Assisted reproductive technology in Australia and New Zealand 2019

UNSW SYDNEY

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NPESU National Perinatal Epidemiology and Statistics Unit

FERTILITY SOCIETY OF AUSTRALIA AND NEW ZEALAND

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

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Contents

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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 and New Zealand (FSANZ) 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 FSANZ.

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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
FSANZ	Fertility Society of Australia and New Zealand
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 88,929 ART treatment cycles reported from Australian and New Zealand fertility clinics in 2019 (81,049 and 7,880 respectively), representing an increase of 6.2% in Australia and 2% in New Zealand from 2018. This equates to 15.6 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 95% of treatments. Embryos and oocytes that had been frozen and thawed were used in 36.7% of autologous cycles.

There were 46,073 women who undertook 84,081 autologous fresh and/or thaw cycles in Australia and New Zealand in 2019. On average, 1.8 autologous fresh and/or thaw cycles per woman were undertaken in 2019, with more cycles per woman in Australia (1.8 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) increased from 9,124 in 2018 to 10,748 in 2019.

Over the last five years the proportion of cycles where all oocytes were cryopreserved for potential future use (oocyte *freeze-all* cycles) has increased from 2.5% of initiated fresh cycles in 2015 to 6.3% in 2019. Over the same period the proportion of initiated fresh cycles that resulted in all embryos being cryopreserved (embryo *freeze-all* cycles) increased from 14.7% in 2015 to 21.7% in 2019. 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 2019 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 40.2 years. Approximately one in four (23.5%) women who underwent an autologous cycle in 2019 were aged 40 years or older. The average age of male partners of women undergoing autologous and recipient cycles was 38 years, with approximately one-third (31%) aged 40 years or older.

Treatment outcomes and number of babies

Of the 88,929 initiated ART cycles, 73,401 (82.5%) resulted in either an embryo transfer or all oocytes/embryos being cryopreserved. Of the initiated cycles, 23.2% (20,668) resulted in a clinical pregnancy and 18.3% (16,310) in a live birth. The overall clinical pregnancy rate for cycles reaching embryo transfer was 35.4%. In 2019, there were no GIFT cycles.

The live birth rate per initiated autologous fresh cycle was 16.5% after *freeze-all* cycles were excluded, and 25.3% for fresh cycles reaching embryo transfer. The live birth rate per initiated autologous thaw cycle was 28.9% and for thaw cycles reaching embryo transfer cycle was 29.8%.

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 33.9% for autologous thaw cycles. For women older than 44 years, the live birth rate per embryo transfer was 1.7% for autologous fresh cycles and 9.2% for thaw cycles.

There were 16,927 babies born (including 16,777 liveborn babies) following ART treatment in 2019. Of these, 15,158 (89.6%) were from Australian clinics and 1,769 (10.5%) 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 15,301 women were followed from the start of their first autologous non-*freeze-all* fresh cycle during 2017, through subsequent fresh and thaw cycles until December 2019 or until they achieved a live birth. The cycle-specific live birth rate per initiated cycle for all women was 24.7% in their first cycle, and 13.0% in their eighth cycle. Approximately one in five 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 73.5% in 2015 to 88.3% in 2019); an increase in vitrification as a cryopreservation method (from 86.1% of thaw blastocyst transfer cycles in 2015 to 95.5% in 2019); and a small decrease in the use of intracytoplasmic sperm injection (ICSI) (from 62.9% of embryo transfer cycles in 2015 to 58.2% in 2019).

The proportion of embryo transfer cycles transferring a cryopreserved embryo increased from 50% in 2015 to 58.5% in 2019. Of the 16,310 live births resulting from ART treatment in 2019, 62.1% resulted from thaw cycles, compared to 52.8% in 2015.

In the last five years the live birth rate per fresh embryo transfer cycle increased from 23.9% to 25.5%, and the live birth rate per thaw embryo transfer cycle increased from 26.7% to 29.7%. The greater increase in live birth rates from thaw embryo transfer cycles could be explained by more *freeze-all* cycles being performed over the years. Overall, live birth rates per embryo transfer have risen from 25.3% in 2015 to 28% in 2019.

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 4.4% in 2015 to 2.9% in 2019. This has been achieved by clinicians and patients shifting to single embryo transfer, with the proportion increasing from 85.7% in 2015 to 91.9% in 2019. Importantly, this decrease in the multiple birth rate has been achieved while overall live birth rates per embryo transfer increased from 25.3% in 2015 to 28% in 2019.

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; 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 2019 received some form of ART treatment (AIHW, 2021).

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 and New Zealand (FSANZ), 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 2019.

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 suboptimal response to 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/couple
- 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 2015 to 2019. 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 2019.

As a joint initiative of the NPESU at UNSW Sydney and the FSANZ, 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 2019 annual report presents cycle-specific success rates for women who started their first autologous (non *freeze-all*) fresh cycle during 2017. These women were followed from their first fresh cycle through subsequent fresh and thaw cycles (excluding *freeze-all* cycles) until 31 December 2019, or until they achieved a live birth (a birth of at least one liveborn baby) up to and including 31 October 2020.

The 2019 data presented in this report were supplied by 87 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 2019', 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 2019', 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 2019', 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 2019', 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 2019', presents data on DI cycles and their outcomes, including a description of pregnancy and perinatal outcomes.

Chapter 7—'Trends in ART treatment and outcomes: 2015–2019', 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 2019', presents information on the number of women undergoing ART treatment in 2019.

Chapter 9—'Cycle-specific rates for women who started their first ART treatment cycle in 2017', presents information for a cohort of women who started their first autologous (non-*freeze-all*) fresh ART treatment cycle during 2017, and were followed through subsequent fresh and thaw cycles (excluding *freeze-all* cycles) until 31 December 2019 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 2019

There were 88,929 ART treatment cycles reported from Australian and New Zealand clinics in 2019 (Table 1). Of these, 91.1% (81,049) were from Australian clinics and 8.9% (7,880) were from New Zealand clinics. The overall number of ART treatment cycles in 2019 increased by 5.8% from the 84,064 cycles in 2018, with a 6.2% increase in Australia and 2.0% increase in New Zealand. In 2019, the number of ART treatment cycles represented 15.6 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 2019; Statistics New Zealand 2019).

Approximately 95% of cycles in 2019 were autologous cycles (where a woman intended to use or used her own oocytes or embryos). Of the 84,081 autologous cycles, 51,453 (57.9%) were fresh cycles and 32,628 (36.7%) were thaw cycles. Other treatments represented a small proportion of cycles: 3.3% were oocyte recipient cycles, 0.7% were embryo recipient cycles, 1.1% were oocyte donation cycles and 0.4% were surrogacy arrangement cycles (Table 1).

Of all initiated ART treatments in 2019, 23.2% (20,668) resulted in a clinical pregnancy and 18.3% (16,310) in a live birth (Table 1). Of these clinical pregnancies, 18,392 (89.0%) were from Australian clinics and 2,276 (11.0%) from New Zealand clinics. There were 16,927 babies born, (including 16,777 liveborn babies) following ART treatment in 2019. Of these, 15,158 (89.6%) were from Australian clinics and 1,769 (10.5%) from New Zealand clinics. Of the liveborn babies, 81.5% (13,680) were singletons at term (gestational age of 37–41 weeks) with normal birthweight (≥ 2,500 grams). The multiple birth rate was 2.9%.

Table 1: Number of initiated ART treatment cycles by treatment type, Australia and New Zealand, 2019

	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	84,081	94.6	19,529	15,408	15,851	12,946
Fresh	*51,453*	*57.9*	*7,695*	*5,994*	*6,197*	*4,885*
Thaw	*32,628*	*36.7*	*11,834*	*9,414*	*9,654*	*8,061*
Oocyte recipient	2,943	3.3	849	677	696	544
Embryo recipient	589	0.7	201	152	157	123
Oocyte donation	965	1.1	0	0	0	0
GIFT[(a)]	0	0.0	0	0	0	0
Surrogacy arrangement cycles	351	0.4	89	73	73	67
Commissioning cycles[(b)]	*126*	*0.1*	*0*	*0*	*0*	*0*
Gestational carrier cycles[(c)]	*225*	*0.3*	*89*	*73*	*73*	*67*
Total	**88,929**	**100.0**	**20,668**	**16,310**	**16,777**	**13,680**

(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 2019

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 36 years. For women undergoing oocyte/embryo recipient cycles, the mean age was 40.2 years, nearly five years older than for autologous cycles (35.8 years). Of all autologous and oocyte/embryo recipient cycles, 24.9% were undertaken by women aged 40 or older (Table 2). The average age of male partners was 38 years, with 31% aged 40 or older. For 26.8% 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, 2019

Age group (years)[(a)]	Autologous				Oocyte /embryo recipient		All	
	Fresh		Thaw					
	n	%	n	%	n	%	n	%
< 30	4,878	9.5	3,456	10.6	185	5.2	8,519	9.7
30–34	13,410	26.1	10,551	32.3	462	13.1	24,423	27.9
35–39	19,228	37.4	12,810	39.3	783	22.2	32,821	37.5
40–44	12,763	24.8	5,410	16.6	1,209	34.2	19,382	22.1
≥ 45	1,174	2.3	401	1.2	893	25.3	2,468	2.8
Total	**51,453**	**100.0**	**32,628**	**100.0**	**3,532**	**100.0**	**87,613**	**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, 2019

Age group (years)[(a)]	Autologous				Oocyte/embryo recipient		All	
	Fresh		Thaw					
	n	%	n	%	n	%	n	%
< 30	2,860	5.6	1,909	5.9	96	2.7	4,865	5.6
30–34	10,542	20.5	7,897	24.2	320	9.1	18,759	21.4
35–39	14,227	27.7	10,703	32.8	658	18.6	25,588	29.2
40–44	9,707	18.9	5,999	18.4	712	20.2	16,418	18.7
≥ 45	6,516	12.7	3,381	10.4	800	22.7	10,697	12.2
Not stated/no partner involved	7,601	14.8	2,739	8.4	946	26.8	11,286	12.9
Total	**51,453**	**100.0**	**32,628**	**100.0**	**3,532**	**100.0**	**87,613**	**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 87,613 initiated autologous and recipient cycles undertaken in 2019, 72.2% were undertaken by nulliparous women. Of autologous cycles (fresh and thaw), 72.4% were undertaken by nulliparous women, compared with 66.5% for oocyte/embryo recipient cycles (Table 4).

Table 4: Number of autologous and recipient cycles by parity and treatment type, Australia and New Zealand, 2019

	Autologous				Oocyte/embryo recipient		All	
	Fresh		Thaw					
Parity	**n**	**%**	**n**	**%**	**n**	**%**	**n**	**%**
Nulliparous	40,059	77.9	20,820	63.8	2,350	66.5	63,229	72.2
Parous	6,949	13.5	8,125	24.9	658	18.6	15,732	18.0
Not stated	4,445	8.6	3,683	11.3	524	14.8	8,652	9.9
Total	**51,453**	**100.0**	**32,628**	**100.0**	**3,532**	**100.0**	**87,613**	**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 87,613 initiated autologous and recipient cycles, 10.9% reported male infertility factors as the only cause of infertility; 40.6% reported only female infertility factors; 7.2% reported combined male–female factors; 17% reported unexplained infertility only; 24.1% reported no cause of infertility and <1% were not stated or unknown.

Intracytoplasmic sperm injection procedures

Of the 42,104 autologous fresh cycles where fertilisation was attempted, 61.9% used ICSI procedures and 38.1% used IVF procedures. Of fresh oocyte recipient cycles where fertilisation was attempted, 80% used ICSI procedures and 19.8% 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, 2019

	Autologous				Oocyte/embryo recipient			
	Fresh[(a)]		Thaw[(b)(d)]		Fresh[(a)]		Thaw[(b)(d)]	
Procedure	**n**	**%**	**n**	**%**	**n**	**%**	**n**	**%**
IVF	16,055	38.1	13,797	43.6	234	19.8	665	29.2
ICSI[(c)]	26,049	61.9	17,829	56.4	946	80.1	1,613	70.7
Not stated	0	0.0	0	0.0	0	0.0	0	0.0
Total	**42,104**	**100.0**	**31,626**	**100.0**	**1,180**	**100.0**	**2,278**	**100.0**

(a) Fresh cycles where fertilisation was attempted.

(b) Thaw cycles where embryos were transferred.

(c) Includes 1,307 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. 1,264 of the 19,442 thaw ICSI cycles had two or more embryos transferred.

