Assisted reproductive technology in Australia and New Zealand 2021

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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The ANZARD is a collaborative effort between the National Perinatal Epidemiology and Statistics Unit (NPESU), the Fertility Society of Australia and New Zealand (FSANZ) and ART Units 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 ART Units must be reported to the ANZARD as part of their accreditation by the Reproductive Technology Accreditation Committee of the FSANZ.

A number of organisations and people make the publication of this annual report possible. Firstly, we would like to thank all staff in the ART Units for their efforts in compiling the data and providing additional information when requested. A complete list of all contributing ART Units can be found in Appendix A. We also thank Professor Luk Rombauts, Dr Christopher Copeland, Professor Michael Chapman, Dr David Molloy, Dr Clare Boothroyd, Jeanette MacKenzie, Dr Natalie Hesketh, Associate Professor Peter Illingworth and Maree Pickens for peer reviewing this report. We would also like to acknowledge the support of the NPESU by UNSW and gratefully acknowledge the financial support from the FSANZ for the compilation of ANZARD and the preparation of this report.

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Abbreviations

ANZARD	Australian and New Zealand Assisted Reproduction Database
ART	assisted reproductive technology
DET	double embryo transfer
DI	donor (sperm) insemination
FSANZ	Fertility Society of Australia and New Zealand
FSH	follicle stimulating hormone
GIFT	gamete intrafallopian transfer
hCG	human chorionic gonadotropin
ICSI	intracytoplasmic sperm injection
IVF	in vitro fertilisation
IUI	intrauterine insemination
LMP	last menstrual period
NPESU	National Perinatal Epidemiology and Statistics Unit
OHSS	ovarian hyperstimulation syndrome
OPU	oocyte pick-up
PCOS	polycystic ovary syndrome
PESA	percutaneous epididymal sperm aspiration
PGT	preimplantation genetic testing
RTAC	Reproductive Technology Accreditation Committee
SET	single embryo transfer
SLK	statistical linkage key
UNSW	University of New South Wales
WHO	World Health Organization

Symbols

..	not applicable
%	percentage
n	number

Summary

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

Over 110,000 ART treatment cycles were performed in Australia and New Zealand in 2021

There were 111,253 ART treatment cycles performed in Australian and New Zealand ART Units in 2021 (102,157 and 9,096 respectively). This represents an increase of 17.1% in Australia and 7.1% in New Zealand from 2020. This equates to 19.6 cycles per 1,000 women of reproductive age (15–44 years) in Australia, compared with 8.7 cycles per 1,000 women of reproductive age in New Zealand. Communities and health services were affected by the COVID pandemic in 2020 and 2021.

Women used their own oocytes or embryos (autologous cycles) in approximately 95% (104,917) of fresh and/or thaw cycles. These cycles were undertaken by 53,509 women, with more cycles per woman in Australia (2.0 cycles per woman) than in New Zealand (1.7 cycles per woman). Thawed embryos or oocytes were transferred in 36.9% of autologous cycles. There were 5,881 cycles where all oocytes or embryos were frozen for medical or non-medical fertility preservation, and 280 surrogacy gestational carrier cycles. Approximately 8% of cycles performed in 2021 underwent preimplantation genetic testing (PGT).

One in three recipient cycles were in single females or female-female couples

Of the 108,273 autologous and recipient cycles, 11.9% were undertaken by single female and 4.1% by female-female intending parents. More than one in three (36.1%) oocyte/embryo recipient cycles were in single female or female-female intending parents, noting that this includes cycles where oocytes or embryos were provided by one female intending parent to her female partner.

The average age of female patients undertaking ART in 2021 was 36 years

The average age of female patients undergoing autologous and recipient cycles in 2021 was 36 years, with one in four (25.3%) aged 40 years or older. The average age of male partners was 38 years.

One in three cycles attributed to male infertility

Male factor infertility was reported in approximately one in three cycles. The principal cause of male infertility was unexplained in the majority (74%) of these cycles.

Thaw cycles had higher live birth rates than fresh cycles

Of the 108,273 autologous and recipient cycles, 67,894 resulted in an embryo transfer and 22,685 resulted in all oocytes/embryos being frozen. The remaining cycles were either cancelled before egg retrieval, did not progress to embryo freezing or to embryo transfer. The overall clinical pregnancy rate for autologous and recipient cycles reaching embryo transfer was 36.6%.

The live birth rate per initiated autologous fresh cycle was 15.5% 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 30.9% and for thaw cycles reaching embryo transfer cycle it was 31.5%.

There was a higher live birth rate in younger women. For women aged under 30 years, the live birth rate per embryo transfer was 40.2% for autologous fresh cycles and 35.9% for autologous thaw cycles. For women older than 44 years, the live birth rate per embryo transfer was 3.7% for autologous fresh cycles and 12.9% for thaw cycles.

More than 20,000 babies were born following ART treatment in Australia and New Zealand

There were 20,690 babies born (including 20,440 liveborn babies) following ART treatment in 2021. Of these, 18,594 (89.9%) were from treatments performed in Australian ART Units and 2,096 (10.1%) were from New Zealand ART Units. Eight in ten liveborn babies (81.8%) were full-term singletons of normal birthweight.

More than one third of women achieved a live birth in their first ever complete ART cycle

More than one third (37.1%) of the 36,123 women who started their first ART ovarian stimulation cycle between January 2018 and December 2019 and were followed until December 2021, achieved a live birth in their first complete ART cycle (defined as an ovarian stimulation cycle including fresh and frozen/thaw embryo transfers), and 57% by their sixth complete ART cycle. Assuming that women who discontinued treatment had an equal chance of achieving a live birth as those who continued, the estimated cumulative live birth rate after the sixth complete cycle would be 76%. Cumulative live birth rates vary by female age.

Trends in ART laboratory practices

The proportion of embryo transfer cycles that used embryos fertilised using intracytoplasmic sperm injection (ICSI) decreased from 62.2% in 2017 to 55.6% in 2021.

The proportion of embryo transfer cycles transferring a cryopreserved (frozen) embryo increased from 55.8% in 2017 to 60.6% in 2021. Of the 19,742 live births resulting from ART treatment in 2021, 65.4% resulted from thaw cycles, compared to 60.2% in 2017. The proportion of initiated fresh cycles that resulted in all oocytes/embryos being frozen (freeze-all cycles) increased from 24.2% in 2017 to 33.4% in 2021.

Other trends in the last five years include the continued shift from cleavage-stage transfers to blastocyst transfers (from 82% in 2017 to 91.5% in 2021) and an increase in vitrification as a cryopreservation method (from 91.5% of thaw blastocyst transfer cycles in 2017 to 97.2% in 2021).

Live birth rates per thaw cycle continue to increase

In the last five years, the live birth rate per fresh embryo transfer cycle increased from 24.1% in 2017 to 25.5% in 2021. The live birth rate per thaw embryo transfer cycle increased from 28.9% in 2017 to 31.4% in 2021. Overall, live birth rate per embryo transfer cycle have risen from 26.8% in 2017 to 29.1% in 2021.

Single embryo transfers continue to increase resulting in a low multiple birth rate

The proportion of single embryo transfers continued to increase from 89.4% in 2017 to 93.6% in 2021. The multiple birth rate (twins and triplets) following ART treatment decreased from 3.6% in 2017 to 2.8% in 2020 and marginally increased to 3% in 2021.

1 Introduction

Infertility affects millions of people around the world. Estimates suggest that approximately one in six people of reproductive age experience infertility in their lifetime (World Health Organization 2023). Infertility is increasingly being overcome through advancements in infertility 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 10 million children worldwide (ESHRE n.d.). The most recent national estimates indicate that 5.4% of all women who gave birth in Australia in 2021 received some form of ART treatment (AIHW 2023).

The purpose of this annual report is to inform clinicians, researchers, government, patients 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) and Australian and New Zealand ART Units, in collaboration with the University of New South Wales (UNSW Sydney), are committed to providing informative annual statistics on ART treatments and pleased to present the annual report on ART performed in Australia and New Zealand in 2021.

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 hyperstimulation during which an ovarian stimulation regimen, typically using follicle stimulating hormone (FSH) or gonadotrophins, is administered to a woman over a number of days to induce the maturation of multiple oocytes (eggs).
2. Oocyte pick-up (OPU) where oocytes are aspirated from ovarian follicles.
3. Fertilisation of the collected oocytes using the male intending parent 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 fresh embryo 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 four 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

- oocyte/embryo donation, when a female patient who is not an intending parent, intends to donate or donates her oocytes/embryos to others, or where a female intending parent provides oocytes/embryos to a female partner who is also an intending parent.
- oocyte/embryo recipient, when a female patient who is an intending parent receives oocytes/embryos from another individual/couple who is not an intending parent, or where a female intending parent receives oocytes/embryos from a female partner who is also an intending parent, to achieve a pregnancy.
- 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 medical and non-medical fertility preservation
- freeze-all cycles where all oocytes or embryos resulting from an OPU are cryopreserved for potential future use
- in vitro maturation where immature oocytes are collected and placed in a special culture medium to mature before fertilisation is attempted.
- surrogacy arrangements, where a female patient, known as the 'gestational carrier' or 'surrogate', agrees to carry a child for another person or couple, known as the 'intending parent(s)', with the intention that the child will be raised by the intending parent(s). The oocytes and/or sperm used to create the embryo(s) in the cycle can be either from the intending parent(s) or from a donor(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 male intending parent's sperm, or donated sperm, also known as 'donor (sperm) insemination' (DI). Only DI performed at an ART Unit is reported to ANZARD.

Data used in this report

This report provides information on ART and DI treatments and the resulting treatment, pregnancy and birth outcomes. Also included is an analysis of trends in ART treatments and outcomes in the five years from 2017 to 2021. Reporting ART treatment cycles in Australia is a requirement for ART Units to be licensed by the FSANZ's Reproductive Technology Accreditation Committee (RTAC). All ART Units in Australia and New Zealand provided data to ANZARD for cycles performed in 2021, comprising 86 ART Units in Australia and 7 ART Units in New Zealand. The full list of contributing ART Units can be found in Appendix A.

ANZARD is a data collection which uses a statistical linkage key (SLK) that links successive treatment cycles undertaken by one female patient. The SLK is a combination of the first two letters of a female patient's first name, the first two letters of her surname and her date of birth. The SLK enables the number of female patients undergoing treatment across time to be reported. As a joint initiative of the NPESU at UNSW Sydney and FSANZ, ANZARD was upgraded in 2020 to the ANZARD 3.0 Data Dictionary to accommodate new treatment types and reflect different types of patients involved in ART treatments. ANZARD 3.0 collects more information about the intending parents, causes of infertility, period of infertility, PGT, lab-only cycles and fertility preservation. As a result, there are new terms specific to ANZARD 3.0 that are used in this report:

- lab-only cycles – where there is no patient under monitoring or receiving treatment in the cycle and no intention to transfer an embryo in the cycle and only laboratory procedures are performed.
- sex of the intending parent(s) – the sex of the intending parent(s) presented in this report is based on their sex at birth to align with the type of ART treatment provided to the individual. This may not be the same as the gender of the intending parent(s).

A more detailed description of ANZARD 3.0 can be found in Appendices B and C.

Structure of this report

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

Chapter 2 — 'Overview of ART treatment in 2021', 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 2021', 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 2021', 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 2021', includes information on surrogacy and GIFT cycles, PGT and assisted hatching procedures.

Chapter 6 — 'Donor sperm insemination cycles in 2021', presents data on DI cycles and their outcomes, including a description of pregnancy and perinatal outcomes.

Chapter 7 — 'Trends in ART treatment and outcomes: 2017–2021', 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 2021', presents information on the number of women undergoing ART treatment in 2021.

Chapter 9 — 'Cycle-specific and cumulative live birth rates', presents information for a cohort of women who started their first autologous ART treatment cycle during between January 2018 and December 2019 and subsequent ART treatments they had up until 31 December 2021, or until they achieved a live birth (a birth of at least one liveborn baby).

Appendices — Appendix A lists the contributing ART Units. Appendix B provides an overview of the ANZARD 3.0 Data Dictionary 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 2021

There were 111,253 ART treatment and lab-only cycles reported from Australian and New Zealand ART Units in 2021 (Table 1). Of these, 91.8% (102,157) were from Australian ART Units and 8.2% (9,096) were from New Zealand ART Units. The overall number of ART treatment and lab-only cycles in 2021 increased by 16.3% from the 95,699 cycles in 2020, with a 17.1% increase in Australia and 7.1% increase in New Zealand. In 2021, the number of ART treatment cycles represented 19.6 cycles per 1,000 women of reproductive age (15–44 years) in Australia, compared with 8.7 cycles per 1,000 women of reproductive age in New Zealand (Australian Bureau of Statistics 2021; Statistics New Zealand 2021).

Approximately 95% of cycles in 2021 were autologous cycles (where a female intending parent intended to use or used her own oocytes or embryos). Of the 104,917 autologous cycles, 65,414 (62.3%) were fresh cycles and 39,503 (37.7%) were thaw cycles. The remainder represented a small proportion of cycles: 2.1% were oocyte recipient cycles, 0.9% were embryo recipient cycles, 1.1% were oocyte donation cycles and 0.4% were surrogacy arrangement cycles (Table 1).

Of all initiated ART cycles (excluding donation, surrogacy commissioning and lab-only cycles) in 2021, 23.1% (25,028) resulted in a clinical pregnancy and 18.3% (19,842) in a live birth (Table 1). Of these clinical pregnancies, 22,475 (89.8%) were from Australian ART Units and 2,553 (10.2%) from New Zealand ART Units. There were 20,690 babies born (including 20,440 liveborn babies) following ART treatment in 2021. Of these, 18,594 (89.9%) were from Australian ART Units and 2,096 (10.1%) from New Zealand ART Units. Of the liveborn babies, 81.8% (16,722) were singletons at term (gestational age of 37–41 weeks) with normal birthweight (≥ 2,500 grams). The multiple birth rate was 3%.

