Assisted reproductive technology in Australia and New Zealand 2018

UNSW SYDNEY

Supported by and in collaboration with

NPESU National Perinatal Epidemiology and Statistics Unit

FERTILITY SOCIETY OF AUSTRALIA

Assisted reproductive technology in Australia and New Zealand 2018

Jade E Newman
Repon C Paul
Georgina M Chambers

September 2020

UNSW Sydney

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 the 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: 978-0-7334-3941-4

Suggested citation

Newman JE, Paul RC, Chambers GM 2020. Assisted reproductive technology in Australia and New Zealand 2018. Sydney: National Perinatal Epidemiology and Statistics Unit, the University of New South Wales, Sydney.

Any enquiries about or comments on this publication should be directed to:
National Perinatal Epidemiology and Statistics Unit
Centre for Big Data Research in Health
UNSW Sydney
Level 2 AGSM Building (G27)
Sydney NSW 2052 Australia
T +61 (2) 93859155
E npesu@unsw.edu.au

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) is a collaborative effort between the National Perinatal Epidemiology and Statistics Unit (NPESU), the Fertility Society of Australia (FSA) 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, Sydney (UNSW).

All assisted reproductive technology (ART) and donor insemination (DI) cycles undertaken in Australian and New Zealand clinics 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 clinics 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 Chris Copeland, Dr David Molloy, Professor Robert Norman and Professor Luk Rombauts for peer reviewing this report. We would also like to acknowledge the support of the NPESU by UNSW 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 bodies.

Abbreviations

ANZARD	Australian and New Zealand Assisted Reproduction Database
ART	assisted reproductive technology
BL	blastocyst
CL	cleavage-stage embryo
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
IUI	intrauterine insemination
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

n.a.	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 woman 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 84,064 ART treatment cycles reported from Australian and New Zealand fertility clinics in 2018 (76,341 and 7,723 respectively), representing an increase of 1.9% in Australia and 6.2% in New Zealand from 2017. This equates to 14.8 cycles per 1,000 women of reproductive age (15–44 years) in Australia, compared with 7.9 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 and oocytes that had been frozen and thawed were used in 36.9% of autologous cycles.

There were 41,927 women who undertook 79,072 autologous fresh and/or thaw cycles in Australia and New Zealand in 2018. On average, 1.9 autologous fresh and/or thaw cycles per woman were undertaken in 2018, with more cycles per woman in Australia (1.9 cycles per woman) than in New Zealand (1.7 cycles per woman). The number of cycles where embryos were selected using preimplantation genetic testing (PGT) marginally decreased from 9,169 in 2017 to 9,124 in 2018.

Over the last five years the proportion of cycles where all oocytes or embryos were cryopreserved for potential future use (*freeze-all* cycles) has doubled from 13% of initiated fresh cycles in 2014 to 26.7% in 2018. 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 or for fertility preservation.

Patient's age

The average age of women undergoing autologous cycles in 2018 was 35.8 years, which is similar to previous years. The average age of women undergoing ART treatment using donor oocytes or embryos was around five years older at 40.3 years. Approximately one in four (23.7%) women who underwent an autologous cycle in 2018 were aged 40 years or older. The average age of male partners of women undergoing autologous and recipient cycles was 38.1 years, with approximately one-third (31.5%) aged 40 years or older.

Treatment outcomes and number of babies

Of the 84,064 initiated ART cycles, 70,196 (83.5%) resulted in either an embryo transfer or all oocytes/embryos being cryopreserved. Of the initiated cycles, 23.2% (19,514) resulted in a clinical pregnancy and 18.4% (15,475) in a live birth. The overall clinical pregnancy rate for cycles reaching embryo transfer was 34.4%. In 2018, there were 4 GIFT cycles resulting in 2 live births.

The live birth rate per initiated autologous fresh cycle was 16.8% after *freeze-all* cycles were excluded, and 24.5% for fresh cycles reaching embryo transfer. The live birth rate per

initiated autologous thaw cycle was 28.5% and for thaw cycles reaching embryo transfer cycle was 29.4%.

There was a higher live birth rate in younger women. For women aged younger than 30 years, the live birth rate per embryo transfer was 40.4% for autologous fresh cycles and 34.9% for autologous thaw cycles. For women older than 44 years, the live birth rate per embryo transfer was 0.8% for autologous fresh cycles and 7.8% for thaw cycles.

There were 16,140 babies born (including 15,980 liveborn babies) following ART treatment in 2018. Of these, 14,355 (88.9%) were from Australian clinics and 1,785 (11.1%) from New Zealand clinics. Eight in ten liveborn babies (81.5%) 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 15,404 women were followed from the start of their first autologous non-*freeze-all* fresh cycle during 2016, through subsequent fresh and thaw cycles until December 2018 or until they achieved a live birth. The cycle-specific live birth rate per initiated cycle for all women was 23.1% in their first cycle, and 11.6% in their eighth cycle. Approximately one in four women who did not achieve a live birth in a specific cycle discontinued ART treatment during the period.

Trends in ART procedures

Treatment trends in the last five years have included a continued shift from cleavage stage transfers to blastocyst transfers (from 67.5% in 2014 to 86.6% in 2018); an increase in vitrification as a cryopreservation method (from 85.6% of thaw blastocyst transfer cycles in 2014 to 94.1% in 2018); and a small decrease in the use of intracytoplasmic sperm injection (ICSI) (from 63.8% of embryo transfer cycles in 2014 to 60.3% in 2018).

The proportion of embryo transfer cycles transferring a cryopreserved embryo increased from 47.1% in 2014 to 57.2% in 2018. Of the 15,475 live births resulting from ART treatment in 2018, 61.5% resulted from thaw cycles, compared to 48.4% in 2014.

In the last five years the live birth rate per fresh embryo transfer cycle increased from 23.7% to 24.6%, and the live birth rate per thaw embryo transfer cycle increased from 24.9% to 29.3%. This could be explained by the increase in *freeze-all* cycles over the years. Overall, live birth rates per embryo transfer have risen from 24.3% in 2014 to 27.3% in 2018, a 12.3% improvement.

Multiple birth trends

A continuing trend in ART treatment in Australia and New Zealand has been the reduction in the rate of multiple births, from 4.9% in 2014 to 3.2% in 2018. This has been achieved by clinicians and patients shifting to single embryo transfer, with the proportion increasing from 79.2% in 2014 to 90.6% in 2018. Importantly, this decrease in the multiple birth rate has been achieved while overall live birth rates per embryo transfer increased from 24.3% in 2014 to 27.3% in 2018.

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 8 million children worldwide (ESHRE 2018). The most recent national estimates indicate that 4.9% of all women who gave birth in Australia in 2018 received some form of ART treatment (AIHW, 2020).

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 2018.

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 (eggs)
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 2–4 days to form a cleavage stage embryo (6–8 cells) or 5–6 days to create a blastocyst (60–100 cells)
5. transfer of one or more fresh embryos into the uterus in order to achieve pregnancy.

Treatment may be discontinued at any stage during a treatment cycle due to several 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 2014 to 2018. Reporting ART treatment cycles in Australia is a requirement for ART clinics to be licensed by the Reproductive Technology Accreditation Committee (RTAC). All ART clinics in Australia and New Zealand provided data to ANZARD for cycles performed in 2018.

As a joint initiative of the NPESU at UNSW Sydney and the FSA, 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 (ANZARD 2.0). A more detailed description of ANZARD 2.0 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 2018 annual report presents cycle-specific success rates for women who started their first autologous (non *freeze-all*) fresh cycle during 2016. These women were followed from their first fresh cycle through subsequent fresh and thaw cycles (excluding *freeze-all* cycles) until 31 December

2018, or until they achieved a live birth (a birth of at least one liveborn baby) up to and including 31 October 2019.

The 2018 data presented in this report were supplied by all 84 fertility clinics in Australia and all 8 fertility clinics in New Zealand and compiled into ANZARD 2.0. 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 2018', 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 2018', presents data on the number of cycles, cycle types and the outcomes of treatment in terms of discontinued treatment, clinical pregnancies and births.

Chapter 4—'Pregnancy and birth outcomes following autologous and recipient embryo transfer cycles in 2018', presents data on the outcomes of clinical pregnancies and births following autologous and recipient cycles including a description of perinatal outcomes.

Chapter 5—'Other cycle types, procedures and treatment complications in 2018', includes information on gestational surrogacy and GIFT cycles, PGT and assisted hatching procedures and ovarian hyperstimulation syndrome (OHSS) complications.

Chapter 6—'Donor sperm insemination cycles in 2018', presents data on DI cycles and their outcomes, including a description of pregnancy and perinatal outcomes.

Chapter 7—'Trends in ART treatment and outcomes: 2014–2018', 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 2018', presents information on the number of women undergoing ART treatment in 2018.

Chapter 9—'Cycle-specific rates for women who started their first ART treatment cycle in 2016', presents information for a cohort of women who started their first autologous (non-*freeze-all*) fresh ART treatment cycle during 2016, and were followed through subsequent fresh and thaw cycles (excluding *freeze-all* cycles) until 31 December 2018 or until they achieved a live birth.

Appendices—Appendix A lists the contributing fertility clinics. Appendix B provides an overview of the ANZARD 2.0 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 2018

There were 84,064 ART treatment cycles reported from Australian and New Zealand clinics in 2018 (Table 1). Of these, 90.8% (76,341) were from Australian clinics and 9.2% (7,723) were from New Zealand clinics. The overall number of ART treatment cycles in 2018 increased by 2.2% from the 82,215 cycles in 2017, with a 1.9% increase in Australia and 6.2% increase in New Zealand. In 2018, the number of ART treatment cycles represented 14.8 cycles per 1,000 women of reproductive age (15–44 years) in Australia, compared with 7.9 cycles per 1,000 women of reproductive age in New Zealand (Australian Bureau of Statistics 2018; Statistics New Zealand 2018).

Approximately 94% of cycles in 2018 were autologous cycles (where a woman intended to use or used her own oocytes or embryos). Of the 79,072 autologous cycles, 48,048 (60.8%) were fresh cycles and 31,024 (39.2%) were thaw cycles. Other treatments represented a small proportion of cycles: 3.5% were oocyte recipient cycles, 0.7% were embryo recipient cycles, 1.3% were oocyte donation cycles and 0.5% were surrogacy arrangement cycles (Table 1).

Of all initiated ART treatments in 2018, 23.2% (19,514) resulted in a clinical pregnancy and 18.4% (15,475) in a live birth (Table 1). Of these clinical pregnancies, 17,320 (88.8%) were from Australian clinics and 2,194 (11.2%) from New Zealand clinics. There were 16,140 babies born, (including 15,980 liveborn babies) following ART treatment in 2018. Of these, 14,355 (88.9%) were from Australian clinics and 1,785 (11.1%) from New Zealand clinics. Of the liveborn babies, 80.2% (13,018) were singletons at term (gestational age of 37–41 weeks) with normal birthweight (≥ 2,500 grams). The multiple birth rate was 3.2%.

Table 1: Number of initiated ART treatment cycles by treatment type, Australia and New Zealand, 2018

	Number of initiated ART cycles	Percentage of treatment types	Number of clinical pregnancies	Number of live births	Number of liveborn babies	Number of liveborn singletons at term with normal birthweight
Autologous	79,072	94.1	18,440	14,626	15,103	12,334
Fresh	*48,048*	*57.2*	*7,399*	*5,799*	*5,994*	*4,803*
Thaw	*31,024*	*36.9*	*11,041*	*8,827*	*9,109*	*7,531*
Oocyte recipient	2,950	3.5	801	629	649	500
Embryo recipient	548	0.7	168	132	139	104
Oocyte donation	1,078	1.3	0	0	0	0
GIFT[(a)]	4	0.0	2	2	2	2
Surrogacy arrangement cycles	412	0.5	103	86	87	78
Commissioning cycles[(b)]	*137*	*0.2*	*0*	*0*	*0*	*0*
Gestational carrier cycles[(c)]	*275*	*0.3*	*103*	*86*	*87*	*78*
Total	**84,064**	**100.0**	**19,514**	**15,475**	**15,980**	**13,018**

(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 2018

This chapter presents data on initiated autologous cycles, oocyte donation cycles and oocyte/embryo recipient cycles. Gestational 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 35.9 years. For women undergoing oocyte/embryo recipient cycles, the mean age was 40.3 years, nearly five years older than for autologous cycles (35.8 years). Of all autologous and oocyte/embryo recipient cycles, 25.4% were undertaken by women aged 40 or older (Table 2). The average age of male partners was 38.1 years, with 31.6% aged 40 or older. For 24.5% 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, 2018

Age group (years)[(a)]	Autologous				Oocyte /embryo recipient		All	
	Fresh		Thaw					
	n	%	n	%	n	%	n	%
< 30	4,545	9.5	3,219	10.4	172	4.9	7,936	9.6
30–34	12,659	26.3	10,434	33.6	460	13.2	23,553	28.5
35–39	17,644	36.7	11,778	38.0	713	20.4	30,135	36.5
40–44	12,097	25.2	5,187	16.7	1,285	36.7	18,569	22.5
≥ 45	1,103	2.3	406	1.3	868	24.8	2,377	2.9
Total	**48,048**	**100.0**	**31,024**	**100.0**	**3,498**	**100.0**	**82,570**	**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, 2018

Age group (years)[(a)]	Autologous				Oocyte/embryo recipient		All	
	Fresh		Thaw					
	n	%	n	%	n	%	n	%
< 30	2,725	5.7	1,833	5.9	91	2.6	4,649	5.6
30–34	9,733	20.3	7,665	24.7	336	9.6	17,734	21.5
35–39	13,296	27.7	10,037	32.4	629	18.0	23,962	29.0
40–44	9,336	19.4	5,758	18.6	754	21.6	15,848	19.2
≥ 45	6,130	12.8	3,239	10.4	831	23.8	10,200	12.4
Not stated/no partner involved	6,828	14.2	2,492	8.0	857	24.5	10,177	12.3
Total	**48,048**	**100.0**	**31,024**	**100.0**	**3,498**	**100.0**	**82,570**	**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 82,570 initiated autologous and recipient cycles undertaken in 2018, 66.1% were undertaken by nulliparous women. Of autologous cycles (fresh and thaw), 66.3% were undertaken by nulliparous women, compared with 62% for oocyte/embryo recipient cycles (Table 4).

Table 4: Number of autologous and recipient cycles by parity and treatment type, Australia and New Zealand, 2018

	Autologous				Oocyte/embryo recipient		All	
	Fresh		Thaw					
Parity	**n**	**%**	**n**	**%**	**n**	**%**	**n**	**%**
Nulliparous	33,864	70.5	18,522	59.7	2,169	62.0	54,555	66.1
Parous	6,792	14.1	7,218	23.3	547	15.6	14,557	17.6
Not stated	7,392	15.4	5,284	17.0	782	22.4	13,458	16.3
Total	**48,048**	**100.0**	**31,024**	**100.0**	**3,498**	**100.0**	**82,570**	**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, 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 82,570 initiated autologous and recipient cycles, 10.4% reported male infertility factors as the only cause of infertility; 36.6% reported only female infertility factors; 7% reported combined male–female factors; 17.4% reported unexplained infertility only; 27.6% reported no cause of infertility and 0.6% were not stated or unknown.