Number of embryos transferred

Of the 58,107 fresh and thaw embryo transfer cycles undertaken in autologous and recipient cycles, 91.9% were single embryo transfer (SET) cycles and 8.1% were double embryo transfer (DET). In women aged under 35, 95.6% of embryo transfer cycles were SET cycles and 4.4% were DET cycles. In women aged 35 or older, 89.5% of cycles were SET cycles and 10.4% 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, 2019

	Number of embryos transferred							
	One		Two		Three or more		Total	
Age group (years)[(a)]	**n**	**%**	**n**	**%**	**n**	**%**	**n**	**%**
< 30	5,458	96.1	223	3.9	0	0.0	5,681	100.0
30–34	16,347	95.4	791	4.6	1	0.0	17,139	100.0
35–39	20,289	93.0	1,526	7.0	3	0.0	21,818	100.0
40–44	9,964	83.9	1,887	15.9	22	0.2	11,873	100.0
≥ 45	1,317	82.5	260	16.3	19	1.2	1,596	100.0
All	**53,375**	**91.9**	**4,687**	**8.1**	**45**	**0.1**	**58,107**	**100.0**

(a) Age at start of a treatment cycle.

Stage of embryo development

Of the 58,107 embryo transfer cycles, 11.7% involved the transfer of day 2-4 embryos (cleavage stage embryos) and 88.3% day 5–6 embryos (blastocysts). Of autologous cycles, blastocyst transfers made up 78.5% of fresh cycles compared with 95.8% of thaw cycles (Table 7).

Table 7: Number of embryo transfer cycles by treatment type and stage of embryo development, Australia and New Zealand, 2019

Stage of embryo development	Autologous				Oocyte/embryo recipient			
	Fresh		Thaw		Fresh		Thaw	
	n	%	n	%	n	%	n	%
Cleavage Stage	5,093	21.5	1,327	4.2	158	29.8	240	10.5
Blastocyst[(a)]	18,578	78.5	30,299	95.8	374	70.2	2,040	89.5
Total	**23,671**	**100.0**	**31,626**	**100.0**	**532**	**100.0**	**2,278**	**100.0**

(a) Includes 5 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 33,904 frozen/thawed embryo transfer cycles, 94.2% involved the transfer of vitrified embryos. Of the frozen/thawed blastocyst transfer cycles 95.5% had vitrified embryos transferred. By comparison, 69.6% 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, 2019

Cryopreservation method	Autologous				Oocyte/embryo recipient			
	Cleavage Stage		Blastocyst		Cleavage Stage		Blastocyst	
	n	%	n	%	n	%	n	%
Slow frozen	403	30.4	1,349	4.5	74	30.8	119	5.8
Vitrification[(a)]	924	69.6	28,950	95.5	166	69.2	1,919	94.2
Total	**1,327**	**100.0**	**30,299**	**100.0**	**240**	**100.0**	**2,038**	**100.0**

(a) Includes 17 cycles where both vitrified and slow frozen embryos were transferred.

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

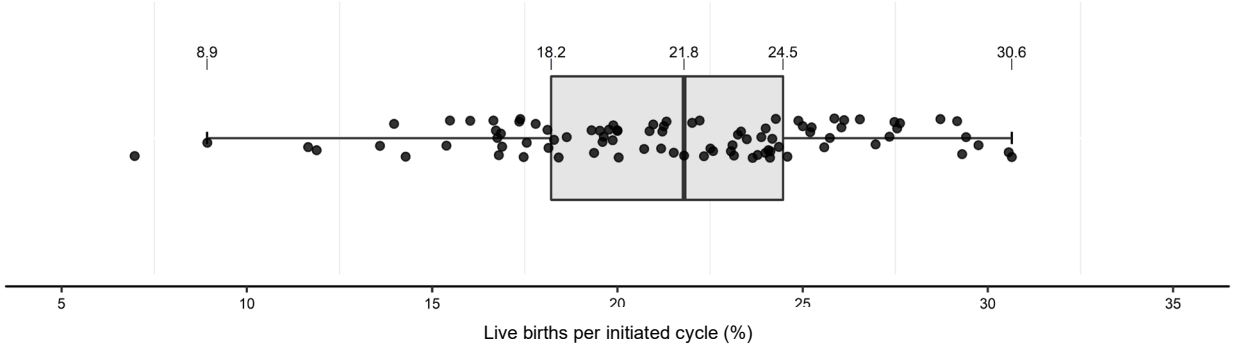
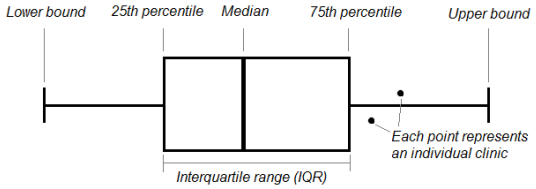


Figure 1: Live birth rate per initiated fresh (excluding *freeze-all*) and thaw autologous and recipient cycle (%) among fertility clinics, Australia and New Zealand, 2019

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 91 fertility clinics who performed more than 50 of these cycles combined in 2019.
- 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 (21.8%).
- The interquartile range (IQR) indicates the range of live birth rates achieved by the middle 50% of clinics (IQR: 18.2% - 24.5%).
- The upper and lower bounds represent the range in which it would be expected that approximately 98% of clinics to fall (8.9% - 30.6%).
- 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.

3.2 Autologous fresh cycles

In 2019, there were 51,453 initiated autologous fresh cycles, comprising 50,515 (98.2%) FSH-stimulated cycles and 938 (1.8%) unstimulated cycles. There were 589 cycles in which thawed oocytes were used. Of the initiated autologous fresh cycles, 92.6% (47,665) were in Australian clinics and 7.4% (3,788) 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 51,453 initiated autologous fresh cycles in 2019, 90.3% had OPU performed; 29.3% were *freeze-all* cycles; 46% 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.

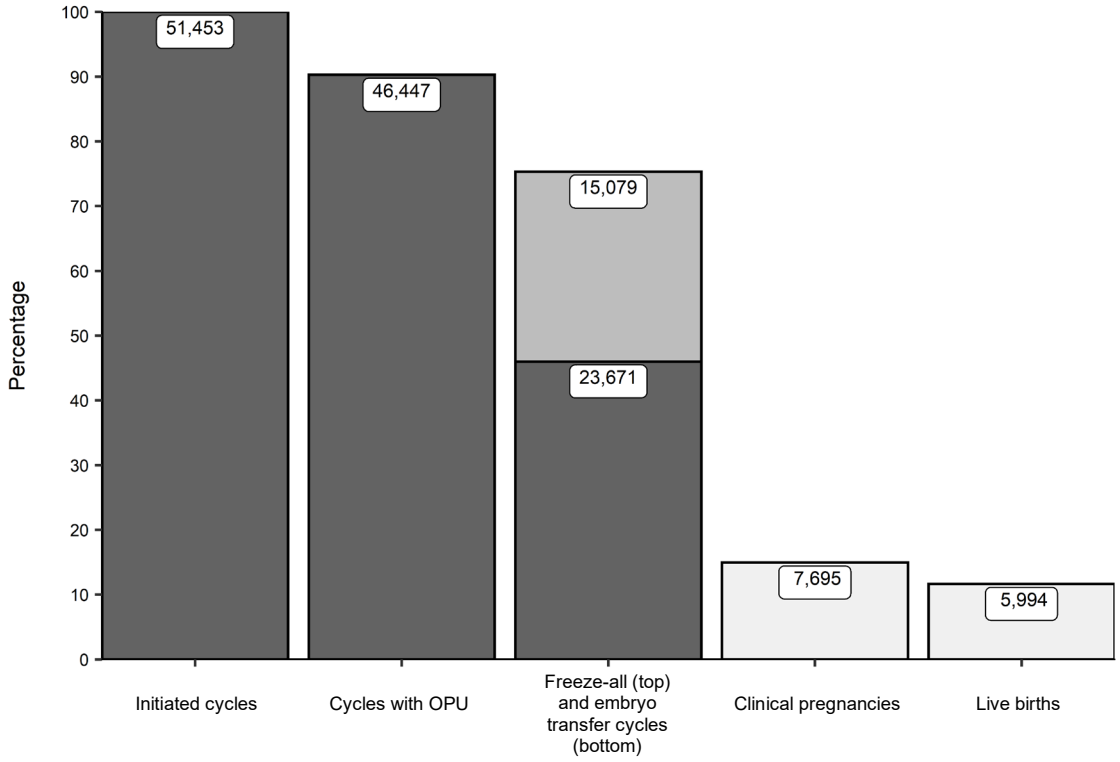


Figure 2: Progression of autologous fresh cycles, Australia and New Zealand, 2019

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 10% for women aged 40–44 and 1.7% for women aged 45 or older (Table 9). In women aged 45 or older, 746 cycles (63.5%) occurred in women aged 45 years and 233 cycles (19.8%) in women age 46 years, with the remaining 195 cycles (16.6%) occurring in women aged 47 or older.

In women aged under 30 years, *freeze-all* cycles accounted for 39% of initiated fresh cycles with the rate decreasing to 9.1% in women 45 years or older.Of the 51,453 initiated fresh cycles, all oocytes were cryopreserved in 3,395 cycles (6.6%), and all embryos where cryopreserved in 11,684 cycles (22.7%). 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, 2019

	Age group (years)[a]					
Stage/outcome of treatment	**< 30**	**30–34**	**35–39**	**40–44**	**≥ 45**	**All**
Initiated cycles	4,878	13,410	19,228	12,763	1,174	51,453
Cycles with OPU	4,465	12,447	17,508	11,061	966	46,447
Freeze-all cycles[b]	1,903	4,578	6,071	2,420	107	15,079
Embryo transfer cycles	2,162	6,488	8,823	5,726	472	23,671
Clinical pregnancies	999	2,687	3,019	969	21	7,695
Live births	873	2,280	2,263	570	8	5,994
Live births per initiated cycle (%)	*17.9*	*17.0*	*11.8*	*4.5*	*0.7*	*11.6*
Live births per initiated cycle (excluding freeze-all)[c] (%)	*29.3*	*25.8*	*17.2*	*5.5*	*0.7*	*16.5*
Live births per embryo transfer cycle (%)	*40.4*	*35.1*	*25.6*	*10.0*	*1.7*	*25.3*
Live births per clinical pregnancy (%)	*87.4*	*84.9*	*75.0*	*58.8*	*38.1*	*77.9*

(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 20s. For women aged 45 or older, only one live birth resulted from every 143 initiated cycles compared with one live birth from every three initiated cycles in women aged between 23 and 24.

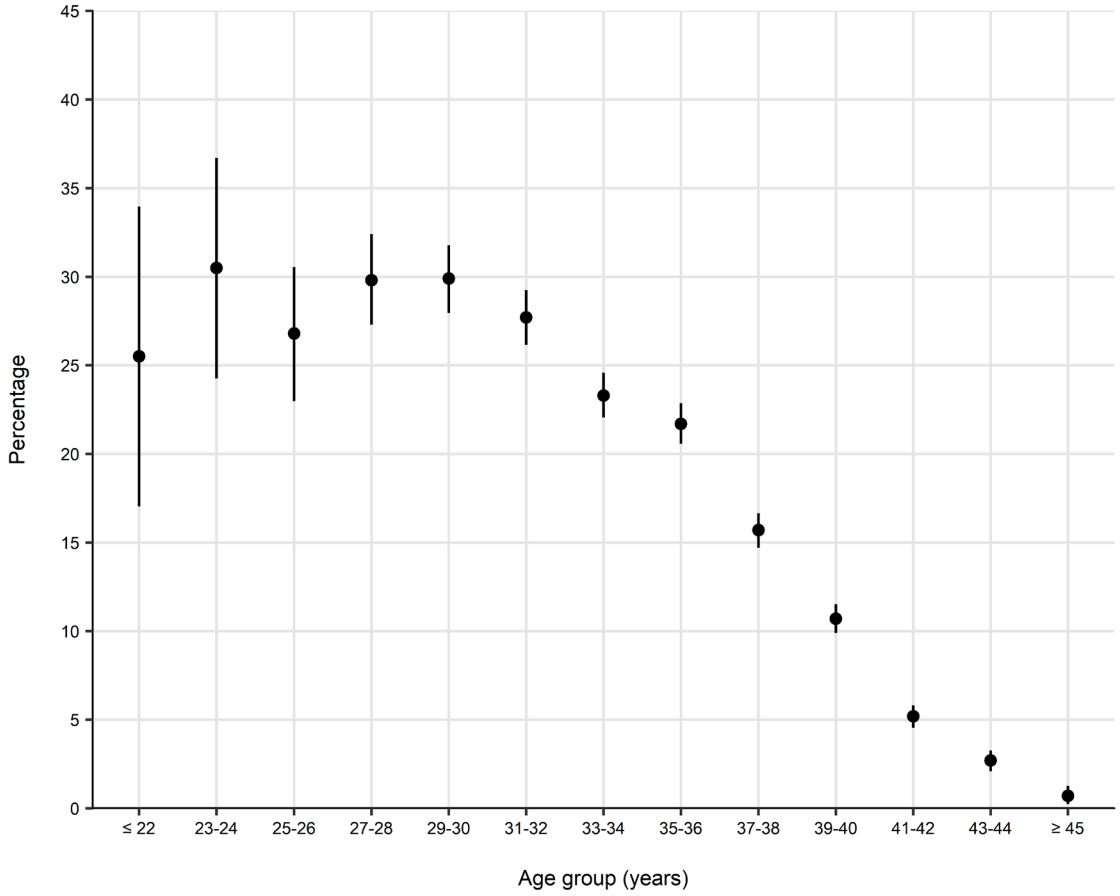


Figure 3: Live birth rate (with 95% confidence interval) per initiated autologous fresh cycle (excluding *freeze-all*) by women's age at start of a treatment cycle, Australia and New Zealand, 2019

Clinical pregnancies and live births by cause of infertility

Cycles that reported the cause of infertility as *male factor only*, *tubal disease only* or *endometriosis only* had the highest live birth rate (19.5%) (Table 10). There were 12,797 (24.9%) autologous fresh cycles where cause of infertility was not stated or where there was no cause of infertility.