Table 1: Number of initiated ART cycles by treatment type, Australia and New Zealand, 2021

Cycle type	Number of initiated ART cycles	Percent of initiated ART cycles	Number of clinical pregnancies	Number of live births	Number of liveborn babies	Number of liveborn singletons at term with normal birthweight
Autologous	104,917	94.3	23,748	18,820	19,388	15,897
Fresh	*65,414*	*58.8*	*8,496*	*6,607*	*6,822*	*5,462*
Thaw	*39,503*	*35.5*	*15,252*	*12,213*	*12,566*	*10,435*
Oocyte recipient	2,360	2.1	763	600	622	469
Embryo recipient	996	0.9	394	322	330	267
Oocyte donation	1,187	1.1	..	..	..	..
Embryo donation	70	0.1	..	..	..	..
GIFT[(a)]	0	0.0	*0*	*0*	..	..
Surrogacy arrangement cycles	400	0.4	123	100	100	89
Commissioning cycles[(b)]	*120*	*0.1*	..	..	..	..
Surrogate gestational carrier cycles[(c)]	*280*	*0.3*	*123*	*100*	*100*	*89*
Lab-only cycles	1,323	1.2	..	..	..	..
Total	**111,253**	**100.0**	**25,028**	**19,842**	**20,440**	**16,722**

(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 intending parents providing their oocytes or embryos for use by the surrogate gestational carrier.
(c) A cycle undertaken by a female patient who carries, or intends to carry, a child on behalf of the intending parent(s) with an agreement that the child will be raised by the intending parent(s).

3 Autologous and donation/recipient cycles in 2021

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

An ‘autologous cycle’ is defined as an ART treatment cycle in which a female intending parent intends to use or uses her own oocytes or embryos to achieve a pregnancy.

A ‘donation cycle’ is defined as an ART treatment cycle in which a female patient who is not an intending parent, intends to donate or donates, her oocytes/embryos to others or where a female intending parent provides oocytes/embryos to a female partner who is also an intending parent.

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 female patient who is an intending parent, receives oocytes or embryos from another individual/couple who is not an intending parent, or where a female intending parent receives oocytes or embryos from a female partner who is also an intending parent, to achieve a pregnancy.

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

3.1 Overview of autologous and recipient cycles

Intending parents

The ART cycles in sections 3.1 to 3.3 include treatment cycles undertaken by female-male, single female and female-female intending parents only. These cycles all involve the intention to transfer an embryo to a female patient. Cycles involving male-male and single male intending parents, such as oocyte/embryo donation cycles and surrogacy arrangement cycles, are covered in section 3.4 and Chapter 5, respectively.

There were 46,399 female-male couples, 7,808 single females and 2,384 female-female couples who undertook autologous and recipient cycles in 2021.

Of the 108,273 autologous and recipient cycles, approximately 84% were undertaken by female-male intending parents, followed by single females (11.9%) and female-female intending parents (4.1%). Almost one in four (24.3%) oocyte/embryo recipient cycles were in female-female intending parents (Table 2).

Table 2: Number of autologous and recipient cycles by intending parents and treatment type, Australia and New Zealand, 2021

	Autologous							
	Fresh		Thaw		Oocyte/Embryo recipient		All	
Intending parents	**n**	**%**	**n**	**%**	**n**	**%**	**n**	**%**
Female-male couple	53,197	81.3	35,677	90.3	2,144	63.9	91,018	84.1
Single female	10,268	15.7	2,189	5.5	396	11.8	12,853	11.9
Female-female couple	1,949	3.0	1,637	4.1	816	24.3	4,402	4.1
Total	**65,414**	**100.0**	**39,503**	**100.0**	**3,356**	**100.0**	**108,273**	**100.0**

Age of female patients and their partners

The average age of female patients undergoing autologous and oocyte/embryo recipient cycles was 36 years. For female patients undergoing oocyte/embryo recipient cycles, the mean age was 40 years, four years older than for autologous cycles (36 years). The largest proportion of autologous fresh and thaw cycles were undertaken by female patients aged 35 – 39 years. Of all autologous and oocyte/embryo recipient cycles, 25.3% were undertaken by female patients aged 40 or older (Table 3).

Table 3: Number of autologous and recipient cycles by female patient age and treatment type, Australia and New Zealand, 2021

	Autologous							
	Fresh		Thaw		Oocyte/Embryo recipient		All	
Age group (years)[(a)]	**n**	**%**	**n**	**%**	**n**	**%**	**n**	**%**
< 30	5,491	8.4	3,846	9.7	185	5.5	9,522	8.8
30–34	16,880	25.8	12,634	32.0	502	15.0	30,016	27.7
35–39	24,994	38.2	15,589	39.5	714	21.3	41,297	38.1
40–44	16,502	25.2	6,907	17.5	1,044	31.1	24,453	22.6
≥ 45	1,547	2.4	527	1.3	911	27.1	2,985	2.8
Total	**65,414**	**100.0**	**39,503**	**100.0**	**3,356**	**100.0**	**108,273**	**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.

The average age of male partners was 38 years, with 36.8% aged 40 or older. The average age of female partners was 35 years (Table 4).

Table 4: Number of autologous and recipient cycles by female patients' partner age and treatment type, Australia and New Zealand, 2021

	Autologous							
	Fresh		Thaw		Oocyte/Embryo recipient		All	
Age group (years) of intending parent[(a)]	n	%	n	%	n	%	n	%
Male partner								
< 30	2,962	5.6	2,139	6.0	58	2.7	5,159	5.7
30–34	11,905	22.4	9,078	25.4	247	11.5	21,230	23.3
35–39	17,863	33.6	12,791	35.9	502	23.4	31,156	34.2
40–44	12,409	23.3	7,552	21.2	563	26.3	20,524	22.5
≥ 45	8,058	15.1	4,117	11.5	774	36.1	12,949	14.2
Not stated	0	0.0	0	0.0	0	0.0	0	0.0
Total male partners	**53,197**	**100.0**	**35,677**	**100.0**	**2,144**	**100.0**	**91,018**	**100.0**
Female partner								
< 30	277	14.2	226	13.8	82	10.0	585	13.3
30–34	605	31.0	470	28.7	296	36.3	1,371	31.1
35–39	570	29.2	495	30.2	334	40.9	1,399	31.8
40–44	330	16.9	292	17.8	85	10.4	707	16.1
≥ 45	165	8.5	154	9.4	19	2.3	338	7.7
Not stated	2	0.1	0	0.0	0	0.0	2	0.0
Total female partners	**1,949**	**100.0**	**1,637**	**100.0**	**816**	**100.0**	**4,402**	**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 108,273 initiated autologous and recipient cycles undertaken in 2021, 74.8% were undertaken by nulliparous women. Of autologous cycles (fresh and thaw), 74.9% were undertaken by nulliparous women, compared with 70.7% for oocyte/embryo recipient cycles.

Table 5: Number of autologous and recipient cycles by parity and treatment type, Australia and New Zealand, 2021

	Autologous							
	Fresh		Thaw		Oocyte/embryo recipient		All	
Parity	**n**	**%**	**n**	**%**	**n**	**%**	**n**	**%**
Nulliparous	52,532	80.3	26,039	65.9	2,374	70.7	80,945	74.8
Parous	12,873	19.7	13,460	34.1	978	29.1	27,311	25.2
Not stated	9	0.0	4	0.0	4	0.1	17	0.0
Total	**65,414**	**100.0**	**39,503**	**100.0**	**3,356**	**100.0**	**108,273**	**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 female intending parent or her male partner, both, or may be unexplained. For ART cycles performed in 2021 (ANZARD 3.0), cause of infertility is reported for female-male intending parents undertaking ART to treat clinical infertility. The clinical diagnoses, including the primary cause of male infertility reported here for the second time, are made by the treating clinician. Diagnostic definitions may vary among ART Units and should be interpreted with considerable caution.

Of the 91,018 initiated autologous and recipient cycles undertaken by female-male intending parents, 39.4% reported only female infertility factors, 15% reported male infertility factors as the only cause of infertility, 13.1% reported combined male-female factors and 29.6% reported infertility as 'unexplained'.

There were 7,633 (8.4%) cycles where the female intending parent had polycystic ovary syndrome (PCOS), regardless of whether it contributed to infertility.

Table 6: Number of autologous and recipient cycles by intending parent cause of infertility, Australia and New Zealand, 2021

	Autologous							
	Fresh		Thaw		Oocyte/embryo recipient		All	
Cause of infertility	**n**	**%**	**n**	**%**	**n**	**%**	**n**	**%**
Tubal disease only	1,931	3.6	1,635	4.6	22	1.0	3,588	3.9
Endometriosis only	3,019	5.7	2,166	6.1	63	2.9	5,248	5.8
Other female factors only	13,586	25.5	7,667	21.5	1,101	51.4	22,354	24.6
Combined female factors only	2,615	4.9	1,927	5.4	152	7.1	4,694	5.2
Combined female-male factors	7,067	13.3	4,505	12.6	350	16.3	11,922	13.1
Male factor infertility only	7,628	14.3	5,882	16.5	119	5.6	13,629	15.0
Unexplained infertility	15,681	29.5	10,994	30.8	291	13.6	26,966	29.6
Not stated	40	0.1	33	0.1	4	0.2	77	0.1
Treatment not for infertility	1,630	3.1	868	2.4	42	2.0	2,540	2.8
Total	**53,197**	**100.0**	**35,677**	**100.0**	**2,144**	**100.0**	**91,018**	**100.0**

There were 25,551 autologous and recipient cycles where the male intending parent was reported as having male factor infertility (Table 7). In 74.0% of these cycles, the primary cause of male infertility was idiopathic (unexplained).

Table 7: Number of autologous and recipient cycles by male intending parent primary cause of infertility, Australia and New Zealand, 2021

	Autologous							
	Fresh		Thaw		Oocyte/embryo recipient		All	
Principal cause of male factor infertility	**n**	**%**	**n**	**%**	**n**	**%**	**n**	**%**
Spermatogenic failure								
Idiopathic (unexplained)	*10,815*	*73.6*	*7,718*	*74.3*	*384*	*81.9*	*18,917*	*74.0*
Genetic – Klinefelter	*115*	*0.8*	*61*	*0.6*	*4*	*0.9*	*180*	*0.7*
Genetic – Y deletion	*67*	*0.5*	*45*	*0.4*	*3*	*0.6*	*115*	*0.5*
Genetic – other aneuploidies, single gene	*389*	*2.6*	*294*	*2.8*	*12*	*2.6*	*695*	*2.7*
Testis damage – cancer treatment	*392*	*2.7*	*277*	*2.7*	*7*	*1.5*	*676*	*2.6*
Testis damage – other (e.g. vascular, infective, trauma)	*658*	*4.5*	*448*	*4.3*	*6*	*1.3*	*1,112*	*4.4*
Gonadotrophin deficiency	*186*	*1.3*	*138*	*1.3*	*7*	*1.5*	*331*	*1.3*
Obstruction								
Vasectomy	*1,263*	*8.6*	*814*	*7.8*	*31*	*6.6*	*2,108*	*8.3*
Congenital absence of the vas deferens/cystic fibrosis	*122*	*0.8*	*115*	*1.1*	*3*	*0.6*	*240*	*0.9*
Obstructive disorder	*289*	*2.0*	*219*	*2.1*	*1*	*0.2*	*509*	*2.0*
Erectile and Ejaculatory								
Erectile dysfunction (incl. psychosexual)	*205*	*1.4*	*142*	*1.4*	*7*	*1.5*	*354*	*1.4*
Ejaculatory disorders (incl. spinal injury, retrograde and anejaculation)	*194*	*1.3*	*116*	*1.1*	*4*	*0.9*	*314*	*1.2*
Total	**14,695**	**100.0**	**10,387**	**100.0**	**469**	**100.0**	**25,551**	**100.0**

Intracytoplasmic sperm injection procedures

Of the 50,736 autologous fresh cycles where fertilisation was attempted, 60% used ICSI procedures and 40% used IVF procedures.

Of fresh oocyte/embryo recipient cycles where fertilisation was attempted to create an embryo, 84.4% used ICSI procedures and 15.6% used IVF procedures (Table 8).

Table 8: Number of autologous and recipient cycles with fertilisation attempted by treatment type and procedure, Australia and New Zealand, 2021

	Autologous[(a)]		Oocyte/embryo recipient[(a)]	
Procedure	**n**	**%**	**n**	**%**
IVF	20,270	40.0	138	15.6
ICSI[(b)]	30,466	60.0	747	84.4
Total	**50,736**	**100.0**	**885**	**100.0**

(a) Fresh cycles where fertilisation was attempted with a fresh or thawed oocyte.

(b) Includes 2,309 mixed IVF/ICSI cycles.

Number of embryos transferred

Of the 67,894 fresh and thaw embryo transfer cycles undertaken in autologous and recipient cycles, 93.6% were single embryo transfer (SET) cycles and 6.4% were double embryo transfer (DET). In women aged under 35, 96.6% of embryo transfer cycles were SET cycles and 3.4% were DET cycles. In women aged 35 or older, 91.6% of cycles were SET cycles, 8.2% were DET cycles and <1% had three or more embryos transferred (Table 9).

Table 9: Number of autologous and recipient cycles by number of embryos transferred and female patient age, Australia and New Zealand, 2021

	One		Two		Three or more		All	
Age group (years)[(a)]	**n**	**%**	**n**	**%**	**n**	**%**	**n**	**%**
< 30	5,879	97.3	166	2.7	0	0.0	6,045	8.9
30–34	19,111	96.5	701	3.5	0	0.0	19,812	29.2
35–39	24,479	94.8	1,328	5.1	4	0.0	25,811	38.0
40–44	12,418	86.9	1,855	13.0	21	0.1	14,294	21.1
≥ 45	1,629	84.3	277	14.3	26	1.3	1,932	2.8
Total	**63,516**	**93.6**	**4,327**	**6.4**	**51**	**0.1**	**67,894**	**100**

(a) Age at start of a treatment cycle.

Stage of embryo development

Of the 67,894 autologous and recipient embryo transfer cycles, 8.5% involved the transfer of day 2–4 embryos (cleavage-stage embryos) and 91.5 day 5–6 embryos (blastocysts). Of autologous cycles, blastocyst transfers made up 82.7% of fresh cycles compared with 97.6% of thaw cycles (Table 10).

Table 10: Number of embryo transfer cycles by treatment type and stage of embryo development, Australia and New Zealand, 2021

	Autologous				Oocyte/embryo recipient			
	Fresh		Thaw		Fresh		Thaw	
Stage of embryo development	n	%	n	%	n	%	n	%
Cleavage embryo	4,529	17.3	940	2.4	121	18.4	200	8.3
Blastocyst[(a)]	21,578	82.7	37,791	97.6	535	81.6	2,200	91.7
Total	**26,107**	**100.0**	**38,731**	**100.0**	**656**	**100.0**	**2,400**	**100.0**

(a) Includes 7 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 41,131 frozen/thawed embryo transfer cycles, 96.6% involved the transfer of vitrified embryos. Of the frozen/thawed blastocyst transfer cycles, 97.2% had vitrified embryos transferred. By comparison, 74.7% of frozen/thawed cleavage-stage embryo transfer cycles used vitrified embryos (Table 11).