Intracytoplasmic sperm injection procedures

Of the 40,711 autologous fresh cycles where fertilisation was attempted, 64.0% used ICSI procedures and 36.0% used IVF procedures. Of fresh oocyte recipient cycles where fertilisation was attempted, 80.4% used ICSI procedures and 19.5% 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, 2018

	Autologous				Oocyte/embryo recipient			
	Fresh[(a)]		Thaw[(b)(d)]		Fresh[(a)]		Thaw[(b)(d)]	
Procedure	**n**	**%**	**n**	**%**	**n**	**%**	**n**	**%**
IVF	14,655	36.0	12,418	41.4	249	19.5	613	28.5
ICSI[(c)]	26,056	64.0	17,597	58.6	1,027	80.4	1,541	71.5
Total	**40,711**	**100.0**	**30,015**	**100.0**	**1,276**	**100.0**	**2,154**	**100.0**

(a) Fresh cycles where fertilisation was attempted.

(b) Thaw cycles where embryos were transferred.

(c) Includes 1,155 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. 1,425 of the 19,138 thaw ICSI cycles had two or more embryos transferred.

Number of embryos transferred

Of the 56,401 fresh and thaw embryo transfer cycles undertaken in autologous and recipient cycles, 90.6% were single embryo transfer (SET) cycles and 9.3% were double embryo transfer (DET). In women aged under 35, 94.6% of embryo transfer cycles were SET cycles and 5.4% were DET cycles. In women aged 35 or older, 87.9% of cycles were SET cycles and 11.9% 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, 2018

	Number of embryos transferred							
	One		Two		Three or more		Total	
Age group (years)[(a)]	**n**	**%**	**n**	**%**	**n**	**%**	**n**	**%**
< 30	5,231	95.6	240	4.4	0	0.0	5,471	100.0
30–34	16,075	94.3	970	5.7	0	0.0	17,045	100.0
35–39	18,888	91.8	1,686	8.2	1	0.0	20,575	100.0
40–44	9,643	82.1	2,061	17.5	44	0.4	11,748	100.0
≥ 45	1,262	80.8	281	18.0	19	1.2	1,562	100.0
All	**51,099**	**90.6**	**5,238**	**9.3**	**64**	**0.1**	**56,401**	**100.0**

(a) Age at start of a treatment cycle.

Stage of embryo development

Of the 56,401 embryo transfer cycles, 13.4% involved the transfer of day 2-4 embryos (cleavage stage embryos) and 86.6% day 5–6 embryos (blastocysts). Of autologous cycles, blastocyst transfers made up 76.7% of fresh cycles compared with 94.4% of thaw cycles (Table 7).

Table 7: Number of embryo transfer cycles by treatment type and stage of embryo development, Australia and New Zealand, 2018

Stage of embryo development	Autologous				Oocyte/embryo recipient			
	Fresh		Thaw		Fresh		Thaw	
	n	%	n	%	n	%	n	%
Cleavage Stage	5,532	23.3	1,677	5.6	135	25.6	205	9.5
Blastocyst[(a)]	18,172	76.7	28,338	94.4	393	74.4	1,949	90.5
Total	**23,704**	**100.0**	**30,015**	**100.0**	**528**	**100.0**	**2,154**	**100.0**

(a) Includes 4 cycles where both blastocyst and cleavage stage embryos 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 32,169 frozen/thawed embryo transfer cycles, 92.3% involved the transfer of vitrified embryos. Of the frozen/thawed blastocyst transfer cycles 94.1% had vitrified embryos transferred. By comparison, 63% of frozen/thawed cleavage stage embryo transfer cycles used vitrified embryos (Table 8).

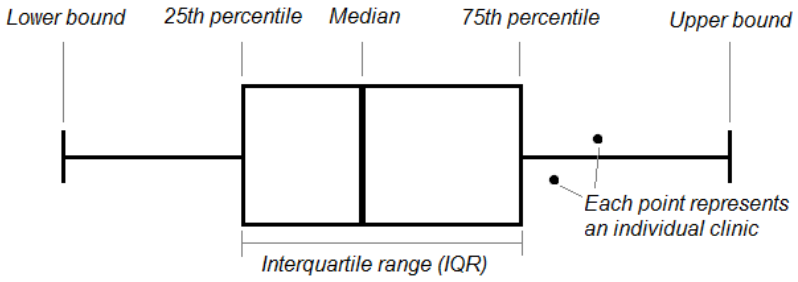
Table 8: Number of embryo transfer cycles by cryopreservation method and stage of embryo development, Australia and New Zealand, 2018

Cryopreservation method	Autologous				Oocyte/embryo recipient			
	Cleavage Stage		Blastocyst		Cleavage Stage		Blastocyst	
	n	%	n	%	n	%	n	%
Slow frozen	569	33.9	1,653	5.8	128	62.4	132	6.8
Vitrification[(a)]	1,108	66.1	26,685	94.2	77	37.6	1,817	93.2
Total	**1,677**	**100.0**	**28,338**	**100.0**	**205**	**100.0**	**1,949**	**100.0**

(a) Includes 54 cycles where both vitrified and slow frozen embryos were transferred.

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

How to interpret Figure 1



- Figure 1 reports on live births per initiated fresh (excluding *freeze-all)* and thaw autologous cycles, and recipient cycles (%) among the 90 fertility clinics who performed more than 50 of these cycles combined in 2018.
- Each point represents a clinic.
- A percentile indicates the value below which a given percentage of clinics' live birth rates fall. For example, 50% of clinics had a live birth rate less than the median (21.6%).
- The interquartile range (IQR) indicates the range of live birth rates achieved by the middle 50% of clinics (IQR: 18.2% - 25%).
- The upper and lower bounds represent the range in which it would be expected that approximately 98% of clinics to fall (8.6% - 31.5%).
- 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 birth 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.

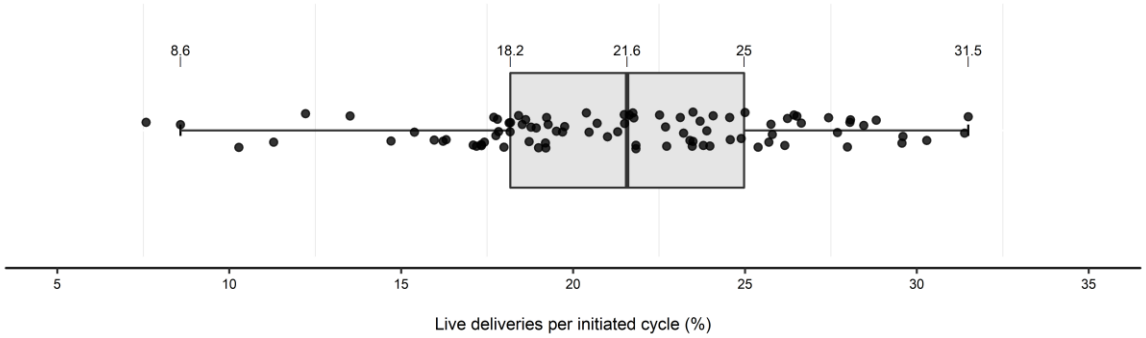


Figure 1: Live birth rate per initiated fresh (excluding *freeze-all*) and thaw autologous and recipient cycle (%) among fertility clinics, Australia and New Zealand, 2018

3.2 Autologous fresh cycles

In 2018, there were 48,048 initiated autologous fresh cycles, comprising 47,203 (98.2%) FSH-stimulated cycles and 845 (1.8%) unstimulated cycles. There were 465 cycles in which thawed oocytes were used. Of the initiated autologous fresh cycles, 92.4% (44,388) were in Australian clinics and 7.6% (3,660) 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 48,048 initiated autologous fresh cycles in 2018, 92.8% had OPU performed; 28.1% were *freeze-all* cycles; 49.3% 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 37) 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.

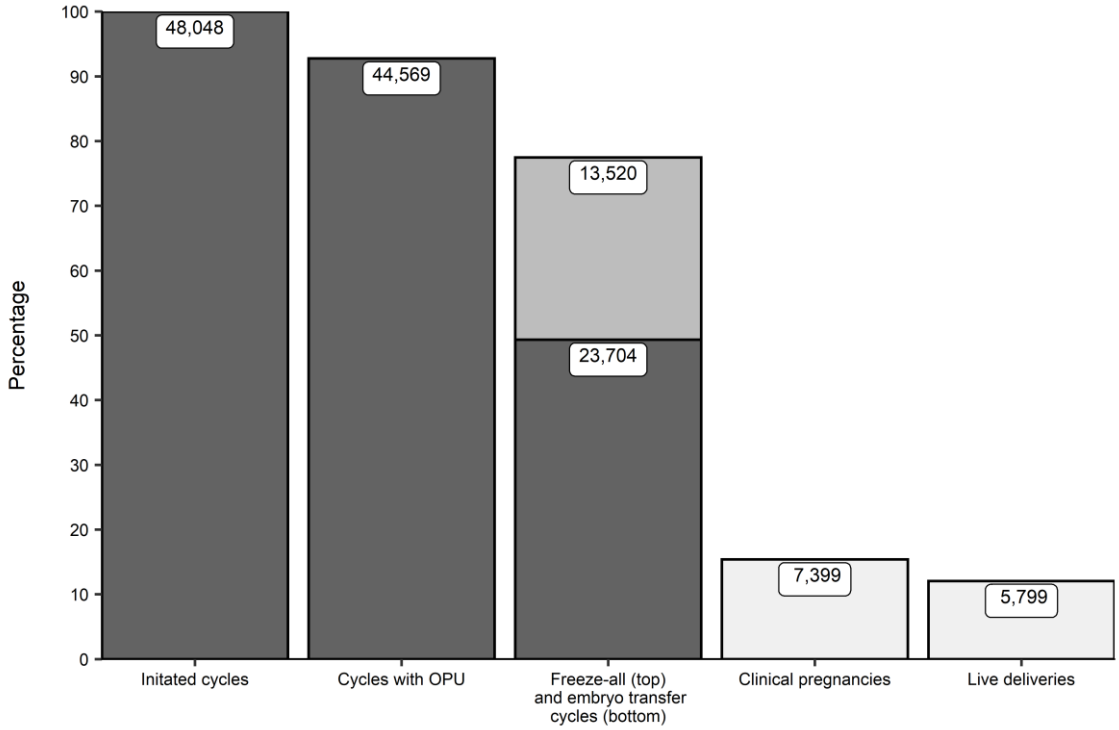


Figure 2: Progression of autologous fresh cycles, Australia and New Zealand, 2018

Clinical pregnancies and live births by women's age

Maternal age is one of the key factors associated with the outcomes of autologous fresh cycles. The highest live birth rate per embryo transfer cycle was in women aged under 30 (40.4%). The rate declined with advancing women's age, with a rate of 9.5% for women aged 40–44 and <1% for women aged 45 or older (Table 9). In women aged 45 or older, 721 cycles (65.4%) occurred in women aged 45 years and 232 cycles (21%) in women age 46 years, with the remaining 150 cycles (13.6%) occurring in women aged 47 or older.

In women aged under 30 years, *freeze-all* cycles accounted for 36.7% of initiated fresh cycles with the rate decreasing to 8.4% in women 45 years or older. Of the 13,520 *freeze-all* cycles 21% (2,831) were for oocyte freezing and 79.1% (10,689) were for embryo freezing. Table 9 presents the live birth rate per initiated fresh cycle and the live birth 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, 2018

	Age group (years)[a]					
Stage/outcome of treatment	**< 30**	**30–34**	**35–39**	**40–44**	**≥ 45**	**All**
Initiated cycles	4,545	12,659	17,644	12,097	1,103	48,048
Cycles with OPU	4,285	11,986	16,440	10,915	943	44,569
Freeze-all cycles[b]	1,670	4,170	5,269	2,318	93	13,520
Embryo transfer cycles	2,211	6,552	8,619	5,843	479	23,704
Clinical pregnancies	1,028	2,626	2,789	941	15	7,399
Live births	894	2,210	2,137	554	4	5,799
Live births per initiated cycle (%)	*19.7*	*17.5*	*12.1*	*4.6*	*0.4*	*12.1*
Live births per initiated cycle (excluding freeze-all)[c] (%)	*31.1*	*26.0*	*17.3*	*5.7*	*0.4*	*16.8*
Live births per embryo transfer cycle (%)	*40.4*	*33.7*	*24.8*	*9.5*	*0.8*	*24.5*
Live births per clinical pregnancy (%)	*87.0*	*84.2*	*76.6*	*58.9*	*26.7*	*78.4*

(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 births per initiated cycle (excluding *freeze-all*) were calculated using live births as the numerator and initiated fresh cycles minus *freeze-all* cycles as the denominator

Figure 3 shows age-specific live birth rates per initiated autologous fresh cycle (excluding freeze-all cycles) by two-year age groups. The 95% confidence intervals represent the uncertainty surrounding the live birth rates for otherwise similar women of that age-group.

The highest live birth rates were in women in their early to mid 20s. For women aged 45 or older, only one live birth resulted from every 250 initiated cycles compared with one live birth from every three initiated cycles in women aged between 25 and 26.

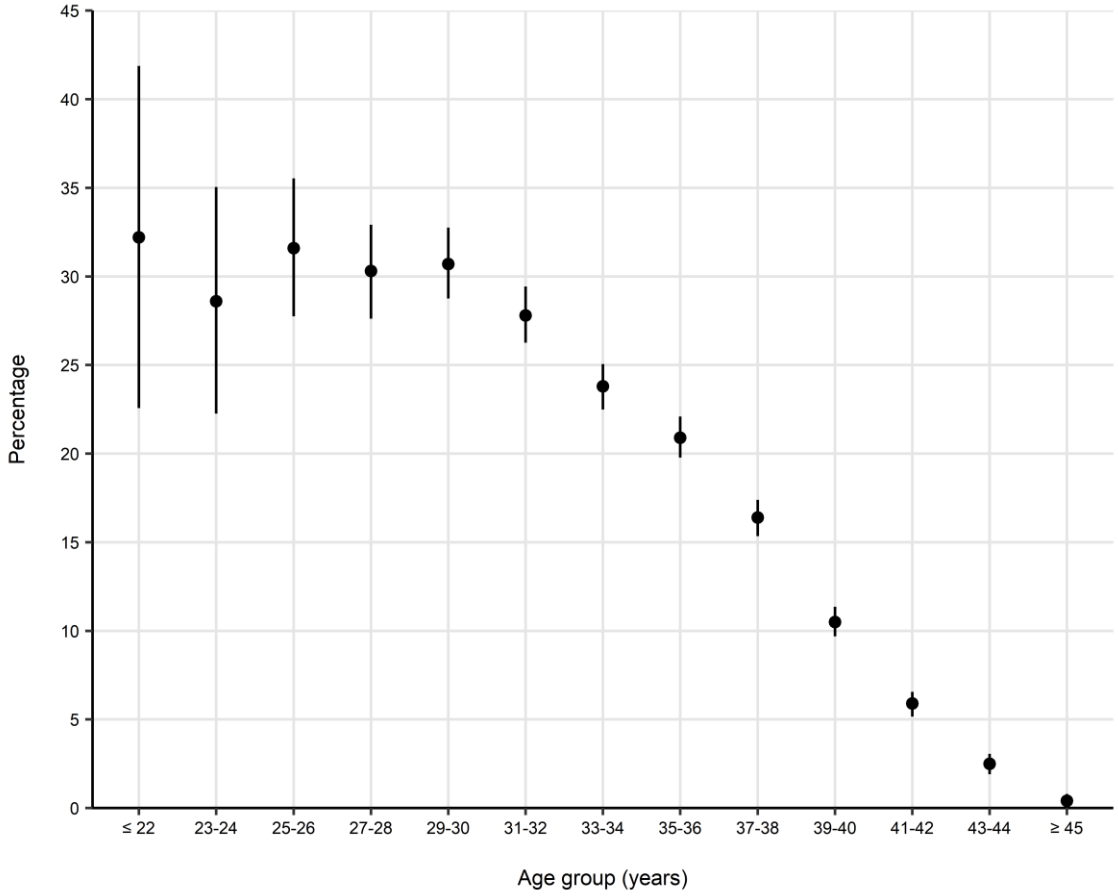


Figure 3: Live birth rate (with 95% confidence interval) per initiated autologous fresh cycle (excluding *freeze-all*) by women's age at start of a treatment cycle, Australia and New Zealand, 2018

Clinical pregnancies and live births by cause of infertility

Cycles reported with male factor infertility as the only cause of infertility had the highest live birth rate (22.0%) and clinical pregnancy per initiated non freeze-all cycle (27%), followed by cycles where combined male-female infertility was reported as the only cause of infertility (18.2% and 22.2% respectively) (Table 10). There were 14,072 (29.3%) autologous fresh cycles where cause of infertility was not stated.