Table 10: Outcomes of autologous fresh cycles by cause of infertility, Australia and New Zealand, 2019

Cause of infertility[a]	Number of initiated cycles	Embryo transfer cycles per initiated cycle (%)	Clinical pregnancies per initiated non-*freeze-all* cycle[b] (%)	Live births per initiated non-*freeze-all* cycle[c] (%)
Male factor only	5,539	52.9	23.6	19.5
Female factor	21,206	45.3	19.5	14.8
Tubal disease only	*1,462*	*54.9*	*24.1*	*19.5*
Endometriosis only	*2,634*	*49.5*	*24.3*	*19.5*
Other female factors only	*13,092*	*42.0*	*17.0*	*12.4*
Combined female factor	*4,018*	*49.8*	*22.4*	*17.8*
Combined male—female	3,471	46.0	20.2	15.4
Unexplained	8,440	44.5	21.5	17.2
Not stated/no cause of infertility	12,797	45.2	23.0	17.8
All	**51,453**	**46.0**	**21.2**	**16.5**

a) 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.

b) 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

c) 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, 88.7% of autologous fresh embryo transfer cycles were SET cycles, 11.2% 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 3 cycles, compared with 37 cycles in women aged 40 or older.

The overall live birth rate per embryo transfer cycle was 26.4% for SET cycles and 16.5% for DET cycles (Table 11). Of embryo transfer cycles in women aged less than 35, the live birth rate was higher for SET cycles (36.5%) than DET cycles (34.9%). Of embryo transfer cycles in women aged 40 or older, the live birth rates were also higher 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.

Table 11: Outcomes of autologous fresh embryo transfer cycles by women's age and number of embryos transferred, Australia and New Zealand, 2019

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][d]
Embryo transfer cycles	8,279	370	8,027	794	4,686	1,475	20,992	2,679
Clinical pregnancies	3,534	152	2,760	258	759	227	7,053	642
Live births	3,024	129	2,080	182	448	130	5,552	441
Clinical pregnancies per embryo transfer cycle (%)	*42.7*	*41.1*	*34.4*	*32.5*	*16.2*	*15.4*	*33.6*	*24.0*
Live births per embryo transfer cycle (%)	*36.5*	*34.9*	*25.9*	*22.9*	*9.6*	*8.8*	*26.4*	*16.5*

(a) Age at start of a treatment cycle.

(b) SET: single embryo transfer.

(c) DET: double embryo transfer.

(d) Includes 40 cycles where three or more embryos were transferred

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 10.4 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, 2019

Stage/outcome of treatment	Age group (years)[a]							
	< 35		35–39		≥ 40		All	
	CL[b]	BL[c][d]	CL[b]	BL[c][e]	CL[b]	BL[c][f]	CL[b]	BL[c][g]
Embryo transfer cycles	1,437	7,213	1,800	7,023	1,856	4,342	5,093	18,578
Clinical pregnancies	483	3,203	464	2,555	213	777	1,160	6,535
Live births	413	2,740	350	1,913	111	467	874	5,120
Clinical pregnancies per embryo transfer cycle (%)	*33.6*	*44.4*	*25.8*	*36.4*	*11.5*	*17.9*	*22.8*	*35.2*
Live births per embryo transfer cycle (%)	*28.7*	*38.0*	*19.4*	*27.2*	*6.0*	*10.8*	*17.2*	*27.6*

(a) Age at start of a treatment cycle.

(b) CL: cleavage stage embryo.

(c) BL: blastocyst.

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

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

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

(g) Includes 4 cycles where both cleavage stage embryos and blastocysts were transferred

3.3 Autologous thaw cycles

There were 32,628 autologous thaw cycles reported in 2019 (Figure 4). Of these, 89.5% (29,208) were in Australian clinics and 10.5% (3,420) 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 32,628 initiated autologous thaw cycles, 96.9% had embryos transferred, 36.3% resulted in a clinical pregnancy and 28.9% 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 2019 (28.9% and 16.5% respectively) (Figure 4 and Table 9).

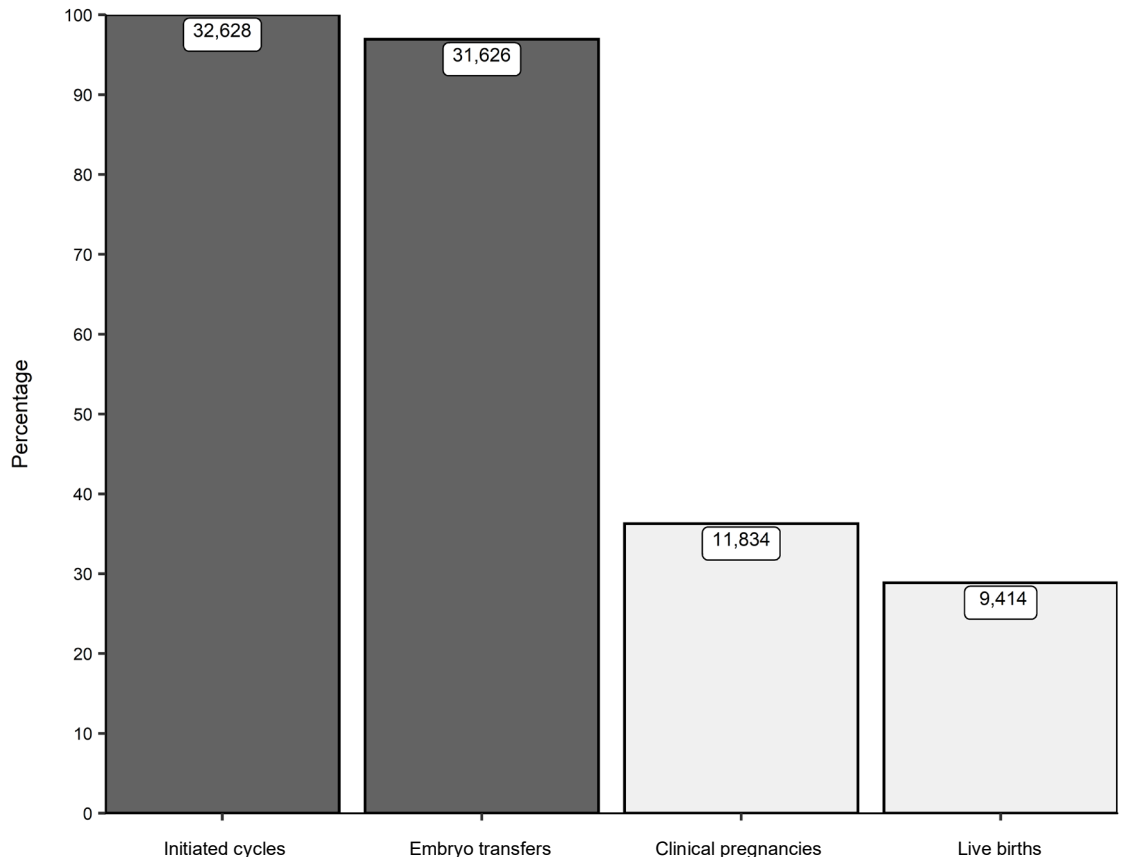


Figure 4: Progression of autologous thaw cycles, Australia and New Zealand, 2019

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

The live birth rate per thawed embryo transfer cycle was higher for women aged 30-34 years (34.1%) than women <30 years (33.9%). This rate declined with advancing women's age 35 years old or more (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, 2019

	Age group (years)[(a)]					
Stage/outcome of treatment	**< 30**	**30–34**	**35–39**	**40–44**	**≥ 45**	**All**
Initiated cycles	3,456	10,551	12,810	5,410	401	32,628
Embryo transfer cycles	3,380	10,304	12,388	5,184	370	31,626
Clinical pregnancies	1,351	4,235	4,708	1,496	44	11,834
Live births	1,147	3,513	3,675	1,045	34	9,414
Live births per initiated cycle (%)	*33.2*	*33.3*	*28.7*	*19.3*	*8.5*	*28.9*
Live births per embryo transfer cycle (%)	*33.9*	*34.1*	*29.7*	*20.2*	*9.2*	*29.8*
Live births per clinical pregnancy (%)	*84.9*	*83.0*	*78.1*	*69.9*	*77.3*	*79.6*

(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, 8.5% 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 (0.7%) (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.

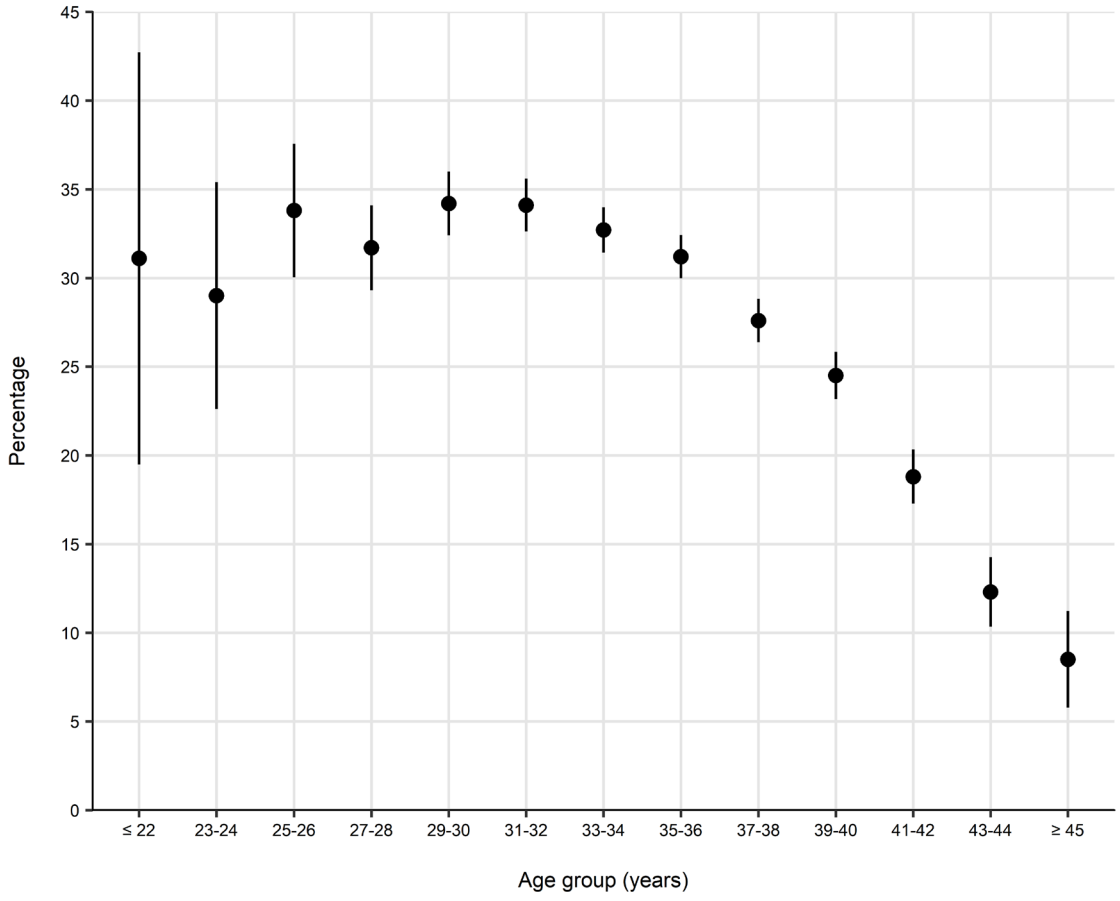


Figure 5: Live birth rate (with 95% confidence intervals) per initiated autologous thaw cycle by women's age at start of a treatment cycle, Australia and New Zealand, 2019

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 (31.3%) followed by cycles where the cause of infertility was reportedly unexplained (30.5%). The live birth rate in cycles with female factors as the only cause of infertility was 29% (Table 14).