Table 11: Number of embryo transfer cycles by cryopreservation method and stage of embryo development, Australia and New Zealand, 2021

	Autologous				Oocyte/embryo recipient			
	Cleavage embryo		Blastocyst		Cleavage embryo		Blastocyst	
Cryopreservation method	n	%	n	%	n	%	n	%
Slow frozen	254	27.0	1,046	2.8	34	17.0	67	3.0
Vitrification[(a)]	686	73.0	36,745	97.2	166	83.0	2,133	97.0
Total	**940**	**100.0**	**37,791**	**100.0**	**200**	**100.0**	**2,200**	**100.0**

(a) Includes 8 cycles where both vitrified and slow-frozen embryos were transferred.

Live births from initiated autologous fresh and thaw, and recipient cycles among ART Units

Figure 1 reports on live births per initiated fresh (excluding freeze-all) and thaw autologous cycles, and recipient cycles among 91 ART Units that performed more than 50 of these cycles combined in 2021.

The highest live birth rate was around 33% and the lowest was less than 10%. These data should be interpreted with caution because of the small number of patients who underwent autologous and recipient cycles in some ART Units. The live birth rates among ART Units may also vary because of differences in the characteristics and prognosis of patients treated, and different approaches to the use of ARTs and other fertility treatments.

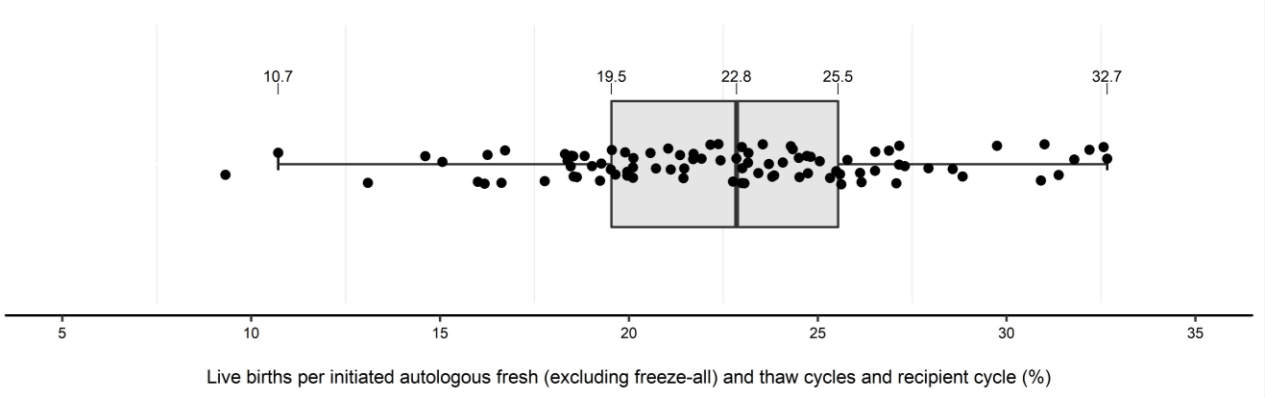
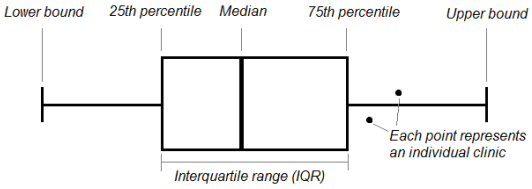


Figure 1: Live birth rate per initiated autologous fresh (excluding freeze-all) and thaw and recipient cycle (%) among ART Units, Australia and New Zealand, 2021

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 ART Units that performed more than 50 of these cycles combined in 2021.
- Each point represents an ART Unit.
- A percentile indicates the value below which a given percentage of ART Units live birth rates fall. For example, 50% of ART Units had a live birth rate less than the median (22.8%).
- The interquartile range (IQR) indicates the range of live birth rates achieved by the middle 50% of ART Units (IQR: 19.5%–25.5%).
- The upper and lower bounds represent the range in which it would be expected that approximately 98% of ART Units will fall (10.7%–32.7%).
- These data should be interpreted with caution because of the small number of patients who underwent autologous and recipient cycles in some ART Units. The live birth rates among ART Units 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.

For more information on ART Unit success rates, refer to the YourIVFSuccess website (yourivfsuccess.com.au).

3.2 Autologous fresh cycles

In 2021, there were 65,414 initiated autologous fresh cycles, comprising 64,608 (98.8%) FSH-stimulated cycles and 806 (1.2%) unstimulated cycles. Of the initiated autologous fresh cycles, 93.6% (61,195) were in Australian ART Units and 6.5% (4,219) were in New Zealand ART Units.

Progression of autologous fresh cycles

Figure 2 shows the main stages of autologous fresh cycles and the resulting treatment outcomes. Of the 65,414 initiated autologous fresh cycles in 2021, 89.3% had OPU performed, 34.7% were freeze-all cycles and 39.9% had embryos transferred (Figure 2). A treatment cycle 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 42) 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.

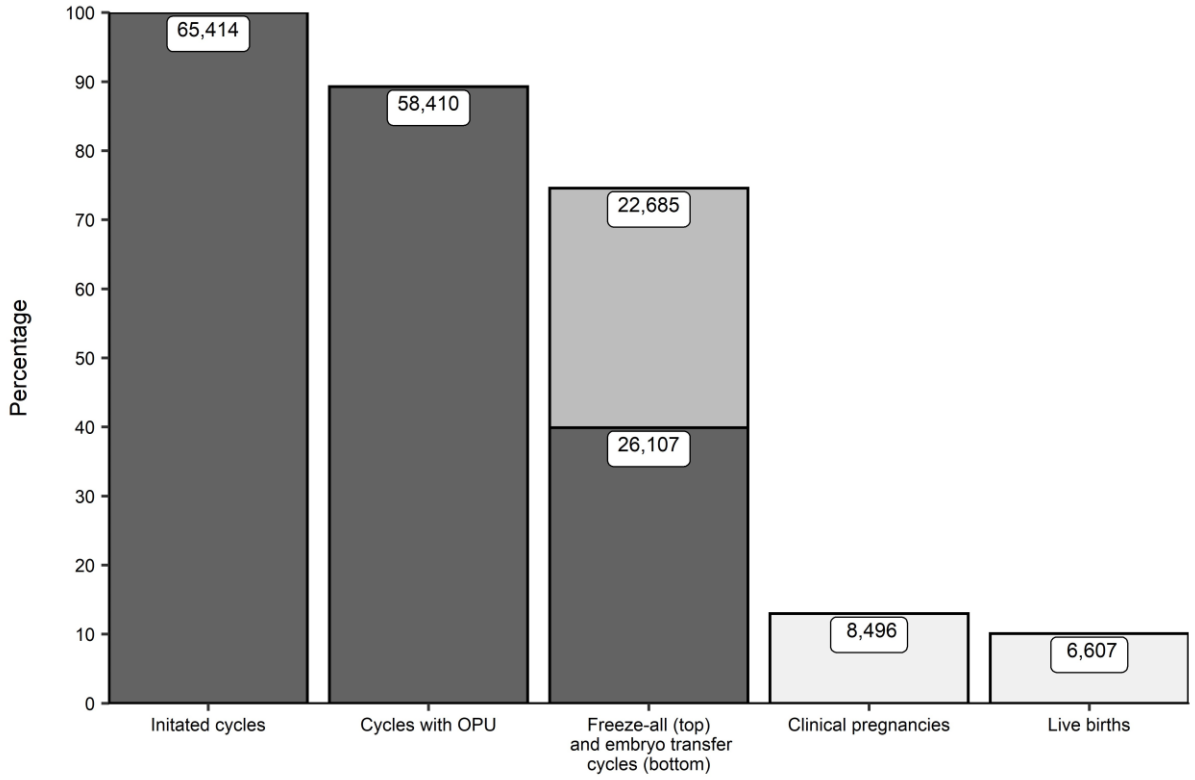


Figure 2: Progression of autologous fresh cycles, Australia and New Zealand, 2021

Fertility preservation

Fertility preservation is where a female patient freezes or intends to freeze all suitable oocytes or embryos for potential future use. This is the second time the reason for fertility preservation was reported to ANZARD by ART Units. There were 5,881 initiated autologous fresh cycles performed for fertility preservation. Of these over one-third (36.5%) were reported as being for non-medical reasons (e.g. not having a partner). Of the 5,881 initiated autologous fresh cycles for fertility preservation, 5,222 (88.8%) resulted in all suitable oocytes or embryos being cryopreserved. The majority (94.6%) of these freeze-all cycles were for oocyte cryopreservation (4,940).

Table 12: Number of autologous fresh fertility preservation cycles for female patients by age and treatment type, Australia and New Zealand, 2021

Reason for fertility preservation	< 35	35–39	≥ 40	All
Medical reason – cancer diagnosis	412	163	42	617
Medical reason – other	1,198	1,527	395	3,120
Non-medical reason	770	1,172	202	2,144
Total	**2,380**	**2,862**	**639**	**5,881**

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 (40.2%). The rate declined with advancing age, with a rate of 10.2% for females aged 40–44 and 3.7% for females aged 45 or older (Table 13). In women aged 45 or older, 994 cycles (64.3%) occurred in women aged 45 years and 323 cycles (20.9%) in women age 46 years, with the remaining 230 cycles (14.9%) occurring in women aged 47 or older.

In women aged under 30 years, freeze-all cycles accounted for 44.1% of initiated fresh cycles with the rate decreasing to 9.5% in women 45 years or older. Of the 65,414 initiated autologous fresh cycles, all oocytes were cryopreserved in 6,460 cycles (28.5%) and all embryos were cryopreserved in 16,225 cycles (24.8%).

Table 13: Outcomes of autologous fresh cycles by female patient age, Australia and New Zealand, 2021

	Age group (years)[(a)]					
Stage/outcome of treatment	**< 30**	**30–34**	**35–39**	**40–44**	**≥ 45**	**All**
Initiated cycles	5,491	16,880	24,994	16,502	1,547	65,414
Cycles with OPU	4,991	15,589	22,519	14,112	1,199	58,410
Freeze-all cycles[(b)]	2,420	7,114	9,184	3,820	147	22,685
Embryo transfer cycles	2,092	6,920	9,862	6,635	598	26,107
Clinical pregnancies	972	2,983	3,296	1,211	34	8,496
Live births	842	2,502	2,565	676	22	6,607
Live births per initiated cycle (%)	*15.3*	*14.8*	*10.3*	*4.1*	*1.4*	*10.1*
Live births per initiated cycle (excluding freeze-all)[(c)] (%)	*27.4*	*25.6*	*16.2*	*5.3*	*1.6*	*15.5*
Live births per embryo transfer cycle (%)	*40.2*	*36.2*	*26.0*	*10.2*	*3.7*	*25.3*
Live births per clinical pregnancy (%)	*86.6*	*83.9*	*77.8*	*55.8*	*64.7*	*77.8*

(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 female patients of that age group. The wider 95% confidence intervals for women in age groups under 30 years indicate greater uncertainty in the birth rates for these female patients as being representative of all female patients of similar age and characteristics.

The highest live birth rates were in females between the ages of 23 and 30 years. For women aged 45 or older, only 1 live birth resulted from every 62 initiated cycles compared with 1 live birth from every 3 initiated cycles in women aged between 23 and 24.

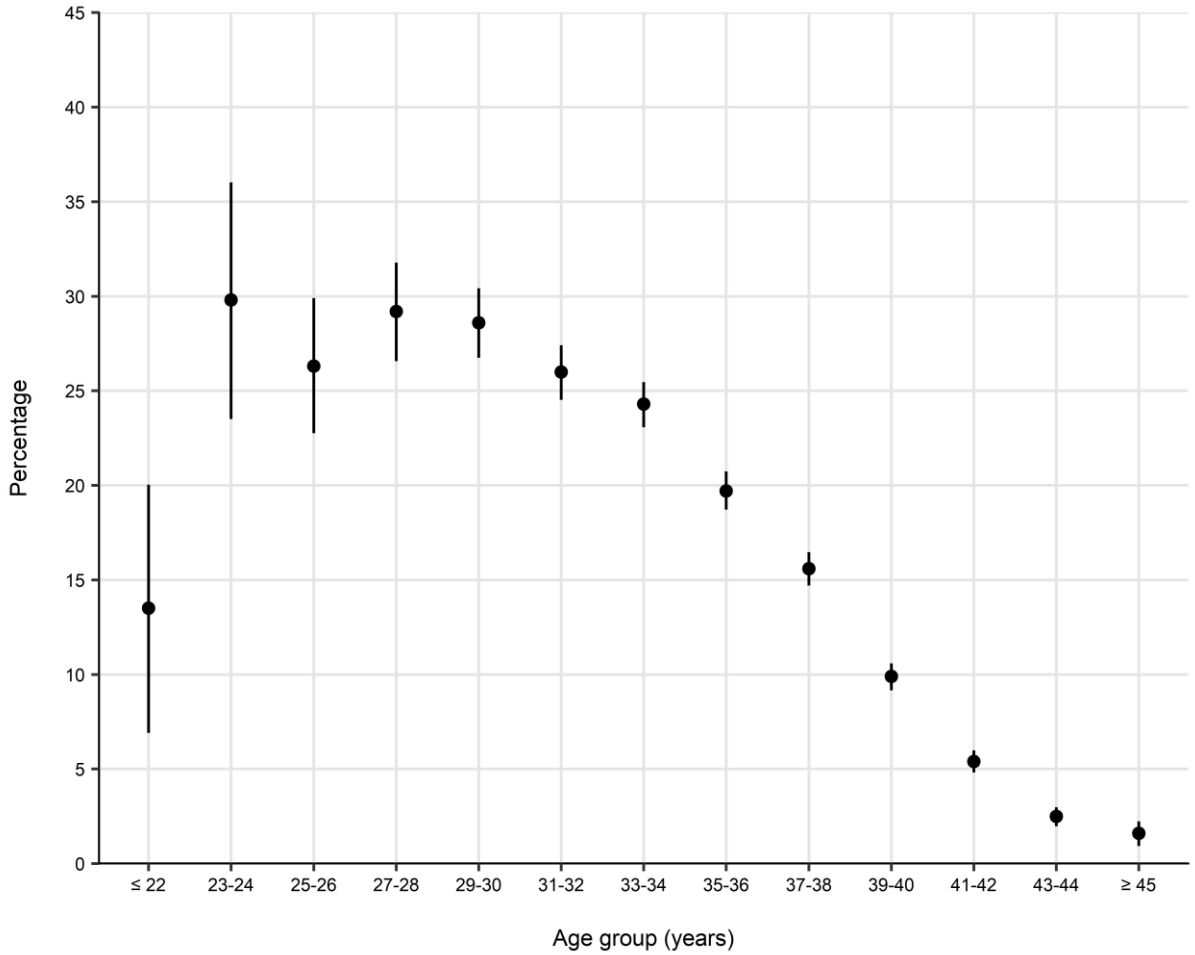


Figure 3: Live birth rate (with 95% confidence intervals) per initiated autologous fresh cycle (excluding freeze-all) by female patient's age at start of a treatment cycle, Australia and New Zealand, 2021

Clinical pregnancies and live births by cause of infertility

Causes of infertility may relate to either the female intending parent or her male partner, both, or may be unexplained. For ART cycles performed in 2021 (ANZARD 3.0), cause of infertility is reported for female-male intending parents undertaking ART to treat clinical infertility. The clinical diagnosis reported to ANZARD is made by the treating clinician. However, the diagnostic definitions may vary among ART Units and should be interpreted with considerable caution.