Table 10: Outcomes of autologous fresh cycles by cause of infertility, Australia and New Zealand, 2018

Cause of infertility	Number of initiated cycles	Embryo transfer cycles per initiated cycle (%)	Clinical pregnancies per initiated non-*freeze-all* cycle[(a)] (%)	Live births per initiated non-*freeze-all* cycle[(b)] (%)
Male factor only	4,679	60.4	27.0	22.0
Female factor	17,693	49.0	19.4	14.3
Tubal disease only	1,424	57.5	22.1	17.0
Endometriosis only	2,231	53.2	21.8	17.1
Other female factors only	10,625	45.4	17.4	12.4
Combined female factor	3,413	53.9	22.6	17.2
Combined male—female	3,406	53.1	22.2	18.2
Unexplained	8,198	50.4	21.6	17.3
Not stated	14,072	44.6	21.7	17.4
All	**48,048**	**49.3**	**21.4**	**16.8**

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 births per initiated non-freeze-all cycle is calculated using live births as the numerator and initiated cycles minus *freeze-all* cycles as the denominator

Clinical pregnancies and live births by number of embryos transferred

Overall, 87% of autologous fresh embryo transfer cycles were SET cycles, 12.7% were DET cycles and 0.2% had three or more embryos transferred. In women aged 30 to 39, three or more fresh embryos were transferred in less than 0.1% of embryo transfer cycles, compared with 0.2% in women aged 40 or older.

The overall live birth rate per embryo transfer cycle was 25.6% for SET cycles and 16.9% for DET cycles (Table 11). Of embryo transfer cycles in women aged less than 35, the live birth rate was higher for SET cycles (35.7%) than DET cycles (30.6%). Of embryo transfer cycles in women aged 40 or older, the live birth rates were lower for SET cycles than DET cycles (Table 11). Caution should be taken when comparing live birth 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, 2018

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	8,273	490	7,699	919	4,659	1,608	20,631	3,017
Clinical pregnancies	3,468	186	2,492	297	680	270	6,640	753
Live births	2,954	150	1,927	210	404	150	5,285	510
Clinical pregnancies per embryo transfer cycle (%)	*41.9*	*38.0*	*32.4*	*32.3*	*14.6*	*16.8*	*32.2*	*25.0*
Live births per embryo transfer cycle (%)	*35.7*	*30.6*	*25.0*	*22.9*	*8.7*	*9.3*	*25.6*	*16.9*

(a) Age at start of a treatment cycle.

(b) SET: single embryo transfer.

(c) DET: double embryo transfer.

Clinical pregnancies and live births by stage of embryo development

Overall, the rates of clinical pregnancy and live birth were higher in blastocyst transfer cycles than in cleavage stage embryo transfer cycles regardless of a woman's age (Table 12). The live birth rate for blastocyst transfer cycles was 10.1 percentage points higher than for cleavage stage embryo transfer cycles.

Caution should be taken when comparing clinical pregnancy and live birth 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, 2018

Stage/outcome of treatment	Age group (years)[a]							
	< 35		35–39		≥ 40		All	
	CL[b]	BL[c]	CL[b]	BL[c][d]	CL[b]	BL[c][e]	CL[b]	BL[c][f]
Embryo transfer cycles	1,567	7,196	1,939	6,680	2,026	4,296	5,532	18,172
Clinical pregnancies	517	3,137	469	2,320	207	749	1,193	6,206
Live births	441	2,663	358	1,779	123	435	922	4,877
Clinical pregnancies per embryo transfer cycle (%)	*33.0*	*43.6*	*24.2*	*34.7*	*10.2*	*17.4*	*21.6*	*34.2*
Live births per embryo transfer cycle (%)	*28.1*	*37.0*	*18.5*	*26.6*	*6.1*	*10.1*	*16.7*	*26.8*

(a) Age at start of a treatment cycle.

(b) CL: cleavage stage embryo.

(c) BL: blastocyst.

(d) Includes 2 cycles where both cleavage stage embryos and blastocysts were transferred

(e) Includes 1 cycle where both cleavage stage embryos and blastocysts were transferred

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

3.3 Autologous thaw cycles

There were 31,024 autologous thaw cycles reported in 2018 (Figure 4). Of these, 89.3% (27,718) were in Australian clinics and 10.7% (3,306) 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 31,024 initiated autologous thaw cycles, 96.7% had embryos transferred, 35.6% resulted in a clinical pregnancy and 28.5% resulted in a live birth (Figure 4). Approximately three 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 births per initiated cycle was higher for autologous thaw cycles than for autologous fresh cycles excluding *freeze-all* cycles in 2018 (28.5% and 16.8% respectively) (Figure 4 and Table 9).

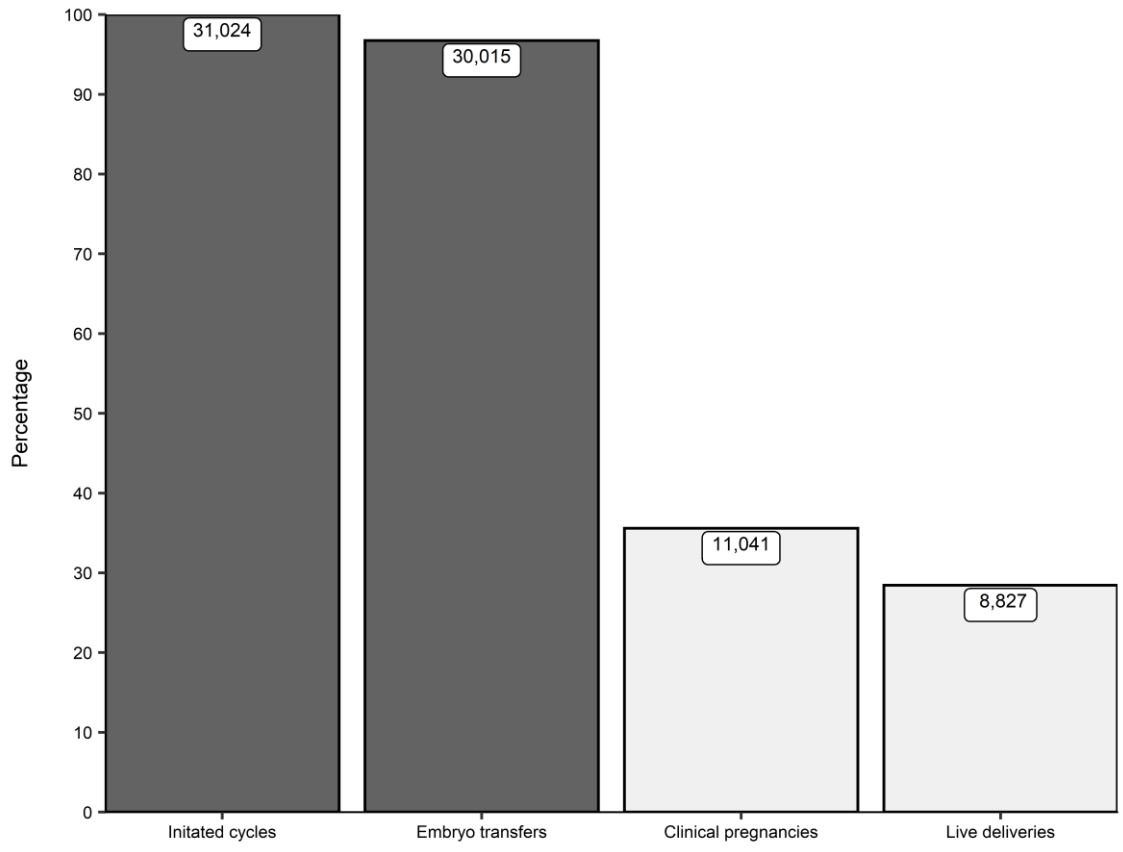


Figure 4: Progression of autologous thaw cycles, Australia and New Zealand, 2018

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

Similar to autologous fresh embryo transfer cycles, the live birth 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 for women aged 35 and older (Table 9).

Table 13: Outcomes of autologous thaw cycles by women's age group, Australia and New Zealand, 2018

	Age group (years)[(a)]					
Stage/outcome of treatment	**< 30**	**30–34**	**35–39**	**40–44**	**≥ 45**	**All**
Initiated cycles	3,219	10,434	11,778	5,187	406	31,024
Embryo transfer cycles	3,143	10,155	11,417	4,928	372	30,015
Clinical pregnancies	1,313	4,070	4,228	1,374	56	11,041
Live births	1,098	3,329	3,381	990	29	8,827
Live births per initiated cycle (%)	*34.1*	*31.9*	*28.7*	*19.1*	*7.1*	*28.5*
Live births per embryo transfer cycle (%)	*34.9*	*32.8*	*29.6*	*20.1*	*7.8*	*29.4*
Live births per clinical pregnancy (%)	*83.6*	*81.8*	*80.0*	*72.1*	*51.8*	*79.9*

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

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

The highest live birth rates were observed in women in their mid to late 20s. The wider 95% confidence intervals for women in age groups under 30 years indicates greater uncertainty in the birth rates for these women as being representative of all women of similar age and characteristics. For women aged 45 or older, 7.1% of initiated autologous thaw cycles resulted in a live birth, which is higher than the live birth rate per initiated autologous fresh cycle in this age group (0.4%) (Figures 3 and 5). Since embryos that are 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.

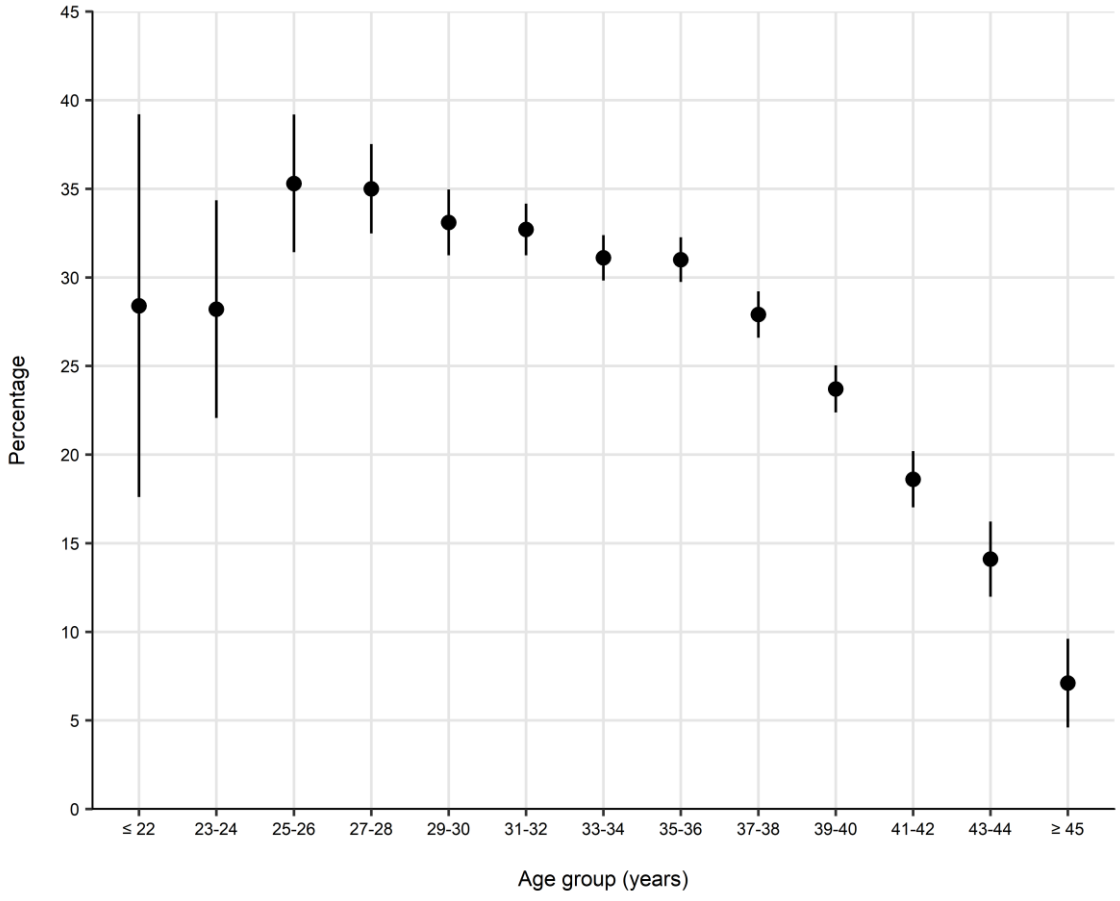


Figure 5: Live birth rate (with 95% confidence intervals) per initiated autologous thaw cycle by women's age at start of a treatment cycle, Australia and New Zealand, 2018

Clinical pregnancies and live births by cause of infertility

Cycles reported with male factor as the only cause of infertility had the highest rate of live birth per initiated autologous thaw cycle (31.9%) followed by cycles where the cause of infertility was reportedly due to combined male-female factors (29.8%). The live birth rate in cycles with female factors as the only cause of infertility was 28.2% (Table 14).

