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Assisted reproductive technology in Australia and New Zealand 2016

The Fertility Society of Australia

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September 2018

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The National Perinatal Epidemiology and Statistics Unit (NPESU) aims to provide national information and statistics in reproductive and perinatal health.

This publication was formerly part of the assisted reproduction technology series of Australian Institute of Health and Welfare. A complete list of the publications in the series is available from the NPESU website <http://npesu.unsw.edu.au/>.

ISBN-13: 978-0-7334-3827-1

Suggested citation

Fitzgerald O, Paul RC, Harris K, Chambers GM 2018. Assisted reproductive technology in Australia and New Zealand 2016. Sydney: National Perinatal Epidemiology and Statistics Unit, the University of New South Wales Sydney.

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Published by the University of New South Wales
Designed and printed by Green Print Centre at UNSW

Please note that there is the potential for minor revisions of data in this report. Please check the online version at <https://npesu.unsw.edu.au/>for any amendments.

Contents

Acknowledgments

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

All assisted reproductive technology (ART) cycles and donor insemination (DI) undertaken in Australia and New Zealand must be reported to the ANZARD as part of their accreditation by the Reproductive Technology Accreditation Committee of the FSA.

A number of organisations and people make the publication of this annual report possible. Firstly, we would like to thank all staff in the fertility centres for their efforts in compiling the data and providing additional information when requested. A complete list of all contributing fertility clinics can be found in Appendix A. We also thank Dr Clare Boothroyd, Professor Michael Chapman, Dr Anne Clark, Professor Cindy Farquhar, Dr Natalie Hesketh, Dr Phill Matson, Dr David Molloy, Professor Robert Norman and Professor Luk Rombauts for peer reviewing the report. We would also like to acknowledge the support of the NPESU by UNSW Sydney and gratefully acknowledge the financial support from the FSA for the compilation of ANZARD and the preparation of this report.

The NPESU produced this report independently with no influence from the funding body.

Abbreviations

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

Symbols

–	not applicable
%	percentage
n	number

Summary

Assisted reproductive technology (ART) is a group of procedures that involve the in vitro (outside of body) handling of human oocytes (eggs) and sperm or embryos for the purposes of establishing a pregnancy. Each ART treatment involves a number of stages and is generally referred to as an ART treatment cycle. The embryos transferred to a women can either originate from the cycle in which they were created (fresh cycle) or be frozen (cryopreserved) and thawed before transfer (thaw cycle).

There were 81,062 ART treatment cycles reported from Australian and New Zealand clinics in 2016 (74,357 and 6,705 respectively) representing a 4.0% increase in Australia and 7.4% increase in New Zealand on 2015. This represented 14.8 cycles per 1,000 women of reproductive age (15–44 years) in Australia, compared with 7.0 cycles per 1,000 women of reproductive age in New Zealand. Women used their own oocytes or embryos (autologous cycles) in 94.1% of treatments. Embryos that had been frozen and thawed were used in 38.1% of autologous cycles.

There were 39,980 women who undertook 76,255 autologous fresh and/or thaw cycles in Australia and New Zealand in 2016. On average, 1.9 fresh and/or thaw cycles per woman were undertaken in 2016, with more cycles per woman in Australia (1.9 cycles per woman) than in New Zealand (1.5 cycles per woman). The number of cycles where embryos were selected using preimplantation genetic testing (PGT) increased from 5,773 in 2015 to 7,425 in 2016 (28.6% increase)

Over the last five years there has been an increasing trend in the proportion of cycles where all oocytes or embryos are cryopreserved for potential future use (*freeze-all* cycles) from 7.2% of initiated fresh cycles in 2012 to 22.6% of initiated fresh cycles in 2016. This practice is used for a variety of reasons, including reducing the risk of ovarian hyperstimulation syndrome (OHSS), improving endometrial - embryo synchronicity, as part of a PGT cycle, for fertility preservation, or as a deliberate treatment option used by clinicians.

Patient's age

The average age of women undergoing autologous cycles was 35.8 years in 2016, similar to previous years. The average age of women undergoing ART treatment using donor oocytes or embryos was approximately five years older at 40.4 years. Approximately, one in four (24.5%) women who underwent an autologous cycle in 2016 were aged 40 or older. The average age of the male partner of the women undergoing autologous and recipient cycles was 38.1 years, with one-third (33.0%) aged 40 or older.

Treatment outcomes and number of babies

Of the 81,062 initiated cycles, 66,664 (82.2%) resulted in either an embryo transfer or all oocytes/embryos being cryopreserved. Of the initiated cycles, 22.5% (18,269) resulted in a clinical pregnancy and 17.9% (14,515) in a live delivery. The overall clinical pregnancy rate for cycles reaching embryo transfer was 33.0%. The live delivery rate per initiated autologous fresh cycle was 16.4% after *freeze-all* cycles were excluded. The live delivery rate for fresh cycles reaching embryo transfer was 23.7%. The live delivery rate per initiated autologous thaw cycle was 27.3% and for thaw cycles reaching embryo transfer cycle was 28.4%.

There was a higher live delivery rate in younger women. For women aged under 30, the live delivery rate per embryo transfer was 36.9% for autologous fresh cycles and 33.3% for

autologous thaw cycles. For women aged over 44, the live delivery rate was 1.3% and 11.8% per embryo transfer for autologous fresh and thaw cycles.

There were 15,198 babies born (including 15,057 liveborn babies) following ART treatment in 2016. Of these, 13,596 (89.5%) were from Australian clinics and 1,602 (10.5%) from New Zealand clinics. Eight in ten of the liveborn babies (80.1%) were full-term singletons of normal birthweight.

Cycle-specific success rates

ANZARD includes data items that make it possible to follow a woman's consecutive ART treatment cycles. A cohort of 15,475 women were followed from the start of their first autologous non *freeze-all* fresh cycle during 2014, through subsequent fresh and thaw cycles until December 2016 or until they achieved a live delivery. The cycle-specific live delivery rate per initiated autologous cycle for all women was 22.5% in their first cycle, and 11.9% after eight cycles. Of women who did not achieve a live birth in a specific cycle, approximately one in four did not return for further ART treatment.

Trends in ART procedures

Treatment trends in the last five years have shown a greater shift from cleavage stage transfers to blastocyst transfers (from 59.8% in 2012 to 78.4% in 2016); an increase in vitrification as a cryopreservation method (from 76.8% of thaw blastocyst transfer cycles in 2012 to 87.8% in 2016). The use of intracytoplasmic sperm injection (ICSI) as a percentage of embryo transfer cycles in has decreased from 64.7% in 2012 to 62.9% in 2016.

The proportion of embryo transfer cycles transferring a cryopreserved embryo increased from 42.9% of embryo transfer cycles in 2012 to 54.1% in 2016. Of the 14,515 live deliveries resulting for ART treatment, 58.1% resulted from thaw cycles, compared to 41.9% in 2012.

In the last five years the live delivery rate per fresh embryo transfer cycle increased from 22.9% to 23.9%, and the live delivery rate per frozen/thaw embryo transfer cycle increased from 22.0% to 28.2%. This is correlated with the shift to *freeze-all* cycles. Overall, live delivery rates per embryo transfer have risen from 22.5% in 2012 to 26.2% in 2016, a 16.7% improvement.

Multiple birth trends

A continuing trend in ART treatment in Australia and New Zealand has been the reduction in the rate of multiple deliveries, with a 42% decrease from 6.5% in 2012 to 3.8% in 2016. This was achieved by clinicians and patients shifting to single embryo transfer, with the proportion increasing from 73.2% in 2012 to 87.7% in 2016. Importantly, this decrease in the multiple delivery rate was achieved while overall live delivery rates per embryo transfer increased from 22.5% in 2012 to 26.2% in 2016.

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1 Introduction

Infertility affects approximately 15% of women of reproductive age at any given time, representing, the source of much personal suffering to millions around the world (World Health Organization 2010). The common medical definition of 'infertility' is the failure to achieve a clinical pregnancy after 12 or more months of regular unprotected sexual intercourse (Zegers-Hochschild et al. 2017). Infertility is increasingly being overcome through advancements in fertility treatment, in particular assisted reproductive technologies (ARTs). ARTs have evolved over the last four decades into a suite of mainstream medical interventions that have resulted in the birth of more than 6 million children worldwide (ICMART 2016). The most recent national estimates indicate that 4.4% of all women who gave birth in Australia in 2015 received some form of ART treatment (AIHW, 2017).

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

The Fertility Society of Australia (FSA), in collaboration with the University of New South Wales (UNSW Sydney), is committed to providing informative annual statistics on ART treatments and is pleased to present the annual report on ART performed in Australia and New Zealand in 2016.

Treatments covered in this report

ART is a group of procedures that involve the in vitro (outside of body) handling of human oocytes (eggs) and sperm or embryos for the purposes of establishing a pregnancy (Zegers-Hochschild et al. 2017). A typical fresh in vitro fertilisation (IVF) cycle involves the following five steps:

1. controlled ovarian stimulation during which an ovarian stimulation regimen, typically using follicle stimulating hormone (FSH), is administered to a woman over a number of days to induce the maturation of multiple oocytes
2. oocyte pick-up (OPU) where mature oocytes are aspirated from ovarian follicles
3. fertilisation of the collected oocytes using the woman's partner or donor sperm
4. embryo maturation during which a fertilised oocyte is cultured for 2–3 days to form a cleavage stage embryo (6–8 cells) or 4–6 days to create a blastocyst (60–100 cells)
5. transfer of one or more fresh embryos into the uterus in order to achieve pregnancy.

Treatment may be discontinued at any stage during a treatment cycle due to a number of reasons including inadequate response of ovaries to medication, excessive ovarian stimulation, failure to obtain oocytes, failure of oocyte fertilisation, inadequate embryo growth or patient choice.

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

- intracytoplasmic sperm injection (ICSI), when a single sperm is injected directly into the oocyte
- assisted hatching, when the outer layer of the embryo, the zona pellucida, is either thinned or perforated in the laboratory to aid 'hatching' of the embryo

- gamete intrafallopian transfer (GIFT), when mature oocytes and sperm are placed directly into a woman's fallopian tubes so that fertilisation may take place in vivo (inside the body). While once popular, this procedure now accounts for only a very small percentage of ART cycles
- preimplantation genetic testing (PGT), when DNA from oocytes or embryos is tested for chromosomal disorders or genetic diseases before embryo transfer. This term includes pre-implantation genetic diagnosis (PGD) and pre-implantation genetic screening (PGS)
- oocyte donation, when a woman donates her oocytes to others
- oocyte/embryo recipient, when a woman receives oocytes or embryos from another woman
- cryopreservation and storage of embryos that are not transferred in the initial fresh treatment cycle. Once thawed or warmed, the embryos can be transferred in subsequent treatment cycles. Cryopreservation techniques include both the traditional slow freezing method and vitrification. Vitrification can be used to cryopreserve gametes and embryos, and uses an ultra-rapid temperature change with exposure to higher concentrations of cryoprotectants
- cryopreservation and storage of oocytes and embryos for fertility preservation
- *freeze-all* cycles are fresh ART treatment cycles where all oocytes or embryos are cryopreserved for potential future use.
- surrogacy arrangements, where a woman, known as the 'gestational carrier', agrees to carry a child for another person or couple, known as the 'intended parent(s)', with the intention that the child will be raised by the intended parent(s).

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

Data used in this report

This report provides information on ART and DI treatments and the resulting pregnancy and birth outcomes. Also included is an analysis of trends in ART treatments and outcomes in the five years from 2012 to 2016. Reporting of ART treatment cycles in Australia is a requirement for ART clinics to be licenced by the Reproductive Technology Accreditation Committee (RTAC). All ART clinics in Australia and New Zealand provided data to ANZARD for cycles performed in 2016.

As a joint initiative of the NPESU at UNSW Sydney and the FSA, the ANZARD was upgraded in 2009 to accommodate new ART treatment types and to transform ANZARD from a cycle-based data collection to a woman-based data collection (ANZARD2.0). A more detailed description of ANZARD2.0 can be found in Appendices B and C. The expanded treatment information in the collection includes data fields for oocyte/embryo vitrification, and duration of oocytes and embryos in storage. The upgrade to a woman-based data collection was achieved by introducing a statistical linkage key (SLK) that links successive treatment cycles undertaken by one woman. The SLK is a combination of the first two letters of a woman's first name, the first two letters of her surname and her date of birth. The SLK enables the number of women undergoing treatment across time to be reported. The 2016 annual report presents cycle-specific success rates for women who started their first autologous (non *freeze-all*) fresh cycle during 2014. These women were followed from their first fresh cycle through subsequent fresh and thaw cycles (excluding *freeze-all* cycles) until

31 December 2016, or until they achieved a live delivery (a delivery of at least one liveborn baby) up to and including 31 October 2017.

The 2016 data presented in this report were supplied by all 86 fertility clinics in Australia and all 8 fertility clinics in New Zealand, and compiled into ANZARD2.0. The full list of contributing fertility clinics can be found in Appendix A.

Structure of this report

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

Chapter 2—'Overview of ART treatment in 2016', 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 2016', presents data on the number of cycles, cycle types, and the outcomes of treatment in terms of discontinued treatment, clinical pregnancies and deliveries.

Chapter 4—'Pregnancy and birth outcomes following autologous and recipient embryo transfer cycles in 2016', presents data on the outcomes of clinical pregnancies and deliveries following autologous and recipient cycles including a description of perinatal outcomes.

Chapter 5—'Other cycle types, procedures and treatment complications in 2016', includes information on cycles, procedures and complications that do not fit into the chapters already described.

Chapter 6—'Donor sperm insemination cycles in 2016', presents data on DI cycles and their outcomes, including a description of pregnancy and perinatal outcomes.

Chapter 7—'Trends in ART treatment and outcomes: 2012–2016', presents trends in ART treatments during the last five years of data collection in Australia and New Zealand.

Chapter 8—'Women undertaking autologous treatment in 2016', presents information on the number of women undergoing ART treatment in 2016.

Chapter 9—'Cycle-specific rates for women who started their first ART treatment cycle in 2014', presents information for a cohort of women who started their first autologous (non-*freeze-all*) fresh ART treatment cycle during 2014, and were followed through subsequent fresh and thaw cycles (excluding *freeze-all* cycles) until 31 December 2016 or until they achieved a live delivery.

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

2 Overview of ART treatment in 2016

There were 81,062 ART treatment cycles reported from Australian and New Zealand clinics in 2016 (Table 1). Of these, 91.7% (74,357) were from Australian clinics and 8.3% (6,705) were from New Zealand clinics. The overall number of ART treatment cycles in 2016 increased by 4.3% from the 77,721 cycles in 2015, with a 4.0% increase in Australia and 7.4% increase in New Zealand. In 2016, the number of ART treatment cycles represented 14.8 cycles per 1,000 women of reproductive age (15–44 years) in Australia, compared with 7.0 cycles per 1,000 women of reproductive age in New Zealand (Australian Bureau of Statistics 2016; Statistics New Zealand 2016).

Nearly 95% of cycles in 2016 were autologous cycles (where a woman intended to use, or used her own oocytes or embryos). Of the 76,255 autologous cycles, 47,172 (61.9%) were fresh cycles and 29,083 (38.1%) were thaw cycles. Other treatment cycles accounted for small proportions: 3.5% were oocyte recipient cycles, 0.6% were embryo recipient cycles, 1.5% were oocyte donation cycles and 0.4% were surrogacy arrangement cycles (Table 1).

Of all initiated ART treatments in 2016, 22.5% (18,269) resulted in a clinical pregnancy and 17.9% (14,515) in a live delivery (Table 1). Of these clinical pregnancies, 16,345 (89.5%) were from Australian clinics and 1,924 (10.5%) from New Zealand clinics. There were 15,198 babies born, (including 15,057 liveborn babies) following ART treatment in 2016. Of these, 13,596 (89.5%) were from Australian clinics and 1,602 (10.5%) from New Zealand clinics. Of the liveborn babies, 80.1% (12,062) were singletons at term (gestational age of 37–41 weeks) with normal birthweight (≥ 2,500 grams). The multiple delivery rate was 3.8%.

Table 1: Number of initiated ART treatment cycles by treatment type, Australia and New Zealand, 2016

	Number of initiated ART cycles	Percentage of treatment types	Number of clinical pregnancies	Number of live deliveries	Number of liveborn babies	Number of liveborn singletons at term with normal birthweight
Autologous	76,255	94.1	17,382	13,804	14,320	11,499
Fresh	*47,172*	*58.2*	*7,461*	*5,874*	*6,109*	*4,797*
Thaw	*29,083*	*35.9*	*9,921*	*7,930*	*8,211*	*6,702*
Oocyte recipient	2,821	3.5	720	585	608	457
Embryo recipient	455	0.6	108	81	83	69
Oocyte donation	1,227	1.5	0	0	0	0
GIFT[(a)]	2	0.0	0	0	0	0
Surrogacy arrangement cycles	302	0.4	59	45	46	37
Commissioning cycles[(b)]	*82*	*0.1*	*0*	*0*	*0*	*0*
Gestational carrier cycles[(c)]	*220*	*0.3*	*59*	*45*	*46*	*37*
Total	**81,062**	**100.0**	**18,269**	**14,515**	**15,057**	**12,062**

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

(b) A variety of cycle types undertaken as part of surrogacy arrangements, e.g. cycles undertaken by intended parents or women donating their oocytes or embryos for use by the gestational carrier.

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

3 Autologous and donation/recipient cycles in 2016

This chapter presents data on initiated autologous cycles, oocyte donation cycles and oocyte/embryo recipient cycles. Surrogacy cycles and GIFT cycles are presented separately in Chapter 5.

An ‘autologous cycle’ is defined as an ART treatment cycle in which a woman intends to use, or uses her own oocytes 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 influence the donor status of the cycle.

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

Autologous and donor/recipient cycles can involve the use of, or intended use of, either fresh or frozen/thawed embryos.

3.1 Overview of autologous and recipient cycles

Age of women and their partners

The average age of women undergoing autologous and oocyte/embryo recipient cycles was 36.0 years. For women undergoing oocyte/embryo recipient cycles, the mean age was 40.4 years, nearly five years older than for autologous cycles (35.8 years). Of all autologous and oocyte/embryo recipient cycles, 26.1% were undertaken by women aged 40 or older (Table 2). The average age of male partners was 38.1 years, with 33.0% aged 40 or older. For 20.7% of oocyte/embryo recipient cycles, the partner's age was not stated or no partner was involved (Table 3).

Table 2: Number of autologous and recipient cycles by women's age group and treatment type, Australia and New Zealand, 2016

Age group (years)[(a)]	Autologous				Oocyte /embryo recipient		All	
	Fresh		Thaw					
	n	%	n	%	n	%	n	%
< 30	4,678	9.9	3,154	10.8	137	4.2	7,969	10.0
30–34	12,447	26.4	9,671	33.3	420	12.8	22,538	28.3
35–39	16,804	35.6	10,804	37.1	703	21.5	28,311	35.6
40–44	12,200	25.9	5,079	17.5	1,220	37.2	18,499	23.3
≥ 45	1,043	2.2	375	1.3	796	24.3	2,214	2.8
Total	**47,172**	**100.0**	**29,083**	**100.0**	**3,276**	**100.0**	**79,531**	**100.0**

(a) Age at start of a treatment cycle.