There were 1,630 autologous fresh cycles where ART was performed for reasons other than to treat medical infertility. Examples include chromosomal testing, human leukocyte antigens (HLA) matching and fertility preservation.

There were 53,197 initiated autologous fresh cycles undertaken by female-male intending parents. Cycles where male factor infertility was reported as the only cause of infertility in the intending parents had the highest live birth rate (20.9%) (Table 14). The cause of infertility was unexplained in the intending parents in 29.5% of autologous fresh cycles.

Table 14: Outcomes of autologous fresh cycles by intending parent cause of infertility, Australia and New Zealand, 2021

Cause of infertility	Number of initiated cycles	Embryo transfer cycles per initiated cycle (%)	Clinical pregnancies per initiated non-freeze-all cycle[(a)] (%)	Live births per initiated non-freeze-all cycle[(b)] (%)
Tubal disease only	1,931	50.0	22.5	18.3
Endometriosis only	3,019	48.0	21.9	17.4
Other female factors only	13,586	39.0	15.1	11.2
Combined female factors only	2,615	42.4	17.2	12.9
Combined female-male factors	7,067	43.2	18.0	13.8
Male factor infertility only	7,628	49.7	26.0	20.9
Unexplained infertility	15,681	48.3	23.0	18.2
Not stated	40	22.5	14.3	7.1
Non-medical infertility	1,630	14.0	15.8	11.9
Total	**53,197**	**44.1**	**20.3**	**15.8**

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

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

There were 14,695 autologous fresh cycles where the male intending parent was reported as having male factor infertility (Table 14). In 73.6% of these cycles, the primary cause of male infertility was idiopathic (unexplained).

The overall live birth rate per initiated non-freeze-all cycle was 17.5%, ranging from 11.5% for genetic – other aneuploidies, single gene to 23.8% for congenital absence of the vas deferens/cystic fibrosis (Table 15).

Table 15: Outcomes of autologous fresh cycles by male intending parent principal cause of infertility, Australia and New Zealand, 2021

Primary cause of male infertility	Number of initiated cycles	Embryo transfer cycles per initiated cycle (%)	Clinical pregnancies per initiated non-freeze-all cycle (%)[a]	Live births per initiated non-freeze-all cycle (%)[b]
Spermatogenic failure				
Idiopathic (unexplained)	10,815	47.4	22.4	17.9
Genetic – Klinefelter	115	39.1	20.3	16.2
Genetic – Y deletion	67	44.8	26.1	19.6
Genetic - other aneuploidies, single gene	389	15.4	16.9	11.5
Testis damage – cancer treatment	392	46.4	25.6	19.9
Testis damage – other (e.g. vascular, infective, trauma)	658	50.3	23.7	17.7
Gonadotrophin deficiency	186	41.9	20.1	14.2
Obstruction				
Vasectomy	1,263	44.9	17.4	13.3
Congenital absence of the vas deferens/cystic fibrosis	122	46.7	30.0	23.8
Obstructive disorder	289	58.1	22.7	18.1
Erectile and ejaculatory				
Erectile dysfunction (incl. psychosexual)	205	53.7	25.5	20.1
Ejaculatory disorders (incl. spinal injury, retrograde and anejaculation)	194	47.9	26.5	19.7
Total	**14,695**	**46.6**	**22.2**	**17.5**

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

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

Clinical pregnancies and live births by stage of embryo development and number of embryos transferred

Overall, 90.8% of autologous fresh embryo transfer cycles were SET cycles, 9.1% were DET cycles and 0.2% had three or more embryos transferred. In female patients aged 35 to 39, three or more fresh embryos were transferred in 3 cycles, compared with 40 cycles in females aged 40 or older.

There were more blastocyst (82.7%) than cleavage-stage embryo transfer cycles (17.3%). The rates of clinical pregnancy and live birth were higher in blastocyst transfer cycles than in cleavage-stage embryo transfer cycles for both SET and DET cycles (Table 16). 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.

The overall live birth rate per embryo transfer cycle was 26.2% for SET cycles and 17.0% for DET cycles (Table 16). 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 16: Outcomes of autologous fresh embryo transfer cycles by stage of embryo development and number of embryos transferred, Australia and New Zealand, 2021

	Cleavage		Blastocyst		Total	
Stage/outcome of treatment	**SET[(a)]**	**DET[(b)(c)(d)]**	**SET[(a)]**	**DET[(b)(c)(d)]**	**SET[(a)]**	**DET[(b)(c)(d)]**
Embryo transfer cycles	3,607	922	20,095	1,483	23,702	2,405
Clinical pregnancies	730	184	7,184	398	7,914	582
Live births	553	126	5,646	282	6,199	408
Clinical pregnancies per embryo transfer cycle (%)	*20.2*	*20.0*	*35.8*	*26.8*	*33.4*	*24.2*
Live births per embryo transfer cycle (%)	*15.3*	*13.7*	*28.1*	*19.0*	*26.2*	*17.0*

(a) SET: single embryo transfer.

(b) DET: double embryo transfer.

(c) Includes 3 cycles where both cleavage-stage embryos and blastocysts were transferred.

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

3.3 Autologous thaw cycles

There were 39,503 autologous thaw cycles reported in 2021 (Figure 4). Of these, 89.8% (35,475) were in Australian ART Units and 10.2% (4,028) in New Zealand ART Units.

Progression of autologous thaw cycles

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

Of the 39,503 initiated autologous thaw cycles, 98% had embryos transferred, 38.6% resulted in a clinical pregnancy and 30.9% resulted in a live birth (Figure 4).

The rate of live births per initiated cycle was higher for autologous thaw cycles than for autologous fresh cycles excluding freeze-all cycles in 2021 (30.9% and 15.5% respectively) (Table 13 and Table 17).

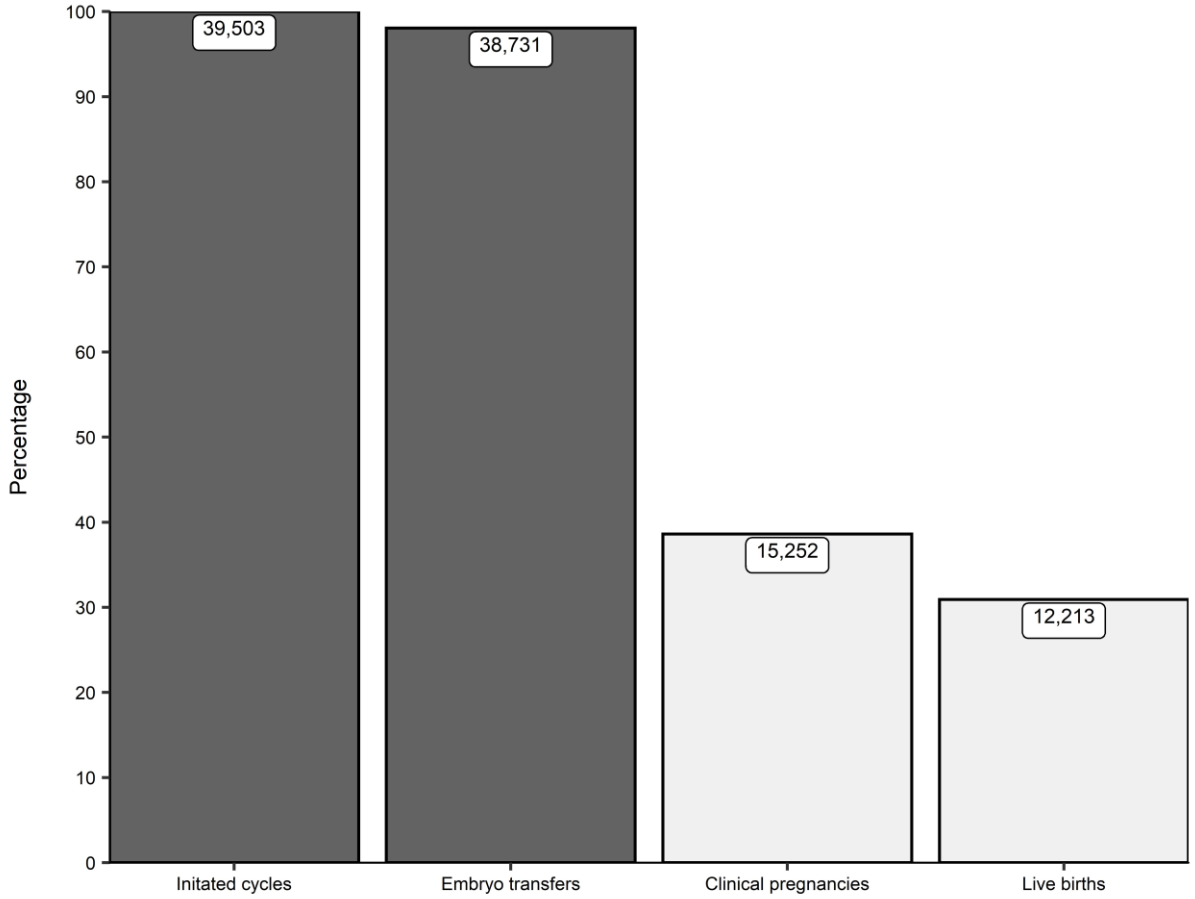


Figure 4: Progression of autologous thaw cycles, Australia and New Zealand, 2021

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

The live birth rate per initiated thaw cycle and per thaw embryo transfer cycle was similar for women aged less than 30 years and women aged 30–34 years, with live birth rates declining for older women (Table 17).

The overall live birth rate per initiated autologous thaw cycle was 30.9%, which is 15 percentage points higher than in autologous fresh cycles (excluding freeze-all cycles) (15.5%) (Table 13 and Table 17).

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 a trend towards freeze-all cycles and PGT in recent years (Table 37 and Table 42), resulting in higher quality embryos being transferred in thaw cycles than fresh embryo transfer cycles. This may contribute to the higher success rates following autologous thaw cycles compared to autologous fresh cycles (Table 13 and Table 17).

Table 17: Outcomes of autologous thaw cycles by female patient age, Australia and New Zealand, 2021

	Age group (years)[(a)]					
Stage/outcome of treatment	**< 30**	**30–34**	**35–39**	**40–44**	**≥ 45**	**All**
Initiated cycles	3,846	12,634	15,589	6,907	527	39,503
Embryo transfers	3,786	12,441	15,297	6,712	495	38,731
Clinical pregnancies	1,625	5,422	6,080	2,024	101	15,252
Live births	1,359	4,555	4,819	1,416	64	12,213
Live births per initiated cycle (%)	*35.3*	*36.1*	*30.9*	*20.5*	*12.1*	*30.9*
Live births per embryo transfer cycle (%)	*35.9*	*36.6*	*31.5*	*21.1*	*12.9*	*31.5*
Live births per clinical pregnancy (%)	*83.6*	*84.0*	*79.3*	*70.0*	*63.4*	*80.1*

(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 female patients of that age group.

The highest live birth rates were observed in females in their mid to late 20s to early 30s. The wider 95% confidence intervals for women in age groups under 30 years indicates greater uncertainty in the birth rates for these female patients.

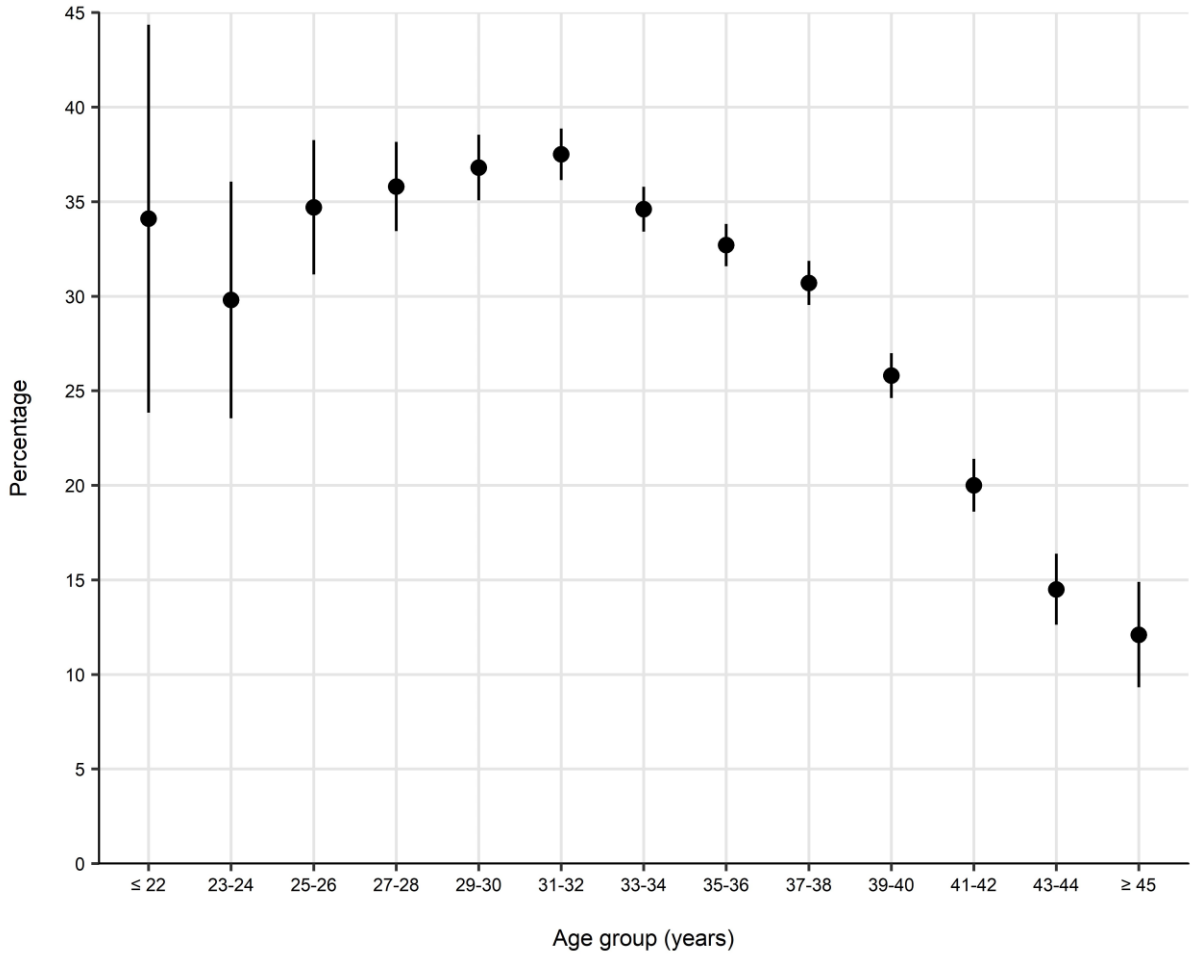


Figure 5: Live birth rate (with 95% confidence intervals) per initiated autologous thaw cycle by female patient's age at start of a treatment cycle, Australia and New Zealand, 2021

Clinical pregnancies and live births by cause of infertility

Causes of infertility may relate to either the female intending parent or her male partner, both, or may be unexplained. For ART cycles performed in 2021 (ANZARD 3.0), cause of infertility is reported for female-male intending parents undertaking ART to treat clinical infertility. The clinical diagnosis reported to ANZARD is made by the treating clinician. However, the diagnostic definitions may vary among ART Units and should be interpreted with considerable caution.

