (840/977) and 13.2% (129/977) were from SET cycles. Of the 3,622 deliveries following DET, 23.2% were twins. This was significantly higher than the proportion of twin deliveries following SET (2.0%) ($p<0.01$, Chi-square test) (Table 26).

Table 26: Deliveries by gestation and number of embryos transferred, Australia and New Zealand, 2007

Gestation	One embryo		Two embryos		Three or more embryos		Total	
	Number	Per cent	Number	Per cent	Number	Per cent	Number	Per cent
Singleton	6,170	97.9	2,769	76.4	31	79.5	8,970	90.0
Multiple	*132*	*2.1*	*853*	*23.6*	*8*	*20.5*	*993*	*10.0*
Twin	129	2.0	840	23.2	8	20.5	977	9.8
Triplet	3	0.0	13	0.4	0	0.0	16	0.2
Total	**6,302**	**100.0**	**3,622**	**100.0**	**39**	**100.0**	**9,963**	**100.0**

Deliveries by maternal age

The average age of women at the time of delivery was 34.8 years. This is five years older than the average age (29.8 years) of women who gave birth in Australia in 2006 (Laws et al. 2008).

Women aged less than 35 years had a marginally higher proportion of multiple gestation deliveries compared with women aged 35 years or older (10.4% and 9.6% respectively) (Table 27).

Table 27: Deliveries by gestation and maternal age group, Australia and New Zealand, 2007

	Age group (years)[a]					
	< 35		≥ 35		Total[b]	
Gestation	**Number**	**Per cent**	**Number**	**Per cent**	**Number**	**Per cent**
Singleton	4,038	89.6	4,929	90.4	8,970	90.0
Multiple	*467*	*10.4*	*526*	*9.6*	*993*	*10.0*
Twin	462	10.3	515	9.4	977	9.8
Triplet	5	0.1	11	0.2	16	0.2
Total	**4,505**	**100.0**	**5,455**	**100.0**	**9,963**	**100.0**

(a) Age at time of delivery.

(b) Includes deliveries where age was not stated.

Caesarean section

Almost half (48.4%, 95% CI 47.5% to 49.4%) of deliveries following embryo transfer cycles in 2007 were by caesarean section (Table 28). This is a markedly higher rate than for all deliveries in Australia in 2006 (30.8%) (Laws et al. 2008).

The caesarean section rate increased with advancing women's age at delivery—37.3% of women aged less than 30 years had a caesarean section compared to 77.3% of women aged 45 years or older (Table 28).

There was also a significant difference in the caesarean section rate for singleton deliveries (45.0%) compared with twin deliveries (79.2%) and triplet deliveries (93.8%) ($p<0.01$, Chi-square test).

Table 28: Deliveries by method of delivery and maternal age group, Australia and New Zealand, 2007

Method of delivery	Age group (years)[a]					
	< 30	30–34	35–39	40–44	≥ 45	Total[b]
			Number			
Caesarean section	450	1,446	2,079	747	102	4,825
Other	756	1,848	2,018	477	30	5,131
Not stated	1	4	1	1	0	7
Total	**1,207**	**3,298**	**4,098**	**1,225**	**132**	**9,963**
			Per cent			
Caesarean section	37.3	43.8	50.7	61.0	77.3	48.4
Other	62.6	56.0	49.2	38.9	22.7	51.5
Not stated	0.1	0.1	0.0	0.1	0.0	0.1
Total	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**

(a) Age at time of delivery.

(b) Includes deliveries where age was not stated.

4.3 Perinatal outcomes of babies conceived following embryo transfer cycles

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

There were 10,972 babies born to women who had embryo transfer cycles in 2007 — 89.5% (9,824) were from fertility centres in Australia and 10.5% (1,148) were from fertility centres in New Zealand. Of the 10,972 babies, 81.8% were singletons, 17.8% were twins and 0.4% were triplets. There were 10,835 liveborn babies, representing 98.8% of all babies. The birth status was not reported for 11 babies.

Sex distribution in babies

There were 5,580 (50.9%) male babies, 5,362 (48.9%) female babies, and 30 (0.3%) babies where gender was not stated. For the 10,835 liveborn babies the secondary sex ratio was 104.6 male babies for every 100 female babies. The secondary sex ratio for all Australian liveborn babies born in 2006 was 106.4 (Laws et al. 2008).

Gestational age of babies

The average gestational age of all babies born follow embryo transfer cycles was 37.7 weeks (Table 29). This is less than the average gestational age of 38.8 weeks for all babies born in Australia in 2006 (Laws et al. 2008).