Table 14: Outcomes of autologous thaw cycles by cause of infertility, Australia and New Zealand, 2018

Cause of infertility	Number of initiated cycles	Embryo transfer cycles per initiated cycle (%)	Clinical pregnancies per initiated cycle (%)	Live births per initiated cycle (%)
Male factor only	3,277	97.2	38.6	31.9
Female factor	10,954	97.2	34.8	27.0
Tubal disease only	*1,186*	*97.6*	*33.8*	*26.6*
Endometriosis only	*1,321*	*98.1*	*36.6*	*29.3*
Other female factors only	*5,992*	*96.8*	*34.1*	*26.1*
Combined female factor	*2,455*	*97.3*	*36.3*	*28.2*
Combined male–female factors	2,642	97.3	38.1	29.8
Unexplained	5,643	96.4	35.8	29.1
Not stated	8,508	96.0	34.4	28.2
All	**31,024**	**96.7**	**35.6**	**28.5**

Clinical pregnancies and live births by number of embryos transferred

Of the 30,015 autologous thaw embryo transfer cycles, 93.5% were SET cycles, 6.5% were DET cycles and less than 0.1% transferred three or more embryos. Only women aged 40 or older had three or more frozen/thawed embryos transferred. Overall, SET cycles were associated with an increase in live births per embryo transfer cycle (Table 15). Caution should be taken when comparing live birth rates following SET and DET cycles because patient characteristics and prognoses 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, 2018

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	12,610	688	10,709	708	4,733	559	28,052	1,955
Clinical pregnancies	5,082	301	3,970	258	1,270	158	10,322	717
Live births	4,185	242	3,175	206	920	97	8,280	545
Clinical pregnancies per embryo transfer cycle (%)	*40.3*	*43.8*	*37.1*	*36.4*	*26.8*	*28.3*	*36.8*	*36.7*
Live births per embryo transfer cycle (%)	*33.2*	*35.2*	*29.6*	*29.1*	*19.4*	*17.4*	*29.5*	*27.9*

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

Clinical pregnancies and live births by stage of embryo development

The rates of clinical pregnancy and live birth were higher for blastocyst transfer cycles than for cleavage stage embryo transfer cycles, regardless of a woman's age. Overall, the rate of live birth for blastocyst transfer cycles was 14.5 percentage points higher than for cleavage stage embryo transfer cycles (Table 16).

Caution should be taken when comparing clinical pregnancy and live birth rates following cleavage stage embryo and blastocyst transfer. Patient characteristics and prognoses 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, 2018

Stage/outcome of treatment	Age group (years)[a]							
	< 35		35–39		≥ 40		All	
	CL[b]	BL[c]	CL[b]	BL[c]	CL[b]	BL[c]	CL[b]	BL[c]
Embryo transfer cycles	559	12,739	591	10,826	527	4,773	1,677	28,338
Clinical pregnancies	141	5,242	136	4,092	64	1,366	341	10,700
Live births	121	4,306	107	3,274	35	984	263	8,564
Clinical pregnancies per embryo transfer cycle (%)	*25.2*	*41.1*	*23.0*	*37.8*	*12.1*	*28.6*	*20.3*	*37.8*
Live births per embryo transfer cycle (%)	*21.6*	*33.8*	*18.1*	*30.2*	*6.6*	*20.6*	*15.7*	*30.2*

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

Clinical pregnancies and live births by embryo freezing methods

Of the autologous thaw cycles where a blastocyst was transferred, 94.2% used vitrified embryos compared with cleavage-stage embryo transfer cycles where 66.1% used vitrified 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, 2018

	Stage of embryo development					
	Cleavage stage		Blastocyst		All	
Stage/outcome of treatment	**Slow freezing**	**Vitrification[a]**	**Slow freezing**	**Vitrification[b]**	**Slow freezing**	**Vitrification[c]**
Embryo transfer cycles	569	1,108	1,653	26,685	2,222	27,793
Clinical pregnancies	127	214	639	10,061	766	10,275
Live births	97	166	511	8,053	608	8,219
Clinical pregnancies per embryo transfer cycle (%)	*22.3*	*19.3*	*38.7*	*37.7*	*34.5*	*37.0*
Live births per embryo transfer cycle (%)	*17.0*	*15.0*	*30.9*	*30.2*	*27.4*	*29.6*

(a) Includes 1 cycle where both vitrified and slow frozen embryos were transferred
(b) Includes 30 cycles where both vitrified and slow frozen embryos were transferred
(c) Includes 31 cycles where both vitrified and slow frozen embryos 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 2018, donation and recipient cycles accounted for 5.4% (4,576) of all treatment cycles in Australia and New Zealand. There were 1,078 initiated cycles where the intention was to donate oocytes to a recipient woman, consisting of 899 (83.4%) cycles in Australia and 179 (16.6%) in New Zealand. There were 3,498 oocyte/embryo recipient cycles (Table 1), comprising 2,975 (85.1%) cycles in Australia and 523 (15%) cycles in New Zealand.

Oocyte donation cycles

Of the 1,078 cycles in Australia and New Zealand where the intention was to donate oocytes to a recipient, 31 (2.9%) cycles were cancelled before OPU, and a further 11 did not result in oocytes being donated.

The average age of women donating oocytes was 32.6 years, with 40.2% 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, 2018

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	269	262	97.4	261	97.0
30–34	376	366	97.3	363	96.5
35–39	373	361	96.8	356	95.4
≥ 40	60	58	96.7	56	93.3
Total	**1,078**	**1,047**	**97.1**	**1,036**	**96.1**

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

Oocyte/embryo recipient cycles

There were 3,498 oocyte/embryo recipient cycles in 2018. Of these, 84.3% (2,950) were oocyte recipient cycles and 15.7% (548) were embryo recipient cycles (Table 1). The average age of women undertaking an oocyte/embryo recipient cycle was 40.3 years.

Progression of oocyte/embryo recipient cycles

Figure 6 shows the main stages of oocyte/embryo recipient cycles and the treatment outcomes. Of the 3,498 initiated oocyte/embryo recipient cycles undertaken in 2018, 76.7% resulted in an embryo transfer; 27.7% resulted in a clinical pregnancy and 21.8% in a live birth.

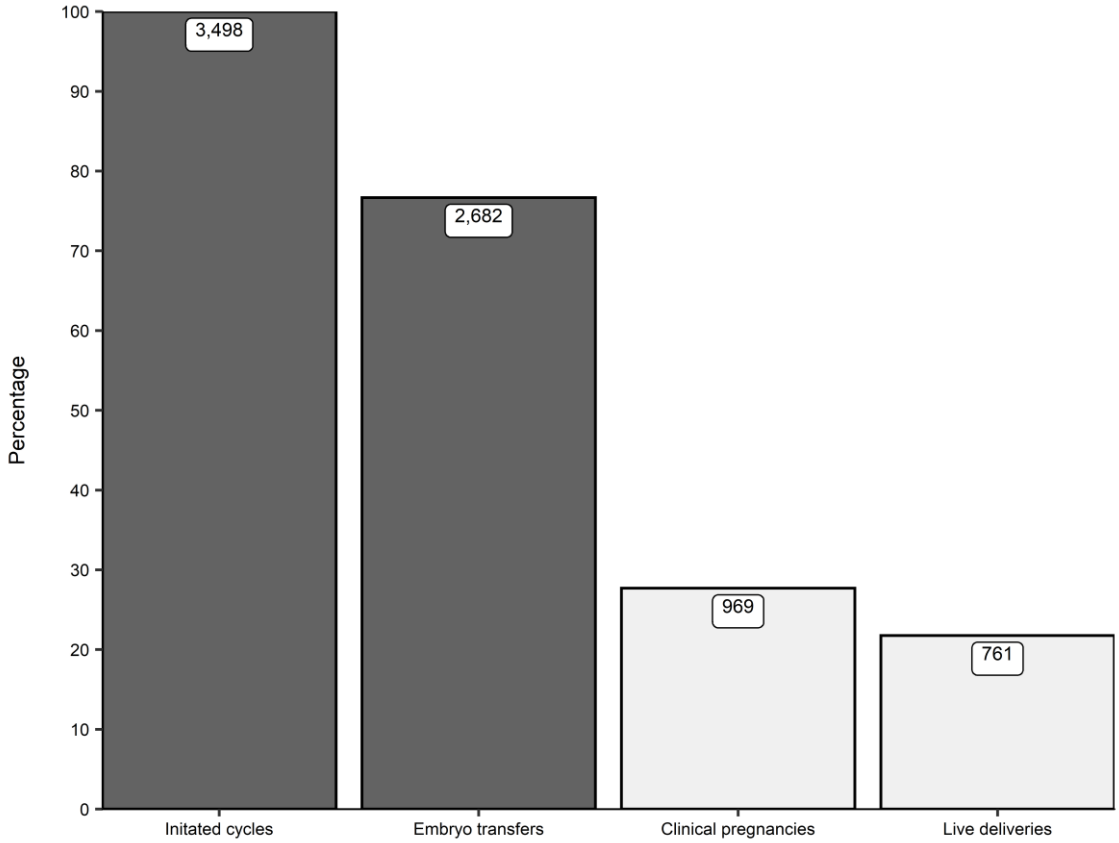


Figure 6: Progression of fresh and thaw oocyte/embryo recipient cycles, Australia and New Zealand, 2018

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

Of the 2,950 oocyte recipient cycles, 43.2% were fresh cycles and 56.8% were thaw cycles. The live birth rate per initiated cycle was 28.3% for thawed oocytes from oocyte recipient cycles, higher than for fresh oocyte recipient cycles (12.1%). Overall, the live birth rate per initiated oocyte/embryo recipient cycle was 21.8% compared to 16.8% for autologous fresh cycles and 28.5% for autologous thaw cycles.

All 548 embryo recipient cycles were thaw cycles. The overall live birth rate per initiated cycle was 24.1% for embryo recipient cycles (Table 19).

Table 19: Outcomes of oocyte/embryo recipient cycles by treatment type, Australia and New Zealand, 2018

	Oocyte recipient			
Stage/outcome of treatment	**Fresh**	**Thaw**	**Embryo recipient**	**All**
Initiated cycles	1,274	1,676	548	3,498
Embryo transfer cycles	528	1,636	518	2,682
Clinical pregnancies	204	597	168	969
Live births	154	475	132	761
Live births per initiated cycle (%)	*12.1*	*28.3*	*24.1*	*21.8*
Live births per embryo transfer cycle (%)	*29.2*	*29.0*	*25.5*	*28.4*
Live births per clinical pregnancy (%)	*75.5*	*79.6*	*78.6*	*78.5*

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

The clinical pregnancy and live birth rates of recipient cycles varied by recipient's age group, with the highest live birth rate per initiated cycle (26.3%) in women aged between 30 and 34. The overall live birth rate per initiated cycle was 21.8%, varying between 18.6% and 26.3% by recipient's age group (Table 20).

Table 20: Outcomes of oocyte/embryo recipient cycles by recipient's age group, Australia and New Zealand, 2018

	Age group (years)[(a)]					
Stage/outcome of treatment	**< 30**	**30–34**	**35–39**	**40–44**	**≥ 45**	**All**
Initiated cycles	172	460	713	1,285	868	3,498
Embryo transfer cycles	117	338	539	977	711	2,682
Clinical pregnancies	43	145	192	359	230	969
Live births	32	121	158	278	172	761
Live births per initiated cycle (%)	*18.6*	*26.3*	*22.2*	*21.6*	*19.8*	*21.8*
Live births per embryo transfer cycle (%)	*27.4*	*35.8*	*29.3*	*28.5*	*24.2*	*28.4*
Live births per clinical pregnancy (%)	*74.4*	*83.4*	*82.3*	*77.4*	*74.8*	*78.5*

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

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

The highest live birth rate per initiated recipient cycle was in donors aged between 30 and 34 (Table 21). As donors' age increased from 35 years or older, the live birth rate per initiated cycle decreased. The live birth rate per initiated cycle in which the donor's age was under 40 was 22.2% compared to 12.7% 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, 2018

	Age group (years)[(a)]				
Stage/outcome of treatment	**< 30**	**30–34**	**35–39**	**≥ 40**	**All**
Initiated cycles	1,108	1,199	1,023	166	3,498
Embryo transfer cycles	885	930	748	117	2,682
Clinical pregnancies	297	367	272	33	969
Live births	235	296	209	21	761
Live births per initiated cycle (%)	*21.2*	*24.7*	*20.4*	*12.7*	*21.8*
Live births per embryo transfer cycle (%)	*26.6*	*31.8*	*27.9*	*17.9*	*28.4*
Live births per clinical pregnancy (%)	*79.1*	*80.7*	*76.8*	*63.6*	*78.5*

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

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

Of the 2,682 oocyte/embryo recipient cycles where embryos were transferred, 90.1% were SET, 9.9% were DET.

Overall the live birth rate per oocyte/embryo recipient cycle where embryos were transferred was 27.8% in DET cycles compared with 28.4% in SET cycles (Table 22).

Table 22: Outcomes of oocyte/embryo recipient cycles by recipient's age and number of embryos transferred, Australia and New Zealand, 2018

	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	423	32	480	59	1,513	175	2,416	266
Clinical pregnancies	174	14	170	22	533	56	877	92
Live births	141	12	138	20	408	42	687	74
Clinical pregnancies per embryo transfer cycle (%)	*41.1*	*43.8*	*35.4*	*37.3*	*35.2*	*32.0*	*36.3*	*34.6*
Live births per embryo transfer cycle (%)	*33.3*	*37.5*	*28.8*	*33.9*	*27.0*	*24.0*	*28.4*	*27.8*

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

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

The live birth 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 birth rates for cleavage stage embryo and blastocyst transfer cycles was 12.3 percentage points (17.6% and 29.9% respectively) (Table 23).

Table 23: Outcomes of oocyte/embryo recipient cycles by recipient's age and stage of embryo development, Australia and New Zealand, 2018

Stage/outcome of treatment	Age group (years)[a]							
	< 35		35–39		≥ 40		All	
	CL[b]	BL[c]	CL[b]	BL[c]	CL[b]	BL[c]	CL[b]	BL[c]
Embryo transfer cycles	42	413	65	474	233	1,455	340	2,342
Clinical pregnancies	15	173	14	178	56	533	85	884
Live births	10	143	11	147	39	411	60	701
Clinical pregnancies per embryo transfer cycle (%)	*35.7*	*41.9*	*21.5*	*37.6*	*24.0*	*36.6*	*25.0*	*37.7*
Live births per embryo transfer cycle (%)	*23.8*	*34.6*	*16.9*	*31.0*	*16.7*	*28.2*	*17.6*	*29.9*

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

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

More than ninety percent (93.2%) of oocyte/embryo recipient thaw cycles where a blastocyst was transferred used vitrified embryos, compared with 37.6% of cycles where a cleavage stage embryo was transferred. Overall, the live birth rate per embryo transfer was higher for the transfer of vitrified embryos (28.5%) compared to slow frozen embryos (26.2%) (Table 24).

Table 24: Outcomes of oocyte/embryo recipient thaw cycles by stage of embryo development and embryo freezing methods, Australia and New Zealand, 2018

	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	128	77	132	1,817	260	1,894
Clinical pregnancies	28	16	52	669	80	685
Live births	26	10	42	529	68	539
Clinical pregnancies per embryo transfer cycle (%)	*21.9*	*20.8*	*39.4*	*36.8*	*30.8*	*36.2*
Live births per embryo transfer cycle (%)	*20.3*	*13.0*	*31.8*	*29.1*	*26.2*	*28.5*

(a) Includes 1 cycle where both vitrified and slow frozen embryos were transferred
(b) Includes 4 cycles where both vitrified and slow frozen embryos were transferred
(c) Includes 5 cycles where both vitrified and slow frozen embryos were transferred

4 Pregnancy and birth outcomes following autologous and recipient embryo transfer cycles in 2018

4.1 Clinical pregnancies

Clinical pregnancies overview

There were 56,401 autologous and recipient embryo transfer cycles undertaken in Australian and New Zealand fertility centres, of which 19,409 resulted in a clinical pregnancy. Of these clinical pregnancies, 17,239 (88.8%) were reported from fertility centres in Australia and 2,170 (11.2%) from New Zealand centres. Clinical pregnancies that resulted from other cycles are described in Chapter 5.