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

Table 3: Number of autologous and recipient cycles by women's male partners' age group and treatment type, Australia and New Zealand, 2016

Age group (years)[(a)]	Autologous				Oocyte/embryo recipient		All	
	Fresh		Thaw					
	n	%	n	%	n	%	n	%
< 30	2,790	5.9	1,748	6.0	85	2.6	4,623	5.8
30–34	9,766	20.7	7,029	24.2	344	10.5	17,139	21.6
35–39	13,057	27.7	9,260	31.8	661	20.2	22,978	28.9
40–44	9,694	20.6	5,725	19.7	740	22.6	16,159	20.3
≥ 45	6,074	12.9	3,221	11.1	768	23.4	10,063	12.7
Not stated	5,791	12.3	2,100	7.2	678	20.7	8,569	10.8
Total	**47,172**	**100.0**	**29,083**	**100.0**	**3,276**	**100.0**	**79,531**	**100.0**

(a) Age at start of a treatment cycle.

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

Parity

Parity is the number of previous pregnancies of 20 weeks or more gestation experienced by a woman. A woman who has had no previous pregnancies of 20 or more weeks gestation is called ‘nulliparous’. A woman who has had at least one previous pregnancy of 20 weeks or more gestation is described as ‘parous’.

Of the 79,531 initiated autologous and recipient cycles undertaken in 2016, 63.4% were undertaken by nulliparous women. Of autologous cycles (fresh and thaw), 63.4% were undertaken by nulliparous women, compared with 63.6% for oocyte/embryo recipient cycles (Table 4).

Table 4: Number of autologous and recipient cycles by parity and treatment type, Australia and New Zealand, 2016

	Autologous				Oocyte/embryo recipient		All	
	Fresh		Thaw					
Parity	**n**	**%**	**n**	**%**	**n**	**%**	**n**	**%**
Nulliparous	31,906	67.6	16,423	56.5	2,084	63.6	50,413	63.4
Parous	7,416	15.7	7,612	26.2	562	17.2	15,590	19.6
Not stated	7,850	16.6	5,048	17.4	630	19.2	13,528	17.0
Total	**47,172**	**100.0**	**29,083**	**100.0**	**3,276**	**100.0**	**79,531**	**100.0**

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

Cause of infertility

Causes of infertility may relate to either the woman or her male partner, or both, or may be unexplained. The reported causes of infertility are based on clinical diagnosis by the treating clinician. However, the diagnostic definitions may vary among fertility centres and should be interpreted with considerable caution.

Of the 79,531 initiated autologous and recipient cycles, 10.7% reported male infertility factors as the only cause of infertility; 31.3% reported only female infertility factors; 12.2% reported combined male–female factors; 21.0% reported unexplained infertility; and 24.8% were not stated.

Intracytoplasmic sperm injection procedures

Of the 39,691 autologous fresh cycles where fertilisation was attempted, 69.4% used ICSI procedures and 30.6% used IVF procedures. Of fresh oocyte recipient cycles where fertilisation was attempted, 83.4% used ICSI procedures and 16.6% used IVF procedures (Table 5).

Table 5: Number of autologous and recipient cycles with fertilisation attempted by treatment type and procedure, Australia and New Zealand, 2016

	Autologous				Oocyte/embryo recipient			
	Fresh[(a)]		Thaw[(b)(d)]		Fresh[(a)]		Thaw[(b)(d)]	
Procedure	**n**	**%**	**n**	**%**	**n**	**%**	**n**	**%**
IVF	12,130	30.6	10,292	36.9	216	16.6	486	25.6
ICSI[(c)]	27,561	69.4	16,665	59.7	1,084	83.4	1,349	70.9
Not stated	0	0.0	961	3.4	0	0.0	67	3.5
Total	**39,691**	**100.0**	**27,918**	**100.0**	**1,300**	**100.0**	**1,902**	**100.0**

(a) Fresh cycles where fertilisation was attempted.

(b) Thaw cycles where embryos were transferred.

(c) Includes 1,018 Mixed IVF/ICSI cycles.

(d) Where two or more thawed embryos were transferred, the number of mixed IVF/ICSI transfers cannot be differentiated from ICSI only transfers. 1,407 of the 16,665 thaw ICSI cycles had two or more embryos transferred.

Number of embryos transferred

Of the 55,192 fresh and thawed embryo transfer cycles undertaken in autologous and recipient cycles, 87.7% were single embryo transfer (SET) cycles and 12.2% were double embryo transfer (DET). In women aged under 35, 93.0% of embryo transfer cycles were SET cycles and 7.0% were DET cycles. In women aged 35 or older, 84.1% of cycles were SET cycles and 15.7% were DET cycles (Table 6).

Table 6: Number of fresh and thawed embryos transferred per cycle by women's age group, Australia and New Zealand, 2016

	Number of embryos transferred							
	One		Two		Three or more		Total	
Age group (years)[(a)]	**n**	**%**	**n**	**%**	**n**	**%**	**n**	**%**
< 30	5,249	93.4	373	6.6	0	0.0	5,622	100.0
30–34	15,483	92.9	1,186	7.1	1	0.0	16,670	100.0
35–39	17,378	88.4	2,280	11.6	8	0.0	19,666	100.0
40–44	9,159	77.8	2,552	21.7	68	0.6	11,779	100.0
≥ 45	1,126	77.4	317	21.8	12	0.8	1,455	100.0
All	**48,395**	**87.7**	**6,708**	**12.2**	**89**	**0.2**	**55,192**	**100.0**

(a) Age at start of a treatment cycle.

Stage of embryo development

Of the 55,192 embryo transfer cycles, 21.6% involved the transfer of day 2-3 embryos (cleavage stage embryos) and 78.4% day 4–6 embryos (blastocysts). Of autologous cycles, blastocyst transfers made up 65.4% of fresh cycles compared with 89.8% of thaw cycles (Table 7).

Table 7: Number of embryo transfer cycles by treatment type and stage of embryo development, Australia and New Zealand, 2016

Stage of embryo development	Autologous				Oocyte/embryo recipient			
	Fresh		Thaw		Fresh		Thaw	
	n	%	n	%	n	%	n	%
Cleavage Stage	8,563	34.6	2,842	10.2	156	24.5	343	18.0
Blastocyst[(a)]	16,171	65.4	25,076	89.8	482	75.5	1,559	82.0
Total	**24,734**	**100.0**	**27,918**	**100.0**	**638**	**100.0**	**1,902**	**100.0**

(a) Includes 17 cycles where both blastocyst and cleavage stage embryos and were transferred.

Transfer of cryopreserved embryos

Embryos created in a fresh cycle can be cryopreserved by either slow freezing or ultra-rapid (vitrification) methods. Slow frozen and vitrified embryos can be thawed/warmed and then transferred in subsequent cycles. Of the 29,820 frozen/thawed embryo transfer cycles, 83.7% involved the transfer of vitrified embryos. Of the frozen/thawed blastocyst transfer cycles 87.8% had vitrified embryos transferred. By comparison, 49.5% of frozen/thawed cleavage stage embryo transfer cycles used vitrified embryos (Table 8).

Table 8: Number of embryo transfer cycles by cryopreservation method and stage of embryo development, Australia and New Zealand, 2016

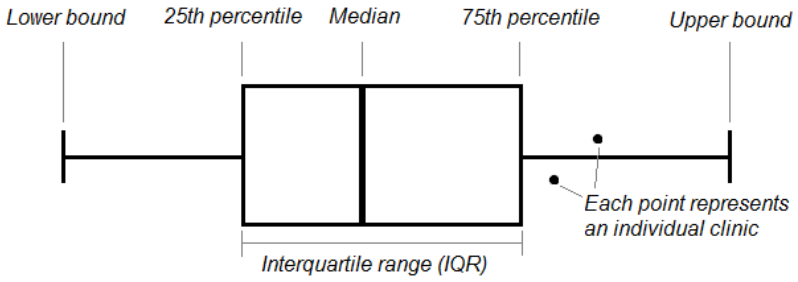
Cryopreservation method	Autologous				Oocyte/embryo recipient			
	Cleavage Stage		Blastocyst[(a)]		Cleavage Stage		Blastocyst	
	n	%	n	%	n	%	n	%
Slow frozen	1,367	48.1	3,022	12.1	240	70.0	229	14.7
Vitrification[(b)]	1,475	51.9	22,054	87.9	103	30.0	1,330	85.3
Total	**2,842**	**100.0**	**25,076**	**100.0**	**343**	**100.0**	**1,559**	**100.0**

(a) Includes 11 cycles where both blastocyst and cleavage stage embryos and were transferred

(b) Includes 211 cycles where both vitrified and slow frozen embryos were transferred.

Live deliveries from initiated fresh and thaw autologous and recipient cycles among fertility clinics

How to interpret Figure 1



- Figure 1 reports on live deliveries per initiated fresh (excluding *freeze-all)* and thaw autologous cycles, and recipient cycles (%) among the 87 fertility clinics who performed more than 50 of these cycles combined in 2016. Eight clinics were excluded because they performed less than 50 autologous and recipient cycles.
- Each point represents a clinic.
- A percentile indicates the value below which a given percentage of clinics' live delivery rates fall. For example, 50% of clinics had a live delivery rate less than the median (20.1%).
- The interquartile range (IQR) indicates the range of live delivery rates achieved by the middle 50% of clinics (IQR: 17.4% - 23.7%).
- The upper and lower bounds represent the range in which it would be expected that approximately 98% of clinics to fall (11.6% - 32.1%).
- These data should be interpreted with caution because of the small number of patients who underwent autologous and recipient cycles in some clinics. The live delivery rates among clinics may also vary because of differences in the characteristics and prognosis of patients treated, and different approaches to the use of ARTs and other fertility treatments.

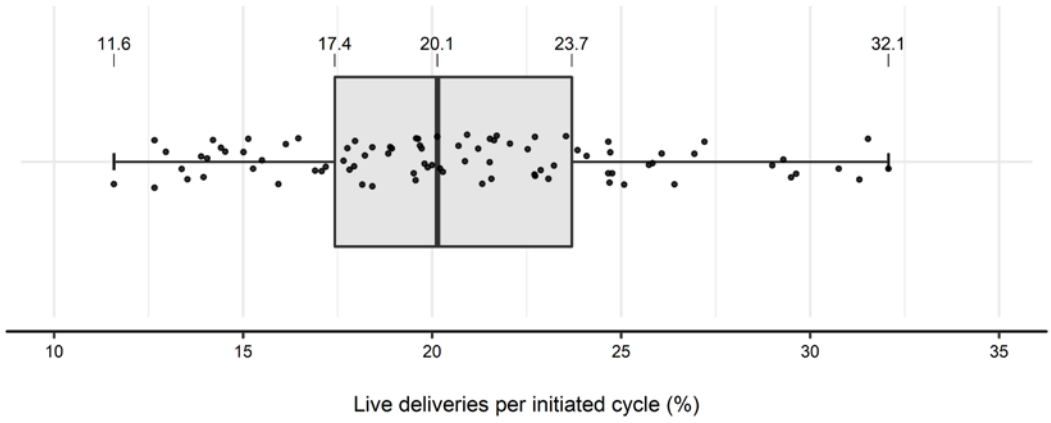


Figure 1: Live delivery rate per initiated fresh (excluding *freeze-all*) and thaw autologous and recipient cycle (%) among fertility clinics, Australia and New Zealand, 2016

3.2 Autologous fresh cycles

In 2016, there were 47,172 initiated autologous fresh cycles, comprising 46,706 (99.0%) FSH-stimulated cycles and 466 (1.0%) unstimulated cycles. There were 301 cycles in which thawed oocytes were used. Of the 47,172 initiated autologous fresh cycles, 92.5% (43,627) were in Australian clinics and 7.5% (3,545) were in New Zealand clinics.

Progression of autologous fresh cycles

Figure 2 shows the main stages of autologous fresh cycles and the resulting treatment outcomes. Of the 47,172 initiated autologous fresh cycles in 2016, 90.2% had OPU performed; 23.9% were *freeze-all* cycles; 52.4% had embryos transferred (Figure 2). A treatment can be discontinued for a variety of reasons, including inadequate response of ovaries to medication, excessive ovarian stimulation, failure to obtain oocytes, failure of oocyte fertilisation, inadequate embryo growth or patient choice.

Freeze-all cycles are fresh ART treatment cycles where all oocytes or embryos are frozen for potential future use. This increasingly common practice (Table 39) is used for a variety of reasons, including reducing the risk of ovarian hyperstimulation syndrome (OHSS), improving endometrial - embryo synchronicity, as part of a PGT cycle, for fertility preservation, or as a deliberate treatment option used by some clinicians.

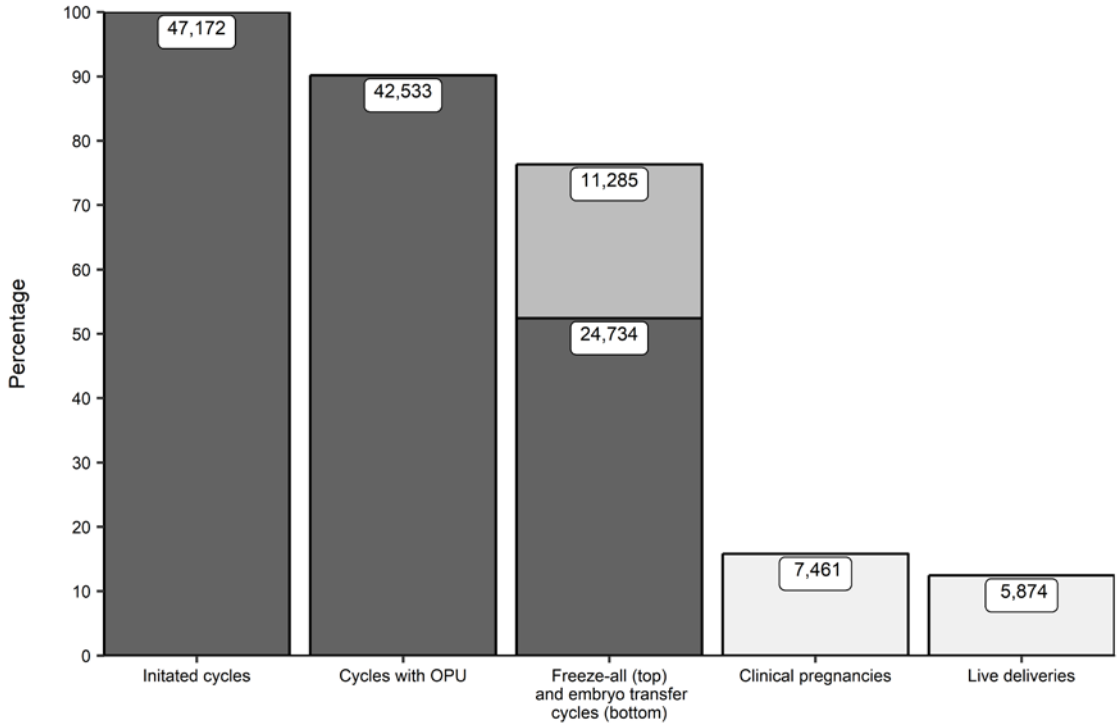


Figure 2: Progression of autologous fresh cycles, Australia and New Zealand, 2016

Clinical pregnancies and live deliveries by women's age

Maternal age is one of the key factors associated with the outcomes of autologous fresh cycles. The highest live delivery rate per embryo transfer cycle was in women aged under 30 (36.9%). The rate declined with advancing women's age, with a rate of 9.5% for women aged 40–44 and 1.3% for women aged 45 or older (Table 9). In women aged 45 or older, 66.6% (695) of cycles occurred in women aged 45 years and 20.4% (213) in women age 46 years, with the remaining 12.9% (135) occurring in women aged 47 or older. Of the 6 live deliveries in women aged 45 or older, five occurred in women age 45 and one in women aged 46.

In women aged under 30 years *freeze-all* cycles accounted for 31.3% of initiated fresh cycles with the rate decreasing to 7.3% in women over 45 years. Of the 11,285 *freeze-all* cycles 15.9% (1,790) were for oocyte freezing and 84.1% (9,495) were for embryo freezing. Table 9 presents the live delivery rate per initiated fresh cycle and the live delivery rate per initiated fresh cycle (excluding *freeze-all* cycles).

Table 9: Outcomes of autologous fresh cycles by women's age group, Australia and New Zealand, 2016

	Age group (years)[a]					
Stage/outcome of treatment	**< 30**	**30–34**	**35–39**	**40–44**	**≥ 45**	**All**
Initiated cycles	4,678	12,447	16,804	12,200	1,043	47,172
Cycles with OPU	4,279	11,519	15,266	10,602	867	42,533
Freeze-all cycles[b]	1,462	3,357	4,309	2,081	76	11,285
Embryo transfer cycles	2,435	7,006	8,833	5,997	463	24,734
Clinical pregnancies	1,039	2,734	2,730	943	15	7,461
Live deliveries	899	2,316	2,086	567	6	5,874
Live deliveries per initiated cycle (%)	*19.2*	*18.6*	*12.4*	*4.6*	*0.6*	*12.5*
Live deliveries per initiated cycle (excluding freeze-all)[c] (%)	*28.0*	*25.5*	*16.7*	*5.6*	*0.6*	*16.4*
Live deliveries per embryo transfer cycle (%)	*36.9*	*33.1*	*23.6*	*9.5*	*1.3*	*23.7*
Live deliveries per clinical pregnancy (%)	*86.5*	*84.7*	*76.4*	*60.1*	*40.0*	*78.7*

(a) Age at start of a treatment cycle.
(b) *Freeze-all* cycles are fresh ART treatment cycles where all oocytes or embryos are cryopreserved for potential future use.
(c) Live deliveries per initiated cycle (excluding *freeze-all*) were calculated using live deliveries as the numerator and initiated fresh cycles minus *freeze-all* cycles as the denominator

Figure 2 shows age-specific live delivery rates per initiated autologous fresh cycle by two-year age groups. The 95% confidence intervals describe the uncertainty surrounding the live delivery rates as representative for otherwise similar women of that age-group.

The highest live delivery rates were for women aged between their mid-20s to early-30s. For women aged 45 or older, only one live delivery resulted from every 170 initiated cycles compared with one live delivery from every 4 initiated cycles in women aged between 25 and 34.

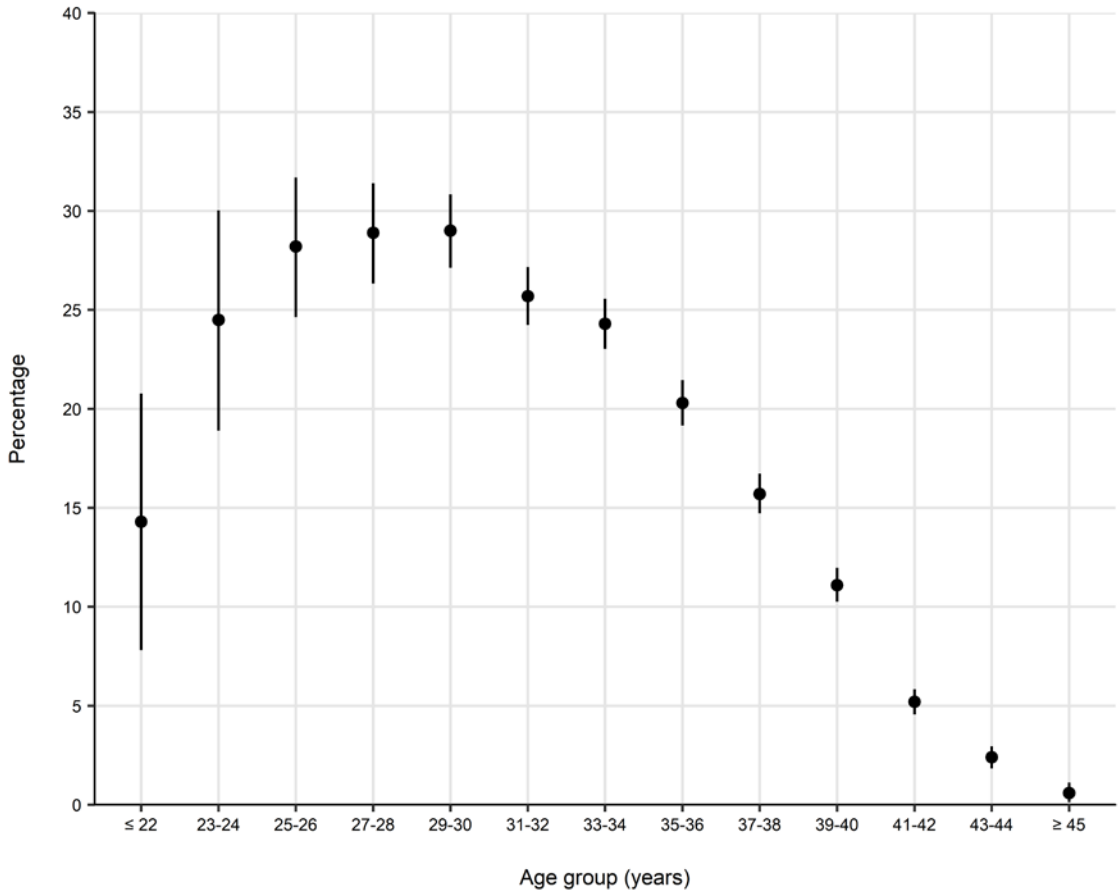


Figure 3: Live delivery rate (with 95% confidence interval) per initiated autologous fresh cycle (excluding *freeze-all*) by women's age at start of a treatment cycle, Australia and New Zealand, 2016

Clinical pregnancies and live deliveries by cause of infertility

Cycles reported with male factor infertility as the only cause of infertility had the highest live delivery rate (19.7%), followed by cycles reported with female tubal disease and endometriosis as the only causes of infertility (19.2% and 19.2%) (Table 10).