Table 14: Outcomes of autologous thaw cycles by cause of infertility, Australia and New Zealand, 2019

Cause of infertility[a]	Number of initiated cycles	Embryo transfer cycles per initiated cycle (%)	Clinical pregnancies per initiated cycle (%)	Live births per initiated cycle (%)
Male factor only	3,888	97.6	38.4	31.3
Female factor	12,759	97.0	36.5	29.0
Tubal disease only	*1,188*	*98.1*	*35.4*	*29.1*
Endometriosis only	*1,617*	*97.3*	*35.5*	*28.3*
Other female factors only	*7,121*	*96.9*	*36.7*	*29.5*
Combined female factor	*2,833*	*96.7*	*37.2*	*28.1*
Combined male–female factors	2,533	97.2	35.9	27.9
Unexplained	5,828	96.7	37.4	30.5
Not stated	7,620	96.5	34.0	26.4
All	**32,628**	**96.9**	**36.3**	**28.9**

a) 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.

Clinical pregnancies and live births by number of embryos transferred

Of the 31,626 autologous thaw embryo transfer cycles, 94.2% were SET cycles, 5.8% were DET cycles and 4 cycles 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, 2019

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][d]
Embryo transfer cycles	13,059	625	11,709	679	5,008	542	29,776	1,850
Clinical pregnancies	5,324	262	4,433	275	1,403	136	11,160	674
Live births	4,456	204	3,478	197	999	80	8,933	481
Clinical pregnancies per embryo transfer cycle (%)	*40.8*	*41.9*	*37.9*	*40.5*	*28.0*	*25.1*	*37.5*	*36.5*
Live births per embryo transfer cycle (%)	*34.1*	*32.6*	*29.7*	*29.0*	*19.9*	*14.8*	*30.0*	*26.1*

(a) Age at start of a treatment cycle.

(b) SET: single embryo transfer.

(c) DET: double embryo transfer.

(d) Includes 4 cycles where three or more embryos were transferred

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 13 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, 2019

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][d]	CL[b]	BL[c][e]
Embryo transfer cycles	455	13,229	437	11,951	435	5,119	1,327	30,299
Clinical pregnancies	122	5,464	108	4,600	66	1,474	296	11,538
Live births	99	4,561	90	3,585	41	1,038	230	9,184
Clinical pregnancies per embryo transfer cycle (%)	*26.8*	*41.3*	*24.7*	*38.5*	*15.2*	*28.8*	*22.3*	*38.1*
Live births per embryo transfer cycle (%)	*21.8*	*34.5*	*20.6*	*30.0*	*9.4*	*20.3*	*17.3*	*30.3*

(a) Age at start of a treatment cycle.
(b) CL: cleavage stage embryo.
(c) BL: blastocyst.
(d) Includes 1 cycle where both blastocyst and cleavage stage embryos were transferred
(e) Includes 1 cycle where both blastocyst and cleavage stage embryos were transferred

Clinical pregnancies and live births by embryo freezing methods

Of the autologous thaw cycles where a blastocyst was transferred, 95.5% used vitrified embryos compared with cleavage-stage embryo transfer cycles where 69.6% 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, 2019

	Stage of embryo development					
	Cleavage stage		Blastocyst[a]		All	
Stage/outcome of treatment	Slow freezing	Vitrification[b]	Slow freezing	Vitrification[c]	Slow freezing	Vitrification[d]
Embryo transfer cycles	403	924	1,349	28,950	1,752	29,874
Clinical pregnancies	86	210	490	11,048	576	11,258
Live births	63	167	403	8,781	466	8,948
Clinical pregnancies per embryo transfer cycle (%)	*21.3*	*22.7*	*36.3*	*38.2*	*32.9*	*37.7*
Live births per embryo transfer cycle (%)	*15.6*	*18.1*	*29.9*	*30.3*	*26.6*	*30.0*

(a) Includes 1 cycle where both blastocyst and cleavage stage embryos were transferred
(b) Includes 1 cycle where both vitrified and slow frozen cleavage stage embryos were transferred
(c) Includes 3 cycles where both vitrified and slow frozen blastocysts were transferred
(d) Includes 4 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 2019, donation and recipient cycles accounted for 5.1% (4,497) of all treatment cycles in Australia and New Zealand. There were 965 initiated cycles where the intention was to donate oocytes to a recipient woman, consisting of 822 (85.2%) cycles in Australia and 143 (14.8%) in New Zealand. There were 3,532 oocyte/embryo recipient cycles (Table 1), comprising 3,044 (86.2%) cycles in Australia and 488 (13.8%) cycles in New Zealand.

Oocyte donation cycles

Of the 965 cycles in Australia and New Zealand where the intention was to donate oocytes to a recipient, 29 (3%) cycles were cancelled before OPU, and a further 9 did not result in oocytes being donated.

The average age of women donating oocytes was 33 years, with 43.9% 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, 2019

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	216	206	95.4	202	93.5
30–34	325	318	97.8	317	97.5
35–39	347	338	97.4	335	96.5
≥ 40	77	74	96.1	73	94.8
Total	**965**	**936**	**97.0**	**927**	**96.1**

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

Oocyte/embryo recipient cycles

There were 3,532 oocyte/embryo recipient cycles in 2019. Of these, 83.3% (2,943) were oocyte recipient cycles and 16.7% (589) were embryo recipient cycles (Table 1). The average age of women undertaking an oocyte/embryo recipient cycle was 40.2 years.

Progression of oocyte/embryo recipient cycles

Figure 6 shows the main stages of oocyte/embryo recipient cycles and the treatment outcomes. Of the 3,532 initiated oocyte/embryo recipient cycles undertaken in 2019, 79.6% resulted in an embryo transfer; 29.7% resulted in a clinical pregnancy and 23.5% in a live birth.

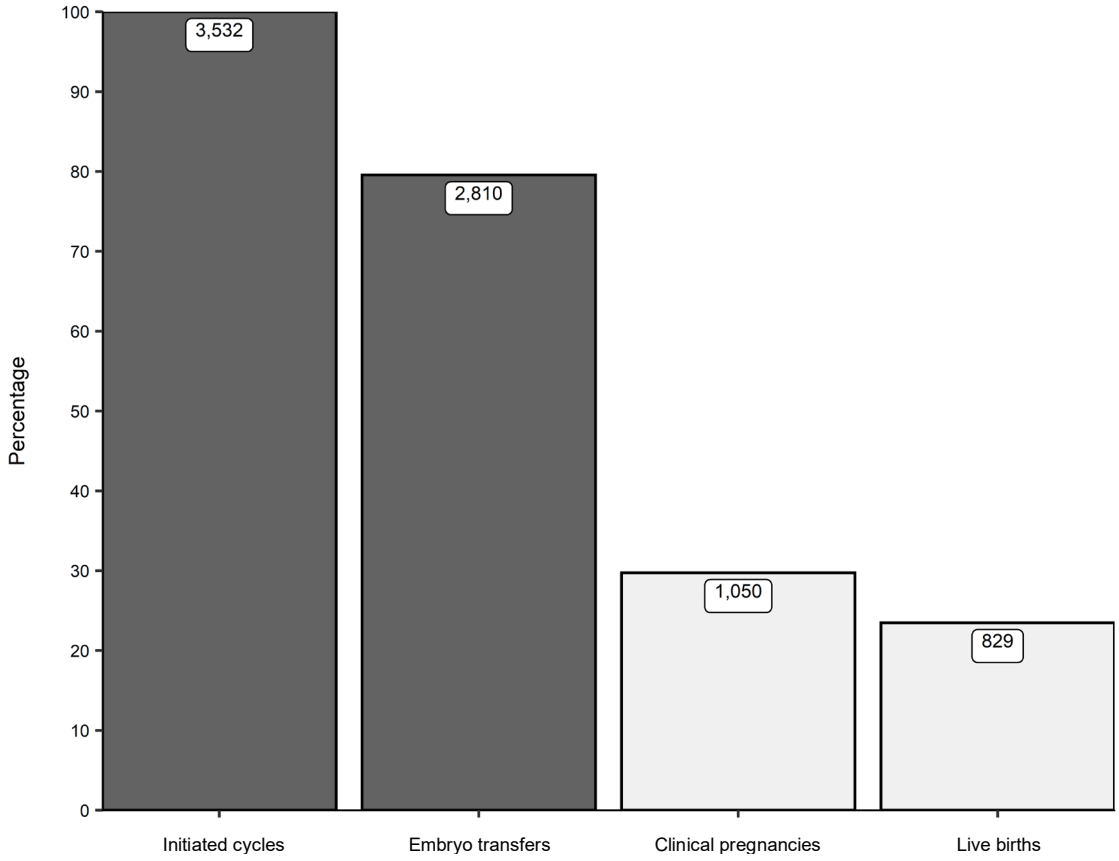


Figure 6: Progression of fresh and thaw oocyte/embryo recipient cycles, Australia and New Zealand, 2019

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

Of the 2,943 oocyte recipient cycles, 40.3% were fresh cycles and 59.7% were thaw cycles. The live birth rate per initiated cycle was 28.2% for thawed oocytes from oocyte recipient cycles, higher than for fresh oocyte recipient cycles (15.2%). Overall, the live birth rate per initiated oocyte/embryo recipient cycle was 23.5% compared to 16.5% for autologous fresh cycles (excluding freeze-all) and 28.9% for autologous thaw cycles.

The overall live birth rate per initiated cycle was 25.8% for embryo recipient cycles (Table 19).

Table 19: Outcomes of oocyte/embryo recipient cycles by treatment type, Australia and New Zealand, 2019

	Oocyte recipient			
Stage/outcome of treatment	**Fresh**	**Thaw**	**Embryo recipient**	**All**
Initiated cycles	1,187	1,756	589[(a)]	3,532
Embryo transfer cycles	530	1,723	557[(a)]	2,810
Clinical pregnancies	237	612	201	1,050
Live births	181	496	152	829
Live births per initiated cycle (%)	*15.2*	*28.2*	*25.8*	*23.5*
Live births per embryo transfer cycle (%)	*34.2*	*28.8*	*27.3*	*29.5*
Live births per clinical pregnancy (%)	*76.4*	*81.0*	*75.6*	*79.0*

a) Includes 2 fresh embryo recipient cycles

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 (25%) in women aged between 35 and 39. The overall live birth rate per initiated cycle was 23.5%, varying between 21.1% and 25% by recipient's age group (Table 20).

Table 20: Outcomes of oocyte/embryo recipient cycles by recipient's age group, Australia and New Zealand, 2019

	Age group (years)[(a)]					
Stage/outcome of treatment	**< 30**	**30–34**	**35–39**	**40–44**	**≥ 45**	**All**
Initiated cycles	185	462	783	1,209	893	3,532
Embryo transfer cycles	139	347	607	963	754	2,810
Clinical pregnancies	52	142	239	369	248	1,050
Live births	44	112	196	289	188	829
Live births per initiated cycle (%)	*23.8*	*24.2*	*25.0*	*23.9*	*21.1*	*23.5*
Live births per embryo transfer cycle (%)	*31.7*	*32.3*	*32.3*	*30.0*	*24.9*	*29.5*
Live births per clinical pregnancy (%)	*84.6*	*78.9*	*82.0*	*78.3*	*75.8*	*79.0*

(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 24.1% compared to 12.8% 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, 2019

	Age group (years)[a]				
Stage/outcome of treatment	**< 30**	**30–34**	**35–39**	**≥ 40**	**All**
Initiated cycles	1,119	1,185	1,016	211	3,532
Embryo transfer cycles	928	953	774	154	2,810
Clinical pregnancies	339	393	278	39	1,050
Live births	284	313	204	27	829
Live births per initiated cycle (%)	*25.4*	*26.4*	*20.1*	*12.8*	*23.5*
Live births per embryo transfer cycle (%)	*30.6*	*32.8*	*26.4*	*17.5*	*29.5*
Live births per clinical pregnancy (%)	*83.8*	*79.6*	*73.4*	*69.2*	*79.0*

(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 2,810 oocyte/embryo recipient cycles where embryos were transferred, 92.8% were SET, 7.2% were DET and less than 0.1% had three or more embryos transferred.