One in five babies (20.6%) were preterm (less than 37 weeks gestation), which was markedly higher than the proportion of preterm babies (8.2%) born in Australia in 2006 (Laws et al. 2008). The high proportion of ART babies born preterm is mainly related to the higher proportion of multiple births among women who had ART treatment. The average gestational age of singletons was 38.3 weeks with 10.5% of singletons being born preterm. This contrasts with the average gestational age for ART twins of 34.9 weeks, with almost 64.9% of twins being born preterm. All ART triplets were born preterm (Table 29).

Table 29: Babies by gestational age and plurality, Australia and New Zealand, 2007

Gestational age (weeks)	Singletons		Twins		Triplets		Total	
	Number	Per cent	Number	Per cent	Number	Per cent	Number	Per cent
Mean (weeks)	*38.3*		*34.9*		*32.1*		*37.7*	
≤ 27	131	1.5	84	4.3	6	12.5	221	2.0
28–31	101	1.1	168	8.6	6	12.5	275	2.5
32–36	713	7.9	1,016	52.0	36	75.0	1,765	16.1
≥ 37	8,022	89.4	686	35.1	0	0.0	8,708	79.4
Total[(a)]	**8,970**	**100.0**	**1,954**	**100.0**	**48**	**100.0**	**10,972**	**100.0**
≤ 36	*945*	*10.5*	*1,268*	*64.9*	*48*	*100.0*	*2,261*	*20.6*

(a) Includes babies where gestational age was not stated.

Figure 8 shows the distribution of gestational age for singletons and twins born to women who had embryo transfer cycles in 2007. The proportions of preterm singletons (10.5%) and twins (64.9%) born to women who had embryo transfer cycles in 2007 were higher than the proportions of preterm singletons and twins born in Australia in 2006 (6.5% and 55.5% respectively) (Laws et al. 2008).

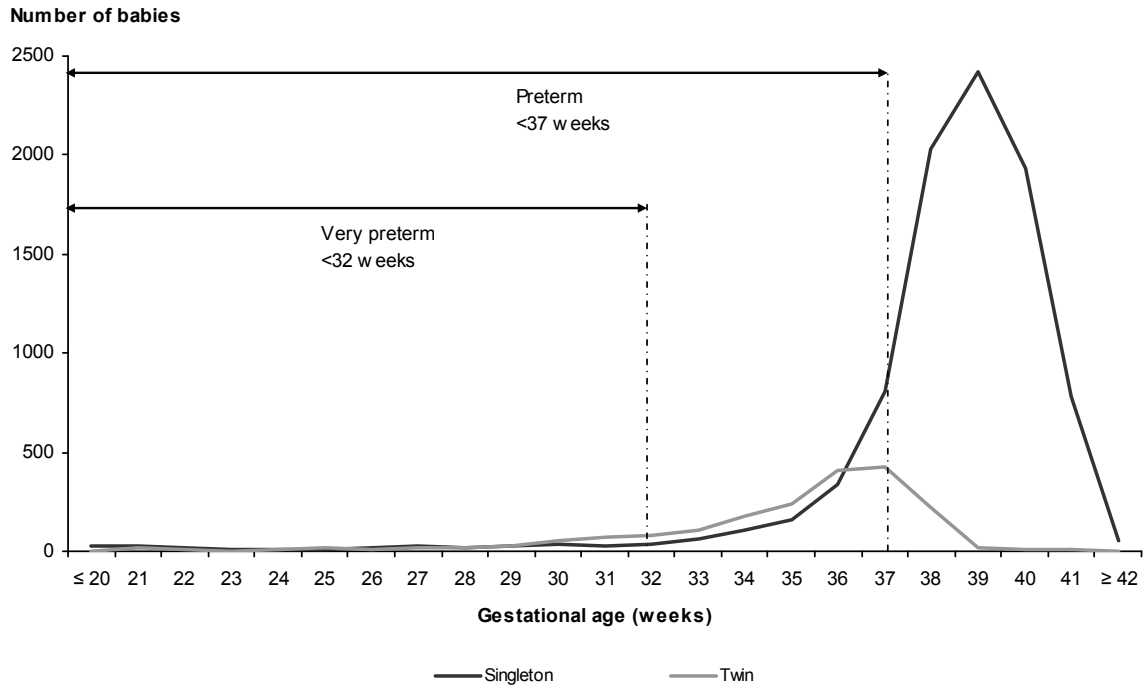


Figure 8: Number of babies by gestational age, Australia and New Zealand, 2007

Birthweight of liveborn babies

The average birthweight for liveborn babies to women who had embryo transfer cycles in 2007 was 3,152 grams. Just over 15% of these babies were low birthweight (< 2,500 grams) (Table 30).