Table 10: Outcomes of autologous fresh cycles by cause of infertility, Australia and New Zealand, 2016

Cause of infertility	Number of initiated cycles	Embryo transfer cycles per initiated cycle (%)	Clinical pregnancies per initiated non-*freeze-all* cycle[(a)] (%)	Live deliveries per initiated non-*freeze-all* cycle[(b)] (%)
Male factor only	5,113	62.0	24.5	19.7
Female factor	14,733	51.1	20.3	16.0
Tubal disease only	1,473	63.3	23.4	19.2
Endometriosis only	1,873	59.6	23.6	19.2
Other female factor only	8,762	45.4	17.7	13.8
Combined female factor	2,625	57.0	24.4	18.7
Combined male—female	5,759	57.4	23.3	18.6
Unexplained	9,956	53.6	19.2	15.2
Not stated	11,611	46.5	19.5	14.9
All	**47,172**	**52.4**	**20.8**	**16.4**

a) Clinical pregnancies per initiated non-*freeze-all* cycle is calculated using clinical pregnancies as the numerator and initiated cycles minus *freeze-all* cycles as the denominator

b) Live deliveries per initiated non-*freeze-all* cycle is calculated using live deliveries as the numerator and initiated cycles minus *freeze-all* cycles as the denominator

Clinical pregnancies and live deliveries by number of embryos transferred

Overall, 82.8% of autologous fresh embryo transfer cycles were SET cycles, 16.9% were DET cycles and 0.3% had three or more embryos transferred. No women aged under 35 received transfers of three or more embryos. In women aged between 30 and 40, three or more fresh embryos were transferred in less than 0.1% of embryo transfer cycles, compared with 1.1% in women aged 40 or older.

The overall live delivery rate was 24.8% for SET cycles and 18.5% for DET cycles (Table 11). Of embryo transfer cycles in women aged under 35 and 35-39 the live delivery rate was higher for SET cycles (34.1% and 23.7%) than DET cycles (33.3% and 22.9%). Of embryo transfer cycles in women aged 40 or older, the live delivery rates were lower for SET (8.3%) cycles than DET (9.8%) cycles. Caution should be taken when comparing live delivery rates following SET and DET cycles because patient characteristics and prognosis are different between these groups. For example, poorer prognosis patients may be more likely to receive DET, if they have two embryos available for transfer, than good prognosis patients.

Table 11: Outcomes of autologous fresh embryo transfer cycles by women's age and number of embryos transferred, Australia and New Zealand, 2016

Stage/outcome of treatment	Age group (years)[a]							
	< 35		35–39		≥ 40		All	
	SET[b]	DET[c]	SET[b]	DET[c]	SET[b]	DET[c]	SET[b]	DET[c]
Embryo transfer cycles	8,690	751	7,418	1,409	4,378	2,012	20,486	4,172
Clinical pregnancies	3,486	287	2,303	425	625	320	6,414	1,032
Live deliveries	2,965	250	1,761	323	364	197	5,090	770
Clinical pregnancies per embryo transfer cycle (%)	*40.1*	*38.2*	*31.0*	*30.2*	*14.3*	*15.9*	*31.3*	*24.7*
Live deliveries per embryo transfer cycle (%)	*34.1*	*33.3*	*23.7*	*22.9*	*8.3*	*9.8*	*24.8*	*18.5*

(a) Age at start of a treatment cycle.

(b) SET: single embryo transfer.

(c) DET: double embryo transfer.

Clinical pregnancies and live deliveries by stage of embryo development

Overall, the rates of clinical pregnancy and live delivery were higher in blastocyst transfer cycles than in cleavage stage embryo transfer cycles regardless of a woman's age (Table 12). The live delivery rate for blastocyst transfer cycles was 11.5 percentage points higher than for cleavage stage embryo transfer cycles.

Caution should be taken when comparing clinical pregnancy and live delivery rates following cleavage stage embryo and blastocyst transfer. Patient characteristics, prognosis and treatment strategies may be different between these groups, and generally fewer embryos are available for transfer and cryopreservation when blastocyst culture is used.

Table 12: Outcomes of autologous fresh embryo transfer cycles by women's age and stage of embryo development, Australia and New Zealand, 2016

Stage/outcome of treatment	Age group (years)[a]							
	< 35		35–39		≥ 40		All	
	CL[b]	BL[c][d]	CL[b]	BL[c][e]	CL[b]	BL[c][f]	CL[b]	BL[c][g]
Embryo transfer cycles	2,586	6,855	3,021	5,812	2,956	3,504	8,563	16,171
Clinical pregnancies	794	2,979	710	2,020	334	624	1,838	5,623
Live deliveries	665	2,550	534	1,552	188	385	1,387	4,487
Clinical pregnancies per embryo transfer cycle (%)	*30.7*	*43.5*	*23.5*	*34.8*	*11.3*	*17.8*	*21.5*	*34.8*
Live deliveries per embryo transfer cycle (%)	*25.7*	*37.2*	*17.7*	*26.7*	*6.4*	*11.0*	*16.2*	*27.7*

(a) Age at start of a treatment cycle.

(b) CL: cleavage stage embryo.

(c) BL: blastocyst.

(d) Includes 1 cycles where both cleavage stage embryos and blastocysts were transferred

(e) Includes 3 cycles where both cleavage stage embryos and blastocysts were transferred

(f) Includes 1 cycles where both cleavage stage embryos and blastocysts were transferred

(g) Includes 5 cycles where both cleavage stage embryos and blastocysts were transferred

3.3 Autologous thaw cycles

There were 29,083 autologous thaw cycles reported in 2016 (Figure 3). Of these, 91.3% (26,545) were in Australian clinics and 8.7% (2,538) in New Zealand clinics.

Progression of autologous thaw cycles

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

Of the 29,083 initiated autologous thaw cycles, 96.0% had embryos transferred, 34.1% resulted in a clinical pregnancy and 27.3% resulted in a live delivery (Figure 4). Four percent of initiated autologous thaw cycles did not progress to embryo transfer, principally due to non-viability following thawing of cryopreserved (frozen) embryo(s).

The rate of live deliveries per initiated cycle was higher for autologous thaw cycles than for autologous fresh cycles excluding *freeze-all* cycles in 2016 (27.3% and 16.4% respectively) (Figure 3 and Table 10).

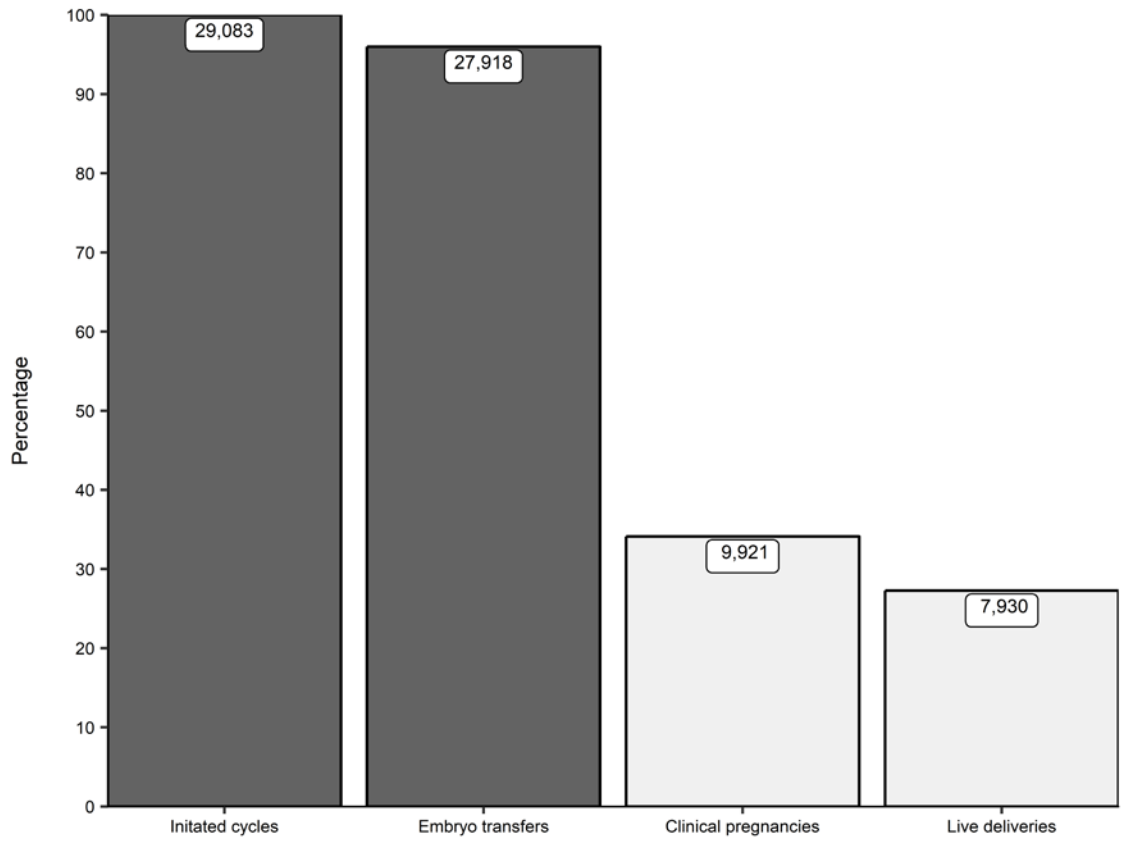


Figure 4: Progression of autologous thaw cycles, Australia and New Zealand, 2016

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

Similar to autologous fresh embryo transfer cycles, the live delivery rate per thawed embryo transfer cycle declined with advancing women's age (Table 13). It is important to note that embryos thawed during a thaw cycle were created in an earlier initiated fresh cycle; therefore, a woman's age at the start of a thaw cycle is older than her age at the start of the initiated fresh cycle. Also, there has been an increasing trend to *freeze-all* cycles in recent years (Table 37), resulting in more women undergoing thaw cycles without undertaking a previous fresh embryo transfer. This may contribute to the higher success rates following autologous thaw cycles compared to autologous fresh cycles (Table 9).

Table 13: Outcomes of autologous thaw cycles by women's age group, Australia and New Zealand, 2016

	Age group (years)[a]					
Stage/outcome of treatment	**< 30**	**30–34**	**35–39**	**40–44**	**≥ 45**	**All**
Initiated cycles	3,154	9,671	10,804	5,079	375	29,083
Embryo transfer cycles	3,085	9,352	10,307	4,819	355	27,918
Clinical pregnancies	1,215	3,675	3,685	1,279	67	9,921
Live deliveries	1,028	3,040	2,924	896	42	7,930
Live deliveries per initiated cycle (%)	*32.6*	*31.4*	*27.1*	*17.6*	*11.2*	*27.3*
Live deliveries per embryo transfer cycle (%)	*33.3*	*32.5*	*28.4*	*18.6*	*11.8*	*28.4*
Live deliveries per clinical pregnancy (%)	*84.6*	*82.7*	*79.3*	*70.1*	*62.7*	*79.9*

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

Figure 5 shows age-specific live delivery rates per initiated autologous thaw cycle by two-year age groups. The 95% confidence intervals describe the uncertainty surrounding the live delivery rates as representative for otherwise similar women of that age-group.

The highest live delivery rates were for women in their early-20s to mid-30s. The wider 95% confidence intervals for women in age groups under 30 years indicates greater uncertainty in the delivery rates for these women as being representative of all women of similar age and characteristics. For women aged 45 or older, 11.2% of initiated autologous thaw cycles resulted in a live delivery, which is higher than the live delivery rate per initiated autologous fresh cycle in this age group (0.6%) (Figures 2 and 4). As embryos thawed during a thaw cycle were created in an earlier initiated fresh cycle, a woman's age at the start of a thaw cycle is older than her age at the start of the initiated fresh cycle.

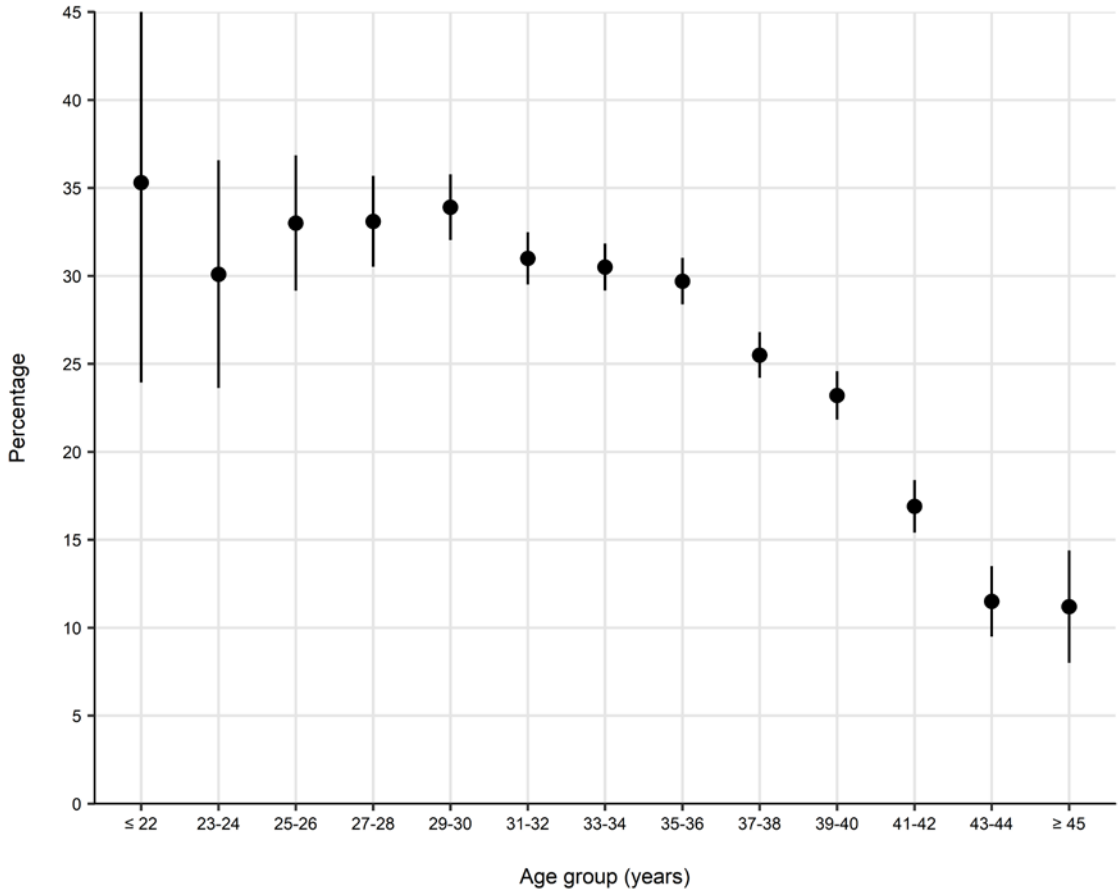


Figure 5: Live delivery rate (with 95% confidence intervals) per initiated autologous thaw cycle by women's age at start of a treatment cycle, Australia and New Zealand, 2016

Clinical pregnancies and live deliveries by cause of infertility

Cycles reported with male factor as the only cause of infertility had a higher rate of live delivery per initiated thaw cycle (29.4%) than those with female factor-only infertility (27.4%) (Table 14).

Table 14: Outcomes of autologous thaw cycles by cause of infertility, Australia and New Zealand, 2016

Cause of infertility	Number of initiated cycles	Embryo transfer cycles per initiated cycle (%)	Clinical pregnancies per initiated cycle (%)	Live deliveries per initiated cycle (%)
Male factor only	3,294	96.7	36.0	29.4
Female factor	8,796	95.6	34.9	27.4
Tubal disease only	*1,158*	*97.3*	*33.2*	*26.6*
Endometriosis only	*1,080*	*96.3*	*33.1*	*25.6*
Other female factor only	*4,859*	*94.9*	*35.9*	*28.4*
Combined female factor	*1,699*	*96.1*	*34.5*	*26.5*
Combined male–female factors	3,564	96.2	34.1	27.1
Unexplained	6,156	95.1	32.7	26.7
Not stated	7,273	96.8	33.4	26.6
All	**29,083**	**96.0**	**34.1**	**27.3**

Clinical pregnancies and live deliveries by number of embryos transferred

Of the 27,918 autologous thaw embryo transfer cycles, 91.8% were SET cycles, 8.2% were DET cycles and less than 0.1% transferred three or more embryos. In women aged under 40, three or more frozen/thawed embryos were transferred in less than 0.1% of embryo transfer cycles, compared with 0.2% in women aged 40 or older. Overall SET was associated with an in increase in live deliveries per embryo transfer cycle of 2.3 percentage points compared to DET (Table 15). Caution should be taken when comparing live delivery rates following SET and DET cycles because patient characteristics and prognosis are different between these groups.

Table 15: Outcomes of autologous thaw embryo transfer cycles by women's age and number of embryos transferred, Australia and New Zealand, 2016

Stage/outcome of treatment	Age group (years)[a]							
	< 35		35–39		≥ 40		All	
	SET[b]	DET[c]	SET[b]	DET[c]	SET[b]	DET[c]	SET[b]	DET[c]
Embryo transfer cycles	11,661	775	9,486	819	4,475	691	25,622	2,285
Clinical pregnancies	4,551	339	3,381	304	1,174	169	9,106	812
Live deliveries	3,797	271	2,698	226	834	103	7,329	600
Clinical pregnancies per embryo transfer cycle (%)	*39.0*	*43.7*	*35.6*	*37.1*	*26.2*	*24.5*	*35.5*	*35.5*
Live deliveries per embryo transfer cycle (%)	*32.6*	*35.0*	*28.4*	*27.6*	*18.6*	*14.9*	*28.6*	*26.3*

(a) Age at start of a treatment cycle.

(b) SET: single embryo transfer.

(c) DET: double embryo transfer.

Clinical pregnancies and live deliveries by stage of embryo development

The rates of clinical pregnancy and live delivery were higher for blastocyst transfer cycles than for cleavage stage embryo transfer cycles, regardless of a woman's age. Overall, the rate of live delivery for blastocyst transfer cycles was 16.0 percentage points higher than for cleavage stage embryo transfer cycles (Table 16).