Overall, the live birth rate per oocyte/embryo recipient cycle where embryos were transferred was 31% in DET cycles compared with 29.4% 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, 2019

	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][d]
Embryo transfer cycles	467	19	553	53	1,587	130	2,607	203
Clinical pregnancies	189	5	216	23	564	53	969	81
Live births	151	5	177	19	438	39	766	63
Clinical pregnancies per embryo transfer cycle (%)	*40.5*	*26.3*	*39.1*	*43.4*	*35.5*	*40.8*	*37.2*	*39.9*
Live births per embryo transfer cycle (%)	*32.3*	*26.3*	*32.0*	*35.8*	*27.6*	*30.0*	*29.4*	*31.0*

(a) Recipient age at start of a treatment cycle.
(b) SET: single embryo transfer.
(c) DET: double embryo transfer.
(d) Includes 1 cycle where three or more embryos were transferred

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 10.4 percentage points (20.6% and 31% respectively) (Table 23).

Table 23: Outcomes of oocyte/embryo recipient cycles by recipient's age and stage of embryo development, Australia and New Zealand, 2019

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	45	441	72	535	281	1,436	398	2,412
Clinical pregnancies	16	178	19	220	70	547	105	945
Live births	12	144	16	180	54	423	82	747
Clinical pregnancies per embryo transfer cycle (%)	*35.6*	*40.4*	*26.4*	*41.1*	*24.9*	*38.1*	*26.4*	*39.2*
Live births per embryo transfer cycle (%)	*26.7*	*32.7*	*22.2*	*33.6*	*19.2*	*29.5*	*20.6*	*31.0*

(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 (94.2%) of oocyte/embryo recipient thaw cycles where a blastocyst was transferred used vitrified embryos, compared with 69.2% 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 (27.5%) (Table 24).

Table 24: Outcomes of oocyte/embryo recipient thaw cycles by stage of embryo development and embryo freezing methods, Australia and New Zealand, 2019

	Stage of embryo development					
	Cleavage embryo		Blastocyst		All	
Stage/outcome of treatment	Slow freezing	Vitrification	Slow freezing	Vitrification	Slow freezing	Vitrification
Embryo transfer cycles	74	166	119	1,919	193	2,085
Clinical pregnancies	18	33	48	713	66	746
Live births	13	27	40	567	53	594
Clinical pregnancies per embryo transfer cycle (%)	*24.3*	*19.9*	*40.3*	*37.2*	*34.2*	*35.8*
Live births per embryo transfer cycle (%)	*17.6*	*16.3*	*33.6*	*29.5*	*27.5*	*28.5*

4 Pregnancy and birth outcomes following autologous and recipient embryo transfer cycles in 2019

4.1 Clinical pregnancies

Clinical pregnancies overview

There were 58,107 autologous and recipient embryo transfer cycles undertaken in Australian and New Zealand fertility centres, of which 20,579 resulted in a clinical pregnancy. Of these clinical pregnancies, 18,321 (89%) were reported from fertility centres in Australia and 2,258 (11%) from New Zealand centres. Clinical pregnancies that resulted from other cycles are described in Chapter 5.

Of the 20,579 clinical pregnancies, 79.5% resulted in a birth and 20.1% resulted in early pregnancy loss (less than 20 weeks gestation or less than 400 grams birthweight). The outcomes of 65 (0.3%) 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 20,579 clinical pregnancies, 85.8% had one fetal heart (single fetus) detected, 2.9% had multiple fetal hearts (multiple fetuses) detected and 11.3% had no fetal heart detected at the time of first intrauterine ultrasound (Table 25). Multiple fetuses are closely related to the number of embryos transferred in ART treatment. Two fetal hearts were detected in 18.3% of clinical pregnancies following DET cycles compared with 1.6% 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, 2019

Number of fetal hearts	One embryo		Two embryos		Three or more embryos		All	
	n	%	n	%	n	%	n	%
0[(a)]	2,084	10.9	233	16.8	3	50.0	2,320	11.3
1	16,764	87.4	889	63.9	3	50.0	17,656	85.8
2	312	1.6	255	18.3	0	0.0	567	2.8
3 or 4	10	0.1	13	0.9	0	0.0	23	0.1
Not stated	12	0.1	1	0.1	0	0.0	13	0.1
Total	**19,182**	**100.0**	**1,391**	**100.0**	**6**	**100.0**	**20,579**	**100.0**

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

Early pregnancy loss

There were 4,145 early pregnancy losses (less than 20 weeks gestation or less than 400 grams birthweight) following embryo transfers, representing 20.1% of clinical pregnancies.

Table 26: Early pregnancy loss by pregnancy outcome and maternal age and number of embryos transferred, Australia and New Zealand, 2019

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	1,341	76	1,417	1,600	148	1,748	813	162	980
Miscarriage	*1,212*	*66*	*1,278*	*1,441*	*138*	*1,579*	*751*	*150*	*906*
Reduction or termination	*51*	*4*	*55*	*68*	*4*	*72*	*38*	*8*	*46*
Ectopic or heterotopic pregnancy	*78*	*6*	*84*	*91*	*6*	*97*	*24*	*4*	*28*
Birth	7,680	341	8,021	5,782	405	6,188	1,907	253	2,160
Not stated	26	2	28	27	3	30	6	1	7
Total	**9,047**	**419**	**9,466**	**7,409**	**556**	**7,966**	**2,726**	**416**	**3,147**
					%				
Early pregnancy loss	14.8	18.1	15.0	21.6	26.6	21.9	29.8	38.9	31.1
Miscarriage	*13.4*	*15.8*	*13.5*	*19.4*	*24.8*	*19.8*	*27.5*	*36.1*	*28.8*
Reduction or termination	*0.6*	*1.0*	*0.6*	*0.9*	*0.7*	*0.9*	*1.4*	*1.9*	*1.5*
Ectopic or heterotopic pregnancy	*0.9*	*1.4*	*0.9*	*1.2*	*1.1*	*1.2*	*0.9*	*1.0*	*0.9*
Birth	84.9	81.4	84.7	78.0	72.8	77.7	70.0	60.8	68.6
Not stated	0.3	0.5	0.3	0.4	0.5	0.4	0.2	0.2	0.2
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 16,369 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% (16,237) 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, 2019

	Autologous				Oocyte /embryo recipient		All	
	Fresh		Thaw					
Birth outcome	**n**	**%**	**n**	**%**	**n**	**%**	**n**	**%**
Live birth	5,994	99.2	9,414	99.2	829	99.0	16,237	99.2
< 37 weeks	*769*	*12.7*	*967*	*10.2*	*128*	*15.3*	*1,864*	*11.4*
≥ 37 weeks	*5,225*	*86.5*	*8,447*	*89.0*	*701*	*83.8*	*14,373*	*87.8*
Gestational age unknown	*0*	*0.0*	*0*	*0.0*	*0*	*0.0*	*0*	*0.0*
Stillbirth[(a)]	45	0.7	76	0.8	8	1.0	129	0.8
Not stated	2	0.0	1	0.0	0	0.0	3	0.0
Total	**6,041**	**100.0**	**9,491**	**100.0**	**837**	**100.0**	**16,369**	**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 16,369 births, 2.9% were multiple births (Table 28), a slightly lower proportion than in 2018 (3.2%) (Newman et al. 2020). By comparison, the proportion of multiple births in Australia from all conceptions in 2019 was 1.5% (AIHW, 2021).

Twin births accounted for 2.9% of births following embryo transfer cycles in 2019. Of twin births, 45.9% resulted from the transfer of two or more embryos. Of the 999 births following DET cycles, 21.8% were twins, markedly higher than the proportion following SET cycles (1.7%) (Table 28).

Table 28: Births by gestation and type of embryo transfer and number of embryos transferred, Australia and New Zealand, 2019

	Fresh			Thaw			
Gestation	**SET[(a)]**	**DET[(b)]**	**Three or more embryos**	**SET[(a)]**	**DET[(b)]**	**Three or more embryos**	**All**
				n			
Singleton	5,642	361	1	9,468	417	0	15,889
Multiple	112	107	0	147	114	0	480
Twin	*111*	*105*	*0*	*146*	*113*	*0*	*475*
Higher order multiple	*1*	*2*	*0*	*1*	*1*	*0*	*5*
Total	**5,754**	**468**	**1**	**9,615**	**531**	0	**16,369**
				%			
Singleton	98.1	77.1	100.0	98.5	78.5	0	97.1
Multiple	1.9	22.9	0.0	1.5	21.5	0	2.9
Twin	*1.9*	*22.4*	*0.0*	*1.5*	*21.3*	*0.0*	*2.9*
Higher order multiple	*0.0*	*0.4*	*0.0*	*0.0*	*0.2*	*0.0*	*0.0*
Total	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**0.0**	**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 35.3 years. This is 4.5 years older than the average age (30.8 years) of all women who gave birth in Australia in 2019 (AIHW, 2021).

Multiple birth rates were similar across age groups, ranging between 2.7% and 3.2% (Table 29). Of births following DET, the proportion of multiple births was higher for women aged under 35 (28.7%) compared with women aged 35–39 (21.3%) and women aged 40 or older (17%) (Table 29).

Table 29: Births by plurality and maternal age group and number of embryos transferred, Australia and New Zealand, 2019

	Age group (years)[a]								
	< 35			35–39			≥ 40		
Gestation	One embryo	Two embryos	All	One embryo	Two embryos	All[b]	One embryo	Two embryos	All
					n				
Singleton	6,531	209	6,740	6,086	310	6,397	2,493	259	2,752
Multiple	136	84	220	91	84	175	32	53	85
Twin	*135*	*84*	*219*	*90*	*83*	*173*	*32*	*51*	*83*
Higher order multiple	*1*	*0*	*1*	*1*	*1*	*2*	*0*	*2*	*2*
Total	**6,667**	**293**	**6,960**	**6,177**	**394**	**6,572**	**2,525**	**312**	**2,837**
					%				
Singleton	98.0	71.3	96.8	98.5	78.7	97.3	98.7	83.0	97.0
Multiple	2.0	28.7	3.2	1.5	21.3	2.7	1.3	17.0	3.0
Twin	*2.0*	*28.7*	*3.1*	*1.5*	*21.1*	*2.6*	*1.3*	*16.3*	*2.9*
Higher order multiple	*0.0*	*0.0*	*0.0*	*0.0*	*0.3*	*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 (53.6%) 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 4.5 years older than women who gave birth in Australia in 2019 and that there were more multiple births following ART treatment.

The caesarean section rate increased with advancing women's age at birth: 40.8% of women aged less than 30 had a caesarean section compared with 82.6% of women aged 45 or older (Table 30).

The caesarean section rate varied by plurality, with 52.7% for singleton births and 82% for multiple births (twins and triplets). The caesarean section rate for all women having a baby in Australia in 2019 was 35.5% for singleton births and 71.9% for multiple births (AIHW, 2021)

Table 30: Births by method of birth and maternal age group, Australia and New Zealand, 2019

	Age group (years)[(a)]					
Method of birth	**< 30**	**30–34**	**35–39**	**40–44**	**≥ 45**	**Total**
			n			
Caesarean section	630	2,608	3,585	1,682	262	8,767
Not stated	14	43	53	25	5	140
Other	902	2,763	2,934	813	50	7,462
Total	**1,546**	**5,414**	**6,572**	**2,520**	**317**	**16,369**
			%			
Caesarean section	40.8	48.2	54.5	66.7	82.6	53.6
Not stated	0.9	0.8	0.8	1.0	1.6	0.9
Other	58.3	51.0	44.6	32.3	15.8	45.6
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 16,854 babies born to women who had autologous and recipient embryo transfer cycles, 89.6% (15,100) were reported from fertility centres in Australia and 10.4% (1,754) from fertility centres in New Zealand. Of the 16,854 babies, 94.3% were singletons, 5.6% were twins and 0.9% were triplets. There were 16,704 liveborn babies (99%). The birth status was not reported for 3 (0.4%) babies.