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

Singletons had an average birthweight of 3,326 grams, compared with 2,370 grams for twins. Just on 7% of ART singletons were low birthweight (Table 30), which is markedly higher than the proportion of low birthweight singletons (4.8%) born in Australia in 2006 (Laws et al. 2008). Of ART twins, 52.1% were low birthweight, which is similar to the proportion of low birthweight twins (51.5%) born in Australia in 2006 (Laws et al. 2008).

Table 30: Liveborn babies by birthweight group and plurality, Australia and New Zealand, 2007

	Singletons		Twins		Triplets		Total	
Birthweight (g)	**Number**	**Per cent**	**Number**	**Per cent**	**Number**	**Per cent**	**Number**	**Per cent**
Mean (g)	*3,326*		*2,370*		*1,737*		*3,152*	
< 1,000	59	0.7	48	2.5	8	16.7	115	1.1
1,000–1,499	70	0.8	122	6.4	3	6.3	195	1.8
1,500–1,999	129	1.5	264	13.8	19	39.6	412	3.8
2,000–2,499	360	4.1	565	29.5	13	27.1	938	8.7
2,500–2,999	1,299	14.6	632	33.0	3	6.3	1,934	17.8
3,000–3,499	3,391	38.2	226	11.8	0	0.0	3,617	33.4
3,500–3,999	2,550	28.7	18	0.9	0	0.0	2,568	23.7
≥ 4,000	942	10.6	6	0.3	0	0.0	948	8.7
Not stated	71	0.8	35	1.8	2	4.2	108	1.0
Total	**8,871**	**100.0**	**1,916**	**100.0**	**48**	**100.0**	**10,835**	**100.0**
< 2,500	*618*	*7.0*	*999*	*52.1*	*43*	*89.6*	*1,660*	*15.3*

Perinatal mortality

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

There were 159 reported perinatal deaths, representing 1.4% of all babies born following embryo transfer cycles in 2007. Of these, 126 were fetal deaths and 33 were neonatal deaths. The perinatal death rate in 2007 was 14.5 deaths per 1,000 births (Table 31). Although, the reported perinatal mortality rate in 2007 was lower than the rate of 17.5 deaths per 1,000 births reported in 2006 (Wang et al. 2008), it remains higher than the perinatal mortality rate of 10.3 per 1,000 births to all women who gave birth in Australia 2006 (Laws et al. 2008).

Singletons had a lower perinatal mortality rate of 12.6 deaths per 1,000 births compared to twins (23.5 deaths per 1,000 births) (Table 31). There were no perinatal deaths among triplets.

These data should be interpreted with caution because of the small numbers and potential variability in case reporting. Data are limited by the self-reported nature of the information, especially on pregnancy complications and infant morbidity and mortality. In 2007, information relating to birth outcomes was not stated for less than 1.7% of clinical pregnancies.

Table 31: Perinatal mortality of babies by type of death and plurality, Australia and New Zealand, 2007

Type of death	Singletons	Twins	Total
		Number	
Fetal deaths	90	36	126
Neonatal deaths	23	10	33
Perinatal deaths[(a)]	**113**	**46**	**159**
		Rate per 1,000 births	
Fetal deaths per 1,000 births	*10.0*	*18.4*	*11.5*
Neonatal deaths per 1,000 live births	*2.6*	*5.2*	*3.0*
Perinatal deaths per 1,000 births[(b)]	*12.6*	*23.5*	*14.5*

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

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

5 GIFT cycles, surrogacy cycles, other procedures and complications in 2007

5.1 GIFT cycles

Gamete intrafallopian transfer (GIFT) is an ART treatment where mature oocytes and sperm are placed directly into a woman's fallopian tubes so that in vivo fertilisation may take place. The use of GIFT has been declining in Australia and New Zealand in recent years. In 2007, there were 133 GIFT cycles or intended GIFT cycles reported to ANZARD. Of these cycles, 107 (80.5%) had oocytes transferred, of which 17.8% (19) resulted in a clinical pregnancy, 13.1% (14) resulted in a delivery (including one twin delivery) and 12.2% (13) resulted in a live delivery.