Caution should be taken when comparing clinical pregnancy and live delivery rates following cleavage stage embryo and blastocyst transfer. Patient characteristics and prognosis are different between these groups, and generally fewer embryos are available for transfer and cryopreservation when blastocyst culture is used.

Table 16: Outcomes of autologous thaw embryo transfer cycles by women's age and stage of embryo development, Australia and New Zealand, 2016

Stage/outcome of treatment	Age group (years)[a]							
	< 35		35–39		≥ 40		All	
	CL[b]	BL[c][d]	CL[b]	BL[c][e]	CL[b]	BL[c][f]	CL[b]	BL[c][g]
Embryo transfer cycles	1,050	11,387	1,002	9,305	790	4,384	2,842	25,076
Clinical pregnancies	228	4,662	203	3,482	94	1,252	525	9,396
Live deliveries	176	3,892	165	2,759	56	882	397	7,533
Clinical pregnancies per embryo transfer cycle (%)	*21.7*	*40.9*	*20.3*	*37.4*	*11.9*	*28.6*	*18.5*	*37.5*
Live deliveries per embryo transfer cycle (%)	*16.8*	*34.2*	*16.5*	*29.7*	*7.1*	*20.1*	*14.0*	*30.0*

(a) Age at start of a treatment cycle.
(b) CL: cleavage stage embryo.
(c) BL: blastocyst.
(d) Includes 2 cycles where both blastocyst and cleavage stage embryos were transferred
(e) Includes 4 cycles where both blastocyst and cleavage stage embryos were transferred
(f) Includes 5 cycles where both blastocyst and cleavage stage embryos were transferred
(g) Includes 11 cycles where both blastocyst and cleavage stage embryos were transferred

Clinical pregnancies and live deliveries by embryo freezing methods

Of the autologous thaw cycles where a blastocyst was transferred, 87.9% used vitrified embryos compared with 51.9% of cycles where a cleavage stage embryo was transferred. Overall the rates of clinical pregnancy and live delivery were higher for the transfer of vitrified embryos than for slow frozen embryos (Table 17).

Table 17: Outcomes of autologous thaw embryo transfer cycles by stage of embryo development and embryo freezing methods, Australia and New Zealand, 2016

	Stage of embryo development					
	Cleavage stage		Blastocyst[a]		All	
Stage/outcome of treatment	Slow freezing	Vitrification[b]	Slow freezing	Vitrification[c]	Slow freezing	Vitrification[d]
Embryo transfer cycles	1,367	1,475	3,022	22,054	4,389	23,529
Clinical pregnancies	281	244	1,082	8,314	1,363	8,558
Live deliveries	216	181	894	6,639	1,110	6,820
Clinical pregnancies per embryo transfer cycle (%)	*20.6*	*16.5*	*35.8*	*37.7*	*31.1*	*36.4*
Live deliveries per embryo transfer cycle (%)	*15.8*	*12.3*	*29.6*	*30.1*	*25.3*	*29.0*

(a) Includes 11 cycles where both blastocyst and cleavage stage embryos were transferred
(b) Includes 16 cycles where both vitrified and slow frozen cycles were transferred
(c) Includes 171 cycles where both vitrified and slow frozen cycles were transferred
(d) Includes 187 cycles where both vitrified and slow frozen cycles were transferred

3.4 Donation and recipient cycles

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

In 2016, donation and recipient cycles accounted for 5.6% (4,503) of all treatment cycles in Australia and New Zealand. There were 1,227 initiated cycles where the intention was to donate oocytes to a recipient woman, consisting of 1,056 (86.0%) cycles in Australia and 171 (14.0%) in New Zealand. There were 3,276 oocyte/embryo recipient cycles (Table 1), comprising 2,884 (88.0%) cycles in Australia and 392 (12.0%) cycles in New Zealand.

Oocyte donation cycles

Of the 1,227 cycles in Australia and New Zealand where the intention was to donate oocytes to a recipient, 41 (3.3%) cycles were cancelled before OPU, and a further 18 did not result in oocytes being donated.

The average age of women donating oocytes was 32.6 years, with 40.8% of cycles in women aged 35 or older (Table 18).

Table 18: Number of oocyte donation cycles by donor's age group, Australia and New Zealand, 2016

Age group (years) [(a)]	Number of initiated cycles	Cycles with OPU performed (n)	Cycles with OPU performed (%)	Number of cycles with oocytes donated	Cycles with oocytes donated (%)
< 30	317	309	97.5	308	97.2
30–34	409	398	97.3	391	95.6
35–39	419	402	95.9	393	93.8
≥ 40	82	77	93.9	76	92.7
Total	**1,227**	**1,186**	**96.7**	**1,168**	**95.2**

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

Oocyte/embryo recipient cycles

There were 3,276 oocyte/embryo recipient cycles in 2016. Of these, 86.1% (2,821) were oocyte recipient cycles and 13.9% (455) were embryo recipient cycles (Table 1). The average age of women undertaking an oocyte/embryo recipient cycle was 40.4 years.

Progression of oocyte/embryo recipient cycles

Figure 6 shows the main stages of oocyte/embryo recipient cycles and the treatment outcomes. Of the 3,276 initiated oocyte/embryo recipient cycles undertaken in 2016, 77.5% resulted in an embryo transfer; 25.3% resulted in a clinical pregnancy and 20.3% in a live delivery.

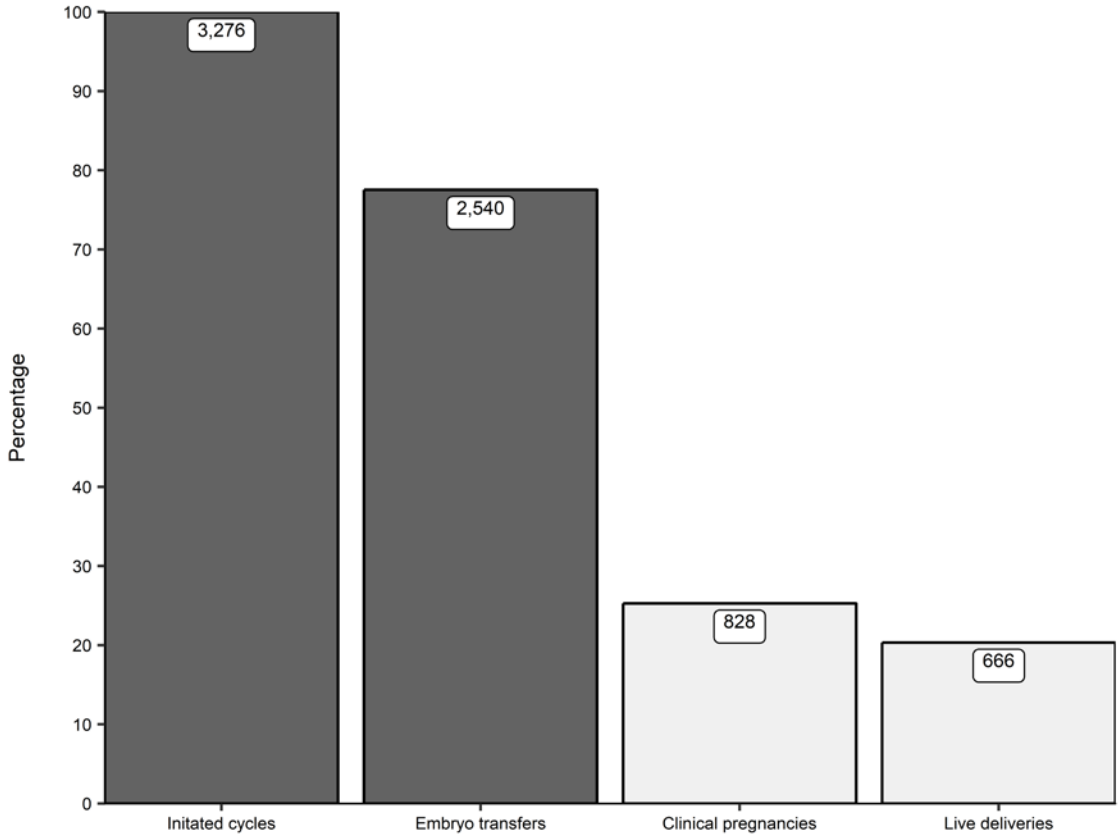


Figure 6: Progression of fresh and thaw oocyte/embryo recipient cycles, Australia and New Zealand, 2016

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

Of the 2,821 oocyte recipient cycles, 46.5% were fresh cycles and 53.5% were thaw cycles. The live delivery rate per initiated cycle was 26.2% for thawed embryos transferred from oocyte recipient cycles, higher than for fresh oocyte recipient cycles (14.5%).

All 455 embryo recipient cycles were thaw cycles. The overall live delivery rate per initiated cycle was 17.8% for embryo recipient cycles (Table 19).

Table 19: Outcomes of oocyte/embryo recipient cycles by treatment type, Australia and New Zealand, 2016

	Oocyte recipient			
Stage/outcome of treatment	**Fresh**	**Thaw**	**Embryo recipient**	**All**
Initiated cycles	1,312	1,509	455	3,276
Embryo transfer cycles	638	1,470	432	2,540
Clinical pregnancies	234	486	108	828
Live deliveries	190	395	81	666
Live deliveries per initiated cycle (%)	*14.5*	*26.2*	*17.8*	*20.3*
Live deliveries per embryo transfer cycle (%)	*29.8*	*26.9*	*18.8*	*26.2*
Live deliveries per clinical pregnancy (%)	*81.2*	*81.3*	*75.0*	*80.4*

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

The clinical pregnancy and live delivery rates of recipient cycles varied by recipient's age group. The overall live delivery rate per initiated cycle was 20.3%, varying between 19.1% and 23.4% by recipient's age group (Table 20).

Table 20: Outcomes of oocyte/embryo recipient cycles by recipient's age group, Australia and New Zealand, 2016

	Age group (years)[a]					
Stage/outcome of treatment	**< 30**	**30–34**	**35–39**	**40–44**	**≥ 45**	**All**
Initiated cycles	137	420	703	1,220	796	3,276
Embryo transfer cycles	102	312	526	963	637	2,540
Clinical pregnancies	37	100	161	337	193	828
Live deliveries	32	82	138	262	152	666
Live deliveries per initiated cycle (%)	*23.4*	*19.5*	*19.6*	*21.5*	*19.1*	*20.3*
Live deliveries per embryo transfer cycle (%)	*31.4*	*26.3*	*26.2*	*27.2*	*23.9*	*26.2*
Live deliveries per clinical pregnancy (%)	*86.5*	*82.0*	*85.7*	*77.7*	*78.8*	*80.4*

(a) Recipient age at start of a treatment cycle.

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

Advancing donor's age was associated with a decrease in the live delivery rate (Table 21). The live delivery rate per initiated cycle in which the donor's age was under 40 was 21.2% compared to 7.2% for cycles in which the donor's age was 40 years or more (Table 21).

Table 21: Outcomes of oocyte/embryo recipient cycles by donor's age group, Australia and New Zealand, 2016

	Age group (years)[a]				
Stage/outcome of treatment	**< 30**	**30–34**	**35–39**	**≥ 40**	**All[b]**
Initiated cycles	1,047	1,045	989	194	3,276
Embryo transfer cycles	847	794	753	145	2,540
Clinical pregnancies	304	273	223	28	828
Live deliveries	253	230	169	14	666
Live deliveries per initiated cycle (%)	*24.2*	*22.0*	*17.1*	*7.2*	*20.3*
Live deliveries per embryo transfer cycle (%)	*29.9*	*29.0*	*22.4*	*9.7*	*26.2*
Live deliveries per clinical pregnancy (%)	*83.2*	*84.2*	*75.8*	*50.0*	*80.4*

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

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

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

Of the 2,540 oocyte/embryo recipient cycles where embryos were transferred, 90.0% were SET, 9.9% were DET and two cycles (less than 0.1%) transferred three embryos.

Overall the live delivery rate per oocyte/embryo recipient cycle where embryos were transferred was higher in SET cycles (26.7%) compared with and DET cycles (21.9%) (Table 22).

Table 22: Outcomes of oocyte/embryo recipient cycles by recipient's age and number of embryos transferred, Australia and New Zealand, 2016

	Age group (years)[a]							
	< 35		35–39		≥ 40		All	
Stage/outcome of treatment	SET[b]	DET[c]	SET[b]	DET[c]	SET[b]	DET[c]	SET[b]	DET[c]
Embryo transfer cycles	381	33	474	52	1,432	166	2,287	251
Clinical pregnancies	130	7	141	20	477	53	748	80
Live deliveries	110	4	123	15	378	36	611	55
Clinical pregnancies per embryo transfer cycle (%)	*34.1*	*21.2*	*29.7*	*38.5*	*33.3*	*31.9*	*32.7*	*31.9*
Live deliveries per embryo transfer cycle (%)	*28.9*	*12.1*	*25.9*	*28.8*	*26.4*	*21.7*	*26.7*	*21.9*

(a) Recipient age at start of a treatment cycle.
(b) SET: single embryo transfer.
(c) DET: double embryo transfer.

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

The live delivery rate per oocyte/embryo recipient cycle with embryos transferred was higher for blastocyst transfer cycles than cleavage stage embryo transfer cycles regardless of a recipient's age group. Overall, the difference in live delivery rates for cleavage stage embryo and blastocyst transfer cycles was 14.0 percentage points (15.0% and 29.0% respectively) (Table 23).

Table 23: Outcomes of oocyte/embryo recipient cycles by recipient's age and stage of embryo development, Australia and New Zealand, 2016

	Age group (years)[a]							
	< 35		35–39		≥ 40		All	
Stage/outcome of treatment	**CL[b]**	**BL[c]**	**CL[b]**	**BL[c]**	**CL[b]**	**BL[c]**	**CL[b]**	**BL[c]**
Embryo transfer cycles	80	334	99	427	320	1,280	499	2,041
Clinical pregnancies	15	122	21	140	68	462	104	724
Live deliveries	12	102	16	122	47	367	75	591
Clinical pregnancies per embryo transfer cycle (%)	*18.8*	*36.5*	*21.2*	*32.8*	*21.2*	*36.1*	*20.8*	*35.5*
Live deliveries per embryo transfer cycle (%)	*15.0*	*30.5*	*16.2*	*28.6*	*14.7*	*28.7*	*15.0*	*29.0*

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

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

More than four-fifths (85.3%) of oocyte/embryo recipient thaw cycles where a blastocyst was transferred used vitrified embryos, compared with 30.0% of cycles where a cleavage stage embryo was transferred. The live delivery rate was comparable for the transfer of vitrified and slow frozen blastocysts (28.0% and 26.2%) and higher for vitrified compared to slow frozen cleavage stage embryos (17.5% and 10.8%) (Table 24).

Table 24: Outcomes of oocyte/embryo recipient thaw cycles by stage of embryo development and embryo freezing methods, Australia and New Zealand, 2016

	Stage of embryo development					
	Cleavage embryo		Blastocyst		All	
Stage/outcome of treatment	Slow freezing	Vitrification[(a)]	Slow freezing	Vitrification[(b)]	Slow freezing	Vitrification[(c)]
Embryo transfer cycles	240	103	229	1,330	469	1,433
Clinical pregnancies	40	23	74	457	114	480
Live deliveries	26	18	60	372	86	390
Clinical pregnancies per embryo transfer cycle (%)	*16.7*	*22.3*	*32.3*	*34.4*	*24.3*	*33.5*
Live deliveries per embryo transfer cycle (%)	*10.8*	*17.5*	*26.2*	*28.0*	*18.3*	*27.2*

(a) Includes 3 cycles where both vitrified and slow frozen embryos were transferred
(b) Includes 21 cycle where both vitrified and slow frozen embryos were transferred
(c) Includes 24 cycle where both vitrified and slow frozen embryos were transferred

4 Pregnancy and birth outcomes following autologous and recipient embryo transfer cycles in 2016

4.1 Clinical pregnancies

Clinical pregnancies overview

There were 55,192 autologous and recipient embryo transfer cycles undertaken in Australian and New Zealand fertility centres, of which 18,210 resulted in a clinical pregnancy. Of these clinical pregnancies, 16,294 (89.5%) were reported from fertility centres in Australia and 1,916 (10.5%) from New Zealand centres. Clinical pregnancies that resulted from other cycles are described in Chapter 5.

Of the 18,210 clinical pregnancies, 80.1% resulted in a delivery and 19.1% resulted in early pregnancy loss (less than 20 weeks gestation and less than 400 grams birthweight). The outcomes of 139 (0.8%) clinical pregnancies were not known because women could not be followed up or contacted by fertility centres.

Fetal hearts by number of embryos transferred

Of the 18,210 clinical pregnancies, 84.9% had one fetal heart (single fetus) detected, 3.8% had multiple fetal hearts (multiple fetuses) detected and 10.8% had no fetal heart detected at the time of ultrasound (Table 25). Multiple fetuses are closely related to the number of embryos transferred in ART treatment. Two fetal hearts were detected in 18.5% of clinical pregnancies following DET cycles compared with in 2.0% of clinical pregnancies following SET cycles (Table 25).

Table 25: Clinical pregnancies by number of fetal hearts and number of embryos transferred, Australia and New Zealand, 2016

Number of fetal hearts	One embryo		Two embryos		Three or more embryos		All	
	n	%	n	%	n	%	n	%
0[(a)]	1,738	10.7	236	12.3	1	5.6	1,975	10.8
1	14,146	87	1,305	67.8	13	72.2	15,464	84.9
2	319	2.0	356	18.5	4	22.2	679	3.7
3 or 4	5	0.1	10	0.5	0	0.0	15	0.1
Not stated	60	0.4	17	0.9	0	0.0	77	0.4
Total	**16,268**	**100.0**	**1,924**	**100.0**	**18**	**100.0**	**18,210**	**100.0**

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

Early pregnancy loss

There were 3,481 early pregnancy losses (less than 20 weeks gestation and less than 400 grams birthweight) following embryo transfers, representing 19.1% of clinical pregnancies.

Table 26: Early pregnancy loss by pregnancy outcome and maternal age and number of embryos transferred, Australia and New Zealand, 2016

Pregnancy outcome	Age group (years)								
	< 35			35–39			≥ 40		
	One embryo	Two embryos	All[(a)]	One embryo	Two embryos	All[(a)]	One embryo	Two embryos	All[(a)]
					n				
Early pregnancy loss	1,171	98	1,269	1,178	168	1,346	666	197	866
Miscarriage	*1,043*	*78*	*1,121*	*1,052*	*148*	*1,200*	*603*	*177*	*783*
Reduction or termination	*56*	*3*	*59*	*65*	*7*	*72*	*39*	*7*	*46*
Ectopic or heterotopic pregnancy	*72*	*17*	*89*	*61*	*13*	*74*	*24*	*13*	*37*
Delivery	6,933	527	7,460	4,617	569	5,188	1,590	339	1,942
Not stated	63	8	71	30	12	42	20	6	26
Total	**8,167**	**633**	**8,800**	**5,825**	**749**	**6,576**	**2,276**	**542**	**2,834**
					%				
Early pregnancy loss	14.4	15.5	14.4	20.2	22.4	20.4	29.3	36.4	30.5
Miscarriage	*12.8*	*12.3*	*12.7*	*18.1*	*19.8*	*18.2*	*26.5*	*32.7*	*27.6*
Reduction or termination	*0.7*	*0.5*	*0.7*	*1.1*	*0.9*	*1.1*	*1.7*	*1.3*	*1.6*
Ectopic or heterotopic pregnancy	*0.9*	*2.7*	*1.0*	*1.0*	*1.7*	*1.1*	*1.1*	*2.4*	*1.3*
Delivery	84.9	83.3	84.8	79.3	76	78.9	69.9	62.5	68.5
Not stated	0.8	1.3	0.8	0.5	1.6	0.6	0.9	1.1	0.9
Total	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**

(a) Includes three or more embryos.