Of the 19,409 clinical pregnancies, 80.1% resulted in a birth and 19.5% resulted in early pregnancy loss (less than 20 weeks gestation or less than 400 grams birthweight). The outcomes of 150 (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 19,409 clinical pregnancies, 85.9% had one fetal heart (single fetus) detected, 3.2% had multiple fetal hearts (multiple fetuses) detected and 10.6% 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 18.9% of clinical pregnancies following DET cycles compared with 1.8% 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, 2018

Number of fetal hearts	One embryo		Two embryos		Three or more embryos		All	
	n	%	n	%	n	%	n	%
0[(a)]	1,852	10.4	202	12.9	1	12.5	2,055	10.6
1	15,610	87.5	1,052	67.3	7	87.5	16,669	85.9
2	313	1.8	295	18.9	0	0.0	608	3.1
3 or 4	15	0.1	7	0.4	0	0.0	22	0.1
Not stated	49	0.3	6	0.4	0	0.0	55	0.3
Total	**17,839**	**100.0**	**1,562**	**100.0**	**8**	**100.0**	**19,409**	**100.0**

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

Early pregnancy loss

There were 3,791 early pregnancy losses (less than 20 weeks gestation or less than 400 grams birthweight) following embryo transfers, representing 19.5% of clinical pregnancies.

Table 26: Early pregnancy loss by pregnancy outcome and maternal age and number of embryos transferred, Australia and New Zealand, 2018

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	1,345	84	1,429	1,314	131	1,445	727	188	917
Miscarriage	*1,197*	*78*	*1,275*	*1,200*	*121*	*1,321*	*685*	*171*	*858*
Reduction or termination	*55*	*2*	*57*	*45*	*3*	*48*	*22*	*7*	*29*
Ectopic or heterotopic pregnancy	*93*	*4*	*97*	*69*	*7*	*76*	*20*	*10*	*30*
Birth	7,344	411	7,755	5,296	444	5,740	1,746	292	2,044
Not stated	35	6	41	22	2	24	10	4	14
Total	**8,724**	**501**	**9,225**	**6,632**	**577**	**7,209**	**2,483**	**484**	**2,975**
					%				
Early pregnancy loss	15.4	16.8	15.5	19.8	22.7	20.0	29.3	38.8	30.8
Miscarriage	*13.7*	*15.6*	*13.8*	*18.1*	*21.0*	*18.3*	*27.6*	*35.3*	*28.8*
Reduction or termination	*0.6*	*0.4*	*0.6*	*0.7*	*0.5*	*0.7*	*0.9*	*1.4*	*1.0*
Ectopic or heterotopic pregnancy	*1.1*	*0.8*	*1.1*	*1.0*	*1.2*	*1.1*	*0.8*	*2.1*	*1.0*
Birth	84.2	82.0	84.1	79.9	76.9	79.6	70.3	60.3	68.7
Not stated	0.4	1.2	0.4	0.3	0.3	0.3	0.4	0.8	0.5
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 Births

There were 15,539 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% (15,387) gave birth to at least one liveborn baby (live birth). The proportion of term live births (≥ 37 weeks) among all births was higher for autologous cycles than for oocyte/embryo recipient cycles (Table 27).

Table 27: Births by birth outcome and treatment type, Australia and New Zealand, 2018

Pregnancy outcome	Autologous				Oocyte /embryo recipient		All	
	Fresh		Thaw					
	n	%	n	%	n	%	n	%
Live birth	5,799	99.0	8,827	99.0	761	99.1	15,387	99.0
< 37 weeks	*709*	*12.1*	*888*	*10.0*	*122*	*15.9*	*1,719*	*11.1*
≥ 37 weeks	*5,089*	*86.9*	*7,939*	*89.1*	*639*	*83.2*	*13,667*	*88.0*
Gestational age unknown	*1*	*0.0*	*0*	*0.0*	*0*	*0.0*	*1*	*0.0*
Stillbirth[(a)]	33	0.6	43	0.5	5	0.7	81	0.5
Not stated	25	0.4	44	0.5	2	0.3	71	0.5
Total	**5,857**	**100.0**	**8,914**	**100.0**	**768**	**100.0**	**15,539**	**100.0**

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

Births by number of embryos transferred

Of the 15,539 births, 3.2% were multiple births (Table 28), a slightly lower proportion than in 2017 (3.6%) (Newman et al. 2019). By comparison, the proportion of multiple births in Australia from all conceptions in 2018 was 1.5% (AIHW, 2020).

Twin births accounted for 3.2% of births following embryo transfer cycles in 2018. Of twin births, 48% resulted from the transfer of two or more embryos. Of the 1,147 births following DET cycles, 20.7% were twins, markedly higher than the proportion following SET cycles (1.8%) (Table 28).

Table 28: Births by gestation and type of embryo transfer and number of embryos transferred, Australia and New Zealand, 2018

	Fresh			Thaw			
Gestation	**SET[(a)]**	**DET[(b)]**	**Three or more embryos**	**SET[(a)]**	**DET[(b)]**	**Three or more embryos**	**All**
				n			
Singleton	5,365	440	4	8,758	466	2	15,035
Multiple	104	99	0	159	142	0	504
Twin	*104*	*97*	*0*	*154*	*141*	*0*	*496*
Higher order multiple	*0*	*2*	*0*	*5*	*1*	*0*	*8*
Total	**5,469**	**539**	**4**	**8,917**	**608**	**2**	**15,539**
				%			
Singleton	98.1	81.6	100.0	98.2	76.6	100.0	96.8
Multiple	1.9	18.4	0.0	1.8	23.4	0.0	3.2
Twin	*1.9*	*18.0*	*0.0*	*1.7*	*23.2*	*0.0*	*3.2*
Higher order multiple	*0.0*	*0.4*	*0.0*	*0.1*	*0.2*	*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.

Births by plurality and maternal age

The average age of women at the time of birth who conceived using ART was 35.2 years. This is five years older than the average age (30.7 years) of all women who gave birth in Australia in 2018 (AIHW, 2020).

Multiple birth rates were similar across age groups, ranging between 2.8% and 3.4% (Table 29). Of births following DET, the proportion of multiple births was higher for women aged under 35 (28.9%) compared with women aged 35–39 (20.6%) and women aged 40 or older (13.7%) (Table 29).

Table 29: Births by plurality and maternal age group and number of embryos transferred, Australia and New Zealand, 2018

	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	6,274	249	6,523	5,580	355	5,935	2,269	302	2,577
Multiple	128	101	229	109	92	201	26	48	74
Twin	*126*	*101*	*227*	*107*	*91*	*198*	*25*	*46*	*71*
Higher order multiple	*2*	*0*	*2*	*2*	*1*	*3*	*1*	*2*	*3*
Total	**6,402**	**350**	**6,752**	**5,689**	**447**	**6,136**	**2,295**	**350**	**2,651**
					%				
Singleton	98.0	71.1	96.6	98.1	79.4	96.7	98.9	86.3	97.2
Multiple	2.0	28.9	3.4	1.9	20.6	3.3	1.1	13.7	2.8
Twin	*2.0*	*28.9*	*3.4*	*1.9*	*20.4*	*3.2*	*1.1*	*13.1*	*2.7*
Higher order multiple	*0.0*	*0.0*	*0.0*	*0.0*	*0.2*	*0.0*	*0.0*	*0.6*	*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 birth.

(b) Includes three or more embryos.

Caesarean section

More than half (53.2%) of births following embryo transfer cycles were by caesarean section (Table 30). The high rate of caesarean section following ART treatment may be related to the fact that on average, women receiving ART treatment were five years older than women who gave birth in Australia in 2018 and that there were more multiple births following ART treatment.

The caesarean section rate increased with advancing women's age at birth: 40.4% of women aged less than 30 had a caesarean section compared with 83.3% of women aged 45 or older (Table 30).

The caesarean section rate varied by plurality, with 52.2% for singleton births, 82.5% for twin births and 100% for triplet births.

Table 30: Births by method of birth and maternal age group, Australia and New Zealand, 2018

	Age group (years)[(a)]					
Method of birth	**< 30**	**30–34**	**35–39**	**40–44**	**≥ 45**	**Total**
			n			
Caesarean section	630	2,501	3,325	1,565	244	8,265
Not stated	15	45	54	16	4	134
Other	913	2,648	2,757	777	45	7,140
Total	**1,558**	**5,194**	**6,136**	**2,358**	**293**	**15,539**
			%			
Caesarean section	40.4	48.2	54.2	66.4	83.3	53.2
Not stated	1.0	0.9	0.9	0.7	1.4	0.9
Other	58.6	51.0	44.9	33.0	15.4	45.9
Total	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**

(a) Age at time of birth.

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 16,051 babies born to women who had autologous and recipient embryo transfer cycles, 89% (14,284) were reported from fertility centres in Australia and 11% (1,767) from fertility centres in New Zealand. Of the 16,051 babies, 93.7% were singletons, 6.2% were twins and 0.2% were triplets. There were 15,891 liveborn babies (99%). The birth status was not reported for 70 (0.4%) babies.

Sex distribution in liveborn babies

There were 8,056 (50.7%) liveborn male babies, 7,767 (48.9%) liveborn female babies and 73 (0.5%) liveborn babies where sex was not stated. For the 15,823 liveborn babies where the baby's sex was stated, the sex ratio was 103 male babies for every 100 female babies. The sex ratio for all Australian liveborn babies born in 2018 was 106.0 male liveborn babies per 100 female liveborn babies (AIHW, 2020).

Liveborn babies following cleavage stage embryo transfers had a sex ratio of 95 male babies for every 100 female babies. Liveborn babies following blastocyst transfers had a sex ratio of 104 male babies for every 100 female babies. In comparison, in 2017, liveborn babies following cleavage stage embryo transfers had a sex ratio of 99 male babies for every 100 female babies, and liveborn babies following blastocyst transfers had a sex ratio of 106 male babies for every 100 female babies (Newman et al. 2019).

Gestational age of babies

The median gestational age of babies born following autologous and recipient embryo transfer cycles was 38 weeks (Table 31). This is lower than the median gestational age of 39 weeks for all babies born in Australia in 2018 (AIHW, 2020).

There were 13.5% of babies born preterm (less than 37 weeks gestation), which is higher than the proportion of preterm babies born in Australia in 2018 (8.7%) (AIHW, 2020). For ART singletons and twins, 10.2% and 76.1% were preterm compared with 7.0% and 66.8% of singletons and twins born in Australia in 2018 (AIHW, 2020).

Table 31: Babies by gestational age and plurality, Australia and New Zealand, 2018

Gestational age (weeks)	Singletons		Twins		Higher order multiples		Total	
Median	*38*		*36*		*31*		*38*	
	n	**%**	**n**	**%**	**n**	**%**	**n**	**%**
≤ 27	*121*	*0.8*	*34*	*3.4*	*3*	*12.5*	*158*	*1.0*
28–31	*150*	*1.0*	*72*	*7.3*	*12*	*50.0*	*234*	*1.5*
32–36	*1,162*	*7.7*	*596*	*60.1*	*9*	*37.5*	*1,767*	*11.0*
≤ 36	1,433	9.5	702	70.8	24	100.0	2,159	13.5
≥ 37	13,598	90.4	290	29.2	0	0.0	13,888	86.5
Not stated	4	0.0	0	0.0	0	0.0	4	0.0
Total	**15,035**	**100.0**	**992**	**100.0**	**24**	**100.0**	**16,051**	**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 2018. Singletons following SET cycles had a lower proportion of preterm birth (10.8%) than singletons following DET cycles (13.9%). The overall proportions of preterm singletons (9.5%) and twins (70.8%) born to women who had embryo transfer cycles in 2018 were higher than the overall proportions of preterm singletons and twins born in Australia in 2018 (7.0% and 66.8% respectively) (AIHW, 2020).

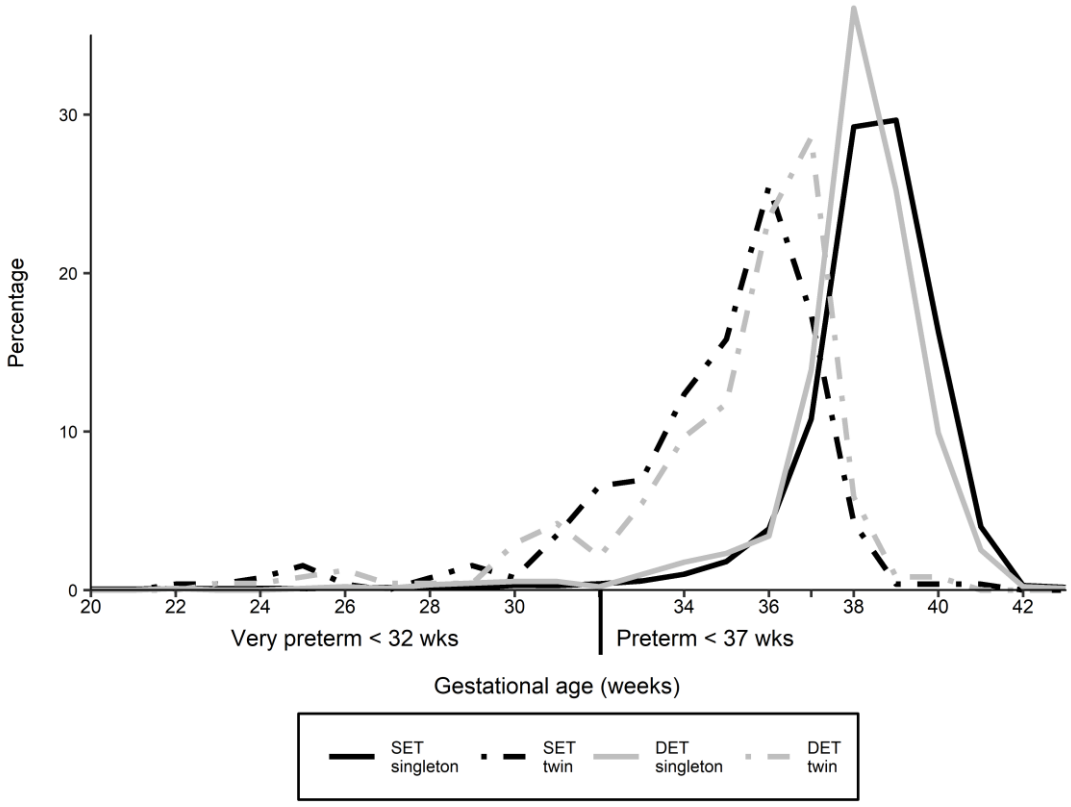


Figure 7: Percentage of babies born following embryo transfer cycles by gestational age, Australia and New Zealand, 2018

Birthweight of liveborn babies

The average birthweight for liveborn babies to women who had autologous and recipient embryo transfer cycles was 3,224 grams. This is slightly lower than the average birthweight of all liveborn babies (3,323 grams) in Australia in 2018 (AIHW, 2020). Approximately one in ten (9.9%) of the 15,891 liveborn babies were low birthweight (less than 2,500 grams) (Table 32).

The average birthweight was 3,288 grams and 2,298 grams for liveborn ART singletons and twins respectively. Low birthweight was reported for 6.5% of liveborn singletons following SET and 8.9% of liveborn singletons following DET in comparison with 5.2% of singleton births in Australia in 2018 (AIHW, 2020). For ART twins 62.1% were reported as low birthweight in comparison with 56% of twin births in Australia in 2018 (AIHW, 2020).