Of the 15 babies born to women who had GIFT cycles in 2007, 20% were born preterm (<37 weeks gestation) and 26.7% were low birthweight (<2,500 grams). One of the 15 babies was reported as a fetal death (stillbirth).

5.2 Surrogacy cycles

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

There were 74 surrogacy cycles reported to ANZARD in 2007, including 52 gestational carrier cycles and 22 commissioning cycles. Among gestational carrier cycles, 14 (26.9%) resulted in a clinical pregnancy and 7 (13.5%) resulted in a live delivery. All seven babies born to surrogacy carriers in 2007 were liveborn singletons.

5.3 Preimplantation genetic diagnosis

Preimplantation genetic diagnosis (PGD) is a procedure whereby embryonic cells are removed and screened for chromosomal disorders or genetic diseases before embryo transfer. In 2007, PGD was performed in 906 cycles, representing 1.8% of cycles in which embryos were created or thawed. Most PGD cycles (762/906) were fresh cycles (Table 32).

Of the 906 PGD cycles, 72.4% (656) had embryos transferred, 23.4% (212) resulted in a clinical pregnancy and 17.8% (161) resulted in a live delivery.

Table 32: Number of cycles with PGD by type of embryo, Australia and New Zealand, 2007

	Stage of treatment		
Type of embryo	Number of cycles with embryo fertilised/thawed	Number of cycles with PGD	PGD per cycle with embryo fertilised/thawed (%)
Fresh	29,133	762	2.6
Thaw	20,991	144	0.7
Total	**50,124**	**906**	**1.8**

5.4 Ovarian hyperstimulation syndrome

ANZARD includes morbidity information that is specifically related to ART treatment. Ovarian hyperstimulation syndrome (OHSS) is a complication of ovarian stimulation, which involves the administration of fertility drugs to stimulate follicular development and oocyte maturation.

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

There were 248 OHSS cases reported in 2007. Of these, 234 (94.4%) were reported as being admitted to hospital. There were 244 OHSS cases in which OPUs were performed. Overall, OHSS occurred in 0.8% of cycles that involved an OPU with the incidence of OHSS increasing with the number of oocytes collected (Table 33).

Table 33: Number of cycles with OPU performed and OHSS by number of oocytes collected, Australia and New Zealand, 2007

	Number of oocytes collected						
	None	1–4	5–9	10–14	15–19	≥ 20	All
Cycles with OHSS	1	7	31	53	67	85	244
Cycles with OPU	568	7,199	10,773	7,174	3,464	2,312	31,490
OHSS per OPU cycle (%)	*0.2*	*0.1*	*0.3*	*0.7*	*1.9*	*3.7*	*0.8*

6 Donor sperm insemination cycles in 2007

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

Number and outcomes of DI cycles

In 2007, there were 2,458 DI cycles reported to ANZARD, which included 16.5% (406) undertaken with controlled ovarian hyperstimulation and 83.5% (2,052) undertaken in unstimulated cycles. The average age of women who had a DI cycle in 2007 was 35.3 years. Of all DI cycles, 14.1% resulted in a clinical pregnancy and 11.2% resulted in a live delivery (Table 34).

Over two-thirds (69.0%) of DI cycles were in women aged between 30 and 39 years. The clinical pregnancy rate and live delivery rate decreased with advancing women's age. About 16% of DI cycles in women aged less than 30 years resulted in a live delivery, compared to only 3% of DI cycles in women aged 40 years or older (Table 34).

Table 34: Number of DI cycles by women's age group, Australia and New Zealand, 2007

	Age group (years)[(a)]				
Stage/outcome of treatment	**< 30**	**30–34**	**35–39**	**≥ 40**	**Total**
DI cycles	303	687	1,009	459	2,458
Clinical pregnancies	54	117	144	32	347
Live deliveries	48	102	111	14	275
Clinical pregnancies per DI cycle (%)	*17.8*	*17.0*	*14.3*	*7.0*	*14.1*
Live deliveries per DI cycle (%)	*15.8*	*14.8*	*11.0*	*3.1*	*11.2*
Live deliveries per clinical pregnancy (%)	*88.9*	*87.2*	*77.1*	*43.8*	*79.3*

(a) Age at time of treatment.

Clinical pregnancies following DI cycles

There were 347 clinical pregnancies following DI cycles in 2007 (Table 34). Of these, 0.6% were ectopic/heterotopic pregnancies and 1.4% were terminations/reductions. Almost 80% of clinical pregnancies (276 of 347) resulted in a delivery (Table 34). One delivery was a fetal death (stillbirth). Multiple gestation deliveries accounted for 6.2% (17 of 276) of all deliveries.