4.2 Deliveries

There were 14,590 women who gave birth to at least one baby of 20 weeks or more gestation or at least 400 grams birthweight following embryo transfer cycles. Of these, 99.1% (14,470) gave birth to at least one liveborn baby (live delivery). The proportion of term live deliveries (≥ 37 weeks) among all deliveries was higher for autologous cycles than for oocyte/embryo recipient cycles (Table 27).

Table 27: Deliveries by delivery outcome and treatment type, Australia and New Zealand, 2016

Pregnancy outcome	Autologous				Oocyte /embryo recipient		All	
	Fresh		Thaw					
	n	%	n	%	n	%	n	%
Live delivery	5,874	99.0	7,930	99.2	666	99.4	14,470	99.1
< 37 weeks	*779*	*13.1*	*872*	*10.9*	*116*	*17.3*	*1,767*	*12.1*
≥ 37 weeks	*5,094*	*85.9*	*7,056*	*88.3*	*550*	*82.1*	*12,700*	*87*
Gestational age unknown	*1*	*0.1*	*2*	*0.1*	*0*	*0.1*	*3*	*0.1*
Stillbirth[(a)]	46	0.8	36	0.5	4	0.6	86	0.6
Not stated	10	0.2	24	0.3	0	0	34	0.2
Total	**5,930**	**100.0**	**7,990**	**100.0**	**670**	**100.0**	**14,590**	**100.0**

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

Deliveries by number of embryos transferred

Of the 14,590 deliveries, 3.8% had multiple deliveries (Table 28), a lower proportion than in 2015 (4.4%) (Fitzgerald et al. 2017). By comparison, the proportion of multiple deliveries in Australia from all conceptions in 2015 was 1.5% (AIHW, 2017).

Twin deliveries accounted for 3.7% of deliveries following embryo transfer cycles in 2016. Of twin deliveries, 52.2% resulted from the transfer of two or more embryos. Of the 1,435 deliveries following DET cycles, 19.4% were twins, markedly higher than the proportion following SET cycles (2.0%) (Table 28).

Table 28: Deliveries by gestation and type of embryo transfer and number of embryos transferred, Australia and New Zealand, 2016

	Fresh			Thaw			
Gestation	**SET[(a)]**	**DET[(b)]**	**Three or more embryos**	**SET[(a)]**	**DET[(b)]**	**Three or more embryos**	**All**
				n			
Singleton	5,211	648	11	7,666	502	1	14,039
Multiple	102	145	3	161	140	0	551
Twin	*99*	*141*	*3*	*159*	*138*	*0*	*540*
Higher order multiple	*3*	*4*	*0*	*2*	*2*	*0*	*11*
Total	**5,313**	**793**	**14**	**7,827**	**642**	**1**	**14,590**
				%			
Singleton	98.1	81.7	78.6	97.9	78.2	100.0	96.2
Multiple	2.0	18.3	21.4	2.0	21.8	0.0	3.8
Twin	*1.9*	*17.8*	*21.4*	*2.0*	*21.5*	*0.0*	*3.7*
Higher order multiple	*0.1*	*0.5*	*0.0*	*0.1*	*0.3*	*0.0*	*0.1*
Total	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**

(a) SET: single embryo transfer
(b) DET: double embryo transfer.

Deliveries by maternal age

The average age of women at the time of delivery was 35.4 years. This is five years older than the average age (30.3 years) of women who gave birth in Australia in 2015 (AIHW, 2017).

Multiple delivery rates were similar across age groups, ranging between 3.3% and 4.0% (Table 29). Of deliveries following DET, the proportion of multiple deliveries was higher for women aged under 35 (26.1%) compared with women aged 35–39 (21.2%) and women aged 40 or older (11.4%) (Table 29).

Table 29: Deliveries by gestation and maternal age group and number of embryos transferred, Australia and New Zealand, 2016

	Age group (years)[a]								
	< 35			35–39			≥ 40		
Gestation	One embryo	Two embryos	All[b]	One embryo	Two embryos	All[b]	One embryo	Two embryos	All[b]
					n				
Singleton	5,935	334	6,269	4,915	442	5,357	2,027	374	2,413
Multiple	126	118	244	104	119	224	33	48	83
Twin	*122*	*116*	*238*	*103*	*118*	*222*	*33*	*45*	*80*
Higher order	*4*	*2*	*6*	*1*	*1*	*2*	*0*	*3*	*3*
Total	**6,061**	**452**	**6,513**	**5,019**	**561**	**5,581**	**2,060**	**422**	**2,496**
					%				
Singleton	97.9	73.9	96.3	97.9	78.8	96.0	98.4	88.6	96.7
Multiple	2.1	26.1	3.8	2.1	21.2	4.0	1.6	11.4	3.3
Twin	*2.0*	*25.7*	*3.7*	*2.1*	*21.1*	*4.0*	*1.6*	*10.7*	*3.2*
Higher order	*0.1*	*0.4*	*0.1*	*0.0*	*0.2*	*0.0*	*0.0*	*0.7*	*0.1*
Total	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**

(a) Age at time of delivery.

(b) Includes three or more embryos.

Caesarean section

More than half (50.5%) of deliveries following embryo transfer cycles were by caesarean section (Table 30). The rate of caesarean section following ART treatment may be related to the fact that women were five years older on average and that there were more multiple births following ART treatment.

The caesarean section rate increased with advancing women's age at delivery: 37.9% of women aged less than 30 had a caesarean section compared with 78.4% of women aged 45 or older (Table 30).

The caesarean section rate varied by plurality, with 49.4% for singleton deliveries, 79.4% for twin deliveries and 72.7% for triplet deliveries.

Table 30: Deliveries by method of delivery and maternal age group, Australia and New Zealand, 2016

	Age group (years)[(a)]					
Method of delivery	**< 30**	**30–34**	**35–39**	**40–44**	**≥ 45**	**Total**
			n			
Caesarean section	562	2,313	2,868	1,406	218	7,367
Not stated	71	174	158	51	2	456
Other	848	2,545	2,555	761	58	6,767
Total	**1,481**	**5,032**	**5,581**	**2,218**	**278**	**14,590**
			%			
Caesarean section	37.9	46.0	51.4	63.4	78.4	50.5
Not stated	4.8	3.5	2.8	2.3	0.7	3.1
Other	57.3	50.6	45.8	34.3	20.9	46.4
Total	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**

(a) Age at time of delivery.

4.3 Perinatal outcomes of babies

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

There were 15,152 babies born to women who had autologous and recipient embryo transfer cycles, 89.5% (13,559) were reported from fertility centres in Australia and 10.5% (1,593) from fertility centres in New Zealand. Of the 15,152 babies, 92.7% were singletons, 7.1% were twins and 0.2% were triplets. There were 15,011 liveborn babies (99.1%). The birth status was not reported for 35 (0.1%) babies.

Sex distribution in liveborn babies

There were 7,727 (51.5%) liveborn male babies, 7,224 (48.1%) liveborn female babies and 60 (0.4%) liveborn babies where sex was not stated. For the 14,591 liveborn babies where the baby's sex was stated, the sex ratio was 107 male babies for every 100 female babies. The sex ratio for all Australian liveborn babies born in 2015 was 105.9 (AIHW, 2017).

Liveborn babies following cleavage stage embryo transfers had a sex ratio of 94.1 male babies for every 100 female babies. Liveborn babies following blastocyst transfers had a sex ratio of 109.0 male babies for every 100 female babies. In comparison, in 2015, liveborn babies following cleavage stage embryo transfers had a sex ratio of 100.5 male babies for every 100 female babies, and liveborn babies following blastocyst transfers had a sex ratio of 110.6 male babies for every 100 female babies (Fitzgerald et al. 2017).

Gestational age of babies

The average gestational age of babies born following autologous and recipient embryo transfer cycles was 38.0 weeks (Table 31). This is lower than the average gestational age of 38.6 weeks for all babies born in Australia in 2015 (AIHW, 2017).

One in seven babies (14.8%) were preterm (less than 37 weeks gestation), which was markedly higher than the proportion of preterm babies (8.7%) born in Australia in 2015 (AIHW, 2017). For ART singletons and twins, 10.3% and 71.5% were preterm compared with 7.0% and 62.8% of babies born in Australia in 2015 (AIHW, 2017).

Table 31: Babies by gestational age and plurality, Australia and New Zealand, 2016

Gestational age (weeks)	Singletons		Twins		Higher order multiples		Total	
Mean	*38.2*		*34.4*		*29.4*		*38.0*	
	n	**%**	**n**	**%**	**n**	**%**	**n**	**%**
≤ 27	*139*	*1.0*	*66*	*6.1*	*12*	*36.4*	*217*	*1.4*
28–31	*132*	*0.9*	*94*	*8.7*	*3*	*9.1*	*229*	*1.5*
32–36	*1,175*	*8.4*	*612*	*56.7*	*18*	*54.5*	*1,805*	*11.9*
≤ 36	1,446	10.3	772	71.5	33	100.0	2,251	14.8
≥ 37	12,590	89.7	308	28.5	0	0.0	12,898	85.1
Not stated	3	0.1	0	0.0	0	0.0	3	0.1
Total	**14,039**	**100.0**	**1,080**	**100**	**33**	**100**	**15,152**	**100.0**

Figure 7 shows the distribution of gestational age for singletons and twins born to women who had autologous and recipient embryo transfer cycles in 2016. Singletons following SET cycles had a lower proportion of preterm birth (10.3%) than singletons following DET cycles (11.1%). The overall proportions of preterm singletons (10.3%) and twins (71.5%) born to women who had embryo transfer cycles in 2016 were higher than the overall proportions of preterm singletons and twins born in Australia in 2015 (7.0% and 62.8% respectively) (AIHW, 2017).

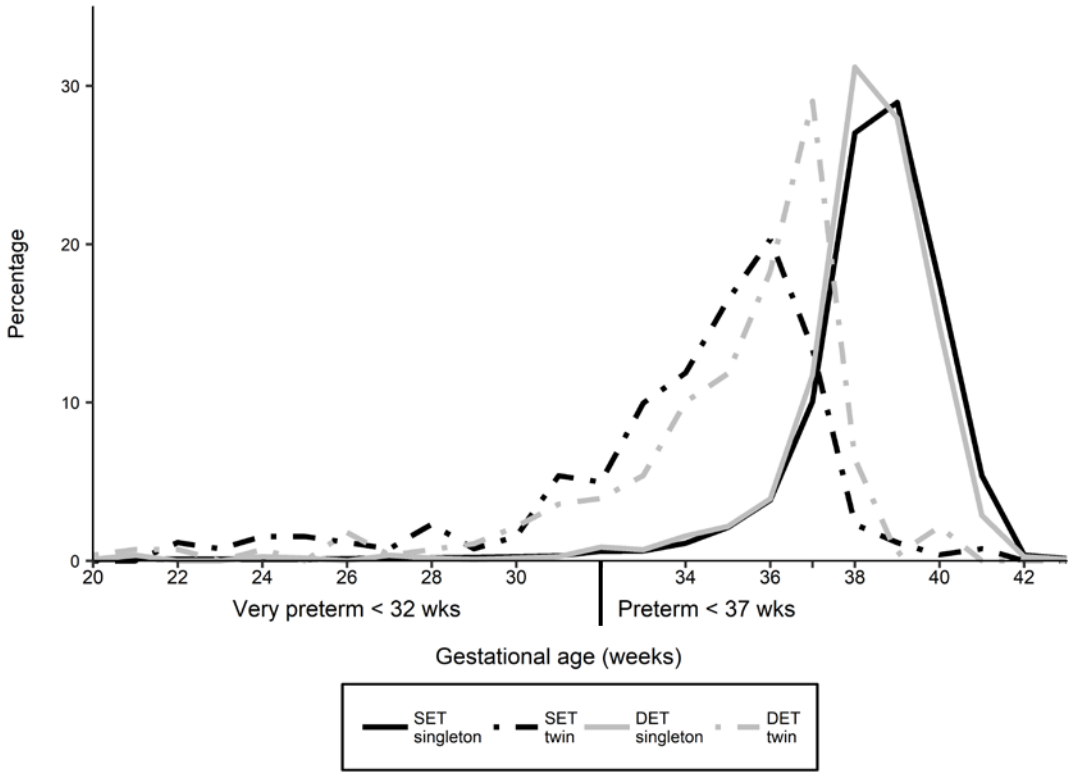


Figure 7: Percentage of babies born following embryo transfer cycles by gestational age, Australia and New Zealand, 2016

Birthweight of liveborn babies

The average birthweight for liveborn babies to women who had autologous and recipient embryo transfer cycles was 3,218 grams. More than one in ten (11.1%) of these babies were low birthweight (less than 2,500 grams) (Table 32).

The average birthweight was 3,295 grams and 2,243 grams for liveborn ART singletons and twins respectively. These were slightly lower than the mean birthweight of all liveborn singletons (3,372 grams) and twins (2,362 grams) in Australia in 2015 (AIHW, 2017). Low birthweight was reported for 6.9% of liveborn singletons following SET and 8.8% of liveborn singletons following DET in comparison with 5.0% of singleton births in Australia in 2015 (AIHW, 2017). For ART twins 61.9% were reported as low birthweight in comparison with 54.0% of twin births in Australia in 2015 (AIHW, 2017).

Table 32: Liveborn babies by birthweight group and plurality, Australia and New Zealand, 2016

	Singletons				
Birthweight (grams)	**SET[a]**	**DET[b]**	**Twins**	**Higher order multiples**	**Total[c]**
			n		
< 1,000	*70*	*11*	*48*	*9*	*138*
1,000–1,499	*87*	*10*	*61*	*5*	*163*
1,500–1,999	*163*	*20*	*172*	*14*	*369*
2,000–2,499	*560*	*58*	*371*	*2*	*991*
< 2,500	880	99	652	30	1,661
2,500–2,999	2,139	208	310	0	2,661
3,000–3,499	4,837	446	60	0	5,348
3,500–3,999	3,607	285	12	0	3,905
≥ 4,000	1,159	95	0	0	1,255
Not stated	152	8	20	0	181
Total	**12,774**	**1,141**	**1,054**	**30**	**15,011**
			%		
< 1,000	*0.5*	*1.0*	*4.6*	*30.0*	*0.9*
1,000–1,499	*0.7*	*0.9*	*5.8*	*16.7*	*1.1*
1,500–1,999	*1.3*	*1.8*	*16.3*	*46.7*	*2.5*
2,000–2,499	*4.4*	*5.1*	*35.2*	*6.7*	*6.6*
< 2,500	6.9	8.8	61.9	100.0	11.1
2,500–2,999	16.7	18.2	29.4	0.0	17.7
3,000–3,499	37.9	39.1	5.7	0.0	35.6
3,500–3,999	28.2	25.0	1.1	0.0	26.0
≥ 4,000	9.1	8.3	0.0	0.0	8.4
Not stated	1.2	0.7	1.9	0.0	1.2
Total	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**

(a) SET: single embryo transfer.

(b) DET: double embryo transfer.

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

Perinatal mortality

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

There were 148 reported perinatal deaths, including 106 stillbirths and 42 neonatal deaths. The perinatal mortality rate in 2016 was 9.8 deaths per 1,000 births (Table 33), which was higher than the rate of 9.2 per 1,000 births for all births in Australia in 2015 (AIHW, 2017). Singletons had a markedly lower perinatal mortality rate (7.3 deaths per 1,000 births) compared with multiples (41.3 deaths per 1,000 births) (Table 33).

These data should be interpreted with caution because of the small numbers and potential variability in case reporting, which is compounded by the self-reported nature of ART birth outcome data. In 2016, information relating to pregnancy outcomes was not stated for 1.0% of clinical pregnancies.

Table 33: Perinatal mortality of babies by type of death and plurality, Australia and New Zealand, 2016

			Stillbirths[a]		Neonatal Deaths		Perinatal Deaths[b]	
Plurality	**All births**	**Live births**	**n**	**Rate[c][e]**	**n**	**Rate[d][f]**	**n**	**Rate[c][g]**
Singletons	14,039	13,927	79	5.6	23	1.7	102	7.3
Multiples	1,113	1,084	27	24.3	19	17.5	46	41.3
Total	**15,152**	**15,011**	**106**	**7.3**	**42**	**2.8**	**148**	**9.8**

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

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

(c) Stillbirth and perinatal mortality rates were calculated using all births (live births and stillbirths) as the denominator.

(d) Neonatal death rate was calculated using live births as the denominator.

(e) Stillbirths per 1,000 births

(f) Neonatal deaths per 1,000 live births

(g) Perinatal deaths per 1,000 births

Note: The birth status was not reported for 35 babies.

5 Other cycle types, procedures and treatment complications in 2016

5.1 Gestational surrogacy cycles

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

There were 302 gestational surrogacy cycles in 2016, including 220 gestational carrier cycles and 82 commissioning cycles. Commissioning cycles include a variety of cycle types involved in the provision of oocytes or embryos by either the intended parents or donors. Among the 220 gestational carrier cycles, 185 (84.1%) involved the transfer of at least one embryo, 59 (26.8%) resulted in a clinical pregnancy and 45 (20.5%) resulted in a live delivery.

5.2 Preimplantation genetic testing

Preimplantation genetic testing (PGT) is a procedure where DNA from oocytes or embryos is tested for chromosomal disorders or genetic diseases before embryo transfer. This term includes pre-implantation genetic diagnosis (PGD) and pre-implantation genetic screening (PGS). The indication for PGT is not recorded in ANZARD. The number of cycles where PGT was performed in 2016 increased by 28.6% from 5,773 in 2015 (Fitzgerald et al. 2017) to 7,425 in 2016 (Table 34).

Among the 7,425 PGT cycles, 2,913 (39.2%) were part of a *freeze-all* cycle. Almost two thirds (67.2%) of the 7,425 cycles where PGT was performed were in woman aged 35 or older. Among the 3,223 thaw cycles where PGT was performed 97.6% (3,146) involved vitrified embryos and 2.4% (78) slow frozen embryos. Of the 7,425 PGT cycles, 53.8% (3,991) had embryos transferred and resulted in 1,780 clinical pregnancies and 1,473 live deliveries. The clinical pregnancy rate and live deliveries rate per embryo transfer were 44.6% and 36.9% respectively. Caution is advised when interpreting these results. In a number of cycles, an untested embryo may have been transferred in a cycle where PGT was performed.

Table 34: Number of cycles with PGT by type of embryo, Australia and New Zealand, 2016

	Stage of treatment	
Type of embryo	**Number of cycles with embryo fertilised/thawed**	**Number of cycles with PGT**
Fresh	38,743	4,202
Freeze-all cycles	*9,495*	*2,913*
Thaw	31,021	3,223
Total	**69,764**	**7,425**

5.3 Assisted hatching

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

There were 3,360 assisted hatching cycles reported in 2016 that did not occur in a PGT cycle. Of these, 2,781 (82.8%) had embryos transferred, resulting in 814 (24.2%) clinical pregnancies and 626 (18.6%) live deliveries. There were 663 babies born following assisted hatching cycles, including 596 singletons, 64 twins and 3 triplets.

5.4 GIFT cycles

Gamete intrafallopian transfer (GIFT) is an ART treatment where mature oocytes and sperm are placed directly into a woman's fallopian tubes. In 2016, there were 2 GIFT cycles, none of which resulted in a clinical pregnancy.