Sex distribution in liveborn babies

There were 8,471 (50.7%) liveborn male babies, 8,193 (49%) liveborn female babies and 40 (0.3%) liveborn babies where sex was not stated. For the 16,664 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 2019 was 105.9 male liveborn babies per 100 female liveborn babies (AIHW, 2021).

Liveborn babies following cleavage stage embryo transfers had a sex ratio of 108 male babies for every 100 female babies. Liveborn babies following blastocyst transfers had a sex ratio of 103 male babies for every 100 female babies. In comparison, in 2018, liveborn babies following cleavage stage embryo transfers had a sex ratio of 95 male babies for every 100 female babies, and liveborn babies following blastocyst transfers had a sex ratio of 104 male babies for every 100 female babies (Newman et al. 2020).

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 2019 (AIHW, 2021).

There were 14% of babies born preterm (less than 37 weeks gestation), which is higher than the proportion of preterm babies born in Australia in 2019 (8.6%) (AIHW, 2021). For ART singletons and twins, 10.1% and 78.1% were preterm compared with 6.8% and 65.4% of singletons and twins born in Australia in 2019 (AIHW, 2021).

Table 31: Babies by gestational age and plurality, Australia and New Zealand, 2019

Gestational age (weeks)	Singletons		Twins		Higher order multiples		Total	
Median	*38*		*35*		*31*		*38*	
	n	**%**	**n**	**%**	**n**	**%**	**n**	**%**
≤ 27	*175*	*1.1*	*62*	*6.5*	*3*	*20.0*	*240*	*1.4*
28–31	*153*	*1.0*	*96*	*10.1*	*6*	*40.0*	*255*	*1.5*
32–36	*1,279*	*8.0*	*584*	*61.5*	*6*	*40.0*	*1,869*	*11.1*
≤ 36	1,607	10.1	742	78.1	15	100.0	2,364	14.0
≥ 37	14,282	89.9	208	21.9	0	0.0	14,490	86.0
Not stated		0.0	0	0.0	0	0.0	0	0.0
Total	**15,889**	**100.0**	**950**	**100.0**	**15**	**100.0**	**16,854**	**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 2019. Singletons following SET cycles had a lower proportion of preterm birth (10%) than singletons following DET cycles (12.3%). The overall proportions of preterm singletons (10.1%) and twins (78.1%) born to women who had embryo transfer cycles in 2019 were higher than the overall proportions of preterm singletons and twins born in Australia in 2019 (6.8% and 65.4% respectively) (AIHW, 2021).

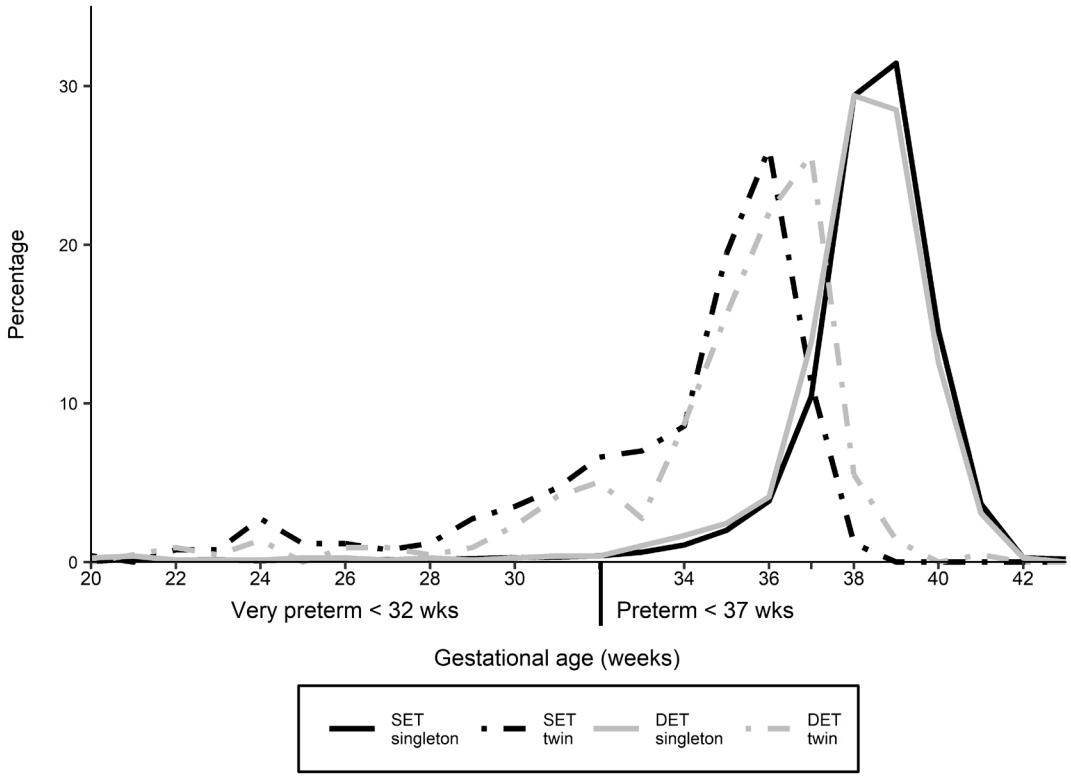


Figure 7: Percentage of babies born following embryo transfer cycles by gestational age, Australia and New Zealand, 2019

Birthweight of liveborn babies

The average birthweight for liveborn babies to women who had autologous and recipient embryo transfer cycles was 3,216 grams. This is slightly lower than the average birthweight of all liveborn babies (3,321 grams) in Australia in 2019 (AIHW, 2021). Approximately one in ten (10.6%) of the 16,704 liveborn babies were low birthweight (less than 2,500 grams) (Table 32).

The average birthweight was 3,277 grams and 2,210 grams for liveborn ART singletons and twins respectively. Low birthweight was reported for 7.2% of liveborn singletons following SET and 8.8% of liveborn singletons following DET in comparison with 5.2% of singleton births in Australia in 2019 (AIHW, 2021). For ART twins 65.9% were reported as low birthweight in comparison with 55% of twin births in Australia in 2019 (AIHW, 2021).

Table 32: Liveborn babies by birthweight group and plurality, Australia and New Zealand, 2019

	Singletons				
Birthweight (grams)	SET[(a)]	DET[(b)(c)]	Twins	Higher order multiples	Total[(c)]
			n		
< 1,000	*74*	*5*	*35*	*3*	*117*
1,000–1,499	*95*	*7*	*62*	*5*	*169*
1,500–1,999	*200*	*12*	*168*	*4*	*384*
2,000–2,499	*713*	*43*	*343*	*1*	*1,101*
< 2,500	1,082	67	608	13	1,771
2,500–2,999	2,579	133	229	0	2,941
3,000–3,499	5,752	292	65	0	6,109
3,500–3,999	4,180	209	10	0	4,399
≥ 4,000	1,221	57	0	0	1,278
Not stated	184	11	11	0	206
Total	**14,998**	**770**	**923**	**13**	**16,704**
			%		
< 1,000	*0.5*	*0.7*	*3.8*	*23.1*	*0.7*
1,000–1,499	*0.6*	*0.9*	*6.7*	*38.5*	*1.0*
1,500–1,999	*1.3*	*1.6*	*18.2*	*30.8*	*2.3*
2,000–2,499	*4.8*	*5.7*	*37.2*	*7.7*	*6.6*
< 2,500	7.2	8.8	65.9	100.0	10.6
2,500–2,999	17.2	17.3	24.8	0.0	17.6
3,000–3,499	38.4	37.9	7.0	0.0	36.6
3,500–3,999	27.9	27.1	1.1	0.0	26.3
≥ 4,000	8.1	7.4	0.0	0.0	7.7
Not stated	1.2	1.4	1.2	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 195 reported perinatal deaths, including 147 stillbirths and 48 neonatal deaths. The perinatal mortality rate in 2019 was 11.6 deaths per 1,000 births (Table 33), which was slightly higher than the rate of 9.4 per 1,000 births for all births in Australia in 2019 (AIHW, 2021). Singletons had a markedly lower perinatal mortality rate (9.7 deaths per 1,000 births) compared with multiples (42.5 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 2019, information relating to birth outcomes was not stated for 3 births.

Table 33: Perinatal mortality of babies by type of death and plurality, Australia and New Zealand, 2019

			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	15,889	15,768	118	7.4	36	2.3	154	9.7
Multiples	965	936	29	30.1	12	12.8	41	42.5
Total	**16,854**	**16,704**	**147**	**8.7**	**48**	**2.9**	**195**	**11.6**

(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 3 babies.

5 Other cycle types, procedures and treatment complications in 2019

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 351 gestational surrogacy cycles in 2019, including 225 gestational carrier cycles and 126 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 225 gestational carrier cycles, 215 (95.6%) involved the transfer of at least one embryo, 89 (39.6%) resulted in a clinical pregnancy and 73 (32.4%) 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, 14.2% also involved PGT. The number of cycles involving PGT increased by 17.8% from 9,124 in 2018 (Newman et al. 2020) to 10,748 in 2019 (Table 34).

Among the 10,748 PGT cycles, 3,754 (34.9%) were part of a *freeze-all* cycle. Over two thirds (69.5%) of the 10,748 cycles where PGT was performed, were in women aged 35 or older. Among the 5,431 thaw cycles where PGT was performed 98.6% (5,356) involved vitrified embryos and 1.4% (75) slow frozen embryos. Of the 6,994 PGT cycles (excluding freeze-all cycles), 89.9% (6,287) had embryos transferred and resulted in 2,955 clinical pregnancies and 2,460 live births. The clinical pregnancy rate and live birth rate per embryo transfer were 47% and 39.1% 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, 2019

	Stage of treatment	
Type of embryo	**Number of cycles with embryo fertilised/thawed**	**Number of cycles with PGT**
Fresh	40,660	5,317
Freeze-all cycles	*11,684*	*3,754*
Thaw	34,970	5,431
Total	**75,630**	**10,748**

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 7,785 assisted hatching cycles reported in 2019 that did not occur in a PGT cycle. Of these, 6,148 (79%) had embryos transferred, resulting in 2,295 (29.5%) clinical pregnancies and 1,730 (22.2%) live births. There were 1,796 babies born following assisted hatching cycles, including 1,698 singletons and 98 twin babies.

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 2019, 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, 2019

	Number of oocytes collected						
	None	**1–4**	**5–9**	**10–14**	**15–19**	**≥ 20**	**All**
Cycles with OHSS requiring hospitalisation	2	3	20	41	42	76	184
Cycles with OPU	910	11,150	16,030	10,073	5,174	4,073	47,410
OHSS per OPU cycle (%)	*0.2*	*0.0*	*0.1*	*0.4*	*0.8*	*1.9*	*0.4*

6 Donor sperm insemination cycles in 2019

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.

Information on ART cycles using donated sperm are presented in Supplementary Table S2.

Number and outcomes of DI cycles

In 2019, there were 3,010 DI cycles reported, which included 32.8% (988) undertaken with controlled ovarian hyperstimulation and 67.2% (2,022) undertaken in unstimulated cycles. Of all DI cycles, 15.8% resulted in a clinical pregnancy and 13.1% resulted in a live birth (Table 36). The multiple birth rate from births following DI cycles was 4.6%.

The average age of women who had a DI cycle was 34.6 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, 17% resulted in a live birth, compared with 3.3% 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, 2019

	Age group (years)[(a)]				
Stage/outcome of treatment	**< 30**	**30–34**	**35–39**	**≥ 40**	**Total**
DI cycles	452	968	1,161	429	3,010
Clinical pregnancies	84	187	181	23	475
Live births	77	164	140	14	395
Clinical pregnancies per DI cycle (%)	*18.6*	*19.3*	*15.6*	*5.4*	*15.8*
Live births per DI cycle (%)	*17.0*	*16.9*	*12.1*	*3.3*	*13.1*
Live births per clinical pregnancy (%)	*91.7*	*87.7*	*77.3*	*60.9*	*83.2*

(a) Age at start of a treatment cycle.

Clinical pregnancies following DI cycles

Of the 475 clinical pregnancies following DI cycles, 83.2% resulted in a birth, 16.8% ended in early pregnancy loss (including 14.7% miscarriages, 1.7% ectopic/heterotopic pregnancies and 0.4% reductions/termination). Of the 395 births, 377 (95.4%) were singleton births and 18 (4.6%) were twin births.