Perinatal outcomes of babies

There were 293 babies born to women who had DI treatment. Of these babies, 13.7% (40) were born preterm (<37 weeks gestation), which is higher than the proportion of preterm babies (8.2%) born in Australia in 2006 (Laws et al. 2008). The mean birthweight of liveborn babies following DI treatment was 3,293 grams. Thirty two babies (11.0%) born with low birthweight (<2,500 grams), which is higher than the proportion of low birthweight babies (6.4%) born in Australia in 2006 (Laws et al. 2008). The perinatal death rate (fetal deaths plus neonatal deaths) was 6.8 per 1,000 births to women who had DI in 2007.

7 Trends in ART treatment and outcomes: 2003–2007

This section includes autologous cycles, donation/recipient cycles, GIFT cycles and surrogacy cycles undertaken in Australia and New Zealand from 2003 to 2007.

ART treatment and outcomes

In 2007, 56,817 initiated ART treatment cycles were undertaken in Australia and New Zealand. This is an increase of 12.5% in ART treatment cycles undertaken in 2006 and an increase of 53.7% in ART treatment cycles undertaken in 2003 (Table 35).

There has also been a steady increase in the number of clinical pregnancies and live deliveries resulting from ART treatment between 2003 and 2007. This increase resulted mainly from the increase in the number of ART treatments undertaken. In 2007, there were 9,874 live deliveries, 1.6 times the 6,022 live deliveries in 2003 (Table 35). This increase represents a growth of 1,260 clinical pregnancies per year ($p<0.01$) and 991 live deliveries per year ($p<0.01$) between 2003 and 2007.

Between 2003 and 2007, the live delivery rate per initiated cycle ranged from 16.2% to 17.8% (Table 35). During this period there was a voluntary shift in clinical practice to SET in Australia and New Zealand, with the proportion of SET cycles increasing from 32.0% to 63.7% (Figure 9). During the same period there was a fall in the multiple delivery rate from 18.7% to 10.0% (Table 36).

Table 35: Number of ART treatment cycles by stage/outcome of treatment, Australia and New Zealand, 2003 to 2007

Stage/outcome of treatment	2003	2004	2005	2006	2007
Initiated cycles[(a)]	36,966	41,904	47,661	50,521	56,817
Embryo transfers[(b)]	30,184	34,232	39,121	41,447	46,620
Clinical pregnancies	7,977	8,794	10,492	11,720	12,815
Live deliveries	6,022	6,792	8,166	8,999	9,874
Clinical pregnancies per initiated cycle (%)	*21.6*	*21.0*	*22.0*	*23.2*	*22.6*
Live deliveries per initiated cycle (%)	*16.3*	*16.2*	*17.1*	*17.8*	*17.4*

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

(b) Includes GIFT cycles that reached oocyte transfer.

Multiple gestation deliveries

Between 2003 and 2007, there was a decrease in multiple gestation deliveries resulting from ART treatment. The proportion of singleton deliveries significantly increased from 80.9% in 2003 to 90.0% in 2007 ($p<0.01$). The multiple delivery rate in 2007 was 10.0%, with the proportion of twin deliveries being 9.8% — the lowest since ANZARD was established (Table 36).

Table 36: Number of deliveries following ART treatment by gestation, Australia and New Zealand, 2003 to 2007

	2003		2004		2005		2006		2007	
Gestation	Number	Per cent	Number	Per cent	Number	Per cent	Number	Per cent	Number	Per cent
Singleton	4,951	80.9	5,740	82.8	7,085	85.9	8,016	88.0	8,990	90.0
Multiple	*1,145*	*18.7*	*1,137*	*16.4*	*1,161*	*14.1*	*1,093*	*12.0*	*994*	*10.0*
Twin	1,124	18.4	1,114	16.1	1,134	13.8	1,070	11.7	978	9.8
Higher order multiple	21	0.3	23	0.3	27	0.3	23	0.3	16	0.2
Total[(a)]	**6,123**	**100.0**	**6,932**	**100.0**	**8,246**	**100.0**	**9,109**	**100.0**	**9,984**	**100.0**

(a) Includes cycles in which gestation was unknown.

Women's age of autologous cycles

The majority of autologous cycles were in women aged 30 to 40 years. The proportion of autologous cycles in women aged 40 years and older increased from 18.3% in 2003 to 21.4% in 2007. The average age of women having autologous cycles in 2007 was 35.5 years which was 0.5 years older than recorded in 2003 (35.0 years) (Table 37).