There were 868 autologous thaw cycles where ART was performed for reasons other than to treat clinical infertility. Examples include chromosomal testing, human leukocyte antigens (HLA) matching and fertility preservation. Of these 868 cycles, 32.1% resulted in a live birth.

There were 35,677 initiated autologous thaw cycles undertaken by female-male intending parents. Cycles reported with endometriosis as the only cause of infertility had the highest rate of live births per initiated autologous thaw cycle (34.9%) (Table 18).

Table 18: Outcomes of autologous thaw cycles by intending parent cause of infertility, Australia and New Zealand, 2021

Cause of infertility	Number of initiated cycles	Embryo transfer cycles per initiated cycle (%)	Clinical pregnancies per initiated cycle (%)	Live births per initiated cycle (%)
Tubal disease only	1,635	98.8	37.8	31.0
Endometriosis only	2,166	98.4	41.5	34.9
Other female factors only	7,667	97.5	37.4	28.5
Combined female factors only	1,927	98.2	36.5	28.9
Combined female-male factors	4,505	98.5	39.3	31.4
Male factor infertility only	5,882	98.2	40.5	33.0
Unexplained infertility	10,994	98.2	39.0	31.5
Not stated	33	100.0	48.5	33.3
Treatment not for infertility	868	95.7	39.5	32.1
All	**35,677**	**98.1**	**38.9**	**31.2**

Of the 35,677 initiated autologous thaw cycles undertaken by female-male intending parents, 10,387 (29.1%) had male factor infertility. The cause of male infertility was unexplained in the majority (74.3%) of cycles. Cycles where the primary cause was genetic due to Klinefelter had the highest live birth rate per initiated cycle (45.9%).

Table 19: Outcomes of autologous thaw cycles by male intending parent principal cause of infertility, Australia and New Zealand, 2021

Primary cause of male infertility	Number of initiated cycles	Embryo transfer cycles per initiated cycle (%)	Clinical pregnancies per initiated cycle (%)	Live births per initiated cycle (%)
Spermatogenic failure				
Idiopathic (unexplained)	*7,718*	*98.5*	*40.1*	*32.4*
Genetic – Klinefelter	*61*	*100.0*	*54.1*	*45.9*
Genetic – Y deletion	*45*	*93.3*	*48.9*	*40.0*
Genetic – other aneuploidies, single gene	*294*	*96.6*	*44.6*	*37.8*
Testis damage – cancer treatment	*277*	*98.2*	*40.4*	*30.7*
Testis damage – other (e.g. vascular, infective, trauma)	*448*	*98.9*	*43.1*	*35.3*
Gonadotrophin deficiency	*138*	*98.6*	*39.9*	*32.6*
Obstruction				
Vasectomy	*814*	*97.4*	*34.5*	*27.4*
Congenital absence of the vas deferens/cystic fibrosis	*115*	*99.1*	*39.1*	*33.9*
Obstructive disorder	*219*	*97.3*	*39.3*	*31.5*
Erectile and ejaculatory				
Erectile dysfunction (incl. psychosexual)	*142*	*97.2*	*38.7*	*30.3*
Ejaculatory disorders (incl. spinal injury, retrograde and anejaculation)	*116*	*99.1*	*40.5*	*32.8*
Total	**10,387**	**98.3**	**40.0**	**32.3**

Of the 38,731 autologous thaw embryo transfer cycles, 95.4% were SET cycles, 4.6% were DET cycles and <1% (8) cycles transferred three or more embryos. Only female patients aged 35 or older had three or more frozen/thawed embryos transferred.

There were more blastocyst transfer cycles (97.6%) than cleavage-stage embryo transfer cycles (2.4%). The rates of clinical pregnancy and live birth were higher in blastocyst transfer cycles (39.8% and 31.9% respectively) than in cleavage-stage embryo transfer cycles (21.1% and 16.5% respectively) (Table 20). 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.

The overall live birth rate per embryo transfer cycle was 31.7% for SET cycles and 28.5% for DET cycles (Table 20). 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 20: Outcomes of autologous thaw embryo transfer cycles by stage of embryo development and number of embryos transferred, Australia and New Zealand, 2021

	Cleavage		Blastocyst[(a)]		Total	
Stage/outcome of treatment	**SET[(b)]**	**DET[(c)(d)]**	**SET[(b)]**	**DET[(c)(d)]**	**SET[(b)]**	**DET[(c)(d)]**
Embryo transfer cycles	733	207	36,207	1,584	36,940	1,791
Clinical pregnancies	149	49	14,434	620	14,583	669
Live births	120	35	11,583	475	11,703	510
Clinical pregnancies per embryo transfer cycle (%)	*20.3*	*23.7*	*39.9*	*39.1*	*39.5*	*37.4*
Live births per embryo transfer cycle (%)	*16.4*	*16.9*	*32.0*	*30.0*	*31.7*	*28.5*

(a) Includes 1 cycle where both cleavage-stage embryos and blastocysts were transferred.

(b) SET: single embryo transfer.

(c) DET: double embryo transfer.

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

Clinical pregnancies and live births by embryo freezing methods

Of the autologous thaw cycles where a blastocyst was transferred, 97.2% used vitrified embryos compared with 73% of cleavage-stage embryo transfer cycles. Live birth rates were higher for vitrified embryos compared to slow-frozen embryos regardless of the stage of embryo development (Table 21).

Table 21: Outcomes of autologous thaw embryo transfer cycles by stage of embryo development and embryo freezing methods, Australia and New Zealand, 2021

	Stage of embryo development					
	Cleavage stage		Blastocyst[(a)]		All	
Stage/outcome of treatment	**Slow freezing**	**Vitrification**	**Slow freezing**	**Vitrification**	**Slow freezing**	**Vitrification**
Embryo transfer cycles	254	686	1,046	36,745	1,300	37,431
Clinical pregnancies	39	159	358	14,696	397	14,855
Live births	33	122	272	11,786	305	11,908
Clinical pregnancies per embryo transfer cycle (%)	*15.4*	*23.2*	*34.2*	*40.0*	*30.5*	*39.7*
Live births per embryo transfer cycle (%)	*13.0*	*17.8*	*26.0*	*32.1*	*23.5*	*31.8*

(a) Includes 1 cycle where both blastocyst and cleavage-stage embryos were transferred.

3.4 Donation and recipient cycles

A donation cycle is an ART treatment cycle in which a female patient who is not an intending parent, intends to donate or donates, her oocytes/embryos to others or where a female intending parent provides oocytes/embryos to a female partner who is also an intending parent. A recipient cycle is defined as an ART treatment cycle in which a female patient who is an intending parent, receives oocytes or embryos from another individual/couple who is not an intending parent, or where a female intending parent receives oocytes or embryos from a female partner who is also an intending parent, to achieve a pregnancy. The use of donor sperm does not alter the donor status of the cycle.

In 2021, donation and recipient cycles accounted for 4.1% (4,613) of all treatment cycles in Australia and New Zealand. There were 1,257 initiated cycles where the intention was to donate oocytes or embryos to a recipient, consisting of 1,111 (88.4%) cycles in Australia and 146 (11.6%) in New Zealand.

This chapter does not include surrogacy arrangement cycles. Refer to Chapter 5.

Oocyte/embryo donation cycles

Of the 1,257 initiated cycles where the intention was to donate oocytes or embryos to a recipient/intending parent(s), 67 (5.3%) cycles were cancelled before OPU, and a further 13 did not result in oocytes being donated. Following OPU, 86.6% of initiated donation cycles resulted in fresh oocytes or embryos being donated and 7.1% resulted in cryopreserved oocytes or embryos being donated.

The average age of females donating oocytes/embryos was 32 years, with 39.3% of cycles in females aged 35 or older (Table 22). There were 689 (54.8%) donation cycles where the recipients were female-male intending parents followed by 284 (22.6%) donation cycles where the recipients were female-female intending parents (Table 23). There were 53 donation cycles where the recipients were single male or male-male intending parents, for use with a surrogate gestational carrier and 59 cycles where oocytes were donated but no intending parents had been assigned to receive the oocytes at the time of the donation cycle.

Table 22: Number of oocyte/embryo donation cycles by donor age, Australia and New Zealand, 2021

Age group (years)[(a)]	Number of initiated cycles	Cycles with OPU performed (%)	Cycles with fresh oocyte(s)/embryo(s) donated[(b)] (%)	Cycles with cryopreserved oocyte(s)/embryo(s) donated (%)
< 30	279	95.3	89.2	5.0
30–34	484	94.8	87.6	6.6
35–39	414	95.7	85.0	9.7
≥ 40	80	86.3	78.8	3.8
Total	**1,257**	**94.7**	**86.6**	**7.1**

(a) Donor's age at the time of their OPU.
(b) Includes 22 cycles where oocytes/embryos were also cryopreserved.

Table 23: Number of oocyte/embryo donation cycles to intending parents, Australia and New Zealand, 2021

Intending parents	Number of initiated cycles	Cycles with OPU performed (%)	Cycles with fresh oocyte(s)/embryo(s) donated (%)[(a)]	Cycles with cryopreserved oocyte(s)/embryo(s) donated (%)
Female-male couple	689	93.3	90.7	1.7
Single female	172	95.9	90.7	4.7
Female-female couple	284	95.1	75.0	18.3
Single male	2	100.0	100.0	0.0
Male-male couple	51	100.0	98.0	2.0
Unknown intending parents	59	100.0	71.2	27.1
Total	**1,257**	**94.7**	**86.6**	**7.1**

(a) Includes 22 cycles where oocytes/embryos were also cryopreserved.

Oocyte/embryo recipient cycles

There were 3,356 oocyte/embryo recipient cycles in 2021, comprising 2,967 (88.4%) cycles in Australia and 389 (11.6) cycles in New Zealand. Of these, 70.3% (2,360) were oocyte recipient cycles and 29.7% (996) were embryo recipient cycles (Table 24). The average age of women undertaking an oocyte/embryo recipient cycle was 40 years.

Progression of oocyte/embryo recipient cycles

Figure 6 shows the main stages of oocyte/embryo recipient cycles and the treatment outcomes. Of the 3,356 initiated oocyte/embryo recipient cycles undertaken in 2021, 91.1% resulted in an embryo transfer, 34.5% resulted in a clinical pregnancy and 27.5% in a live birth.

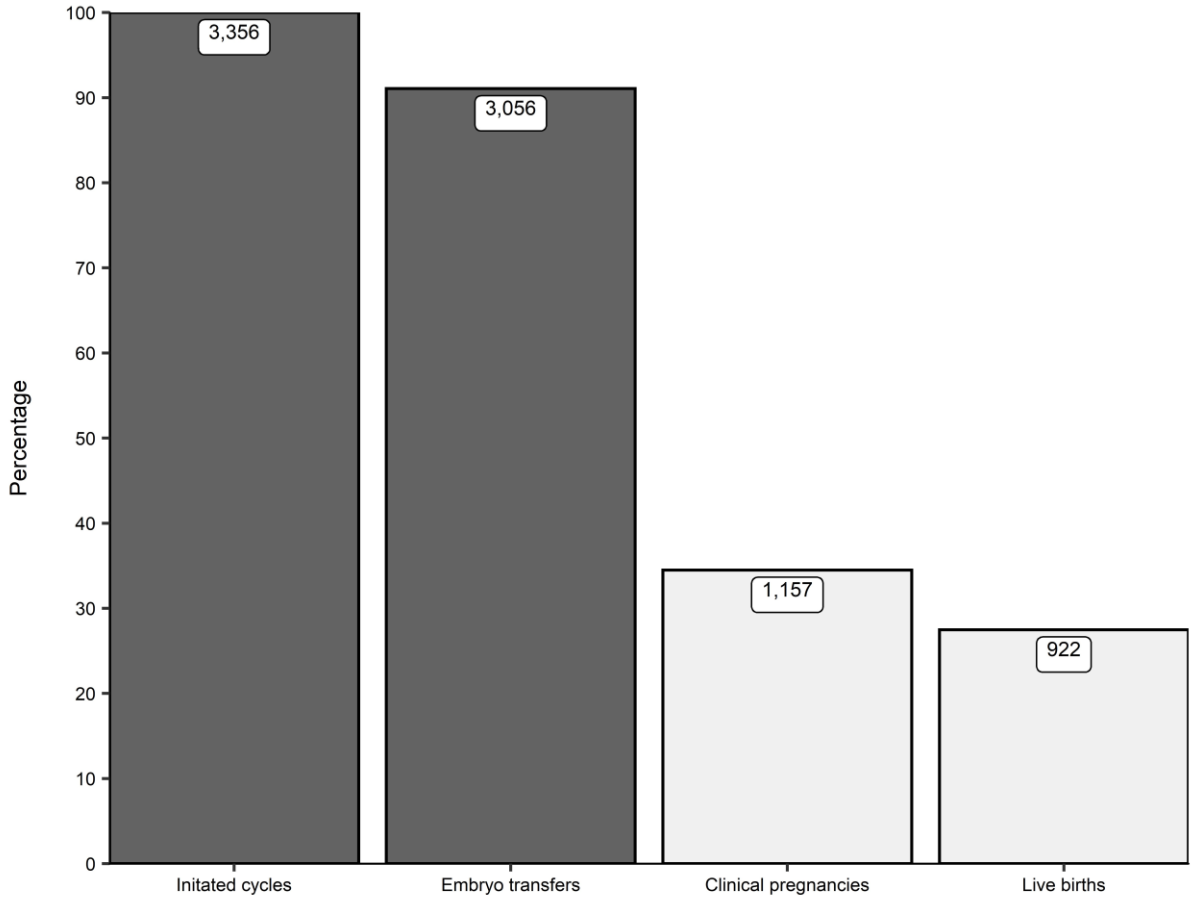


Figure 6: Progression of fresh and thaw oocyte/embryo recipient cycles, Australia and New Zealand, 2021

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

Of the 3,356 oocyte/embryo recipient cycles, 27.5% were fresh cycles and 72.5% were thaw cycles. The overall live birth rate per initiated cycle was 25.4% for oocyte recipient cycles and 32.3% for embryo recipient cycles (Table 24).