Table 32: Liveborn babies by birthweight group and plurality, Australia and New Zealand, 2018

	Singletons				
Birthweight (grams)	**SET[(a)]**	**DET[(b)]**	**Twins**	**Higher order multiples**	**Total[(c)]**
			n		
< 1,000	*57*	*7*	*27*	*4*	*95*
1,000–1,499	*95*	*7*	*54*	*7*	*163*
1,500–1,999	*162*	*11*	*161*	*12*	*346*
2,000–2,499	*589*	*54*	*320*	*1*	*965*
< 2,500	903	79	562	24	1,569
2,500–2,999	2,475	166	327	0	2,969
3,000–3,499	5,357	389	70	0	5,819
3,500–3,999	3,928	177	6	0	4,112
≥ 4,000	1,171	59	0	0	1,230
Not stated	158	18	16	0	192
Total	**13,992**	**888**	**981**	**24**	**15,891**
			%		
< 1,000	*0.4*	*0.8*	*2.8*	*16.7*	*0.6*
1,000–1,499	*0.7*	*0.8*	*5.5*	*29.2*	*1.0*
1,500–1,999	*1.2*	*1.2*	*16.4*	*50.0*	*2.2*
2,000–2,499	*4.2*	*6.1*	*32.6*	*4.2*	*6.1*
< 2,500	6.5	8.9	57.3	100.0	9.9
2,500–2,999	17.7	18.7	33.3	0.0	18.7
3,000–3,499	38.3	43.8	7.1	0.0	36.6
3,500–3,999	28.1	19.9	0.6	0.0	25.9
≥ 4,000	8.4	6.6	0.0	0.0	7.7
Not stated	1.1	2.0	1.6	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 and neonatal deaths (defined as the death of liveborn infants within 28 days of birth).

There were 131 reported perinatal deaths, including 89 stillbirths and 42 neonatal deaths. The perinatal mortality rate in 2018 was 8.2 deaths per 1,000 births (Table 33), which was slightly lower than the rate of 9.2 per 1,000 births for all births in Australia in 2018 (AIHW, 2020). Singletons had a markedly lower perinatal mortality rate (7.6 deaths per 1,000 births) compared with multiples (16.7 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 2018, information relating to birth outcomes was not stated for 0.5% of births.

Table 33: Perinatal mortality of babies by type of death and plurality, Australia and New Zealand, 2018

			Stillbirths[(a)]		Neonatal Deaths[(b)]		Perinatal Deaths[(b)]	
Plurality	**All births**	**Live births**	**n**	**Rate[(c)(e)]**	**n**	**Rate[(d)(f)]**	**n**	**Rate[(c)(g)]**
Singletons	15,035	14,886	78	5.2	36	2.4	114	7.6
Multiples	1,016	1,005	11	10.8	6	6.0	17	16.7
Total	**16,051**	**15,891**	**89**	**5.5**	**42**	**2.6**	**131**	**8.2**

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

(b) Neonatal 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 adequately reported for 71 babies.

5 Other cycle types, procedures and treatment complications in 2018

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 412 gestational surrogacy cycles in 2018, including 275 gestational carrier cycles and 137 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 275 gestational carrier cycles, 271 (98.5%) involved the transfer of at least one embryo, 103 (37.5%) resulted in a clinical pregnancy and 86 (31.3%) resulted in a live birth.

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 2.0. Among cycles involving fertilisation and/or embryo thawing, 12.6% also involved PGT. The number of cycles involving PGT decreased by 0.5% from 9,169 in 2017 (Newman et al. 2019) to 9,124 in 2018 (Table 34).

Among the 9,124 PGT cycles, 3,150 (34.5%) were part of a *freeze-all* cycle. Over two thirds (69.3%) of the 9,124 cycles where PGT was performed, were in women aged 35 or older. Among the 4,560 thaw cycles where PGT was performed 98.7% (4,501) involved vitrified embryos and 1.3% (59) slow frozen embryos. Of the 5,974 PGT cycles (excluding freeze-all cycles), 90.5% (5,407) had embryos transferred and resulted in 2,507 clinical pregnancies and 2,098 live births. The clinical pregnancy rate and live birth rate per embryo transfer were 46.4% and 38.8% 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, 2018

	Stage of treatment	
Type of embryo	**Number of cycles with embryo fertilised/thawed**	**Number of cycles with PGT**
Fresh	39,416	4,564
Freeze-all cycles	*10,689*	*3,150*
Thaw	33,241	4,560
Total	**72,657**	**9,124**

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 6,228 assisted hatching cycles reported in 2018 that did not occur in a PGT cycle. Of these, 5,146 (82.6%) had embryos transferred, resulting in 1,788 (28.7%) clinical pregnancies and 1,380 (22.2%) live births. There were 1,435 babies born following assisted hatching cycles, including 1,335 singletons and 100 twins.

5.4 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. However, caution should be used when interpreting these data because OHSS is not consistently reported. In 2018, there were 184 OHSS cases reported that were admitted to hospital (Table 35).

Table 35: Number of cycles with OPU performed and hospitalised OHSS by number of oocytes collected, Australia and New Zealand, 2018

	Number of oocytes collected						
	None	**1–4**	**5–9**	**10–14**	**15–19**	**≥ 20**	**All**
Cycles with OHSS requiring hospitalisation	1	8	25	56	37	57	184
Cycles with OPU	917	10,733	15,597	9,770	4,939	3,700	45,656
OHSS per OPU cycle (%)	*0.1*	*0.1*	*0.2*	*0.6*	*0.7*	*1.5*	*0.4*

6 Donor sperm insemination cycles in 2018

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 2018, there were 3,262 DI cycles reported, which included 23.6% (769) undertaken with controlled ovarian hyperstimulation and 76.4% (2,493) undertaken in unstimulated cycles. Of all DI cycles, 14.4% resulted in a clinical pregnancy and 12% resulted in a live birth (Table 36). The multiple birth rate from births following DI cycles was 4.1%.

The average age of women who had a DI cycle was 34.5 years. The clinical pregnancy rate was highest in women aged between 30 and 34. The live birth rate was highest in women aged less than 30 and decreased with advancing women's age. Of the DI cycles in women aged under 35, 16.4% resulted in a live birth, compared with 2.8% 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, 2018

	Age group (years)[a]				
Stage/outcome of treatment	**< 30**	**30–34**	**35–39**	**≥ 40**	**Total**
DI cycles	511	1,079	1,214	458	3,262
Clinical pregnancies	93	204	154	19	470
Live births	84	176	117	13	390
Clinical pregnancies per DI cycle (%)	*18.2*	*18.9*	*12.7*	*4.1*	*14.4*
Live births per DI cycle (%)	*16.4*	*16.3*	*9.6*	*2.8*	*12.0*
Live births per clinical pregnancy (%)	*90.3*	*86.3*	*76.0*	*68.4*	*83.0*

(a) Age at start of a treatment cycle.

Clinical pregnancies following DI cycles

Of the 470 clinical pregnancies following DI cycles, 83% resulted in a birth, 17% ended in early pregnancy loss (including 14.9% miscarriages, 1.1% ectopic/heterotopic pregnancies and 0.4% reductions/termination), and 0.6% were unknown pregnancy outcomes. Of the 390 births, 374 (95.9%) were singleton births, 15 (3.9%) were twin births and 1 was triplets (0.3%).

Perinatal outcomes of babies

There were 407 babies born to women who had DI treatment, including 406 liveborn babies, and 1 neonatal death. Of these liveborn babies, 51 (12.6%) were born preterm (less than 37 weeks gestation). The mean birthweight of liveborn babies following DI treatment was 3,324 grams. This was higher than the mean birthweight of liveborn babies following autologous and recipient embryo transfer cycles (3,228 grams). Thirty-six liveborn babies (8.9%) were born with low birthweight (less than 2,500 grams).

7 Trends in ART treatment and outcomes: 2014 – 2018

This section includes autologous cycles, donation/recipient cycles, surrogacy cycles and GIFT cycles undertaken in Australia and New Zealand from 2014 to 2018. It does not include DI cycles.

ART treatment and outcomes

In 2018, there were 84,064 initiated ART cycles in Australia and New Zealand, a 2.2% increase on 2017. Of these initiated ART cycles, 50,559 were fresh cycles, representing an increase of 0.9% on 2017 (Table 37).

The proportion of initiated fresh cycles reaching embryo transfer has decreased from 63.7% in 2014 to 48% in 2018 partly due to changes in clinical practice, including increasing proportions of *freeze-all* cycles. Since 2014 there has been an average 23.5% yearly increase in the number of *freeze-all* cycles (Table 37)

Between 2014 and 2018, the live birth rate per initiated fresh non *freeze-all* cycle decreased from 17.3% to 16.1% (Table 37). However, the live birth rate per embryo transfer cycle marginally increased from 23.7% in 2014 to 24.6% in 2018.

Table 37: Number of fresh cycles by stage/outcome of treatment, Australia and New Zealand, 2014 to 2018

Stage/outcome of treatment	2014	2015	2016	2017	2018
Initiated cycles[(a)]	45,775	48,367	49,826	50,096	50,559
Cycles with OPU[(b)]	40,735	42,937	43,752	43,814	45,656
Freeze-all[(c)]	5,970	8,336	11,285	12,110	13,520
Embryo transfers	29,137	27,770	25,405	24,588	24,254
Clinical pregnancies	8,920	8,446	7,708	7,694	7,612
Live births	6,903	6,628	6,075	5,929	5,961
Clinical pregnancy per embryo transfer (%)	*30.6*	*30.4*	*30.3*	*31.3*	*31.4*
Clinical pregnancies per initiated cycle (%)	*19.5*	*17.5*	*15.5*	*15.4*	*15.1*
Live births per embryo transfer (%)	*23.7*	*23.9*	*23.9*	*24.1*	*24.6*
Live births per initiated cycle (%)	*15.1*	*13.7*	*12.2*	*11.8*	*11.8*
Live births per initiated non freeze-all cycle (%)[(d)]	*17.3*	*16.6*	*15.8*	*15.6*	*16.1*

(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 births per initiated non freeze-all cycle* is calculated using live births as the numerator and initiated cycles minus *freeze-all* cycles as the denominator.

In comparison, 33,505 initiated thaw cycles were undertaken in 2018, an increase of 4.3% on 2017 (Table 38). The live birth rate per initiated thaw cycle increased from 23.3% in 2014 to 28.4% in 2018 (Table 38).

For the period 2014 to 2018 the clinical pregnancy and live birth rate per embryo transfer has remained stable for fresh embryo transfers while increasing for thaw embryo transfers (Figure 8).

Table 38: Number of thaw cycles by stage/outcome of treatment, Australia and New Zealand, 2014 to 2018

Stage/outcome of treatment	2014	2015	2016	2017	2018
Initiated cycles[(a)]	27,823	29,354	31,236	32,119	33,505
Embryo transfers	25,969	27,742	29,974	31,006	32,422
Clinical pregnancies	8,507	9,280	10,561	11,166	11,902
Live births	6,470	7,412	8,440	8,953	9,514
Clinical pregnancy per embryo transfer (%)	*32.8*	*33.5*	*35.2*	*36.0*	*36.7*
Clinical pregnancies per initiated cycle (%)	*30.7*	*31.6*	*33.8*	*34.8*	*35.5*
Live births per embryo transfer (%)	*24.9*	*26.7*	*28.2*	*28.9*	*29.3*
Live births per initiated cycle (%)	*23.3*	*25.3*	*27.0*	*27.9*	*28.4*

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

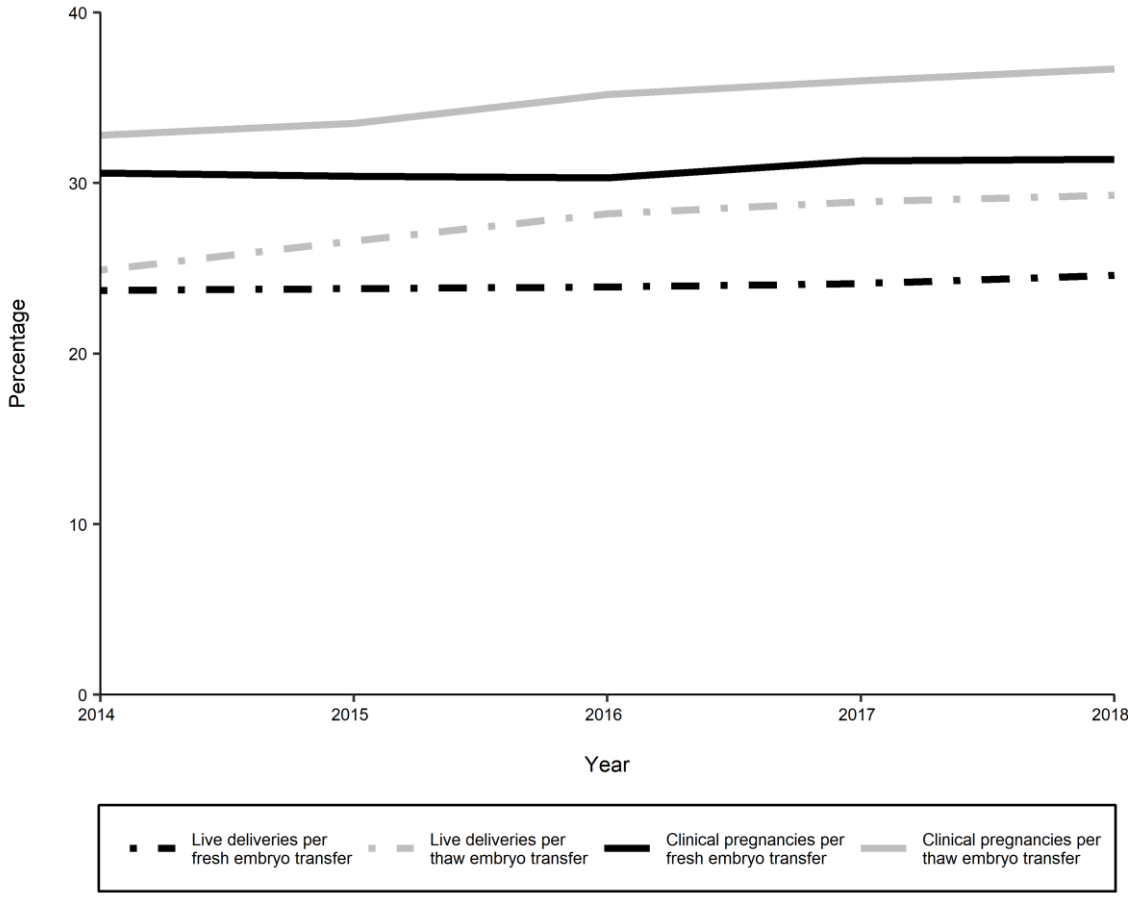


Figure 8: Clinical pregnancy and live birth rates per fresh and thaw embryo transfers, Australia and New Zealand, 2014 to 2018

The clinical pregnancy and live birth rates per OPU provide an estimate of the chances of success following a single OPU cycle. All OPUs and fresh and thaw embryo transfers were performed in 2018 and embryo transfers were not linked to the OPU from which they originated. The calculation is the sum of clinical pregnancies or live births from fresh and thaw cycles as the numerator and the number of OPUs in the same year as denominator.