Table 37: Number of autologous cycles by women's age group, Australia and New Zealand, 2003 to 2007

	2003		2004		2005		2006		2007	
Age group (years)[(a)]	Number	Per cent	Number	Per cent	Number	Per cent	Number	Per cent	Number	Per cent
Mean (years)	*35.0*		*35.1*		*35.3*		*35.4*		*35.5*	
< 30	4,432	12.9	4,680	12.0	5,144	11.5	5,539	11.6	6,021	11.2
30–34	11,532	33.6	12,970	33.2	14,499	32.4	14,312	30.0	15,376	28.6
35–39	12,055	35.1	13,937	35.7	16,328	36.5	17,947	37.7	20,799	38.7
40–44	5,851	17.0	6,928	17.7	8,158	18.2	9,153	19.2	10,680	19.9
≥ 45	443	1.3	557	1.4	634	1.4	688	1.4	819	1.5
Not stated	6	0.0	0	0.0	0	0.0	4	0.0	1	0.0
Total	**34,319**	**100.0**	**39,072**	**100.0**	**44,763**	**100.0**	**47,643**	**100.0**	**53,696**	**100.0**

(a) Age at time of treatment.

Types of ART treatment and stage of embryo development

The number and proportion of blastocyst transfer cycles has increased significantly over the five-year period 2003 to 2007. For fresh and thaw embryo transfer cycles the proportion of blastocyst transfer cycles increased from 13.4% in 2003 to 30.6% in 2007 ($p<0.01$) (Table 38).

Table 38: Number of embryo transfer cycles by treatment type, Australia and New Zealand, 2003 to 2007

	2003		2004		2005		2006		2007	
Treatment type/procedure	Number	Per cent	Number	Per cent	Number	Per cent	Number	Per cent	Number	Per cent
					Fresh					
Cleavage stage	14,885	85.3	16,381	82.1	17,452	77.0	17,773	73.4	19,504	71.9
Blastocyst	2,568	14.7	3,571	17.9	5,222	23.0	6,428	26.6	7,629	28.1
					Thaw					
Cleavage stage	11,097	88.4	11,875	84.0	12,791	78.4	12,372	72.3	12,757	65.8
Blastocyst	1,458	11.6	2,266	16.0	3,533	21.6	4,751	27.7	6,623	34.2

Number of embryos transferred per embryo transfer cycle

There has been a significant decline in the number of cycles in which three or more embryos were transferred, from 4.3% in 2003 to 0.4% in 2007 ($p<0.01$). There has also been a significant shift in practice to SET, with the proportion of SET cycles increasing from 32.0% in 2003 to 63.7% in 2007 ($p<0.01$) in Australia and New Zealand (Figure 9).