Table 24: Outcomes of oocyte/embryo recipient cycles by treatment type, Australia and New Zealand, 2021

	Oocyte recipient		Embryo recipient		
Stage/outcome of treatment	**Fresh**	**Thaw**	**Fresh**	**Thaw**	**All**
Initiated cycles	886	1,474	37	959	3,356
Embryo transfer cycles	619	1,458	37	942	3,056
Clinical pregnancies	259	504	13	381	1,157
Live births	212	388	11	311	922
Live births per initiated cycle (%)	*23.9*	*26.3*	*29.7*	*32.4*	*27.5*
Live births per embryo transfer cycle (%)	*34.2*	*26.6*	*29.7*	*33.0*	*30.2*
Live births per clinical pregnancy (%)	*81.9*	*77.0*	*84.6*	*81.6*	*79.7*

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

The clinical pregnancy and live birth rates of recipient cycles varied by recipients' age. The overall live birth rate per initiated recipient cycle was 27.5%, varying between 23.1% and 34.5% by recipients' age (Table 25).

Table 25: Outcomes of oocyte/embryo recipient cycles by recipient age, Australia and New Zealand, 2021

	Age group (years)[(a)]					
Stage/outcome of treatment	**< 30**	**30–34**	**35–39**	**40–44**	**≥ 45**	**All**
Initiated cycles	185	502	714	1,044	911	3,356
Embryo transfer cycles	167	451	652	947	839	3,056
Clinical pregnancies	70	206	245	361	275	1,157
Live births	50	173	204	285	210	922
Live births per initiated cycle (%)	*27.0*	*34.5*	*28.6*	*27.3*	*23.1*	*27.5*
Live births per embryo transfer cycle (%)	*29.9*	*38.4*	*31.3*	*30.1*	*25.0*	*30.2*
Live births per clinical pregnancy (%)	*71.4*	*84.0*	*83.3*	*78.9*	*76.4*	*79.7*

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

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

The clinical pregnancy and live birth rates of recipient cycles varied by donors' age. The highest live birth rate per initiated recipient cycle was in donors aged less than 30 years (29.9%). The live birth rate per initiated recipient cycle in which the donor's age was 40 years or more was 10.2%. (Table 26).

Table 26: Outcomes of oocyte/embryo recipient cycles by donor age, Australia and New Zealand, 2021

	Age group (years)[(a)]				
Stage/outcome of treatment	**< 30**	**30–34**	**35–39**	**≥ 40**	**All[(b)]**
Initiated cycles	1,078	1,169	945	147	3,356
Embryo transfers	994	1,066	859	127	3,056
Clinical pregnancies	389	424	314	27	1,157
Live births	322	344	239	15	922
Live births per initiated cycle (%)	*29.9*	*29.4*	*25.3*	*10.2*	*27.5*
Live births per embryo transfer cycle (%)	*32.4*	*32.3*	*27.8*	*11.8*	*30.2*
Live births per clinical pregnancy (%)	*82.8*	*81.1*	*76.1*	*55.6*	*79.7*

(a) Donor age at the time of their OPU.

(b) Includes 17 cycles where the donor's age was unknown.

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

Of the 3,056 oocyte/embryo recipient cycles where embryos were transferred, 94% were SET, 6% were DET and there were no cycles where three or more embryos were transferred.

Overall, the live birth rate per oocyte/embryo recipient cycle where embryos were transferred was 26.4% in DET cycles compared with 30.4% in SET cycles (Table 27).

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 27: Outcomes of oocyte/embryo recipient embryo transfer cycles by stage of embryo development and number of embryos transferred, Australia and New Zealand, 2021

	Cleavage		Blastocyst		All	
Stage/outcome of treatment	**SET**	**DET**	**SET**	**DET**	**SET**	**DET**
Embryo transfer cycles	286	35	2,588	147	2,874	182
Clinical pregnancies	78	7	1,022	50	1,100	57
Live births	63	7	811	41	874	48
Clinical pregnancies per embryo transfer cycle (%)	*27.3*	*20.0*	*39.5*	*34.0*	*38.3*	*31.3*
Live births per embryo transfer cycle (%)	*22.0*	*20.0*	*31.3*	*27.9*	*30.4*	*26.4*

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

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

The majority (97%) of oocyte/embryo recipient thaw cycles where a blastocyst was transferred used vitrified embryos, compared with 83% 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 (29.5%) compared to slow-frozen embryos (20.8%) (Table 28).

Table 28: Outcomes of oocyte/embryo recipient thaw cycles by stage of embryo development and embryo freezing methods, Australia and New Zealand, 2021

	Stage of embryo development					
	Cleavage embryo		Blastocyst		All	
Stage/outcome of treatment	**Slow freezing**	**Vitrification**	**Slow freezing**	**Vitrification**	**Slow freezing**	**Vitrification**
Embryo transfer cycles	34	166	67	2,133	101	2,299
Clinical pregnancies	6	40	21	818	27	858
Live births	6	32	15	646	21	678
Clinical pregnancies per embryo transfer cycle (%)	*17.6*	*24.1*	*31.3*	*38.3*	*26.7*	*37.3*
Live births per embryo transfer cycle (%)	*17.6*	*19.3*	*22.4*	*30.3*	*20.8*	*29.5*

4 Pregnancy and birth outcomes following autologous and recipient embryo transfer cycles in 2021

4.1 Clinical pregnancies

Clinical pregnancies overview

There were 67,894 autologous and recipient embryo transfer cycles undertaken in Australian and New Zealand ART Units, of which 24,905 resulted in a clinical pregnancy. Of these clinical pregnancies, 22,375 (89.8%) were reported from ART Units in Australia and 2,530 (10.2%) from New Zealand Units. Clinical pregnancies that resulted from other ART treatment cycles are described in Chapters 5 and 6.

Of the 24,905 clinical pregnancies, 80.2% resulted in a birth and 19.6% resulted in early pregnancy loss (less than 20 weeks gestation and less than 400 grams birthweight). The outcomes of 57 (0.2%) clinical pregnancies were not known because women could not be followed up or contacted by ART Units.

Early pregnancy loss

There were 4,877 early pregnancy losses (less than 20 weeks gestation and less than 400 grams birthweight) following embryo transfers, representing 19.6% of clinical pregnancies. There was a larger proportion of early pregnancy loss following double embryo transfer cycles (25.3%) than single embryo transfer cycles (19.3%).

Table 29: Early pregnancy loss by pregnancy outcome and maternal age and number of embryos transferred, Australia and New Zealand, 2021

	Age group (years)[a]							
	< 35		35–39		≥ 40		All	
Pregnancy outcome	**One embryo**	**Two embryos[b]**	**One embryo**	**Two embryos[b]**	**One embryo**	**Two embryos[b]**	**One embryo**	**Two embryos[b]**
				n				
Early pregnancy loss	1,612	60	1,827	88	1,107	183	4,546	331
Miscarriage	*1,443*	*48*	*1,666*	*82*	*994*	*168*	*4,103*	*298*
Reduction or termination	*71*	*4*	*78*	*4*	*62*	*7*	*211*	*15*
Ectopic or heterotopic pregnancy	*98*	*8*	*83*	*2*	*51*	*8*	*232*	*18*
Birth	9,273	310	7,284	394	2,437	273	18,994	977
Not stated	23	0	28	0	6	0	57	0
Total pregnancies	**10,908**	**370**	**9,139**	**482**	**3,550**	**456**	**23,597**	**1,308**
				%				
Early pregnancy loss	14.8	16.2	20.0	18.3	31.2	40.1	19.3	25.3
Miscarriage	*13.2*	*13.0*	*18.2*	*17.0*	*28.0*	*36.8*	*17.4*	*22.8*
Reduction or termination	*0.7*	*1.1*	*0.9*	*0.8*	*1.7*	*1.5*	*0.9*	*1.1*
Ectopic or heterotopic pregnancy	*0.9*	*2.2*	*0.9*	*0.4*	*1.4*	*1.8*	*1.0*	*1.4*
Birth	85.0	83.8	79.7	81.7	68.6	59.9	80.5	74.7
Not stated	0.2	0.0	0.3	0.0	0.2	0.0	0.2	0.0
Total pregnancies	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**

(a) Age at start of treatment cycle.

(b) Includes three or more embryos.

4.2 Births

There were 19,971 female patients who gave birth to at least one baby of 20 weeks or more gestation or at least 400 grams birthweight following embryo transfer cycles. Of these, 98.9% (19,742) 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 30). The overall proportion of term live births following autologous and recipient cycles was 88.2% which is slightly lower than the proportion of term live birth in Australia (91.3%) (AIHW 2023).

Table 30: Births by birth outcome and treatment type, Australia and New Zealand, 2021

	Autologous				Oocyte /embryo recipient		All	
	Fresh		Thaw					
Birth outcome	**n**	**%**	**n**	**%**	**n**	**%**	**n**	**%**
Live birth	6,607	99.0	12,213	98.8	922	98.6	19,742	98.9
< 37 weeks	*766*	*11.5*	*1,214*	*9.8*	*140*	*15.0*	*2,120*	*10.6*
≥ 37 weeks	*5,841*	*87.5*	*10,998*	*89.0*	*782*	*83.6*	*17,621*	*88.2*
Gestational age unknown	*0*	*0.0*	*1*	*0.0*	*0*	*0.0*	*1*	*0.0*
Stillbirth[(a)]	50	0.7	99	0.8	12	1.3	161	0.8
Not stated	16	0.2	51	0.4	1	0.1	68	0.3
Total	**6,673**	**100.0**	**12,363**	**100.0**	**935**	**100.0**	**19,971**	**100.0**

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

Births by gestation and maternal age and number of embryos transferred

Of the 19,971 births, 3.0% were multiple births (Table 31), a slightly higher proportion than in 2020 (2.8%) (Newman et al. 2022). By comparison, the proportion of multiple births in Australia from all conceptions in 2021 was 1.4% (AIHW 2023).

Twin births accounted for 3.0% of births following embryo transfer cycles in 2021. Of the 592 twin births, 36.3% resulted from the transfer of two embryos and 63.5% from the transfer of one embryo. Of births following DET, the proportion of multiple births was higher for women aged under 35 (32.1%) compared with females aged 35–39 (25.1%) and females aged 40 or older (12.3%) (Table 31).

The average age of female patients at the time of birth who conceived using ART was 35 years. This is four years older than the average age (31.1 years) of all women who gave birth in Australia in 2021 (AIHW 2023).

Table 31: Births by gestation and maternal age and number of embryos transferred, Australia and New Zealand, 2021

	Age group (years)[a]								
	< 35		35–39		≥ 40		All		
Gestation	**One embryo**	**Two embryos[b]**	**One embryo**	**Two embryos[b]**	**One embryo**	**Two embryos[b]**	**One embryo**	**Two embryos[b]**	**Total**
					n				
Singleton	7,781	180	7,655	296	3,176	278	18,612	754	19,366
Multiple	176	85	166	99	40	39	382	223	605
Twin	*173*	*81*	*163*	*96*	*40*	*39*	*376*	*216*	*592*
Higher order multiple	*3*	*4*	*3*	*3*	*0*	*0*	*6*	*7*	*13*
Total	**7,957**	**265**	**7,821**	**395**	**3,216**	**317**	**18,994**	**977**	**19,971**
					%				
Singleton	97.8	67.9	97.9	74.9	98.8	87.7	98.0	77.2	97.0
Multiple	2.2	32.1	2.1	25.1	1.2	12.3	2.0	22.7	3.0
Twin	*2.2*	*30.6*	*2.1*	*24.3*	*1.2*	*12.3*	*2.0*	*22.1*	*3.0*
Higher order multiple	*0.0*	*1.5*	*0.0*	*0.8*	*0.0*	*0.0*	*0.0*	*0.7*	*0.1*
Total	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**

(a) Age at time of birth.

(b) Includes three or more embryos.

Caesarean section

More than half (55.5%) of births following embryo transfer cycles were by caesarean section (Table 32). The high rate of caesarean section following ART treatment may be related to the fact that on average, female patients receiving ART treatment were four years older than women who gave birth in Australia in 2021 and that there were more multiple births following ART treatment.

The caesarean section rate increased with advancing female age at birth: 44.7% of females aged less than 30 had a caesarean section compared with 81.1% of females aged 45 or older (Table 32).

The caesarean section rate varied by plurality, with 54.6% for singleton births and 85.5% for multiple births (twins and triplets). The caesarean section rate for women having a baby in Australia in 2021 was 38% (AIHW 2023).

Table 32: Births by method of birth and maternal age, Australia and New Zealand, 2021

	Age group (years)[(a)]					
Method of birth	**< 30**	**30–34**	**35–39**	**40–44**	**≥ 45**	**Total**
			n			
Caesarean section	751	3,252	4,693	2,072	318	11,086
Not stated	19	66	95	39	10	229
Other	911	3,223	3,428	1,030	64	8,656
Total	**1,681**	**6,541**	**8,216**	**3,141**	**392**	**19,971**
			%			
Caesarean section	44.7	49.7	57.1	66.0	81.1	55.5
Not stated	1.1	1.0	1.2	1.2	2.6	1.1
Other	54.2	49.3	41.7	32.8	16.3	43.3
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 ART cycles are described in Chapter 5.

There were 20,589 babies born to females who had autologous and recipient embryo transfer cycles. Of these, 89.9% (18,514) were reported from ART Units in Australia and 10.1% (2,075) from ART Units in New Zealand. Of the 20,589 babies, 94.1% were singletons, 5.8% were twins and < 1% were triplets. There were 20,340 liveborn babies. The birth status was not reported for 68 (0.3%) babies.