Perinatal outcomes of babies

There were 413 babies born to women who had DI treatment, all of which were liveborn babies. Of these liveborn babies, 41 (9.9%) were born preterm (less than 37 weeks gestation). The mean birthweight of liveborn babies following DI treatment was 3,296 grams. This was higher than the mean birthweight of liveborn babies following autologous and recipient embryo transfer cycles (3,221 grams). Thirty-five liveborn babies (8.5%) were born with low birthweight (less than 2,500 grams).

7 Trends in ART treatment and outcomes: 2015 – 2019

This section includes autologous cycles, donation/recipient cycles, surrogacy cycles and GIFT cycles undertaken in Australia and New Zealand from 2015 to 2019. It does not include DI cycles.

ART treatment and outcomes

In 2019, there were 88,929 initiated ART cycles in Australia and New Zealand, a 5.8% increase on 2018. Of these initiated ART cycles, 53,736 were fresh cycles, representing an increase of 6.3% on 2018 (Table 37).

The proportion of initiated fresh cycles reaching embryo transfer has decreased from 57.4% in 2015 to 45% in 2019 partly due to changes in clinical practice, including increasing proportions of *freeze-all* cycles. Since 2015 there has been an average 13.5% yearly increase in the number of *freeze-all* cycles (Table 37)

Between 2015 and 2019, the live birth rate per initiated fresh non *freeze-all* cycle decreased from 16.6% to 16% (Table 37). However, the live birth rate per embryo transfer cycle marginally increased from 23.9% in 2015 to 25.5% in 2019.

Table 37: Number of fresh cycles by stage/outcome of treatment, Australia and New Zealand, 2015 to 2019

Stage/outcome of treatment	2015	2016	2017	2018	2019
Initiated cycles[(a)]	48,367	49,826	50,096	50,559	53,736
Cycles with OPU[(b)]	42,937	43,752	43,814	45,656	47,410
Freeze-all[(c)]	8,336	11,285	12,110	13,520	15,079
Embryo transfers	27,770	25,405	24,588	24,254	24,206
Clinical pregnancies	8,446	7,708	7,694	7,612	7,934
Live births	6,628	6,075	5,929	5,961	6,177
Clinical pregnancy per embryo transfer (%)	*30.4*	*30.3*	*31.3*	*31.4*	*32.8*
Clinical pregnancies per initiated cycle (%)	*17.5*	*15.5*	*15.4*	*15.1*	*14.8*
Live births per embryo transfer (%)	*23.9*	*23.9*	*24.1*	*24.6*	*25.5*
Live births per initiated cycle (%)	*13.7*	*12.2*	*11.8*	*11.8*	*11.5*
Live births per initiated non freeze-all cycle (%)[(d)]	*16.6*	*15.8*	*15.6*	*16.1*	*16.0*

(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, 33,193 initiated thaw cycles were undertaken in 2019, an increase of 5% on 2018 (Table 38). The live birth rate per initiated thaw cycle increased from 25.3% in 2015 to 28.8% in 2019 (Table 38).

For the period 2015 to 2019 the clinical pregnancy and live birth rate per embryo transfer has remained relatively 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, 2015 to 2019

Stage/outcome of treatment	2015	2016	2017	2018	2019
Initiated cycles[(a)]	29,354	31,236	32,119	33,505	35,193
Embryo transfers	27,742	29,974	31,006	32,422	34,116
Clinical pregnancies	9,280	10,561	11,166	11,902	12,734
Live births	7,412	8,440	8,953	9,514	10,133
Clinical pregnancy per embryo transfer (%)	*33.5*	*35.2*	*36.0*	*36.7*	*37.3*
Clinical pregnancies per initiated cycle (%)	*31.6*	*33.8*	*34.8*	*35.5*	*36.2*
Live births per embryo transfer (%)	*26.7*	*28.2*	*28.9*	*29.3*	*29.7*
Live births per initiated cycle (%)	*25.3*	*27.0*	*27.9*	*28.4*	*28.8*

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

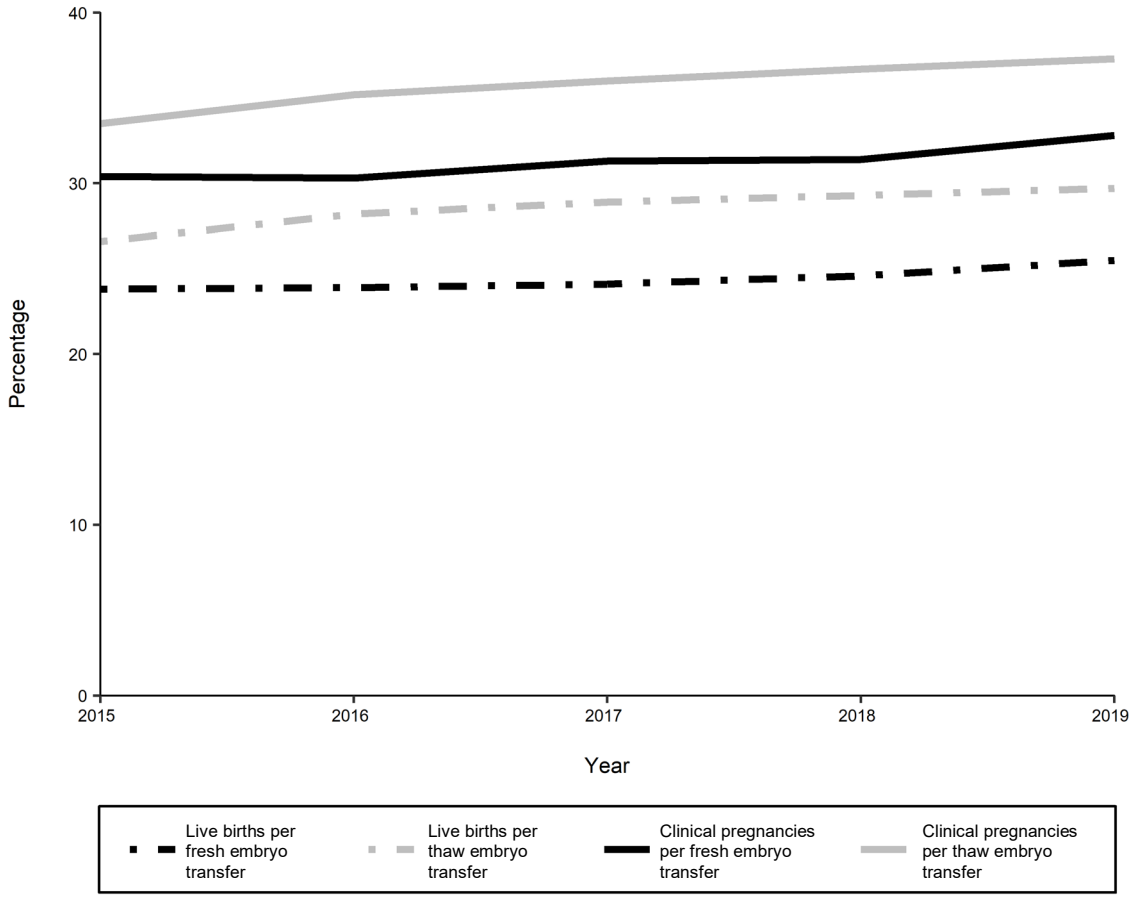


Figure 8: Clinical pregnancy and live birth rates per fresh and thaw embryo transfers, Australia and New Zealand, 2015 to 2019

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 2019 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 2015 and 2019, the live birth rate from fresh and thaw cycles per OPU cycle increased from 32.7% to 34.4% (Table 39).

Table 39: Outcomes of fresh and thaw cycles following OPU, Australia and New Zealand, 2015 to 2019

Outcome of treatment	2015	2016	2017	2018	2019
Cycles with OPU[(a)]	42,937	43,752	43,814	45,656	47,410
Clinical pregnancies	17,726	18,269	18,860	19,514	20,668
Live births	14,040	14,515	14,882	15,475	16,310
Clinical pregnancies from fresh and thaw cycles per OPU cycles[(b)]	*41.3*	*41.8*	*43.0*	*42.7*	*43.6*
Live births from fresh and thaw cycles per OPU cycle[(c)]	*32.7*	*33.2*	*34.0*	*33.9*	*34.4*

(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 2019. The proportion of multiple births decreased from 4.4% in 2015 to 2.9% in 2019 (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, 2015 to 2019

Gestation	2015		2016		2017		2018		2019	
	n	%	n	%	n	%	n	%	n	%
Singleton	13,519	95.6	14,098	96.2	14,528	96.4	15,129	96.8	15,962	97.1
Multiple	628	4.4	554	3.8	539	3.6	505	3.2	480	2.9
Twin	*615*	4.3	*543*	3.7	*532*	*3.5*	*497*	*3.2*	*475*	*2.9*
Higher order multiple	*14*	0.1	*11*	0.1	*7*	*0.0*	*8*	*0.1*	*5*	*0.0*
Total[(a)]	**14,148**	**100.0**	**14,652**	**100.0**	**15,067**	**100.0**	**15,634**	**100.0**	**16,442**	**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 2015 and 2019. The average age of women having autologous cycles remained stable over the period at 35.8 years. The proportion of autologous cycles in women aged 40 and older ranged between 23.4% and 24.8% between 2015 and 2019 (Table 41).

Table 41: Number of fresh and thaw autologous cycles by women's age group, Australia and New Zealand, 2015 to 2019

Age group (years)[(a)]	2015		2016		2017		2018		2019	
Mean	*35.8*		*35.8*		*35.7*		*35.8*		*35.8*	
	n	%	n	%	n	%	n	%	n	%
< 30	7,760	10.6	7,832	10.3	8,219	10.6	7,764	9.8	8,334	9.9
30–34	21,039	28.6	22,118	29.0	22,482	29.1	23,093	29.2	23,961	28.5
35–39	26,444	36.0	27,608	36.2	28,547	36.9	29,422	37.2	32,038	38.1
40–44	16,935	23.0	17,279	22.7	16,544	21.4	17,284	21.9	18,173	21.6
≥ 45	1,303	1.8	1,418	1.9	1,561	2.0	1,509	1.9	1,575	1.9
Total	**73,481**	**100.0**	**76,255**	**100.0**	**77,353**	**100.0**	**79,072**	**100.0**	**84,081**	**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 62.9% in 2015 to 58.2% in 2019. The proportion of blastocyst transfer cycles increased from 73.5% in 2015 to 88.3% in 2019 (Table 42).

Table 42: Number of embryo transfer cycles by treatment type, Australia and New Zealand, 2015 to 2019

Treatment type[a] and procedure	2015		2016		2017		2018		2019	
	n	%	n	%	n	%	n	%	n	%
Fertilisation procedure										
IVF	20,568	37.1	19,507	35.2	20,325	36.6	22,473	39.7	24,405	41.8
ICSI[b]	34,941	62.9	34,830	62.9	34,597	62.2	34,201	60.3	33,917	58.2
Not stated	0	0.0	1,040	1.9	672	1.2	0	0.0	0	0.0
Total	**55,509**	**100.0**	**55,377**	**100.0**	**55,594**	**100.0**	**56,674**	**100.0**	**58,322**	**100.0**
Stage of embryo development										
Cleavage stage	14,734	26.5	11,939	21.6	10,018	18.0	7,566	13.4	6,833	11.7
Blastocyst[c]	40,775	73.5	43,438	78.4	45,576	82.0	49,108	86.6	51,489	88.3
Total	**55,509**	**100.0**	**55,377**	**100.0**	**55,594**	**100.0**	**56,674**	**100.0**	**58,322**	**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 2015 and 2019 (Table 43).

Table 43: Number of embryo transfer cycles by cryopreservation method and stage of embryo development, Australia and New Zealand, 2015 to 2019

Treatment type and procedure	2015		2016		2017		2018		2019	
	n	%	n	%	n	%	n	%	n	%
Cleavage stage										
Slow frozen	2,767	64.0	1,631	50.7	1,033	42.4	710	37.4	486	30.7
Vitrification[(a)]	1,555	36.0	1,583	49.7	1,405	57.6	1,186	62.6	1,095	69.3
Not stated	2	0.0	0	0.0	0	0.0	0	0.0	0	0.0
Total	**4,324**	**100.0**	**3,214**	**100.0**	**2,438**	**100.0**	**1,896**	**100.0**	**1,581**	**100.0**
Blastocyst										
Slow frozen	3,237	13.8	3,266	12.2	2,440	8.5	1,801	5.9	1,478	4.5
Vitrification[(a)]	20,161	86.1	23,494	87.8	26,128	91.5	28,725	94.1	31,055	95.5
Not stated	20	0.1	0	0.0	0	0.0	0	0.0	0	0.0
Total	**23,418**	**100.0**	**26,760**	**100.0**	**28,568**	**100.0**	**30,526**	**100.0**	**32,533**	**100.0**

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

Number of embryos transferred per embryo transfer cycle

There has been an ongoing shift towards performing SET cycles in Australia and New Zealand. In 2015, the proportion of SET cycles accounted for 85.7% of embryo transfer cycles increasing to 91.9% in 2019 (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, 2015 to 2019

Number of embryos transferred	2015	2016	2017	2018	2019
One embryo	85.7	87.7	89.4	90.6	91.9
Two embryos	14.0	12.1	10.5	9.3	8.0
Three or more embryos	0.3	0.2	0.1	0.1	0.1

8 Women undertaking autologous treatment in 2019

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 2019. 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 43,862 women who undertook 84,081 autologous fresh and/or thaw cycles in Australia and New Zealand in 2019. Of these women, 39,706 had treatment in Australia, 7,208 in New Zealand, including 16 having treatment in both Australia and New Zealand.