Between 2014 and 2018, the live birth rate from fresh and thaw cycles per OPU cycle increased from 32.8% to 33.9% (Table 39).

Table 39: Outcomes of fresh and thaw cycles following OPU, Australia and New Zealand, 2014 to 2018

Outcome of treatment	2014	2015	2016	2017	2018
Cycles with OPU[(a)]	40,735	42,937	43,752	43,814	45,656
Clinical pregnancies	17,427	17,726	18,269	18,860	19,514
Live births	13,373	14,040	14,515	14,882	15,475
Clinical pregnancies from fresh and thaw cycles per OPU cycles[(b)]	*42.8*	*41.3*	*41.8*	*43.0*	*42.7*
Live births from fresh and thaw cycles per OPU cycle[(c)]	*32.8*	*32.7*	*33.2*	*34.0*	*33.9*

(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 clinical pregnancies from fresh and thaw cycles as the numerator and cycles with OPU as the denominator.
(c) *Live births from fresh and thaw cycles per OPU cycle* is calculated using live births from fresh and thaw cycles as the numerator and cycles with OPU as the denominator.

Multiple gestation births

The decline in multiple gestation births resulting from ART treatment continued in 2018. The proportion of multiple births decreased from 4.9% in 2014 to 3.2% in 2018 (Table 40). The decline is primarily the result of the increasing uptake of SET (Table 44).

Table 40: Number of births following ART treatment by gestation, Australia and New Zealand, 2014 to 2018

Gestation	2014		2015		2016		2017		2018	
	n	%	n	%	n	%	n	%	n	%
Singleton	12,900	95.1	13,519	95.6	14,098	96.2	14,528	96.4	15,129	96.8
Multiple	662	4.9	628	4.4	554	3.8	539	3.6	505	3.2
Twin	*647*	*4.8*	*615*	4.3	*543*	3.7	*532*	*3.5*	*497*	*3.2*
Higher order multiple	*15*	*0.1*	*14*	0.1	*11*	0.1	*7*	*0.0*	*8*	*0.1*
Total[(a)]	**13,562**	**100.0**	**14,148**	**100.0**	**14,652**	**100.0**	**15,067**	**100.0**	**15,634**	**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 2014 and 2018. The average age of women having autologous cycles remained relatively stable over the period at 35.8 years. The proportion of autologous cycles in women aged 40 and older ranged between 23.4% and 25.5% between 2014 and 2018 (Table 41).

Table 41: Number of fresh and thaw autologous cycles by women's age group, Australia and New Zealand, 2014 to 2018

Age group (years)[(a)]	2014		2015		2016		2017		2018	
Mean	*35.8*		*35.8*		*35.8*		*35.7*		*35.8*	
	n	%	n	%	n	%	n	%	n	%
< 30	7,566	10.9	7,760	10.6	7,832	10.3	8,219	10.6	7,764	9.8
30–34	19,754	28.4	21,039	28.6	22,118	29.0	22,482	29.1	23,093	29.2
35–39	24,559	35.3	26,444	36.0	27,608	36.2	28,547	36.9	29,422	37.2
40–44	16,416	23.6	16,935	23.0	17,279	22.7	16,544	21.4	17,284	21.9
≥ 45	1,343	1.9	1,303	1.8	1,418	1.9	1,561	2.0	1,509	1.9
Total	**69,638**	**100.0**	**73,481**	**100.0**	**76,255**	**100.0**	**77,353**	**100.0**	**79,072**	**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 63.8% in 2014 to 60.3% in 2018. The proportion of blastocyst transfer cycles increased from 67.5% in 2014 to 86.6% in 2018 (Table 42).

Table 42: Number of embryo transfer cycles by treatment type, Australia and New Zealand, 2014 to 2018

Treatment type[a] and procedure	2014		2015		2016		2017		2018	
	n	%	n	%	n	%	n	%	n	%
Fertilisation procedure										
IVF	19,935	36.2	20,568	37.1	19,507	35.2	20,325	36.6	22,473	39.7
ICSI[b]	35,161	63.8	34,941	62.9	34,830	62.9	34,597	62.2	34,201	60.3
Not stated	4	0.0	0	0.0	1,040	1.9	672	1.2	0	0.0
Total	**55,100**	**100.0**	**55,509**	**100.0**	**55,377**	**100.0**	**55,594**	**100.0**	**56,674**	**100.0**
Stage of embryo development										
Cleavage stage	17,907	32.5	14,734	26.5	11,939	21.6	10,018	18.0	7,566	13.4
Blastocyst[c]	37,193	67.5	40,775	73.5	43,438	78.4	45,576	82.0	49,108	86.6
Total	**55,100**	**100.0**	**55,509**	**100.0**	**55,377**	**100.0**	**55,594**	**100.0**	**56,674**	**100.0**

(a) Includes autologous cycles, oocyte/embryo recipient cycles, and surrogacy cycles
(b) Includes cycles where both ICSI and IVF fertilised embryos were transferred.
(c) Includes cycles where both cleavage stage embryos and blastocysts were transferred.

Types of cryopreservation and stage of embryo development

The proportion of thaw embryo transfer cycles that used vitrified embryos increased for cleavage-stage embryos and blastocysts between 2014 and 2018 (Table 43 and Figure 9).

Table 43: Number of embryo transfer cycles by cryopreservation method and stage of embryo development, Australia and New Zealand, 2014 to 2018

Treatment type and procedure	2014		2015		2016		2017		2018	
	n	%	n	%	n	%	n	%	n	%
Cleavage stage										
Slow frozen	4,313	77.0	2,767	64.0	1,631	50.7	1,033	42.4	710	37.4
Vitrification[(a)]	1,282	22.9	1,555	36.0	1,583	49.7	1,405	57.6	1,186	62.6
Not stated	5	0.1	2	0.0	0	0.0	0	0.0	0	0.0
Total	**5,600**	**100.0**	**4,324**	**100.0**	**3,214**	**100.0**	**2,438**	**100.0**	**1,896**	**100.0**
Blastocyst										
Slow frozen	2,928	14.4	3,237	13.8	3,266	12.2	2,440	8.5	1,801	5.9
Vitrification[(a)]	17,428	85.6	20,161	86.1	23,494	87.8	26,128	91.5	28,725	94.1
Not stated	13	0.1	20	0.1	0	0.0	0	0.0	0	0.0
Total	**20,369**	**100.0**	**23,418**	**100.0**	**26,760**	**100.0**	**28,568**	**100.0**	**30,526**	**100.0**

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

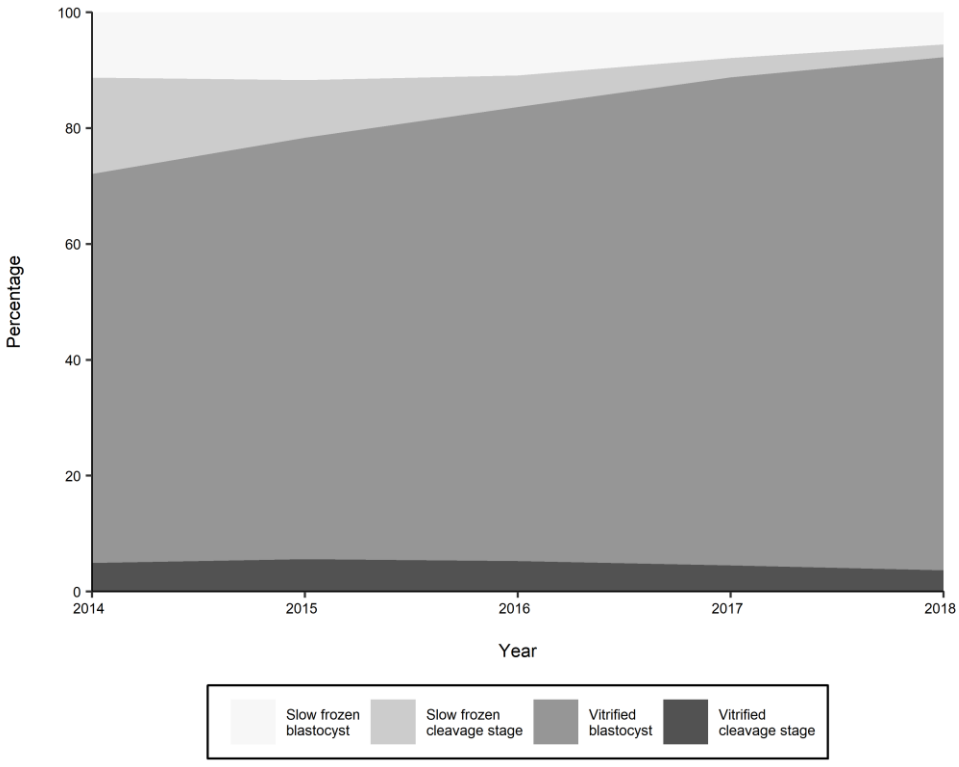


Figure 9: Percentage of embryo transfer cycles by cryopreservation method and stage of embryo development, Australia and New Zealand, 2014 to 2018

Number of embryos transferred per embryo transfer cycle

There has been an ongoing shift towards performing SET cycles in Australia and New Zealand. In 2014, the proportion of SET cycles accounted for 79.2% of embryo transfer cycles increasing to 90.6% in 2018 (Table 44). Simultaneously, the proportion of DET cycles and transferring three or more embryos, has declined over time.

Table 44: Percentage of embryo transfer cycles by number of embryos transferred, Australia and New Zealand, 2014 to 2018

Number of embryos transferred	2014	2015	2016	2017	2018
One embryo	79.2	82.9	87.7	89.4	90.6
Two embryos	20.1	16.6	12.1	10.5	9.3
Three or more embryos	0.7	0.5	0.2	0.1	0.1

8 Women undertaking autologous treatment in 2018

ANZARD was upgraded from a cycle-based data collection to a woman-based data collection for treatments undertaken from 2009 onwards (ANZARD 2.0). 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 2018. 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 41,888 women who undertook 79,072 autologous fresh and/or thaw cycles in Australia and New Zealand in 2018. Of these women, 37,839 had treatment in Australia, 6,966 in New Zealand, including 12 having treatment in both Australia and New Zealand.

On average, 1.9 fresh and/or thaw cycles per woman were undertaken in 2018, with more cycles per woman in Australia (1.9 cycles per woman) than in New Zealand (1.7 cycles per woman). In Australia, more than half (50.8%) of the women had two or more autologous treatment cycles compared with 46.0% of women in New Zealand. In line with this, 9.9% of women in Australia had four or more cycles in 2018 compared with 5.6% 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, 2018

Number of cycles	Australia		New Zealand		All	
	n	%	n	%	n	%
One	18,625	49.2	2,194	54.0	20,806	49.7
Two	10,401	27.5	1,157	28.5	11,552	27.6
Three	5,052	13.4	482	11.9	5,538	13.2
Four or more	3,761	9.9	228	5.6	3,992	9.5
Total	**37,839**	**100.0**	**4,061**	**100.0**	41,888	**100.0**

Note: Only women who undertook cycles in 2018 are included. Twelve women had treatment in both Australia and New Zealand.

Women who undertook autologous fresh cycles

There were 48,048 fresh cycles undertaken by 32,926 women in Australia and New Zealand in 2018; an average of 1.5 fresh cycles per woman. Younger women had fewer fresh cycles with one in five (20.8%) women aged under 30 having two or more autologous fresh cycles compared to nearly one in three (31.0%) 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 7.0% for women aged 40 to 44 and 6.5% for women aged 45 or older (Table 46).

Table 46: Women undertaking autologous fresh cycles by number of cycles, Australia and New Zealand, 2018

	Age group (years)[(a)]					
Number of cycles	**< 30**	**30–34**	**35–39**	**40–44**	**≥ 45**	**All**
			n			
One	2,902	7,323	8,273	3,860	369	22,727
Two	597	1,751	2,690	1,776	121	6,935
Three	130	445	817	735	53	2,180
Four or more	35	163	371	477	38	1,084
Total	**3,664**	**9,682**	**12,151**	**6,848**	**581**	**32,926**
			%			
One	79.2	75.6	68.1	56.4	63.5	69.0
Two	16.3	18.1	22.1	25.9	20.8	21.1
Three	3.5	4.6	6.7	10.7	9.1	6.6
Four or more	1.0	1.7	3.1	7.0	6.5	3.3
Total	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**

(a) Age at start of first autologous fresh cycle in 2018.

Women who undertook autologous thaw cycles

There were 31,024 thaw cycles undertaken by 21,187 women in Australia and New Zealand in 2018; an average of 1.5 thaw cycles per woman. Thirty five percent of women aged under 30 had two or more thaw cycles compared with 15.2% 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, 2018

	Age group (years)[(a)]					
Number of cycles	**< 30**	**30–34**	**35–39**	**40–44**	**≥ 45**	**All**
			n			
One	1,444	4,497	5,429	2,633	267	14,270
Two	550	1,689	1,809	744	29	4,821
Three	166	545	550	205	13	1,479
Four or more	67	244	232	68	6	617
Total	**2,227**	**6,975**	**8,020**	**3,650**	**315**	**21,187**
			%			
One	64.8	64.5	67.7	72.1	84.8	67.4
Two	24.7	24.2	22.6	20.4	9.2	22.8
Three	7.5	7.8	6.9	5.6	4.1	7.0
Four or more	3.0	3.5	2.9	1.9	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 2018.

9 Cycle-specific rates for women who started their first ART treatment cycle in 2016

This chapter presents information for the cohort of women who started their first ART treatment cycle between 1 January 2016 and 31 December 2016. 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 2018 or until they achieved a live birth (a birth of at least one liveborn baby) up to and including 31 October 2019. 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 2018 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 2016, the cycle-specific live birth 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 are not counted as a live birth.

In 2016, 16,596 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 3,101 women representing 9.7% of all women having autologous fresh cycles in 2016. Of the 16,596 women identified as having their first fresh autologous cycle in 2016, 1,192 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 15,404 women who undertook their first autologous (non *freeze-all*) fresh cycle in 2016. Tables 49 to 53 present cycle-specific live birth 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 2016, <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 (81 women and 18 live births) undertaking 11 or more treatment cycles between 1 January 2016 and 31 December 2018.

The *cycle-specific live birth* rate is calculated as the number of live births 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 2018, divided by the number of women who did not have a live birth in that cycle.

Number of cycles by women's age group

Table 48 presents the number of cycles by women's age group. Seventy six percent of these women had between one and three cycles, and 24 percent 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 2016 and 31 December 2016, Australia and New Zealand

	Age group (years)[(b)]					
Cycle number	**< 30**	**30-34**	**35-39**	**40-44**	**≥ 45**	**All**
			n			
One	904	1,978	1,792	863	103	5,640
Two	533	1,293	1,218	689	43	3,776
Three	309	713	782	436	31	2,271
Four	179	459	498	314	15	1,465
Five	123	283	312	181	5	904
Six	50	170	224	108	4	556
Seven	36	97	122	79	2	336
Eight	26	48	80	46	2	202
Nine	11	27	45	22	2	107
Ten or more	14	32	56	42	3	147
Total	**2,185**	**5,100**	**5,129**	**2,780**	**210**	**15,404**
			%			
One	41.4	38.8	34.9	31.0	49.0	36.6
Two	24.4	25.4	23.7	24.8	20.5	24.5
Three	14.1	14.0	15.2	15.7	14.8	14.7
Four	8.2	9.0	9.7	11.3	7.1	9.5
Five	5.6	5.5	6.1	6.5	2.4	5.9
Six	2.3	3.3	4.4	3.9	1.9	3.6
Seven	1.6	1.9	2.4	2.8	1.0	2.2
Eight	1.2	0.9	1.6	1.7	1.0	1.3
Nine	0.5	0.5	0.9	0.8	1.0	0.7
Ten or more	0.6	0.6	1.1	1.5	1.4	1.0
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 2016.