5.5 Ovarian hyperstimulation syndrome

Ovarian hyperstimulation syndrome (OHSS) is a complication of controlled ovarian stimulation where excessive follicles are produced with high levels of oestrogen secretion.

Cases of OHSS that require hospitalisation are reported by patients and clinicians, and validated against hospital records by fertility centre staff. There were 215 OHSS cases reported in 2016 that were admitted to hospital. A higher number of oocytes retrieved at OPU was associated with OHSS (Table 35). Caution should be used when interpreting these data because OHSS is not consistently reported.

Table 35: Number of cycles with OPU performed and OHSS by number of oocytes collected, Australia and New Zealand, 2016

	Number of oocytes collected						
	None	**1–4**	**5–9**	**10–14**	**15–19**	**≥ 20**	**All**
Cycles with OHSS	0	5	27	43	45	95	215
Cycles with OPU	817	10,338	15,239	9,449	4,585	3,324	43,752
OHSS per OPU cycle (%)	*0.0*	*0.1*	*0.2*	*0.5*	*1.0*	*2.9*	*0.5*

6 Donor sperm insemination cycles in 2016

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

Number and outcomes of DI cycles

In 2016, there were 3,198 DI cycles reported, which included 28.5% (910) undertaken with controlled ovarian hyperstimulation and 71.5% (2,288) undertaken in unstimulated cycles. Of all DI cycles, 15.6% resulted in a clinical pregnancy and 13.0% resulted in a live delivery (Table 36). The multiple birth rate following DI cycles was 5.5%.

The average age of women who had a DI cycle was 34.8. The clinical pregnancy rate and live delivery rate was highest in women aged under 35 and decreased with advancing women's age. Of the DI cycles in women aged under 35, 16.5% resulted in a live delivery, compared with 5.1% of DI cycles in women aged 40 or older (Table 36).

Table 36: Outcomes of DI cycles by women's age group, Australia and New Zealand, 2016

	Age group (years)[a]				
Stage/outcome of treatment	**< 30**	**30–34**	**35–39**	**≥ 40**	**Total**
DI cycles	487	951	1,265	495	3,198
Clinical pregnancies	95	174	201	30	500
Live deliveries	84	153	153	25	415
Clinical pregnancies per DI cycle (%)	*19.5*	*18.3*	*15.9*	*6.1*	*15.6*
Live deliveries per DI cycle (%)	*17.2*	*16.1*	*12.1*	*5.1*	*13.0*
Live deliveries per clinical pregnancy (%)	*88.4*	*87.9*	*76.1*	*83.3*	*83.0*

(a) Age at start of a treatment cycle.

Clinical pregnancies following DI cycles

Of the 500 clinical pregnancies following DI cycles, 83.6% resulted in a delivery, 15.4% ended in early pregnancy loss (including 13.8% miscarriages and 0.4% ectopic/heterotopic pregnancies), and 1.0% were unknown pregnancy outcomes. Of the 418 deliveries, 395 (94.5%) were singleton deliveries and 23 (5.5%) were twin deliveries.

Perinatal outcomes of babies

There were 441 babies born to women who had DI treatment, including 437 liveborn babies, 2 stillborn babies and 2 babies with an unknown outcome. Of these liveborn babies, 36 (11.7%) were born preterm (less than 37 weeks gestation). The mean birthweight of liveborn babies following DI treatment was 3,296 grams. This was higher than the mean birthweight (3,218 grams) of liveborn babies following autologous and recipient embryo transfer cycles. Thirty-eight liveborn babies (8.7%) were born with low birthweight (less than 2,500 grams).

7 Trends in ART treatment and outcomes: 2012 – 2016

This section includes autologous cycles, donation/recipient cycles, surrogacy cycles and GIFT cycles undertaken in Australia and New Zealand from 2012 to 2016. It does not include DI cycles.

ART treatment and outcomes

In 2016, there were 81,062 initiated ART cycles in Australia and New Zealand, a 4.3% increase on 2015. Of these initiated ART cycles, 49,826 were fresh cycles, representing an increase of 2.9% on 2015 (Table 37).

The proportion of initiated fresh cycles reaching embryo transfer has decreased from 72.0% in 2012 to 51.0% in 2016 partly due to changes in clinical practice, including increasing proportions of *freeze-all* cycles. Since 2012 there has been an average 37.4% yearly increase in the number of *freeze-all* cycles (Table 37)

Between 2012 and 2016, the clinical pregnancy and live delivery rates per initiated fresh cycle decreased from 21.9% to 15.5% and from 17.6% to 12.2% respectively. The live delivery rate per initiated fresh non *freeze-all* cycles decreased from 17.6% to 15.8% (Table 37).

Table 37: Number of fresh cycles by stage/outcome of treatment, Australia and New Zealand, 2012 to 2016

Stage/outcome of treatment	2012	2013	2014	2015	2016
Initiated cycles[(a)]	44,238	45,115	45,775	48,367	49,826
Cycles with OPU[(b)]	39,709	40,524	40,735	42,937	43,752
Freeze-all[(c)]	3,183	4,717	5,970	8,336	11,285
Embryo transfers	31,837	30,460	29,137	27,770	25,405
Clinical pregnancies	9,673	9,410	8,920	8,446	7,708
Live deliveries	7,275	7,230	6,903	6,628	6,075
Clinical pregnancy per embryo transfer (%)	*30.4*	*30.9*	*30.6*	*30.4*	*30.3*
Clinical pregnancies per initiated cycle (%)	*21.9*	*20.9*	*19.5*	*17.5*	*15.5*
Live deliveries per embryo transfer (%)	*22.9*	*23.7*	*23.7*	*23.9*	*23.9*
Live deliveries per initiated cycle (%)	*16.4*	*16.0*	*15.1*	*13.7*	*12.2*
Live deliveries per initiated non freeze-all cycle (%)[(d)]	*17.6*	*17.7*	*17.3*	*16.6*	*15.8*

(a) Included autologous cycles, oocyte donation cycles, oocyte/embryo recipient cycles, GIFT cycles and surrogacy cycles.
(b) Cycles with OPU includes cycles where no oocytes were collected during the procedure.
(c) *Freeze-all* cycles are fresh ART treatment cycles where all oocytes or embryos are cryopreserved for potential future use
(d) *Live deliveries per initiated non freeze-all cycle* is calculated using live deliveries as the numerator and initiated cycles minus *freeze-all* cycles as the denominator.

In comparison, 31,236 initiated thaw cycles were undertaken in 2016, an increase of 6.4% on 2015 (Table 38). The live delivery rate per initiated thaw cycle increased from 20.3% in 2012 to 27.0% in 2016 (Table 38).

For the period 2012 to 2016 the clinical pregnancy and live delivery rate per embryo transfer has remained stable for fresh embryo transfers while increasing for thaw embryo transfers (Figure 7).

Table 38: Number of thaw cycles by stage/outcome of treatment, Australia and New Zealand, 2012 to 2016

Stage/outcome of treatment	2012	2013	2014	2015	2016
Initiated cycles[(a)]	25,844	26,401	27,823	29,354	31,236
Embryo transfers	23,891	24,607	25,969	27,742	29,974
Clinical pregnancies	7,044	7,644	8,507	9,280	10,561
Live deliveries	5,246	5,767	6,470	7,412	8,440
Clinical pregnancy per embryo transfer (%)	*29.5*	*31.1*	*32.8*	*33.5*	*35.2*
Clinical pregnancies per initiated cycle (%)	*27.3*	*29.0*	*30.7*	*31.6*	*33.8*
Live deliveries per embryo transfer (%)	*22.0*	*23.4*	*24.9*	*26.7*	*28.2*
Live deliveries per initiated cycle (%)	*20.3*	*21.8*	*23.3*	*25.3*	*27.0*

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

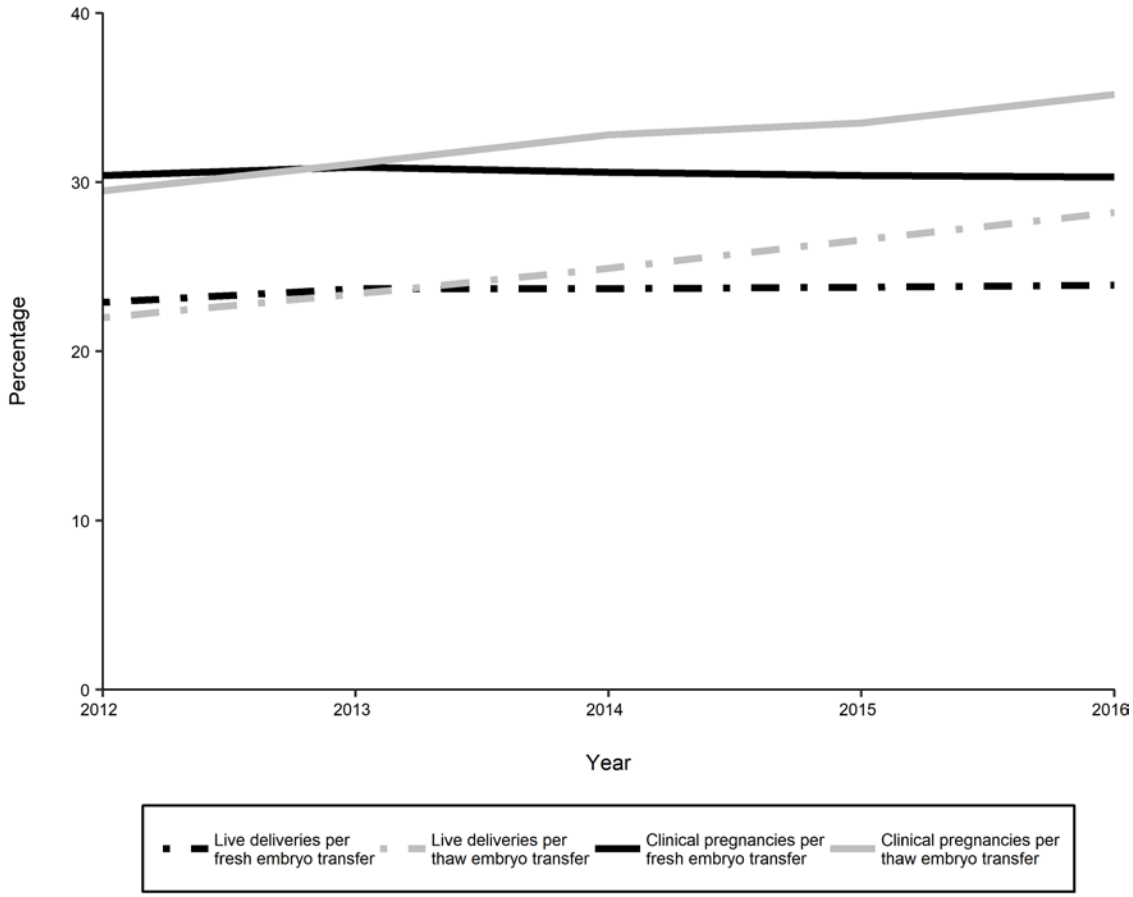


Figure 8: Clinical pregnancy and live delivery rates per fresh and thaw embryo transfers, Australia and New Zealand, 2012 to 2016

The clinical pregnancy and live delivery rates per OPU provide an estimate of the chances of success following a single OPU cycle. All OPUs and fresh and thaw embryo transfers where preformed within the year presented, and embryo transfers were not linked to the OPU from which they originated. The calculation is the sum of fresh and thaw clinical pregnancies or live deliveries as the numerator and the number of OPUs of the same year as denominator.

Between 2012 and 2016, the live delivery rate from fresh and thaw cycles per OPU cycles increased from 31.5% to 33.2% (Table 39).

Table 39: Outcomes of fresh and thaw cycles following OPU, Australia and New Zealand, 2012 to 2016

Outcome of treatment	2012	2013	2014	2015	2016
Cycles with OPU[(a)]	39,709	40,524	40,735	42,937	43,752
Clinical pregnancies	16,717	17,054	17,427	17,726	18,269
Live deliveries	12,521	12,997	13,373	14,040	14,515
Clinical pregnancies from fresh and thaw cycles per OPU cycles[(b)]	*42.1*	*42.1*	*42.8*	*41.3*	*41.8*
Live deliveries from fresh and thaw cycles per OPU cycle[(c)]	*31.5*	*32.1*	*32.8*	*32.7*	*33.2*

(a) Cycles with OPU includes cycles where no oocytes were collected during the procedure.
(b) *Clinical pregnancies from fresh and thaw cycles per OPU cycle* is calculated using live deliveries from fresh and thaw cycles as the numerator and cycles with OPU as the denominator.
(c) *Live deliveries from fresh and thaw cycles per OPU cycle* is calculated using live deliveries from fresh and thaw cycles as the numerator and cycles with OPU as the denominator.

Multiple gestation deliveries

The decline in multiple gestation deliveries resulting from ART treatment continued in 2016. The proportion of multiple deliveries decreased from 6.5% in 2012 to 3.8% in 2016 (Table 40). The decline is primarily the result of the increasing uptake of SET (Table 44).

Table 40: Number of deliveries following ART treatment by gestation, Australia and New Zealand, 2012 to 2016

Gestation	2012		2013		2014		2015		2016	
	n	%	n	%	n	%	n	%	n	%
Singleton	11,919	93.5	12,460	94.4	12,900	95.1	13,519	95.6	14,098	96.2
Multiple	826	6.5	733	5.6	662	4.9	628	4.4	554	3.8
Twin	*807*	*6.3*	*720*	*5.5*	*647*	*4.8*	*615*	4.3	*543*	3.7
Higher order multiple	*19*	*0.1*	*13*	*0.1*	*15*	*0.1*	*14*	0.1	*11*	0.1
Total[(a)]	**12,745**	**100.0**	**13,193**	**100.0**	**13,562**	**100.0**	**14,148**	**100.0**	**14,652**	**100.0**

(a) Includes cycles in which gestation was unknown.

Women's age for autologous cycles

Women aged 35 to 39 were the largest age group undertaking autologous cycles between 2012 and 2016. The average age of women having autologous cycles remained relatively stable over the period ranging from 35.8 to 35.9 years. The proportion of autologous cycles in women aged 40 and older ranged from 24.6% to 25.6% between 2012 and 2016 (Table 41).

Table 41: Number of fresh and thaw autologous cycles by women's age group, Australia and New Zealand, 2012 to 2016

Age group (years)[(a)]	2012		2013		2014		2015		2016	
Mean	*35.8*		*35.9*		*35.8*		*35.8*		*35.8*	
	n	%	n	%	n	%	n	%	n	%
< 30	7,353	11.0	7,257	10.7	7,566	10.9	7,760	10.6	7,832	10.3
30–34	18,132	27.2	18,791	27.6	19,754	28.4	21,039	28.6	22,118	29.0
35–39	24,344	36.5	24,548	36.1	24,559	35.3	26,444	36.0	27,608	36.2
40–44	15,763	23.6	16,167	23.8	16,416	23.6	16,935	23.0	17,279	22.7
≥ 45	1,118	1.7	1,217	1.8	1,343	1.9	1,303	1.8	1,418	1.9
Total	**66,710**	**100.0**	**67,980**	**100.0**	**69,638**	**100.0**	**73,481**	**100.0**	**76,255**	**100.0**

(a) Age at start of treatment cycle.

Types of ART treatment and stage of embryo development

In Australia and New Zealand, the proportion of ART embryo transfer cycles that used embryos created with ICSI has decreased from 64.7% in 2012 to 62.9% in 2016. The proportion of blastocyst transfer cycles increased from 59.8% in 2012 to 78.4% in 2016 (Table 42). The proportion of thaw embryo transfer cycles that used vitrified embryos increased for both cleavage stage embryos and blastocysts (Table 43 and Figure 8).

Table 42: Number of embryo transfer cycles by treatment type, Australia and New Zealand, 2012 to 2016

Treatment type and procedure	2012		2013		2014		2015		2016	
	n	%	n	%	n	%	n	%	n	%
Fertilisation procedure										
IVF	19,653	35.3	19,900	36.1	19,935	36.2	20,568	37.1	19,507	35.2
ICSI[(a)]	36,067	64.7	35,162	63.9	35,161	63.8	34,941	62.9	34,830	62.9
Not stated	2	0.0	1	0.0	4	0.0	0	0.0	1,040	1.9
Total	**55,722**	**100.0**	**55,063**	**100.0**	**55,100**	**100.0**	**55,509**	**100.0**	**55,377**	**100.0**
Stage of embryo development										
Cleavage stage	22,392	40.2	21,408	38.9	17,907	32.5	14,734	26.5	11,939	21.6
Blastocyst[(b)]	33,330	59.8	33,655	61.1	37,193	67.5	40,775	73.5	43,438	78.4
Total	**55,722**	**100.0**	**55,063**	**100.0**	**55,100**	**100.0**	**55,509**	**100.0**	**55,377**	**100.0**

(a) Includes cycles where both ICSI and IVF fertilised embryos were transferred.
(b) Includes cycles where both cleavage stage embryos and blastocysts were transferred.

Table 43: Number of embryo transfer cycles by cryopreservation method and stage of embryo development, Australia and New Zealand, 2012 to 2016

Treatment type and procedure	2012		2013		2014		2015		2016	
	n	%	n	%	n	%	n	%	n	%
Cleavage stage										
Slow frozen	6,839	88.4	5,951	84.4	4,313	77.0	2,767	64.0	1,631	50.7
Vitrification[(a)]	892	11.5	1,097	15.6	1,282	22.9	1,555	36.0	1,583	49.7
Not stated	4	0.1	1	0.0	5	0.1	2	0.0	0	0.0
Total	**7,735**	**100.0**	**7,049**	**100.0**	**5,600**	**100.0**	**4,324**	**100.0**	**3,214**	**100.0**
Blastocyst										
Slow frozen	3,734	23.1	2,982	17.0	2,928	14.4	3,237	13.8	3,266	12.2
Vitrification[(a)]	12,409	76.8	14,558	82.9	17,428	85.6	20,161	86.1	23,494	87.8
Not stated	13	0.1	18	0.1	13	0.1	20	0.1	0	0.0
Total	**16,156**	**100.0**	**17,558**	**100.0**	**20,369**	**100.0**	**23,418**	**100.0**	**26,760**	**100.0**

(a) Includes cycles were both vitrified and slow frozen embryos were transferred.