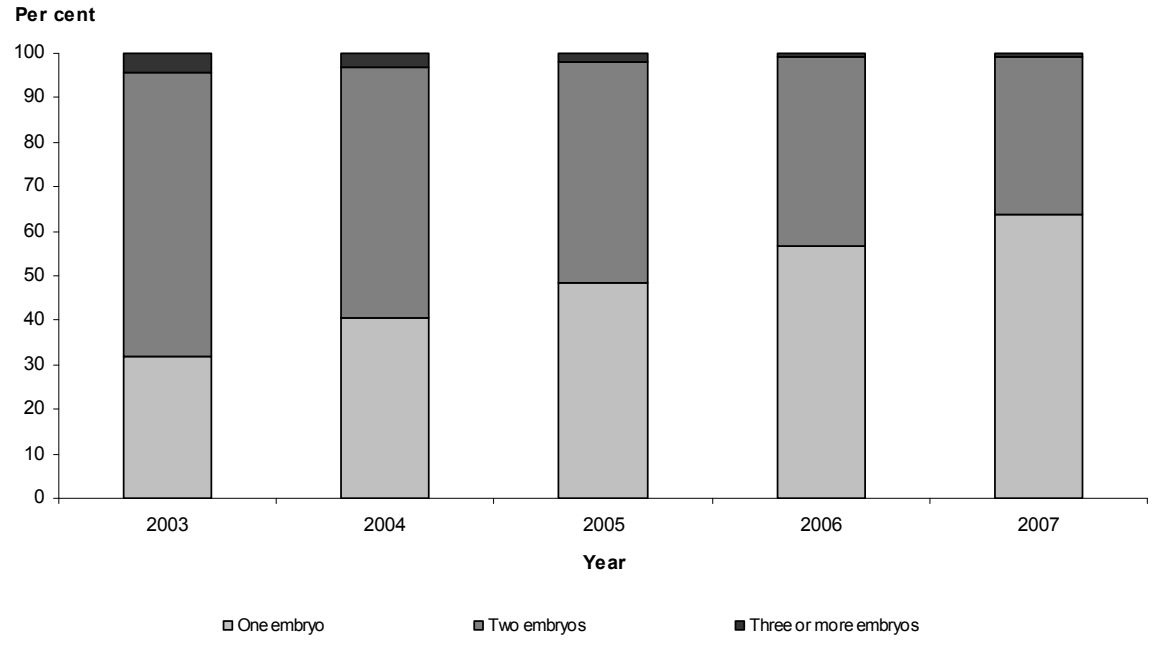


Figure 9: Proportion of embryo transfer cycles by number of embryos transferred, Australia and New Zealand, 2003 to 2007

Appendix 1: Data used in this report

The data presented in this report are supplied 35 fertility centres in Australia and New Zealand and are compiled into ANZARD. ANZARD includes information about the ART treatment procedures of IVF and GIFT. It also includes information about ART treatment using fresh and cryopreserved/thawed embryos, treatment involving donated oocytes or embryos, and treatment involving surrogacy arrangements. ANZARD collects data on the use of ART techniques such as ICSI, assisted hatching, PGD and blastocyst culture. In addition to ART procedures, ANZARD also collects data from fertility centres about artificial insemination cycles using donated sperm (donor insemination (DI)). The outcomes of pregnancies, deliveries and babies born following ART and DI treatments are also maintained in ANZARD. This includes the method of birth, birth status, birthweight, gestational age, plurality, perinatal mortality and selected information on maternal morbidity.

This report presents information on ART and DI treatment cycles that took place in fertility clinics in Australia and New Zealand in 2007, and the resulting pregnancies and births. The babies included in this report were conceived through treatment cycles undertaken in 2007, and were born in either 2007 or 2008.

Data validation

Most fertility centres have computerised data information management systems and are able to provide the NPSU with high quality data. All data processed by NPSU undergo a validation process, with data queries being followed up with fertility centre staff. In 2007, information relating to pregnancy and birth outcomes was not provided for 1.7% of clinical pregnancies. The Reproductive Technology Accreditation Committee of the Fertility Society of Australia also plays a role in ensuring the quality of ANZARD data by validating selected records against clinic files in their annual inspections.

Data presentation

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

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

Where applicable, percentages in tables have been calculated including the 'Not stated' category. Throughout the report, for totals, percentages may not add up to 100.0 and, for subtotals, they may not add up to the sum of the percentages for the categories. This is due to rounding error.

Data limitations

Follow-up of pregnancy and birth outcomes is limited because the ongoing care of pregnant patients is often carried out by non-ART practitioners. The method of follow-up varies by fertility centre and includes follow-up with the patient or clinician or the use of routine data sourced from a health department. In a small proportion of cases this information is not available. For pregnancies in which there is successful follow-up, data are limited by the self-reported nature of the information. These data include pregnancy complications, complications of fertility treatment and infant morbidity. Fertility centre staff invest significant effort in validating such information by obtaining medical records from clinicians or hospitals. Data about previous ART treatment and history of pregnancies are, in some cases, reported by patients.