Sex distribution in liveborn babies

There were 10,266 (50.5%) liveborn male babies, 10,005 (49.2%) liveborn female babies and 69 (0.3%) liveborn babies where sex was not stated. For the 20,271 liveborn babies where the baby's sex was stated, the sex ratio was 102.6 male babies for every 100 female babies. The sex ratio for all Australian liveborn babies born in 2021 was 105.4 male liveborn babies per 100 female liveborn babies (AIHW 2023).

Liveborn babies following cleavage-stage embryo transfers had a sex ratio of 96.6 male babies for every 100 female babies. Liveborn babies following blastocyst transfers had a sex ratio of 102.9 male babies for every 100 female babies.

Gestational age of babies

The overall proportions of preterm (less than 37 weeks gestation) singletons (9.4%) and twins (74%) born to women who had embryo transfer cycles in 2021 were higher than the overall proportions of preterm singletons and twins born in Australia in 2021 (6.6% and 64.9% respectively) (AIHW 2023).

The median gestational age of babies born following autologous and recipient embryo transfer cycles was 38 weeks (Table 33). This is lower than the median gestational age of 39 weeks for all babies born in Australia in 2021 (AIHW 2023).

There were 13.3% of babies born preterm, which is higher than the proportion of preterm babies born in Australia in 2021 (8.2%) (AIHW 2023).

Table 33: Babies by gestational age and plurality, Australia and New Zealand, 2021

Gestational age (weeks)	Singletons		Twins		Higher order multiples		Total	
Median	*38*		*35*		*32*		*38*	
	n	**%**	**n**	**%**	**n**	**%**	**n**	**%**
≤ 27	*246*	*1.3*	*58*	*4.9*	*3*	*7.7*	*307*	*1.5*
28–31	*164*	*0.8*	*76*	*6.4*	*6*	*15.4*	*246*	*1.2*
32–36	*1,407*	*7.3*	*742*	*62.7*	*30*	*76.9*	*2,179*	*10.6*
≤ 36	1,817	9.4	876	74.0	39	100.0	2,732	13.3
≥ 37	17,547	90.6	308	26.0	0	0.0	17,855	86.7
Not stated	2	0.0	0	0.0	0	0.0	2	0.0
Total	**19,366**	**100.0**	**1,184**	**100.0**	**39**	**100.0**	**20,589**	**100.0**

Birthweight of liveborn babies

The average birthweight for liveborn babies to women who had autologous and recipient embryo transfer cycles was 3,214 grams. This is comparable the average birthweight of all liveborn babies (3,322 grams) in Australia in 2021 (AIHW 2023). Approximately one in ten (10.3%) of the 20,340 liveborn babies were low birthweight (less than 2,500 grams) (Table 34).

The average birthweight was 3,273 grams and 2,289 grams for liveborn ART singletons and twins respectively. Low birthweight was reported for 8.9% of liveborn singletons following fresh cycles and 6.4% of liveborn singletons following thaw cycles. For ART twins, 57.8% were reported as low birthweight in comparison with 53.5% of twin births in Australia in 2021 (AIHW 2023).

Table 34: Liveborn babies by birthweight group and plurality, Australia and New Zealand, 2021

	Fresh			Thaw		
Birthweight (grams)	**Singletons**	**Twins**	**Higher order multiples**	**Singletons**	**Twins**	**Higher order multiples**
			n			
< 1,500	103	55	5	140	61	3
1,500–2,499	486	228	9	658	326	18
2,500–3,499	3,942	128	0	6,785	321	0
3,500–4,500	1,941	4	0	4,646	7	0
> 4,500	46	1	0	166	0	0
Not stated	87	16	3	143	12	0
Total	**6,605**	**432**	**17**	**12,538**	**727**	**21**
			%			
< 1,500	1.6	12.7	29.4	1.1	8.4	14.3
1,500–2,499	7.4	52.8	52.9	5.2	44.8	85.7
2,500–3,499	59.7	29.6	0.0	54.1	44.2	0.0
3,500–4,500	29.4	0.9	0.0	37.1	1.0	0.0
> 4,500	0.7	0.2	0.0	1.3	0.0	0.0
Not stated	1.3	3.7	17.6	1.1	1.7	0.0
Total	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**

Perinatal mortality

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

There were 259 reported perinatal deaths, including 181 stillbirths and 78 neonatal deaths. The perinatal mortality rate in 2021 was 12.6 deaths per 1,000 births (Table 35), which was higher than the rate of 9.4 per 1,000 births for all births in Australia in 2021 (AIHW 2023). Singletons had a markedly lower perinatal mortality rate (11.2 deaths per 1,000 births) compared with multiples (35.2 deaths per 1,000 births) (Table 35).

These data should be interpreted with caution because of the small numbers and potential variability in case reporting, which is compounded by the self-reported nature of ART birth outcome data. In 2021, information relating to birth outcomes was not stated for 68 births.

Table 35: Perinatal mortality of babies by type of death and plurality, Australia and New Zealand, 2021

			Stillbirths[(a)]		Neonatal deaths[(b)]		Perinatal deaths[(a)(b)]	
Plurality	All births	Live births	**n**	**Rate[(c)(e)]**	**n**	**Rate[(d)(f)]**	**n**	**Rate[(c)(g)]**
Singletons	19,366	19,143	155	8.0	61	3.2	216	11.2
Multiples	1,223	1,197	26	21.3	17	14.2	43	35.2
Total	**20,589**	**20,340**	**181**	**8.8**	**78**	**3.8**	**259**	**12.6**

(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 68 births.

5 Other cycle types, procedures and treatment complications in 2021

5.1 Surrogacy arrangements

A surrogacy arrangement is an arrangement between the intending parent(s) and a female patient, known as the 'gestational carrier' or 'surrogate'. The surrogate gestational carrier agrees to carry a child for another person or couple, known as the 'intending parent(s)', with the intention that the child will be raised by the intending parent(s). The oocytes and/or sperm used to create the embryo(s) can be either from the intending parents or from a donor(s).

There were 400 surrogacy arrangement cycles in 2021, including 280 surrogate gestational carrier cycles and 120 commissioning cycles. Commissioning cycles include a variety of cycle types involved in the provision of oocytes or embryos by either the intending parents or donors. Among the 280 surrogate gestational carrier cycles, 274 (97.9%) resulted in an embryo transfer, all of which were single embryo transfers. Of the embryo transfer cycles, 123 (44.9%) resulted in a clinical pregnancy and 100 (36.5%) resulted in a live birth (Table 36).

Table 36: Outcomes of surrogate gestational carrier cycles by number of embryos transferred, Australia and New Zealand, 2021

Outcome	SET	DET	Total
Embryo transfer cycles	274	0	274
Clinical pregnancies	123	0	123
Live births	100	0	100
Singletons	100	0	100
Multiples	0	0	0
Clinical pregnancies per embryo transfer cycle (%)	*44.9*	..	*44.9*
Live births per embryo transfer cycle (%)	*36.5*	..	*36.5*
Live births per clinical pregnancy (%)	*81.3*	..	*81.3*

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 PGT for aneuploidies (PGT-A), PGT for monogenic/single gene defects (PGT-M) and PGT for chromosomal structural rearrangements (PGT-SR).

There were 8,807 autologous, recipient, surrogacy and lab-only cycles where PGT was performed in 2021 (Table 37), representing 8% of these cycles (Table 1). Of the 7,846 fresh cycles where PGT was performed in 2021, 78.9% (6,191) were freeze-all cycles, 20.5% (1,607) were fresh embryo transfer cycles where the embryo transferred did not undergo PGT (not all embryos were tested), <1% (5) were fresh embryo transfer cycles where the embryo transferred underwent PGT in the same cycle and 0.5% (43) of the cycles did not proceed to embryo transfer.

Of the 319 frozen cycles where PGT was performed in 2021, 61.1% (195) were embryo transfer cycles, 31.7% (101) were part of mixed cycle where fresh and/or frozen embryos were tested and in 6.3% (20) of frozen cycles, embryos were thawed, tested and re-frozen and the remaining 0.9% (3) cycles did not survive the embryo thawing process.

Table 37: Number of autologous, recipient, surrogacy and lab-only cycles with PGT performed in that cycle, by reason for PGT, Australia and New Zealand, 2021

Indication	Fresh embryo/s	Frozen embryo/s	Lab-only cycles	Total
Aneuploidy	6,452	237	545	7,234
Single gene variation	866	54	65	985
Chromosomal structural arrangements	447	27	23	497
Other	81	1	9	91
Total	**7,846**	**319**	**642**	**8,807**

Almost one third of PGT cycles were performed in women aged 40 years or more (29.7%) (Table 38). It is important to note that embryos thawed in a thaw or lab-only cycle were created in an earlier initiated fresh cycle; therefore, a woman's age at the start of a thaw or lab-only cycle is older than her age when the embryo was created.

Table 38: Number of autologous, recipient, surrogacy and lab-only cycles with PGT performed in that cycle, by female intending parent age, Australia and New Zealand, 2021

Female age group (years)[(a)]	Fresh embryo/s	Frozen embryo/s	Lab-only cycles	Total
< 30	343	19	39	401
30–34	1,774	86	128	1,988
35–39	3,445	119	225	3,789
40–44	2,222	94	196	2,512
≥ 45	62	1	40	103
Total	**7,846**	**319**	**628**	**8,793**

(a) Female age at start of cycle. Table 38 excludes cycles where there was no female intending parent.

There were 6,846 autologous, recipient and gestational carrier cycles initiated in 2021 where PGT embryos were transferred. Of these, 49.1% resulted in a clinical pregnancy and 41.6% resulted in a live birth (Table 39). The PGT procedure could have occurred in 2021 or previous years for thaw cycles.

Table 39: Stage/outcome of autologous, recipient and surrogacy cycles with PGT performed, by treatment type, Australia and New Zealand, 2021

Stage/Outcome of PGT-tested embryos	Fresh	Frozen	Total
Embryo transfers	5	6,841	6,846
Clinical pregnancies	2	3,362	3,364
Live births	2	2,845	2,847
Clinical pregnancies per embryo transfer cycle (%)	*40.0*	*49.1*	*49.1*
Live births per embryo transfer cycle (%)	*40.0*	*41.6*	*41.6*

Almost half (45.6%) of the embryo transfer cycles where PGT embryos were transferred were undertaken in women aged 35–39 years. The highest live birth rate per embryo transfer cycle was in women aged 30 to 34 years (42.7%) followed by women aged 35–39 years (42%) (Table 40). It is important to note that embryos thawed in a thaw cycle were created in an earlier initiated fresh cycle; therefore, a woman's age at the start of a thaw cycle may be older than her age when the embryo was created.

Table 40: Stage/outcome of autologous, recipient and surrogacy cycles with PGT performed, by female patient age, Australia and New Zealand, 2021

	Age group (in years)[(a)]					
Stage/Outcome of PGT-tested embryos	< 30	30–34	35–39	40–44	≥ 45	Total
Embryo transfers	345	1,794	3,119	1,493	95	6,846
Clinical pregnancies	167	887	1,545	726	39	3,364
Live births	135	766	1,310	605	31	2,847
Clinical pregnancies per embryo transfer cycle (%)	*48.4*	*49.4*	*49.5*	*48.6*	*41.1*	*49.1*
Live births per embryo transfer cycle (%)	*39.1*	*42.7*	*42.0*	*40.5*	*32.6*	*41.6*

(a) Age at start of treatment cycle.

5.3 Assisted hatching

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

There were 6,515 assisted hatching cycles reported in 2021 that did not occur in an autologous or recipient cycle where PGT was performed in 2021. Of these, 3,427 (52.6%) were thaw cycles and 3,088 (47.4%) were fresh cycles. Embryos were transferred in 5,258 (80.7%) of assisted hatching cycles, resulting in 1,983 (30.4%) clinical pregnancies and 1,583 (24.3%) live births. There were 1,629 babies born following assisted hatching cycles, including 1,537 singletons and 46 twin babies.

6 Donor sperm insemination cycles in 2021

Donor sperm insemination (DI) covers a range of techniques of placing sperm into the female genital tract using donated sperm from a male who is not an intending parent. The information presented in this section only describes DI cycles undertaken in ART Units 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 Tables which accompany this report.

Number and outcomes of DI cycles

In 2021, there were 3,379 DI cycles reported. Of all DI cycles, 16.3% resulted in a clinical pregnancy and 13.6% resulted in a live birth (Table 41). The multiple birth rate from births following DI cycles was 3.3%.

The average age of women who had a DI cycle was 35 years. The clinical pregnancy and live birth rates decreased with age (Table 41).

Table 41: Outcomes of DI cycles by female patient age, Australia and New Zealand, 2021

	Age group (years)[(a)]				
Stage/outcome of treatment	**< 30**	**30–34**	**35–39**	**≥ 40**	**Total**
DI cycles	473	1,121	1,285	500	3,379
Clinical pregnancies	104	217	196	33	550
Live births	91	185	161	24	461
Clinical pregnancies per DI cycle (%)	*22.0*	*19.4*	*15.3*	*6.6*	*16.3*
Live births per DI cycle (%)	*19.2*	*16.5*	*12.5*	*4.8*	*13.6*
Live births per clinical pregnancy (%)	*87.5*	*85.3*	*82.1*	*72.7*	*83.8*

(a) Age at start of a treatment cycle.

Clinical pregnancies following DI cycles

Of the 550 clinical pregnancies following DI cycles, 83.8% resulted in a birth and 15.8% ended in early pregnancy loss (including 14.4% miscarriages, 0.9% ectopic/heterotopic pregnancies and 0.6% reductions/termination). Of the 463 births, 448 (96.7%) were singleton births, 12 (2.6%) were twin births and 3 were triplet births (0.7%).

Perinatal outcomes of babies following DI cycles

There were 481 babies born to females who had DI treatment. Of these, 477 were liveborn, 2 were neonatal deaths, and 2 were stillborn. Of the liveborn babies, 48 (10.1%) were born preterm (less than 37 weeks gestation). The mean birthweight of liveborn babies following DI treatment was 3,319 grams. This was higher than the mean birthweight of liveborn babies following autologous and recipient embryo transfer cycles (3,222 grams). Thirty-three liveborn babies (6.9%) were born with low birthweight (less than 2,500 grams).

7 Trends in ART treatment and outcomes: 2017–2021

This section includes autologous cycles, donation/recipient cycles, surrogacy cycles and GIFT cycles undertaken in Australia and New Zealand from 2017 to 2021. It does not include DI cycles or lab-only cycles.

ART treatment and outcomes

In 2021, there were 109,840 initiated ART cycles in Australia and New Zealand. This represents a 15.6% increase on 2020 (Table 42 and Table 43), noting that communities and health services were affected by the COVID pandemic in 2020 and 2021.