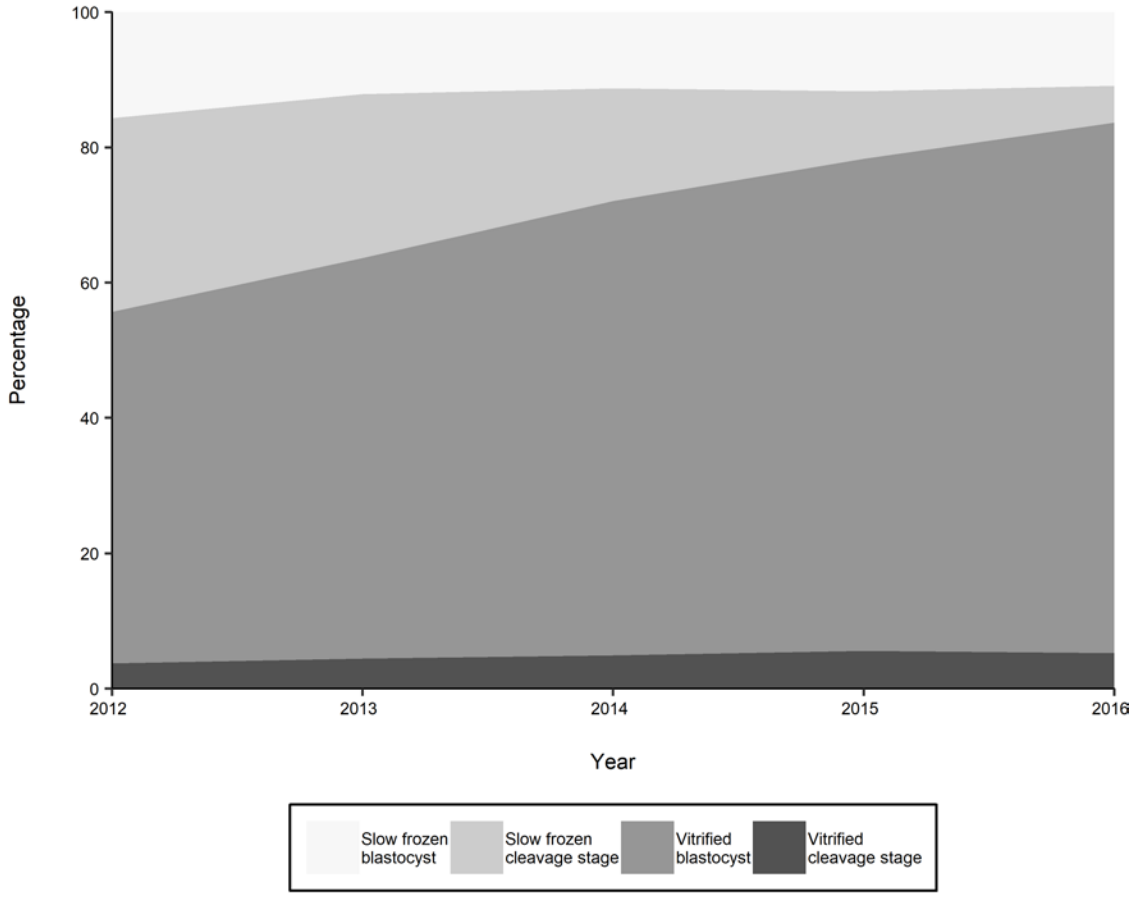


Figure 9: Percentage of embryo transfer cycles by cryopreservation method and stage of embryo development, Australia and New Zealand, 2012 to 2016

Number of embryos transferred per embryo transfer cycle

There has been an ongoing shift to SET cycles in Australia and New Zealand. In 2012, the proportion of SET cycles accounted for 73.2% of embryo transfer cycles increasing to 87.7% (Table 44).

Table 44: Percentage of embryo transfer cycles by number of embryos transferred, Australia and New Zealand, 2012 to 2016

Number of embryos transferred	2012	2013	2014	2015	2016
One embryo	73.2	76.3	79.2	82.9	87.7
Two embryos	26	23	20.1	16.6	12.1
Three or more embryos	0.7	0.7	0.7	0.5	0.2

8 Women undertaking autologous treatment in 2016

ANZARD was upgraded from a cycle-based data collection to a woman-based data collection for treatments undertaken from 2009 onwards (ANZARD2.0). This allows reporting of the number of women undergoing treatment and the number of cycles per woman over time. The upgrade to a woman-based data collection was achieved by introducing a statistical linkage key (SLK) that links successive treatment cycles undertaken by one woman. The SLK is a combination of the first two letters of a woman's first name, the first two letters of her surname and her date of birth. The SLK enables the number of women undergoing treatment across time to be reported. This section presents the number of women who underwent autologous ART treatment in 2016. The number of cycles undertaken by a woman included both fresh and thaw cycles. For some women, if their fresh cycles were undertaken in previous years, only thaw cycles were reported and presented.

Women who undertook autologous treatment

There were 39,980 women who undertook 76,255 autologous fresh and/or thaw cycles in Australia and New Zealand in 2016. Of these women, 39,162 had treatment in Australia, 3,828 in New Zealand, and 10 had treatment in both Australia and New Zealand.

On average, 1.9 fresh and/or thaw cycles per woman were undertaken in 2016, with more cycles per woman in Australia (1.9 cycles per woman) than in New Zealand (1.5 cycles per woman). In Australia, more than half (52.3%) of the women had two or more autologous treatment cycles compared with 40.4% of women in New Zealand. In line with this, 10.7% of women in Australia had four or more cycles in 2016 compared with 3.7% of women in New Zealand (Table 45).

Table 45: Women undertaking autologous fresh and/or thaw cycles by number of cycles, Australia and New Zealand, 2016

Number of cycles	Australia		New Zealand		All	
	n	%	n	%	n	%
One	17,233	47.7	2,281	59.6	19,504	48.8
Two	10,141	28.0	1,040	27.2	11,180	28.0
Three	4,915	13.6	365	9.5	5,279	13.2
Four or more	3,873	10.7	142	3.7	4,017	10.0
Total	**36,162**	**100.0**	**3,828**	**100.0**	**39,980**	**100.0**

Note: Only women who undertook cycles in 2016 are included. Ten women had treatment in both Australia and New Zealand.

Women who undertook autologous fresh cycles

There were 47,172 fresh cycles undertaken by 31,870 women in Australia and New Zealand in 2016; an average of 1.5 fresh cycles per woman. Younger women had fewer fresh cycles with one in four (23.6%) women aged under 30 having two or more autologous fresh cycles compared to nearly one in three (32.4%) overall. This partly reflects the higher success rate per initiated fresh autologous cycle among younger women, and the fact that younger women tend to have more cryopreserved embryos available for subsequent thaw cycles. One percent of women aged under 30 had four or more cycles. This proportion increased to 7.1% for women aged 40 to 44 and 5.9% for women aged 45 or older (Table 46).

Table 46: Women undertaking autologous fresh cycles by number of cycles, Australia and New Zealand, 2016

	Age group (years)[(a)]					
Number of cycles	**< 30**	**30–34**	**35–39**	**40–44**	**≥ 45**	**All**
			n			
One	2,806	7,014	7,612	3,788	335	21,555
Two	664	1,845	2,569	1,780	116	6,974
Three	167	443	814	744	62	2,230
Four or more	38	150	405	486	32	1,111
Total	**3,675**	**9,452**	**11,400**	**6,798**	**545**	**31,870**
			%			
One	76.4	74.2	66.8	55.7	61.5	67.6
Two	18.1	19.5	22.5	26.2	21.3	21.9
Three	4.5	4.7	7.1	10.9	11.4	7.0
Four or more	1.0	1.6	3.6	7.1	5.9	3.5
Total	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**

(a) Age at start of first autologous fresh cycle in 2016.

Women who undertook autologous thaw cycles

There were 29,083 thaw cycles undertaken by 19,787 women in Australia and New Zealand in 2016; an average of 1.5 thaw cycles per woman. One third (33.9%) of women aged under 30 had two or more thaw cycles compared with 20.5% of women aged 45 or older (Table 47).

Advancing women's age was associated with a decrease in the proportion of women having two or more thaw cycles, while advancing women's age saw an increase in the proportion of women having two or more fresh cycles (Table 46 and Table 47).

Table 47: Women undertaking autologous thaw cycles by number of cycles, Australia and New Zealand, 2016

	Age group (years)[(a)]					
Number of cycles	**< 30**	**30–34**	**35–39**	**40–44**	**≥ 45**	**All**
			n			
One	1,485	4,323	4,831	2,399	206	13,244
Two	481	1,556	1,722	731	41	4,531
Three	203	519	531	184	7	1,444
Four or more	76	207	202	78	5	568
Total	**2,245**	**6,605**	**7,286**	**3,392**	**259**	**19,787**
			%			
One	66.1	65.5	66.3	70.7	79.5	66.9
Two	21.4	23.6	23.6	21.6	15.8	22.9
Three	9.0	7.9	7.3	5.4	2.7	7.3
Four or more	3.4	3.1	2.8	2.3	1.9	2.9
Total	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**

(a) Age at start of first autologous thaw cycle in 2016.

9 Cycle-specific rates for women who started their first ART treatment cycle in 2014

This Chapter presents information for the cohort of women who started their first ART treatment cycle between 1 January 2014 and 31 December 2014. Women in this cohort were followed from the start of their first autologous (non *freeze-all*) fresh cycle through subsequent fresh and thaw cycles, excluding *freeze-all* cycles, until 31 December 2016 or until they achieved a live delivery (a delivery of at least one liveborn baby). This cohort was defined using the SLK described in Chapter 8.

This longitudinal perspective provides a measure of the outcomes of successive ART treatment cycles undertaken by the same woman. These women might have had additional treatment cycles after 2016 and their treatment information and resulting outcomes will be captured in subsequent annual reports. Therefore, in this dynamic cohort of women undergoing their first autologous fresh ART treatment in 2014, the cycle-specific live delivery rates may change over time as more women return for treatment at a later date.

ART treatment cycles presented in Tables 48 to 53 include all initiated autologous fresh and thaw cycles, excluding *freeze-all* cycles. Donor sperm insemination cycles, oocyte/embryo recipient cycles, oocyte/embryo donation cycles, surrogacy arrangement cycles and GIFT cycles were also excluded. A pregnancy that ended before 20 weeks or in a stillbirth (fetal death) are not counted as a live delivery.

In 2014, 16,101 women were identified as having their first ever fresh autologous cycle in that year. Information on whether a fresh cycle was a first or subsequent cycle was not available for 1,292 women representing 4.4% of all women having autologous fresh cycles in 2014. Of the 16,101 women identified as having their first fresh autologous cycle in 2014, 626 had only *freeze-all* cycles without subsequent embryo transfers, and are therefore excluded from the cycle-specific live birth rates.

Table 48 presents the number of cycles undertaken by 15,475 women who undertook their first autologous (non *freeze-all*) fresh cycle in 2014. Tables 49 to 53 present cycle-specific live delivery rates and non-progression rates for these women. The rates are presented for all women (Table 49) and by women's age group at the time of their first cycle in 2014, <30, 30–34, 35–39 and 40–44 (Tables 50 to 53). Only the first 10 cycles are presented in Tables 48 to 53 due to the small number of women (99 women and 27 live deliveries) undertaking 11 or more treatment cycles between 1 January 2014 and 31 December 2016.

The *cycle-specific live delivery* rate is calculated as the number of live deliveries in that cycle divided by the number of women who commenced ART treatment in that cycle. The *non-progression rate* for a specific cycle is calculated as the number of women who did not return for further ART treatment cycles before 31 December 2016, divided by the number of women who did not have a live delivery in that cycle.

Number of cycles by women's age group

Table 48 presents the number of cycles by women's age group. Three-quarters (75.6%) of these women had between one and three cycles, and one-quarter (24.4%) had four or more cycles.

Table 48 : Number of cycles by women's age group for all women who started their first autologous fresh cycle (excluding *freeze-all* cycles [(a)]) between 1 January 2014 and 31 December 2014, Australia and New Zealand

	Age group (years)[(b)]					
Cycle number	**< 30**	**30-34**	**35-39**	**40-44**	**≥ 45**	**All**
			n			
One	1,002	1,905	1,691	894	108	5,600
Two	558	1,238	1,180	696	62	3,734
Three	338	764	786	442	33	2,363
Four	187	451	501	311	16	1,466
Five	110	276	307	181	4	878
Six	57	179	180	132	1	549
Seven	40	97	136	82	1	356
Eight	26	53	67	49	3	198
Nine	9	32	59	39	1	140
Ten or more	13	43	69	65	1	191
Total	**2,340**	**5,038**	**4,976**	**2,891**	**230**	**15,475**
			%			
One	42.8	37.8	34.0	30.9	47.0	36.2
Two	23.8	24.6	23.7	24.1	27.0	24.1
Three	14.4	15.2	15.8	15.3	14.3	15.3
Four	8.0	9.0	10.1	10.8	7.0	9.5
Five	4.7	5.5	6.2	6.3	1.7	5.7
Six	2.4	3.6	3.6	4.6	0.4	3.5
Seven	1.7	1.9	2.7	2.8	0.4	2.3
Eight	1.1	1.1	1.3	1.7	1.3	1.3
Nine	0.4	0.6	1.2	1.3	0.4	0.9
Ten or more	0.6	0.9	1.4	2.2	0.4	1.2
Total	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**

(a) *Freeze-all* cycles are fresh ART treatment cycles where all oocytes or embryos are frozen and an embryo transfer does not take place.

(b) Age at start of first autologous fresh ART treatment cycle (excluding *freeze-all* cycles) undertaken in 2014.

Note: Women who started their first autologous fresh non-*freeze-all* ART treatment cycle between 1 January 2014 and 31 December 2014 and were followed through subsequent fresh and thaw cycles, excluding *freeze-all* cycles, until 31 December 2016 or delivery of a liveborn baby up to 31 October 2017.Totals and subtotals may not equal 100.0 due to rounding. Data should be interpreted with caution due to small numbers in certain cells.

Cycle-specific live delivery rates

How to interpret Tables 49 to 53

- The following tables report on women who started their first ART treatment cycle in 2014. They present the proportion of live deliveries achieved in the first and subsequent ART cycles.
- The first cycle is always a fresh ART treatment cycle, where an OPU was performed but cycles two to ten, can be either an initiated fresh or frozen/thaw cycle. Cycles where all embryos were frozen (*freeze-all* cycles) are not counted.
- Only cycles undertaken in 2014–2016 are counted.
- Only the first live delivery by a woman is counted.
- The *cycle-specific rate* is the percentage of women who had a live delivery in a specific cycle after previous failed treatment attempts. For example, 16.0% of women who undertook a fifth cycle achieved a live delivery in that cycle (Table 49).
- The *non-progression rate* is the percentage of women who did not return for further ART treatment cycles before 31 December 2016. For example, 26.2% of women who did not achieve a live delivery by their fifth cycle did not return for a sixth cycle (Table 49).

Table 49: Cycle-specific live delivery rates for all women who started their first autologous fresh cycle (excluding *freeze-all* cycles) between 1 January 2014 and 31 December 2014, Australia and New Zealand

Cycle number[a]	Number of women starting cycle	Number of women who had a live delivery[b]	Cycle-specific live delivery rate (%)[c]	Number of women who did not progress to next treatment	Non-progression rate (%)[d]
One	15,475	3,486	22.5	2,118	17.7
Two	9,875	1,968	19.9	1,767	22.3
Three	6,141	1,078	17.6	1,284	25.4
Four	3,778	688	18.2	778	25.2
Five	2,312	369	16.0	509	26.2
Six	1,434	227	15.8	323	26.8
Seven	885	124	14.0	231	30.4
Eight	529	63	11.9	135	29.0
Nine	331	41	12.4	100	34.5
Ten	191	34	17.8	58	36.9

(a) Cycle one represents a woman's first autologous (non *freeze-all*) fresh ART treatment cycle between 1 January 2014 and 31 December 2014. Cycles two to ten could be either a fresh or thaw cycle (excluding *freeze-all* cycles) undertaken by a woman until 31 December 2016 or delivery of a liveborn baby up to 31 October 2017.

(b) A live delivery is the delivery of one or more liveborn infants, with the birth of twins or higher order multiples counted as one live delivery.

(c) The cycle-specific live delivery rate for a specific cycle is calculated as the number of live deliveries in that specific cycle divided by the number of women who commenced ART treatment at that cycle.

(d) The non-progression rate for a specific cycle is calculated as the number of women who did not return for further ART treatment cycles before 31 December 2016 divided by the number of women who did not have a live delivery in that cycle. Reasons that a woman did not progress to the next treatment, such as poor prognosis, spontaneous pregnancy, migration, financial, psychological and other unrelated reasons, are not collected in ANZARD.

Note: Further treatment cycles after the tenth cycle and resulting live deliveries are not presented in this table due to small numbers. Data should be interpreted with caution due to small numbers in certain cells.

Table 50: Cycle-specific live delivery rates for women aged less than 30 who started their first autologous fresh cycle (excluding *freeze-all* cycles) between 1 January 2014 and 31 December 2014, Australia and New Zealand

Cycle number[a]	Number of women starting cycle	Number of women who had a live delivery[b]	Cycle-specific live delivery rate (%)[c]	Number of women who did not progress to next treatment	Non-progression rate (%)[d]
One	2,340	771	32.9	231	14.7
Two	1,338	384	28.7	174	18.2
Three	780	204	26.2	134	23.3
Four	442	113	25.6	74	22.5
Five	255	67	26.3	43	22.9
Six	145	36	24.8	21	19.3
Seven	88	25	28.4	15	23.8
Eight	48	16	33.3	10	31.3
Nine	22	2	9.1	7	35.0
Ten	13	6	46.2	3	42.9

(a) Cycle one represents a woman's first autologous (non *freeze-all*) fresh ART treatment cycle between 1 January 2014 and 31 December 2014. Cycles two to ten could be either a fresh or thaw cycle (excluding *freeze-all* cycles) undertaken by a woman until 31 December 2016 or delivery of a liveborn baby up to 31 October 2017.

(b) A live delivery is the delivery of one or more liveborn infants, with the birth of twins or higher order multiples counted as one live delivery.

(c) The cycle-specific live delivery rate for a specific cycle is calculated as the number of live deliveries in that specific cycle divided by the number of women who commenced ART treatment at that cycle.

(d) The non-progression rate for a specific cycle is calculated as the number of women who did not return for further ART treatment cycles before 31 December 2016 divided by the number of women who did not have a live delivery in that cycle. Reasons that a woman did not progress to the next treatment, such as poor prognosis, spontaneous pregnancy, migration, financial, psychological and other unrelated reasons, are not collected in ANZARD.

Note: Further treatment cycles after the tenth cycle and resulting live deliveries are not presented in this table due to small numbers. Data should be interpreted with caution due to small numbers in certain cells.

Table 51: Cycle-specific live delivery rates for women aged 30–34 who started their first autologous fresh cycle (excluding *freeze-all* cycles) between 1 January 2014 and 31 December 2014, Australia and New Zealand

Cycle number[a]	Number of women starting cycle	Number of women who had a live delivery[b]	Cycle-specific live delivery rate (%)[c]	Number of women who did not progress to next treatment	Non-progression rate (%)[d]
One	5,038	1,440	28.6	466	13.0
Two	3,133	836	26.7	403	17.5
Three	1,895	435	23.0	328	22.5
Four	1,131	268	23.7	183	21.2
Five	680	150	22.1	126	23.8
Six	404	96	23.8	84	27.3
Seven	225	46	20.4	50	27.9
Eight	128	19	14.8	34	31.2
Nine	75	10	13.3	22	33.8
Ten	43	11	25.6	10	31.3

(a) Cycle one represents a woman's first autologous (non *freeze-all*) fresh ART treatment cycle between 1 January 2014 and 31 December 2014. Cycles two to ten could be either a fresh or thaw cycle (excluding *freeze-all* cycles) undertaken by a woman until 31 December 2016 or delivery of a liveborn baby up to 31 October 2017.

(b) A live delivery is the delivery of one or more liveborn infants, with the birth of twins or higher order multiples counted as one live delivery.

(c) The cycle-specific live delivery rate for a specific cycle is calculated as the number of live deliveries in that specific cycle divided by the number of women who commenced ART treatment at that cycle.

(d) The non-progression rate for a specific cycle is calculated as the number of women who did not return for further ART treatment cycles before 31 December 2016 divided by the number of women who did not have a live delivery in that cycle. Reasons that a woman did not progress to the next treatment, such as poor prognosis, spontaneous pregnancy, migration, financial, psychological and other unrelated reasons, are not collected in ANZARD.

Note: Further treatment cycles after the tenth cycle and resulting live deliveries are not presented in this table due to small numbers. Data should be interpreted with caution due to small numbers in certain cells.