Note: Women who started their first autologous fresh non-*freeze-all* ART treatment cycle between 1 January 2016 and 31 December 2016 and were followed through subsequent fresh and thaw cycles, excluding *freeze-all* cycles, until 31 December 2018 or birth of a liveborn baby up to 31 October 2019.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 birth rates

How to interpret Tables 49 to 53

- The following tables report on women who started their first ART treatment cycle in 2016. They present the proportion of live births 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 2016–2018 are counted.
- Only the first live birth by a woman is counted.
- The *cycle-specific rate* is the percentage of women who had a live birth in a specific cycle after previous failed treatment attempts. For example,16.4% of women who undertook a fifth cycle achieved a live birth 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 2018. For example, 28.7% of women who did not achieve a live birth by their fifth cycle did not return for a sixth cycle (Table 49).

Table 49: Cycle-specific live birth rates for all women who started their first autologous fresh cycle (excluding *freeze-all* cycles) between 1 January 2016 and 31 December 2016, Australia and New Zealand

Cycle number[a]	Number of women starting cycle	Number of women who had a live birth[b]	Cycle-specific live birth rate (%)[c]	Number of women who did not progress to next treatment	Non-progression rate (%)[d]
One	15,404	3,551	23.1	2,089	17.6
Two	9,764	2,083	21.3	1,695	22.1
Three	5,988	1,177	19.7	1,094	22.7
Four	3,717	671	18.1	794	26.1
Five	2,252	369	16.4	535	28.4
Six	1,348	237	17.6	319	28.7
Seven	792	115	14.5	221	32.6
Eight	456	53	11.6	149	37.0
Nine	254	31	12.2	76	34.1
Ten	147	12	8.2	54	40.0

(a) Cycle one represents a woman's first autologous (non *freeze-all*) fresh ART treatment cycle between 1 January 2016 and 31 December 2016. Cycles two to ten could be either a fresh or thaw cycle (excluding *freeze-all* cycles) undertaken by a woman until 31 December 2018 or birth of a liveborn baby up to 31 October 2019. For freeze-all cycles, subsequent transfers are included in cycles two to ten.

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

(c) The cycle-specific live birth rate for a specific cycle is calculated as the number of live births 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 2018 divided by the number of women who did not have a live birth 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 births 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 birth rates for women aged less than 30 who started their first autologous fresh cycle (excluding *freeze-all* cycles) between 1 January 2016 and 31 December 2016, Australia and New Zealand

Cycle number[a]	Number of women starting cycle	Number of women who had a live birth[b]	Cycle-specific live birth rate (%)[c]	Number of women who did not progress to next treatment	Non-progression rate (%)[d]
One	2,185	653	29.9	251	16.4
Two	1,281	360	28.1	173	18.8
Three	748	225	30.1	85	16.3
Four	439	102	23.2	77	22.8
Five	260	81	31.2	42	23.5
Six	137	32	23.4	18	17.1
Seven	87	18	20.7	18	26.1
Eight	51	12	23.5	14	35.9
Nine	25	6	24.0	5	26.3
Ten	14	3	21.4	3	27.3

(a) Cycle one represents a woman's first autologous (non *freeze-all*) fresh ART treatment cycle between 1 January 2016 and 31 December 2016. Cycles two to ten could be either a fresh or thaw cycle (excluding *freeze-all* cycles) undertaken by a woman until 31 December 2018 or birth of a liveborn baby up to 31 October 2019. For freeze-all cycles, subsequent transfers are included in cycles two to ten.

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

(c) The cycle-specific live birth rate for a specific cycle is calculated as the number of live births 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 2018 divided by the number of women who did not have a live birth 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 births 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 birth rates for women aged 30–34 who started their first autologous fresh cycle (excluding *freeze-all* cycles) between 1 January 2016 and 31 December 2016, Australia and New Zealand

Cycle number[(a)]	Number of women starting cycle	Number of women who had a live birth[(b)]	Cycle-specific live birth rate (%)[(c)]	Number of women who did not progress to next treatment	Non-progression rate (%)[(d)]
One	5,100	1,523	29.9	456	12.7
Two	3,122	894	28.6	398	17.9
Three	1,829	468	25.6	245	18.0
Four	1,116	297	26.6	162	19.8
Five	657	140	21.3	143	27.7
Six	374	92	24.6	78	27.7
Seven	204	47	23.0	50	31.8
Eight	107	14	13.1	34	36.6
Nine	59	10	16.9	17	34.7
Ten	32	4	12.5	14	50.0

(a) Cycle one represents a woman's first autologous (non *freeze-all*) fresh ART treatment cycle between 1 January 2016 and 31 December 2016. Cycles two to ten could be either a fresh or thaw cycle (excluding *freeze-all* cycles) undertaken by a woman until 31 December 2018 or birth of a liveborn baby up to 31 October 2019. For freeze-all cycles, subsequent transfers are included in cycles two to ten.

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

(c) The cycle-specific live birth rate for a specific cycle is calculated as the number of live births 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 2018 divided by the number of women who did not have a live birth 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 births 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 birth rates for women aged 35–39 who started their first autologous fresh cycle(excluding *freeze-all* cycles) between 1 January 2016 and 31 December 2016, Australia and New Zealand

Cycle number[(a)]	Number of women starting cycle	Number of women who had a live birth[(b)]	Cycle-specific live birth rate (%)[(c)]	Number of women who did not progress to next treatment	Non-progression rate (%)[(d)]
One	5,129	1,126	22.0	666	16.6
Two	3,337	674	20.2	545	20.5
Three	2,119	405	19.1	376	21.9
Four	1,337	217	16.2	281	25.1
Five	839	125	14.9	187	26.2
Six	527	94	17.8	130	30.0
Seven	303	41	13.5	81	30.9
Eight	181	24	13.3	56	35.7
Nine	101	13	12.9	32	36.4
Ten	56	3	5.4	19	35.8

(a) Cycle one represents a woman's first autologous (non-*freeze-all*) fresh ART treatment cycle between 1 January 2016 and 31 December 2016. Cycles two to ten could be either a fresh or thaw cycle (excluding *freeze-all* cycles) undertaken by a woman until 31 December 2018 or birth of a liveborn baby up to 31 October 2019. For freeze-all cycles, subsequent transfers are included in cycles two to ten.

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

(c) The cycle-specific live birth rate for a specific cycle is calculated as the number of live births 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 2018 divided by the number of women who did not have a live birth 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 births 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 birth rates for women aged 40–44 who started their first autologous fresh cycle (excluding *freeze-all* cycles) between 1 January 2016 and 31 December 2016, Australia and New Zealand

Cycle number[a]	Number of women starting cycle	Number of women who had a live birth[b]	Cycle-specific live birth rate (%)[c]	Number of women who did not progress to next treatment	Non-progression rate (%)[d]
One	2,780	248	8.9	615	24.3
Two	1,917	153	8.0	536	30.4
Three	1,228	79	6.4	358	31.2
Four	792	55	6.9	259	35.1
Five	478	23	4.8	158	34.7
Six	297	19	6.4	89	32.0
Seven	189	9	4.8	70	38.9
Eight	110	3	2.7	43	40.2
Nine	64	2	3.1	20	32.3
Ten	42	2	4.8	17	42.5

(a) Cycle one represents a woman's first autologous (non *freeze-all*) fresh ART treatment cycle between 1 January 2016 and 31 December 2016. Cycles two to ten could be either a fresh or thaw cycle (excluding *freeze-all* cycles) undertaken by a woman until 31 December 2018 or birth of a liveborn baby up to 31 October 2019. For freeze-all cycles, subsequent transfers are included in cycles two to ten.

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

(c) The cycle-specific live birth rate for a specific cycle is calculated as the number of live births 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 2018 divided by the number of women who did not have a live birth 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 births 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

IVF Australia Canberra, Deakin (A/Prof Peter Illingworth)

COMPASS Fertility, Barton (Dr Nicole Sides)

Genea Canberra, Barton (A/Prof Mark Bowman)

New South Wales

Adora Fertility, Sydney (Dr Paul Atkinson)

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

Demeter Fertility, Liverpool (Dr David Knight)

Fertility First, Hurstville (Dr Anne Clark)

Genea – Illawarra, Wollongong (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)

Monash IVF – Mosman, Mosman (Dr Peter Benny)

Monash IVF – Bondi Junction, Bondi Junction (Dr Kim Matthews)

Monash IVF – Parramatta, Parramatta (Dr Kim Matthews)

Reproductive Medicine Albury, Albury (Dr Kim Matthews)

Reproductive Medicine Wagga, Wagga Wagga (Dr Scott Giltrap)

Royal Hospital for Women – Fertility & Research Centre, 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 (Prof Kelton Tremellen)

Queensland

Adora Fertility, Brisbane (Dr Paul Atkinson)

CARE Fertility, Greenslopes (Dr Clare Boothroyd)

CARE Fertility, Toowoomba (Dr Clare Boothroyd)

Cairns Fertility Centre, Cairns (Dr John Yovich)

City Fertility Centre – Brisbane (Dr Julie Lindstrum)

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 (A/Prof Anusch Yazdani)

QFG Gold Coast, Benowa (A/Prof Anusch Yazdani)

QFG Mackay, North Mackay (A/Prof Anusch Yazdani)

QFG Toowoomba, Toowoomba (A/Prof Anusch Yazdani)

QFG Townsville, Hyde Park (A/Prof Anusch Yazdani)

QFG, Spring Hill (A/Prof Anusch Yazdani)

The Fertility Centre, Springwood (A/Prof Anusch Yazdani)

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

South Australia

City Fertility Centre – Adelaide, (Dr Marcin Stankiewicz)

Fertility SA, Adelaide (Dr Bruno Radesic)

Flinders Fertility, Glenelg (Dr Enzo Lombardi)

Repromed, Dulwich (Prof Kelton Tremellen)

Tasmania

Fertility Tasmania, Hobart (Dr Richard Henshaw)

TasIVF Hobart, Hobart (Dr Bill Watkins)

TasIVF Launceston, East Launceston (Dr Bill Watkins)

Victoria

Adora Fertility, Greensborough (Dr Paul Atkinson)

Ballarat IVF, Wendouree (Dr Russell Dalton)

City Fertility Centre Bundoora, Bundoora (Dr Alex Eskander)

City Fertility Centre Melbourne, Melbourne (Dr Anne Poliness)

Genea Melbourne, Melbourne (A/Prof Mark Bowman)

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

Melbourne IVF, East Melbourne (Dr Lyndon Hale)

Monash IVF Bendigo, Bendigo (Prof Luk Rombauts)

Monash IVF Geelong, Geelong (Prof Luk Rombauts)

Monash IVF Mildura (Prof Luk Rombauts)

Monash IVF Sale, Sale (Prof Luk Rombauts)

Monash IVF Sunshine, St Albans (Prof Luk Rombauts)

Monash IVF Hawthorn, Hawthorn (Prof Luk Rombauts)

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

Number 1 Fertility, Geelong (Dr Lynn Burmeister)

Reproductive Services, Parkville (Dr Lyndon Hale)

Western Australia

Adora Fertility, Perth (Dr Paul Atkinson)

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)

New Zealand

Fertility Associates, Auckland (Dr Simon Kelly)

Fertility Associates Christchurch, Christchurch (Dr Sarah Wakeman)

Fertility Associates Hamilton, Hamilton (Dr VP Singh)

Fertility Associates Dunedin, Dunedin (A/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 92 fertility clinics in Australia and New Zealand and are compiled into ANZARD 2.0. ANZARD 2.0 includes autologous treatment cycles, treatment involving donated oocytes or embryos, and treatment involving surrogacy arrangements. ANZARD 2.0 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, ANZARD 2.0 also collects data on artificial insemination cycles using donated sperm (DI) from fertility centres. The outcomes of pregnancies, births and babies born following ART and DI treatments are also maintained in ANZARD 2.0. 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 can provide NPESU with high-quality data. All data processed by NPESU undergoes a validation process, with data queries being followed up with fertility centre staff. In 2018, information relating to pregnancy and birth outcomes was not provided for 1.1% 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 Practice, 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 2018, and the resulting pregnancies and births. The babies included in this report were conceived following treatment cycles undertaken in 2018 and were born in either 2018 or 2019. 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 birth 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 2018.

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 2016.

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: ANZARD 2.0 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 blastocysts 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 birth, 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 birth	Yes–birth 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.

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

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

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

Cleavage stage embryo: an embryo comprising about eight cells usually developed two to four 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.

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.

***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 births are counted as birth events, e.g. the birth of one or more liveborn infants. For example, where a multiple birth (twins, triplets) results in a liveborn and a stillborn baby, this is still considered one live birth event.

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

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

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).

Perinatal death: a 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.

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

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.

References

Australian Bureau of Statistics 2018. ABS.Stat beta: Quarterly Population Estimates (ERP), by State/Territory, Sex and Age Dec 2018. Viewed 28 April 2020, <http://stat.data.abs.gov.au//Index.aspx?DataSetCode=ERP_QUARTERLY# >.

Australian Institute of Health and Welfare. (2020). Australia's mothers and babies 2018—in brief. Canberra: AIHW.

Australian Institute of Health and Welfare. (2020). Australia's morthers and babies 2018 – in brief supplementary tables. Canberra: AIHW

Fitzgerald O, Harris K, Paul RC, & 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.

European Society of Human Reproduction and Embryology (ESHRE), Focus on Reproduction, July 2018. Grimbergen. Belgium.

https://www.focusonreproduction.eu/article/ESHRE-News-GlobalIVF18

Adamson GD, de Mouzon J, Chambers GM, Zegers-Hochschild F, Mansour R, Ishihara O, Banker M, Dyer S (2018) International Committee for Monitoring Assisted Reproductive Technologies world report: Assisted Reproductive Technology 2011 Fertility and Sterility, 110 (6) 1067-1080

World Health Organization 2010. Mother or nothing: the agony of infertility. Bulletin of the World Health Organization. Volume 88, Number 12, December 2010, 877-953.

Statistics New Zealand 2018.Estimated Resident Population by Age and Sex (1991+) (Annual-Dec). Viewed 28 April 2020, <http://www.stats.govt.nz/infoshare/ViewTable.aspx?pxID=21783f55-c46d-46c7-b87f-1ee5dce9edfb#information>.

Zegers-Hochschild F, Adamson GD, Dyer S, Racowsky C, de Mouza J, Sokol R, Rienzi L, Sunde A, Schmit L, Cooke ID, Leigh Simpson J,Van der Poel 2017. The International Glossary on Infertility and Fertility Care, Fertility and Sterility. 2017 Sep;108(3).

List of Figures

List of Tables

In 2018, Australian and New Zealand fertility clinics performed **84,064** ART treatment cycles resulting in the birth of **15,980 babies**.