Appendix 2: ANZARD data items

Variable	*Data domain*
Unit identifier	3-digit code for clinics provided by NPSU.
Site of main treatment	For centres with multiple sites, this identifies location of most significant part of the treatment.
Unit patient ID/medical record number	Unique ID for patient.
Woman's date of birth	Day/month/year.
Husband/male partner DOB	Day/month/year.
Oocyte/embryo donor's age	Completed years at time of donation.
Previous Medicare item 13200s	The number of billed Australian Medicare item 13200. New Zealand units leave this field blank.
Cause of infertility: tubal disease	Yes—in the opinion of the treating clinician or clinic there is significant tubal disease present.
	No—other.
Cause of infertility: endometriosis	Yes—in the opinion of the treating clinician or clinic there is significant endometriosis contributing to this couple's subfertility.
	No—other.
Cause of infertility: male factor	Yes—in the opinion of the treating clinician or clinic there is a significant male factor problem.
	No—other.
Cause of infertility: other factors	Yes—in the opinion of the treating clinician or clinic there is subfertility due to any other factors apart from female age, tubal disease, male factor or endometriosis. Possible examples are fibroids, ovulation disorders or premature ovarian failure. There is no clinical subfertility (e.g. egg donor, preimplantation genetic diagnosis or other non-fertility reason for ART).
	No—other.
Cause of infertility: idiopathic	Yes—in the opinion of the treating clinician or clinic there is clinical subfertility without any apparent explanation.
	No—other, including case of PGD for genetic disease.
Previous pregnancies < 20 weeks	Number of known pregnancies less than 20 weeks in the female partner regardless of whether by ART or by a different partner.
Previous pregnancies ≥ 20 weeks	Number of known pregnancies reaching 20 weeks or more in the female partner regardless of whether by ART or by a different partner.
Cycle ID	Unique cycle identifier.
Cycle date	For treatment cycles this is according to the Medicare definition and is the date of LMP for unstimulated cycles or, where FSH is used, the first day of FSH administration. For cycles where the only process is movement or disposal of embryos, this is the date of embryo movement. This date defines the year in which a cycle is reported to NPSU.
Surrogacy	Yes—the procedure is part of a surrogate arrangement.
	No—the procedure is not part of a surrogate arrangement.
Injectable FSH stimulation given	Yes—FSH administered. Does not include clomiphene or hCG alone unless FSH was also given.
	No—other.
DI date	Date of first insemination with donor sperm.
OPU date	Date of oocyte retrieval.
Number of eggs retrieved	Number of eggs retrieved at OPU. Include any immature oocytes that are identified.
Number of eggs donated	Number of eggs donated to someone else.
Number of eggs received	Number of eggs received from someone else.

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

Variable	*Data domain*
Fetal abnormality in a pregnancy ending < 20 weeks or in a fetus removed by selective reduction	Details of elective terminations of pregnancy and fetal reductions due to fetal abnormality.
Maternal complications of pregnancy	Describes morbidity related to pregnancy.
Number of babies delivered	Include all liveborn and stillborn babies.
Caesarean delivery	Yes—delivery by planned or emergency caesarean section.
	No—other.
Baby 1 outcome	Liveborn, stillborn or neonatal death.
Baby 1 sex	Male or female.
Baby 1 birthweight	Weight in grams.
Baby 1 abnormality	Describes any known congenital malformation.
Baby 1 date of neonatal death	Date of neonatal death.
Baby 2 outcome	Liveborn, stillborn or neonatal death.
Baby 2 sex	Male or female.
Baby 2 weight	Weight in grams.
Baby 2 abnormality	Describes any known congenital malformation.
Baby 2 date of neonatal death	Date of neonatal death.
Baby 3 outcome	Liveborn, stillborn or neonatal death.
Baby 3 sex	Male or female.
Baby 3 weight	Weight in grams.
Baby 3 abnormality	Describes any known congenital malformation.
Baby 3 date of neonatal death	Date of neonatal death.
Baby 4 outcome	Liveborn, stillborn or neonatal death.
Baby 4 sex	Male or female.
Baby 4 weight	Weight in grams.
Baby 4 abnormality	Describes any known congenital malformation.
Baby 4 date of neonatal death	Date of neonatal death.
Admitted with ART morbidity	Yes—woman is admitted to hospital with any condition (excluding any pregnancy-related issues, such as ectopic pregnancy) that could be in any way related to fertility treatment.
OHSS	Yes—admission to hospital is due to symptoms of OHSS.
Morbidity detail	Describes symptoms of treatment-related morbidity.

Terminology used in this report

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

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

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

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

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

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

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

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

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

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

Cryopreservation: freezing embryos for potential future ART treatment.

Delivery: a birth event in which one or more babies of 20 weeks or more of gestation or of 400 grams or more in 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 of gestation or 400 grams or more of birthweight that shows no signs of life.

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

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

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

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

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

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

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

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

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

PGD (preimplantation genetic diagnosis): a procedure where embryonic cells are removed and screened for chromosomal disorders or genetic diseases before embryo transfer.

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

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

Preterm: a gestation of less than 37 weeks.

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

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

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

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

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

Note: the International Committee for the Monitoring of Assisted Reproductive Technologies (ICMART) has published an ART glossary for the terms used in ART data collections (Zegers-Hochschild et al. 2006). However, the terminology used in this report may differ from that in the ICMART glossary.

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List of tables

Supplementary tables

The supplementary tables are available on the Internet at <www.npsu.unsw.edu.au>.

List of figures