Table 52: Cycle-specific live delivery rates for women aged 35–39 who started their first autologous fresh cycle(excluding *freeze-all* cycles) between 1 January 2014 and 31 December 2014, Australia and New Zealand

Cycle number[(a)]	Number of women starting cycle	Number of women who had a live delivery[(b)]	Cycle-specific live delivery rate (%)[(c)]	Number of women who did not progress to next treatment	Non-progression rate (%)[(d)]
One	4,976	1,025	20.6	668	16.9
Two	3,285	604	18.4	576	21.5
Three	2,105	354	16.8	432	24.7
Four	1,319	256	19.4	245	23.0
Five	818	125	15.3	182	26.3
Six	511	70	13.7	110	24.9
Seven	331	43	13.0	93	32.3
Eight	195	22	11.3	45	26.0
Nine	128	24	18.8	35	33.7
Ten	69	11	15.9	23	39.7

(a) Cycle one represents a woman's first autologous (non-*freeze-all*) fresh ART treatment cycle between 1 January 2014 and 31 December 2014. Cycles two to ten could be either a fresh or thaw cycle (excluding *freeze-all* cycles) undertaken by a woman until 31 December 2016 or delivery of a liveborn baby up to 31 October 2017.

(b) A live delivery is the delivery of one or more liveborn infants, with the birth of twins or higher order multiples counted as one live delivery.

(c) The cycle-specific live delivery rate for a specific cycle is calculated as the number of live deliveries in that specific cycle divided by the number of women who commenced ART treatment at that cycle.

(d) The non-progression rate for a specific cycle is calculated as the number of women who did not return for further ART treatment cycles before 31 December 2016 divided by the number of women who did not have a live delivery in that cycle. Reasons that a woman did not progress to the next treatment, such as poor prognosis, spontaneous pregnancy, migration, financial, psychological and other unrelated reasons, are not collected in ANZARD.

Note: Further treatment cycles after the tenth cycle and resulting live deliveries are not presented in this table due to small numbers. Data should be interpreted with caution due to small numbers in certain cells.

Table 53: Cycle-specific live delivery rates for women aged 40–44 who started their first autologous fresh cycle (excluding *freeze-all* cycles) between 1 January 2014 and 31 December 2014, Australia and New Zealand

Cycle number[a]	Number of women starting cycle	Number of women who had a live delivery[b]	Cycle-specific live delivery rate (%)[c]	Number of women who did not progress to next treatment	Non-progression rate (%)[d]
One	2,891	247	8.5	647	24.5
Two	1,997	145	7.3	552	29.8
Three	1,301	84	6.5	358	29.4
Four	859	50	5.8	261	32.3
Five	548	27	4.9	154	29.6
Six	367	25	6.8	107	31.3
Seven	235	10	4.3	72	32.0
Eight	153	6	3.9	43	29.3
Nine	104	5	4.8	35	35.4
Ten	65	6	9.2	21	35.6

(a) Cycle one represents a woman's first autologous (non *freeze-all*) fresh ART treatment cycle between 1 January 2014 and 31 December 2014. Cycles two to ten could be either a fresh or thaw cycle (excluding *freeze-all* cycles) undertaken by a woman until 31 December 2016 or delivery of a liveborn baby up to 31 October 2017.

(b) A live delivery is the delivery of one or more liveborn infants, with the birth of twins or higher order multiples counted as one live delivery.

(c) The cycle-specific live delivery rate for a specific cycle is calculated as the number of live deliveries in that specific cycle divided by the number of women who commenced ART treatment at that cycle.

(d) The non-progression rate for a specific cycle is calculated as the number of women who did not return for further ART treatment cycles before 31 December 2016 divided by the number of women who did not have a live delivery in that cycle. Reasons that a woman did not progress to the next treatment, such as poor prognosis, spontaneous pregnancy, migration, financial, psychological and other unrelated reasons, are not collected in ANZARD.

Note: Further treatment cycles after the tenth cycle and resulting live deliveries are not presented in this table due to small numbers. Data should be interpreted with caution due to small numbers in certain cells.

Appendix A: Contributing fertility clinics

Australian Capital Territory

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

COMPASS Fertility, Barton (Dr Nicole Sides)

Genea - Canberra, Deakin (Associate Professor Mark Bowman)

New South Wales

City Fertility Centre – Sydney, Liverpool (Dr Georgina Tang)

Demeter Fertility, Liverpool (Dr David Knight)

Fertility First, Hurstville (Dr Anne Clark)

Genea – Coffs Harbour, Coffs Harbour (A/Prof Mark Bowman)

Genea – Illawarra, Wollongong (A/Prof Mark Bowman)

Genea – Lismore, Lismore (A/Prof Mark Bowman)

Genea – Liverpool, Liverpool (A/Prof Mark Bowman)

Genea – Newcastle, Merewether (A/Prof Mark Bowman)

Genea – Northwest, Bella Vista (A/Prof Mark Bowman)

Genea – Orange, Orange (A/Prof Mark Bowman)

Genea – RPAH, Camperdown (A/Prof Mark Bowman)

Genea, Sydney (A/Prof Mark Bowman)

Hunter IVF (IVF Australia), New Lambton Heights (A/Prof Peter Illingworth)

IVF Australia – Eastern Sydney, Maroubra (A/Prof Peter Illingworth)

IVF Australia – North Shore, Greenwich (A/Prof Peter Illingworth)

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

IVF Australia – Central Coast, Gosford (A/Prof Peter Illingworth)

Monash IVF – Mosman, Mosman (Dr Peter Benny)

Monash IVF – Bondi Junction, Bondi Junction (Dr Bronwyn Devine)

Monash IVF – Parramatta, Parramatta (Dr Peter Benny)

Primary IVF, Sydney (Dr Janelle McDonald)

Reproductive Medicine Albury, Albury (Dr Scott Giltrap)

Reproductive Medicine Wagga, Wagga Wagga (Dr Scott Giltrap)

Royal Hospital for Women – DRM, Randwick (Prof William Ledger)

The Fertility Centre – Liverpool, Liverpool (A/Prof Peter Illingworth)

The Fertility Centre – Wollongong, Wollongong (A/Prof Peter Illingworth)

Westmead Fertility Centre, Westmead (Dr Howard Smith)

Northern Territory

Repromed Darwin, Tiwi (Dr Greg Phiillipson)

Queensland

CARE Fertility, Greenslopes (Dr Clare Boothroyd)

CARE Fertility, Toowoomba (Dr Clare Boothroyd)

Cairns Fertility Centre, Cairns (Dr John Yovich)

City Fertility Centre – Brisbane, (Dr Ashish Das)

City Fertility Centre – Southside, Sunnybank (Dr Neil Astill)

City Fertility Centre – Gold Coast, Robina (Dr Andrew Davidson)

Coastal IVF, Maroochydore (Dr Paul Stokes)

Fertility Solutions Sunshine Coast, Buderim (Dr James Orford)

Fertility Solutions Bundaberg, Bundaberg (Dr James Orford)

QFG Sunshine Coast, (Dr David Molloy)

Life Fertility Centre, (Dr Glenn Sterling)

Monash IVF Gold Coast, Southport (Dr Irving Korman)

Monash IVF Rockhampton, Rockhampton (Dr Mark Leydon)

Monash IVF Townsville, (Dr Mark Leydon)

Monash IVF Auchenflower, Auchenflower (Dr John Chenoweth)

MyIVF, North Lakes (Dr John Chenoweth)

QFG Cairns, Cairns (Dr David Molloy)

QFG Gold Coast, Benowa (Dr David Molloy)

QFG Mackay, North Mackay (Dr David Molloy)

QFG Toowoomba, Toowoomba (Dr David Molloy)

QFG Townsville, Hyde Park (Dr David Molloy)

QFG, Spring Hill (Dr David Molloy)

The Fertility Centre, Springwood (Dr David Molloy)

QFG North Brisbane, Everton Park, (Dr David Molloy)

The Fertility Centre Sunshine Coast, Birtinya (Dr David Molloy)

South Australia

City Fertility Centre – Adelaide, Henley Beach (Dr Marcin Stankiewicz)

Fertility SA, Adelaide (Prof Robert Norman)

Flinders Fertility, Bedford Park (Dr Michael McEvoy)

Repromed, Dulwich (Dr Richard Henshaw)

Tasmania

TasIVF Hobart, Hobart (Dr Bill Watkins)

TasIVF Launceston, East Launceston (Dr Bill Watkins)

Victoria

Ballarat IVF, Wendouree (Dr Russell Dalton)

City Fertility Centre Bundoora, Bundoora (Dr David Wilkinson)

City Fertility Centre Melbourne, Melbourne (Dr David Wilkinson)

Melbourne IVF Mt Waverley, Mt Waverley (Dr Lyndon Hale)

Melbourne IVF Werribee, Werribee (Dr Lyndon Hale)

Melbourne IVF, East Melbourne (Dr Lyndon Hale)

Monash IVF Bendigo, Bendigo (Dr Mark Jalland)

Monash IVF Frankston, Frankston (Dr Alon Talmor)

Monash IVF Geelong, Geelong (Dr Prue Johnstone)

Monash IVF Sale, Sale (Dr Gareth Weston)

Monash IVF Sunshine, St Albans (Dr Gareth Weston)

Monash IVF Epworth Hospital, Richmond, (Dr Lyn Burmeister)

Monash IVF Hawthorn (Dr Lyn Burmeister)

Monash IVF Monash Surgical Private Hospital, Clayton, (Prof Luk Rombauts)

Primary IVF, Preston (Dr Janelle McDonald)

Reproductive Services, Parkville (Dr Lyndon Hale)

Western Australia

Concept Fertility Centre, Subiaco (Dr Lucy Williams)

Fertility Great Southern, Denmark (Dr Jay Natalwala)

Fertility North, Joondalup (Dr Vince Chapple)

Fertility Specialists South, Attadale (Prof Roger Hart)

Fertility Specialists WA, Claremont (Prof Roger Hart)

Genea Hollywood Fertility Centre, Hollywood (Dr Simon Turner)

PIVET Medical Centre, Leederville (Dr John Yovich)

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

New Zealand

Fertility Associates, Auckland (Dr Simon Kelly)

Fertility Associates Christchurch, Christchurch (Dr Sarah Wakeman)

Fertility Associates Hamilton, Hamilton (Dr VP Singh)

Fertility Associates Otago, Dunedin (Associate Professor Wayne Gillett)

Fertility Associates Wellington, Wellington (Dr Andrew Murray)

Fertility Plus, Auckland (Dr Cindy Farquhar)

Genea Oxford Women's Health, Christchurch (Dr Robert Woolcott)

Repromed Auckland, Auckland (Dr Guy Gudex)

Appendix B: Data used in this report

The data presented in this report are supplied by 94 fertility clinics in Australia and New Zealand and are compiled into ANZARD2.0. ANZARD2.0 includes autologous treatment cycles, treatment involving donated oocytes or embryos, and treatment involving surrogacy arrangements. ANZARD2.0 collects data on the use of ART techniques such as ICSI, oocyte/embryo freezing methods, PGT and cleavage/blastocyst transfers. In addition to ART procedures, ANZARD2.0 also collects data on artificial insemination cycles using donated sperm (DI) from fertility centres. The outcomes of pregnancies, deliveries and babies born following ART and DI treatments are also maintained in ANZARD2.0. This includes the method of birth, birth status, birthweight, gestational age, plurality, perinatal mortality and selected information on maternal morbidity.

Data validation

Most fertility centres have computerised data information management systems and are able to provide NPESU with high-quality data. All data processed by NPESU undergo a validation process, with data queries being followed up with fertility centre staff. In 2016, information relating to pregnancy and birth outcomes was not provided for 1.0% of clinical pregnancies.

The Reproductive Technology Accreditation Committee (RTAC) of FSA also plays a role in ensuring the quality of ANZARD 2.0 data. ANZARD submissions from fertility clinics are audited by Certifying Bodies according to the RTAC Code of Practise, this includes selected records against clinic files in their annual inspections. All assisted reproductive technology (ART) cycles and donor insemination (DI) undertaken in Australia and New Zealand must be reported to ANZARD as part of their accreditation by the Reproductive Technology Accreditation Committee of the Fertility Society of Australia.

Data presentation

Chapters 2 to 7 of this report present information on ART and DI treatment cycles that took place in fertility clinics in Australia and New Zealand in 2016, and the resulting pregnancies and births. The babies included in this report were conceived following treatment cycles undertaken in 2016, and were born in either 2016 or 2017. Data presented in Chapters 2 to 7 are for treatment cycles and not women. It is possible for an individual woman to undergo more than one treatment cycle in a year or experience more than one pregnancy. This means that information reported about patient characteristics in Chapters 2 to 7, such as age, parity and cause of infertility, is based on calculations in which individuals may be counted more than once. The rates of clinical pregnancy and live delivery in Chapters 2 to 7 were measured per initiated cycle. Where the number of initiated cycles was not available, the rates were calculated per embryo transfer cycle.

Chapter 8 presents information on women undergoing ART treatment cycles in 2016.

Chapter 9 presents longitudinal information on the cohort of women who were identified as starting their first autologous (non *freeze-all*) fresh ART cycle in 2014.

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

Data limitations

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

Appendix C: ANZARD2.0 data items

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

Variable	Data domain
Date of cancellation for cancelled OPU	Date of the last day FSH is administered in a cancelled cycle. DD/MM/YYYY.
OPU date	Date of oocyte pickup.
Number of eggs retrieved	Number of eggs retrieved at OPU.
Number of eggs donated	Number of eggs donated to someone else.
Number of eggs received	Number of eggs received from someone else.
Number of eggs imported	Records number of oocytes imported into the current unit from another unit.
Number of eggs exported	Records number of oocytes exported from the current unit into another unit.
Number of oocytes slow frozen	Number of oocytes frozen by slow freezing method in this cycle.
Number of oocytes vitrified	Number of oocytes frozen by vitrification in this cycle.
Number of slow frozen oocytes thawed	Number of slow frozen oocytes thawed in this cycle.
Number of vitrified oocytes warmed	Number of vitrified oocytes warmed in this cycle.
Freezing date of thawed/warmed oocytes	DD/MM/YYYY.
Number of eggs GIFT	Number of eggs replaced in a GIFT procedure.
Number of eggs IVF	Number of eggs treated (inseminated) with IVF.
Number of eggs ICSI	Number of eggs treated with ICSI.
Site of sperm used	Site of sperm extraction: ejaculated, epididymal (whether by open biopsy or by PESA), testicular or other.
Person who provided sperm	Husband/partner (h), known donor (k), anonymous donor (a), unknown (u).
Number of eggs fertilised normally	Number of eggs fertilised normally.
Preimplantation genetic diagnosis	Yes–preimplantation genetic diagnosis in any form (including aneuploidy screening or sex selection) has been performed on any of the embryos (transferred or not). No–PGD not performed.
Assisted hatching	Yes–where assisted hatching in any form has been performed on any of the embryos (transferred or not). No–assisted hatching not performed.
Number of embryos imported from another clinic	Records number of embryos imported into the unit from another unit.
Number of embryos received from another patient/ clinic	Records the number of embryos that a patient/couple received from another patient/couple.
Number of slow frozen cleavage embryos thawed	Number of slow frozen cleavage embryos thawed with the intention of performing an embryo transfer.
Number of vitrified cleavage embryos warmed	Number of vitrified cleavage embryos warmed with the intention of performing an embryo transfer.
Number of slow frozen blastocysts thawed	Number of slow frozen blastocysts thawed with the intention of performing an embryo transfer.
Number of vitrified blastocysts warmed	Number of vitrified blastocyst embryos warmed with the intention of performing an embryo transfer.
Freezing date of thawed/warmed embryos	Freezing date of thawed/warmed embryos.
Thawed/warmed embryos originally from oocyte donor or embryo donor	o–embryo from donated oocyte. e–donated embryo.
ET date	Embryo transfer date.
Number of cleavage embryos transferred	Number of cleavage stage embryos transferred.
Number of blastocyst transferred	Number of blastocyst stage embryos transferred.

Variable	Data domain
Any embryos ICSI?	Yes–any embryos transferred were fertilised by ICSI. No–no transferred embryos were fertilised by ICSI.
Number of cleavage embryos slow frozen	Number of cleavage embryos frozen by slow freezing method in this cycle.
Number of cleavage embryos vitrified	Number of cleavage embryos frozen by vitrification in this cycle.
Number of blastocysts slow frozen	Number of blastocysts frozen by slow freezing method in this cycle.
Number of blastocysts vitrified	Number of blastocysts frozen by vitrification method in this cycle.
Number of embryos exported	Number of embryos exported from the current unit to another unit.
Number of embryos donated	Number of embryos donated to another patient.
Number of potentially usable frozen embryos discarded	Frozen embryos disposed in accordance with patient's request or Government regulation.
Clinical pregnancy	A pregnancy that fulfils one of the following criteria: 1. Known to be ongoing at 20 weeks 2. Evidence by ultrasound of an intrauterine sac (with or without a fetal heart) 3. Examination of products of conception reveal chorionic villi 4. A definite ectopic pregnancy that has been diagnosed laparoscopically or by ultrasound.
Date pregnancy ended	Date on which delivery, miscarriage or termination takes place.
Number of fetal hearts	Number of fetal hearts seen on first ultrasound (intrauterine only).
Ectopic pregnancy	If this pregnancy is an ectopic pregnancy, or a combined ectopic and uterine pregnancy (heterotopic). n–No e–Ectopic h–Heterotopic
Elective termination of pregnancy	Yes–pregnancy is terminated. No–pregnancy not terminated.
Selective reduction performed	Yes–If selective reduction has been performed due to fetal abnormality/other reasons. No–If no selective reduction has been performed.
Fetal abnormality in a pregnancy ending < 20 weeks or by selective reduction	Fetal abnormality in a pregnancy ending < 20 weeks or by selective reduction.
Maternal complications of pregnancy	Maternal complications of pregnancy.
Number of babies delivered	Include all liveborn and stillborn babies after 20 weeks gestation or at least 400 grams birthweight.
Caesarean delivery	Yes–delivery by planned or emergency caesarean section. No–other.
Baby 1 outcome	Liveborn, stillborn or neonatal death.
Baby 1 sex	Male or female.
Baby 1 birthweight	Weight in grams.
Baby 1 abnormality	Describes any known congenital malformation.
Baby 1 date of neonatal death	Date of neonatal death.
Baby 2 outcome	Liveborn, stillborn or neonatal death.
Baby 2 sex	Male or female.
Baby 2 weight	Weight in grams.
Baby 2 abnormality	Describes any known congenital malformation.
Baby 2 date of neonatal death	Date of neonatal death.
Baby 3 outcome	Liveborn, stillborn or neonatal death.

Variable	Data domain
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	Answer yes if OHSS occurred.
Morbidity detail	Describes symptoms of treatment-related morbidity.
Postcode	Postcode of patient residential area.
Comments	Any comments on this cycle.

Glossary

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

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

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

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

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

Blastocyst: an embryo comprising around 100 cells usually developed by five or six days after fertilisation.

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

Cleavage stage embryo: an embryo comprising about eight cells usually developed by two or three days after fertilisation.

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

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

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

Cryopreservation: freezing embryos for potential future ART treatment.

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

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

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

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

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

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

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

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

***Freeze-all (freeze only)* cycle:** a fresh cycle where all oocytes or embryos that are potentially suitable for transfer are cryopreserved for potential future use.

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

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

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

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

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

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

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

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

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

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

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

Oocyte (egg): a female reproductive cell.

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

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

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

PGT (preimplantation genetic testing): a procedure where DNA from oocytes or embryos is tested for chromosomal disorders or genetic diseases before embryo transfer. This term includes pre-implantation genetic diagnosis (PGD) and pre-implantation genetic screening (PGS).

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

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

Preterm: a gestation of less than 37 weeks.

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

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

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

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

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

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

Note: The International Committee Monitoring Assisted Reproductive Technologies (ICMART) has published an Infertility and Fertility Care glossary for the terms used in ART data collections (Zegers-Hochschild et al. 2017). However, the terminology used in this report may differ from that in the ICMART glossary.

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