On average, 1.9 fresh and/or thaw cycles per woman were undertaken in 2019, 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 (51.9%) of the women had two or more autologous treatment cycles compared with 47.3% of women in New Zealand. In line with this, 10.7% of women in Australia had four or more cycles in 2019 compared with 5.4% 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, 2019

Number of cycles	Australia		New Zealand		All	
	n	%	n	%	n	%
One	19,100	48.1	2,199	52.7	21,285	48.5
Two	10,950	27.6	1,243	29.8	12,187	27.8
Three	5,417	13.6	504	12.1	5,921	13.5
Four or more	4,239	10.7	226	5.4	4,469	10.2
Total	**39,706**	**100.0**	**4,172**	**100.0**	43,862	**100.0**

Note: Only women who undertook cycles in 2019 are included. Sixteen women had treatment in both Australia and New Zealand.

Women who undertook autologous fresh cycles

There were 51,453 fresh cycles undertaken by 34,619 women in Australia and New Zealand in 2019; an average of 1.5 fresh cycles per woman. Younger women had fewer fresh cycles with around one in five (22.0%) women aged under 30 having two or more autologous fresh cycles compared to nearly one in three (32.3%) 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 7.6% 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, 2019

	Age group (years)[(a)]					
Number of cycles	**< 30**	**30–34**	**35–39**	**40–44**	**≥ 45**	**All**
			n			
One	3,009	7,403	8,788	3,845	375	23,420
Two	646	1,947	2,894	1,817	153	7,457
Three	159	511	964	822	57	2,513
Four or more	44	186	421	537	41	1,229
Total	**3,858**	**10,047**	**13,067**	**7,021**	**626**	**34,619**
			%			
One	78.0	73.7	67.3	54.8	59.9	67.7
Two	16.7	19.4	22.1	25.9	24.4	21.5
Three	4.1	5.1	7.4	11.7	9.1	7.3
Four or more	1.1	1.9	3.2	7.6	6.5	3.6
Total	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**

(a) Age at start of first autologous fresh cycle in 2019.

Women who undertook autologous thaw cycles

There were 32,028 thaw cycles undertaken by 22,213 women in Australia and New Zealand in 2019; an average of 1.4 thaw cycles per woman. Thirty seven percent of women aged under 30 had two or more thaw cycles compared with 17.9% 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, 2019

	Age group (years)[a]					
Number of cycles	**< 30**	**30–34**	**35–39**	**40–44**	**≥ 45**	**All**
			n			
One	1,463	4,564	5,889	2,732	253	14,901
Two	558	1,686	1,977	810	44	5,075
Three	198	551	631	192	6	1,578
Four or more	99	252	232	71	5	659
Total	**2,318**	**7,053**	**8,729**	**3,805**	**308**	**22,213**
			%			
One	63.1	64.7	67.5	71.8	82.1	67.1
Two	24.1	23.9	22.6	21.3	14.3	22.8
Three	8.5	7.8	7.2	5.0	1.9	7.1
Four or more	4.3	3.6	2.7	1.9	1.6	3.0
Total	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**

(a) Age at start of first autologous thaw cycle in 2019.

9 Cycle-specific rates for women who started their first ART treatment cycle in 2017

This chapter presents information for the cohort of women who started their first ART treatment cycle between 1 January 2017 and 31 December 2017. 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 2019 or until they achieved a live birth (a birth of at least one liveborn baby) up to and including 31 October 2020. 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 2019 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 2017, 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 2017, 16,586 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 2,681 women representing 8.4% of all women having autologous fresh cycles in 2017. Of the 16,586 women identified as having their first fresh autologous cycle in 2017, 1285 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 15,301 women who undertook their first autologous (non *freeze-all*) fresh cycle in 2017. 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 2017, <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 (106 women and 20 live births) undertaking 11 or more treatment cycles between 1 January 2017 and 31 December 2019.

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 2019, 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 2017 and 31 December 2017, Australia and New Zealand

	Age group (years)[(b)]					
Cycle number	**< 30**	**30-34**	**35-39**	**40-44**	**≥ 45**	**All**
			n			
One	994	2,055	1,815	760	98	5,722
Two	539	1,211	1,274	593	49	3,666
Three	310	742	799	415	40	2,306
Four	180	448	499	250	17	1,394
Five	105	272	313	159	6	855
Six	56	169	186	111	1	523
Seven	31	89	119	74	5	318
Eight	28	51	74	47	1	201
Nine	15	32	47	37	1	132
Ten or more	10	43	72	58	1	184
Total	**2,268**	**5,112**	**5,198**	**2,504**	**219**	**15,301**
			%			
One	43.8	40.2	34.9	30.4	44.7	37.4
Two	23.8	23.7	24.5	23.7	22.4	24.0
Three	13.7	14.5	15.4	16.6	18.3	15.1
Four	7.9	8.8	9.6	10.0	7.8	9.1
Five	4.6	5.3	6.0	6.3	2.7	5.6
Six	2.5	3.3	3.6	4.4	0.5	3.4
Seven	1.4	1.7	2.3	3.0	2.3	2.1
Eight	1.2	1.0	1.4	1.9	0.5	1.3
Nine	0.7	0.6	0.9	1.5	0.5	0.9
Ten or more	0.4	0.8	1.4	2.3	0.5	1.2
Total	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**

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

(b) Age at start of first autologous fresh ART treatment cycle (excluding *freeze-all* cycles) undertaken in 2017.

Note: Women who started their first autologous fresh non-*freeze-all* ART treatment cycle between 1 January 2017 and 31 December 2017 and were followed through subsequent fresh and thaw cycles, excluding *freeze-all* cycles, until 31 December 2019 or birth of a liveborn baby up to 31 October 2020.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 2017. 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 2017–2019 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,17.5% 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 2019. For example, 25.6% 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 2017 and 31 December 2017, 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	15,301	3,782	24.7	1,941	16.9
Two	9,579	2,124	22.2	1,541	20.7
Three	5,913	1,135	19.2	1,171	24.5
Four	3,607	669	18.5	725	24.7
Five	2,213	388	17.5	467	25.6
Six	1,358	221	16.3	302	26.6
Seven	835	108	12.9	210	28.9
Eight	517	67	13.0	134	29.8
Nine	316	38	12.0	94	33.8
Ten	184	17	9.2	61	36.5

(a) Cycle one represents a woman's first autologous (non *freeze-all*) fresh ART treatment cycle between 1 January 2017 and 31 December 2017. Cycles two to ten could be either a fresh or thaw cycle (excluding *freeze-all* cycles) undertaken by a woman until 31 December 2019 or birth of a liveborn baby up to 31 October 2020. 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 2019 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 2017 and 31 December 2017, 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	2,268	797	35.1	197	13.4
Two	1,274	379	29.7	160	17.9
Three	735	203	27.6	107	20.1
Four	425	112	26.4	68	21.7
Five	245	60	24.5	45	24.3
Six	140	34	24.3	22	20.8
Seven	84	18	21.4	13	19.7
Eight	53	13	24.5	15	37.5
Nine	25	10	40.0	5	33.3
Ten	10	4	40.0	1	16.7

(a) Cycle one represents a woman's first autologous (non *freeze-all*) fresh ART treatment cycle between 1 January 2017 and 31 December 2017. Cycles two to ten could be either a fresh or thaw cycle (excluding *freeze-all* cycles) undertaken by a woman until 31 December 2019 or birth of a liveborn baby up to 31 October 2020. 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 2019 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 2017 and 31 December 2017, 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	5,112	1,648	32.2	407	11.7
Two	3,057	835	27.3	376	16.9
Three	1,846	489	26.5	253	18.6
Four	1,104	276	25.0	172	20.8
Five	656	151	23.0	121	24.0
Six	384	101	26.3	68	24.0
Seven	215	46	21.4	43	25.4
Eight	126	27	21.4	24	24.2
Nine	75	13	17.3	19	30.6
Ten	43	7	16.3	17	47.2

(a) Cycle one represents a woman's first autologous (non *freeze-all*) fresh ART treatment cycle between 1 January 2017 and 31 December 2017. Cycles two to ten could be either a fresh or thaw cycle (excluding *freeze-all* cycles) undertaken by a woman until 31 December 2019 or birth of a liveborn baby up to 31 October 2020. 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 2019 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 2017 and 31 December 2017, 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	5,198	1,130	21.7	685	16.8
Two	3,383	768	22.7	506	19.3
Three	2,109	367	17.4	432	24.8
Four	1,310	229	17.5	270	25.0
Five	811	148	18.2	165	24.9
Six	498	75	15.1	111	26.2
Seven	312	38	12.2	81	29.6
Eight	193	23	11.9	51	30.0
Nine	119	11	9.2	36	33.3
Ten	72	5	6.9	25	37.3

(a) Cycle one represents a woman's first autologous (non-*freeze-all*) fresh ART treatment cycle between 1 January 2017 and 31 December 2017. Cycles two to ten could be either a fresh or thaw cycle (excluding *freeze-all* cycles) undertaken by a woman until 31 December 2019 or birth of a liveborn baby up to 31 October 2020. 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 2019 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 2017 and 31 December 2017, 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	2,504	204	8.1	556	24.2
Two	1,744	141	8.1	452	28.2
Three	1,151	76	6.6	339	31.5
Four	736	52	7.1	198	28.9
Five	486	29	6.0	130	28.4
Six	327	11	3.4	100	31.6
Seven	216	6	2.8	68	32.4
Eight	142	4	2.8	43	31.2
Nine	95	4	4.2	33	36.3
Ten	58	1	1.7	17	29.8

(a) Cycle one represents a woman's first autologous (non *freeze-all*) fresh ART treatment cycle between 1 January 2017 and 31 December 2017. Cycles two to ten could be either a fresh or thaw cycle (excluding *freeze-all* cycles) undertaken by a woman until 31 December 2019 or birth of a liveborn baby up to 31 October 2020. 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 2019 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 Devora Lieberman)

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 (Dr Robert Woolcott)

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 Simone Campbell)

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 Irving Korman)

Monash IVF Townsville, (Dr Irving Korman)

Monash IVF Auchenflower, Auchenflower (Dr Irving Korman)

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)

Family Fertility Centre – Ashford (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 Irena Nikakis)

TasIVF Hobart, Hobart (Dr Lyndon Hale)

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 Fleur Cattrall)

Melbourne IVF, East Melbourne (Dr Fleur Cattrall)

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)

Newlife IVF, Boxhill (Dr Nicole Hope)

Number 1 Fertility, Geelong (Dr Lynn Burmeister)

Number 1 Fertility, East Melbourne (Dr Lynn Burmeister)

Reproductive Services, Parkville (Dr Kate Stern)

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 (Dr Kate van Harselaar)

Fertility Associates Wellington, Wellington (Dr Andrew Murray)

Fertility Plus, Auckland (Professor 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 95 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 2019, information relating to pregnancy and birth outcomes was not provided for 0.3% of clinical pregnancies.

The Reproductive Technology Accreditation Committee (RTAC) of FSANZ 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 and New Zealand.

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 2019, and the resulting pregnancies and births. The babies included in this report were conceived following treatment cycles undertaken in 2019 and were born in either 2019 or 2020. 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 2019.

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 2017.

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.

Note that some contributing clinics may have closed or changed their name since 2019. The Medical Director listed is based on information provided by the FSANZ at the time this report was prepared.

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, either liveborn or stillborn.

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.

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List of Figures

List of Tables

There were **88,929** ART treatment cycles reported from Australian and New Zealand fertility clinics in 2019, resulting in **16,777** liveborn babies following ART treatment.