The proportion of initiated fresh cycles reaching embryo transfer decreased from 49.1% in 2017 to 39.6% in 2021 partly due to changes in clinical practice, including an increase in the proportion of freeze-all cycles. Since 2017, there has been an average 17.2% yearly increase in the number of freeze-all cycles (Table 42).

Between 2017 and 2021, the live birth rate per initiated fresh non-freeze-all cycle ranged between 15.2% and 16.1% (Table 42). The live birth rate per embryo transfer cycle has been stable from 24.1% in 2017 to 25.5% in 2021.

Table 42: Number of fresh cycles by stage/outcome of treatment, Australia and New Zealand, 2017–2021

Stage/outcome of treatment	2017	2018	2019	2020	2021
Initiated cycles[(a)]	50,096	50,559	53,736	56,691	67,632
Cycles with OPU[(b)]	43,814	45,656	47,410	50,694	59,629
Freeze-all cycles[(c)]	12,110	13,520	15,079	17,939	22,709
Embryo transfers	24,588	24,254	24,206	24,154	26,771
Clinical pregnancies	7,694	7,612	7,934	7,906	8,772
Live births	5,929	5,961	6,177	6,138	6,833
Clinical pregnancy per embryo transfer (%)	*31.3*	*31.4*	*32.8*	*32.7*	*32.8*
Clinical pregnancies per initiated cycle (%)	*15.4*	*15.1*	*14.8*	*13.9*	*13.0*
Live births per embryo transfer (%)	*24.1*	*24.6*	*25.5*	*25.4*	*25.5*
Live births per initiated cycle (%)	*11.8*	*11.8*	*11.5*	*10.8*	*10.1*
Live births per initiated non-freeze-all cycle (%)[(d)]	*15.6*	*16.1*	*16.0*	*15.8*	*15.2*

(a) Included autologous cycles, oocyte donation cycles, oocyte/embryo recipient cycles, GIFT cycles and surrogacy cycles.
(b) Cycles with OPU include 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.

There were 42,208 initiated thaw cycles undertaken in 2021, an increase of 12.1% on 2020 (Table 43). The live birth rate per initiated thaw cycle increased from 27.9% in 2017 to 30.8% in 2021 (Table 43).

Table 43: Number of thaw cycles by stage/outcome of treatment, Australia and New Zealand, 2017–2021

Stage/outcome of treatment	2017	2018	2019	2020	2021
Initiated cycles[(a)]	32,119	33,505	35,193	37,649	42,208
Embryo transfers	31,006	32,422	34,116	36,964	41,397
Clinical pregnancies	11,166	11,902	12,734	14,248	16,256
Live births	8,953	9,514	10,133	11,532	13,009
Clinical pregnancy per embryo transfer (%)	*36.0*	*36.7*	*37.3*	*38.5*	*39.3*
Clinical pregnancies per initiated cycle (%)	*34.8*	*35.5*	*36.2*	*37.8*	*38.5*
Live births per embryo transfer (%)	*28.9*	*29.3*	*29.7*	*31.2*	*31.4*
Live births per initiated cycle (%)	*27.9*	*28.4*	*28.8*	*30.6*	*30.8*

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

The clinical pregnancy and live birth rates per OPU provide an estimate of the chances of success following a single OPU cycle. For this measure, all OPUs and fresh and thaw embryo transfers were performed in 2021 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 as the denominator.

Between 2017 and 2021, the live birth rate from fresh and thaw cycles per OPU cycle has varied between 33.9% and 35% (Table 44).

Table 44: Outcomes of fresh and thaw cycles following OPU, Australia and New Zealand, 2017–2021

Outcome of treatment	2017	2018	2019	2020	2021
Cycles with OPU[(a)]	43,814	45,656	47,410	50,694	56,629
Clinical pregnancies	18,860	19,514	20,668	22,154	25,028
Live births	14,882	15,475	16,310	17,670	19,842
Clinical pregnancies from fresh and thaw cycles per OPU cycles[(b)]	*43.0*	*42.7*	*43.6*	*43.7*	*44.2*
Live births from fresh and thaw cycles per OPU cycle[(c)]	*34.0*	*33.9*	*34.4*	*34.9*	*35.0*

(a) Cycles with OPU include 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 proportion of multiple births decreased from 3.6% in 2017 to 2.8% in 2020 with a marginal increase to 3.0% in 2021 (Table 45). This low rate is primarily the result of the single embryo transfers. (Table 49).

Table 45: Number of births following ART treatment by gestation, Australia and New Zealand, 2017–2021

Gestation	2017		2018		2019		2020		2021	
	n	%	n	%	n	%	n	%	n	%
Singleton	14,528	96.4	15,129	96.8	15,962	97.1	17,375	97.2	19,467	97.0
Multiple	539	3.6	505	3.2	480	2.9	502	2.8	605	3.0
Twin	*532*	*3.5*	*497*	*3.2*	*475*	*2.9*	*493*	*2.8*	*592*	*2.9*
Higher order multiple	*7*	*0.0*	*8*	*0.1*	*5*	*0.0*	*9*	*0.1*	*13*	*0.1*
Total[(a)]	**15,067**	**100.0**	**15,634**	**100.0**	**16,442**	**100.0**	**17,877**	**100.0**	**20,072**	**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 2017 and 2021. The average age of women having autologous cycles remained stable over the period, at 36 years. The proportion of autologous cycles in women aged 40 and older ranged between 23% and 24.3% between 2017 and 2020 (Table 46).

Table 46: Number of fresh and thaw autologous cycles by women's age group, Australia and New Zealand, 2017–2021

Age group (years)[(a)]	2017		2018		2019		2020		2021	
Mean	*36*		*36*		*36*		*36*		*36*	
	n	**%**	**n**	**%**	**n**	**%**	**n**	**%**	**n**	**%**
< 30	8,219	10.6	7,764	9.8	8,334	9.9	8,899	9.8	9,337	8.9
30–34	22,482	29.1	23,093	29.2	23,961	28.5	25,820	28.5	29,514	28.1
35–39	28,547	36.9	29,422	37.2	32,038	38.1	34,971	38.6	40,583	38.7
40–44	16,544	21.4	17,284	21.9	18,173	21.6	19,238	21.3	23,409	22.3
≥ 45	1,561	2.0	1,509	1.9	1,575	1.9	1,601	1.8	2,074	2.0
Total	**77,353**	**100.0**	**79,072**	**100.0**	**84,081**	**100.0**	**90,529**	**100.0**	**104,917**	**100.0**

(a) Age at start of treatment cycle.

Types of ART treatment and stage of embryo development

The proportion of embryo transfer cycles that used embryos fertilised using ICSI has decreased from 62.2% in 2017 to 55.6% in 2021. The proportion of blastocyst transfer cycles increased from 82% in 2017 to 91.5% in 2021 (Table 47).

Table 47: Number of embryo transfer cycles by treatment type, Australia and New Zealand, 2017–2021

Treatment type[(a)] and procedure	2017		2018		2019		2020		2021	
	n	%	n	%	n	%	n	%	n	%
Fertilisation procedure										
IVF	20,325	36.6	22,473	39.7	24,405	41.8	26,815	43.9	30,249	44.4
ICSI[(b)]	34,597	62.2	34,201	60.3	33,917	58.2	34,299	56.1	37,919	55.6
Not stated/GIFT	672	1.2	0	0.0	0	0.0	4	0.0	0	0.0
Total	**55,594**	**100.0**	**56,674**	**100.0**	**58,322**	**100.0**	**61,118**	**100.0**	**68,168**	**100.0**
Stage of embryo development										
Cleavage stage	10,018	18.0	7,566	13.4	6,833	11.7	6,495	10.6	5,803	8.5
Blastocyst[(c)]	45,576	82.0	49,108	86.6	51,489	88.3	54,619	89.4	62,365	91.5
Not stated/GIFT	**0**	**0.0**	**0**	**0.0**	**0**	**0.0**	**4**	**0.0**	0	0.0
Total	**55,594**	**100.0**	**56,674**	**100.0**	**58,322**	**100.0**	**61,118**	**100.0**	**68,168**	**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 blastocysts between 2017 and 2021 (Table 48). In 2021, 97.3% of blastocyst transfers and 74.5% of cleavage-stage transfers used vitrified embryos.

Table 48: Number of thaw embryo transfer cycles by cryopreservation method and stage of embryo development, Australia and New Zealand, 2017–2021

Treatment type and procedure	2017		2018		2019		2020		2021	
	n	%	n	%	n	%	n	%	n	%
					Cleavage stage					
Slow frozen	1,033	42.4	710	37.4	486	30.7	322	19.0	294	25.5
Vitrification[(a)]	1,405	57.6	1,186	62.6	1,095	69.3	1,370	81.0	859	74.5
Not stated	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
Total	**2,438**	**100.0**	**1,896**	**100.0**	**1,581**	**100.0**	**1,692**	**100.0**	**1,153**	**100.0**
					Blastocyst					
Slow frozen	2,440	8.5	1,801	5.9	1,478	4.5	1,265	3.6	1,121	2.8
Vitrification[(a)]	26,128	91.5	28,725	94.1	31,055	95.5	34,007	96.4	39,123	97.3
Not stated	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
Total	**28,568**	**100.0**	**30,526**	**100.0**	**32,533**	**100.0**	**35,272**	**100.0**	**40,244**	**100.0**

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

Number of embryos transferred per embryo transfer cycle

The proportion of SET cycles has increased from 89.4% of embryo transfer cycles in 2017 to 93.6% of embryo transfer cycles in 2021 (Table 49).

Table 49: Percentage of embryo transfer cycles by number of embryos transferred, Australia and New Zealand, 2017–2021

Number of embryos transferred	2017	2018	2019	2020	2021
One embryo	89.4	90.6	91.9	93.0	93.6
Two embryos	10.5	9.3	8.0	6.9	6.4
Three or more embryos	0.1	0.1	0.1	0.1	0.1

8 Women undertaking autologous treatment in 2021

This section presents the number of women who underwent autologous ART treatment in 2021. 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 53,509 women who undertook 104,917 autologous fresh and/or thaw cycles in Australia and New Zealand in 2021. Of these women, 48,705 had treatment in Australia, 4,815 in New Zealand, including 11 having treatment in both Australia and New Zealand.

On average, 2.0 fresh and/or thaw cycles per woman were undertaken in 2021, with more cycles per woman in Australia (2.0 cycles per woman) than in New Zealand (1.7 cycles per woman). In Australia, more than half (53.8%) of the women had two or more autologous treatment cycles compared with 46.9% of women in New Zealand. In line with this, 11.4% of women in Australia had four or more cycles in 2021 compared with 5.5% of women in New Zealand (Table 50).

Table 50: Women undertaking autologous fresh and/or thaw cycles by number of cycles, Australia and New Zealand, 2021

Number of cycles	Australia		New Zealand		All	
	n	%	n	%	n	%
One	22,488	46.2	2,556	53.1	25,033	46.8
Two	13,876	28.5	1,464	30.4	15,334	28.7
Three	6,793	13.9	532	11.0	7,329	13.7
Four or more	5,548	11.4	263	5.5	5,813	10.9
Total	**48,705**	**100.0**	**4,815**	**100.0**	**53,509**	**100.0**

Note: Only women who undertook cycles in 2021 are included. Elven women had treatment in both Australia and New Zealand.

Women who undertook autologous fresh cycles

There were 65,414 fresh cycles undertaken by 42,750 women in Australia and New Zealand in 2021, an average of 1.5 fresh cycles per woman. Younger women had fewer fresh cycles, with around one in four (23.5%) women aged under 30 having two or more autologous fresh cycles compared to nearly one in three (34.0%) overall. This partly reflects the higher success rate per initiated fresh autologous cycle among younger women, and the fact that younger women tend to have more cryopreserved embryos available for subsequent thaw cycles. One percent of women aged under 30 had four or more cycles. This proportion increased to 2.2% for women aged 30 to 34 years, 4.2% for women aged 35 to 39 years and 8.9% for women aged 40 to 44 years (Table 51).

Table 51: Women undertaking autologous fresh cycles by number of cycles, Australia and New Zealand, 2021

	Age group (years)[(a)]					
Number of cycles	**< 30**	**30–34**	**35–39**	**40–44**	**≥ 45**	**All**
			n			
One	3,303	9,260	10,629	4,607	418	28,217
Two	787	2,379	3,760	2,271	184	9,381
Three	176	640	1,316	1,078	73	3,283
Four or more	49	277	688	779	66	1,859
Total	**4,315**	**12,556**	**16,393**	**8,735**	**741**	**42,740**
			%			
One	76.5	73.7	64.8	52.7	56.4	66.0
Two	18.2	18.9	22.9	26.0	24.8	21.9
Three	4.1	5.1	8.0	12.3	9.9	7.7
Four or more	1.1	2.2	4.2	8.9	8.9	4.3
Total	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**

(a) Age at start of first autologous fresh cycle in 2021.

Women who undertook autologous thaw cycles

There were 39,503 thaw cycles undertaken by 26,946 women in Australia and New Zealand in 2021, an average of 1.5 thaw cycles per woman. Thirty-six percent of women aged under 30 had two or more thaw cycles compared with 19.5% of women aged 45 or older (Table 52).

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 51 and Table 52).

Table 52: Women undertaking autologous thaw cycles by number of cycles, Australia and New Zealand, 2021

	Age group (years)[(a)]					
Number of cycles	**< 30**	**30–34**	**35–39**	**40–44**	**≥ 45**	**All**
			n			
One	1,665	5,587	7,074	3,452	317	18,095
Two	658	2,008	2,439	1,014	57	6,176
Three	189	662	763	264	17	1,895
Four or more	106	272	308	91	3	780
Total	**2,618**	**8,529**	**10,584**	**4,821**	**394**	**26,946**
			%			
One	63.6	65.5	66.8	71.6	80.5	67.2
Two	25.1	23.5	23.0	21.0	14.5	22.9
Three	7.2	7.8	7.2	5.5	4.3	7.0
Four or more	4.0	3.2	2.9	1.9	0.8	2.9
Total	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**

(a) Age at start of first autologous thaw cycle in 2021.

9 Cycle-specific and cumulative live birth rates

This chapter provides a longitudinal perspective on the outcomes of success for ART treatment undertaken by the same woman. The analysis includes women who started their first autologous ART treatment cycle between 1 January 2018 and 31 December 2019 and subsequent ART treatments they had up until 31 December 2021, or until they achieved a live birth (a birth of at least one liveborn baby).

Donor sperm insemination cycles, oocyte/embryo recipient cycles, oocyte/embryo donation cycles, surrogacy arrangement cycles and GIFT cycles were excluded. Only the first six ART cycles are presented due to the small number of women undertaking six or more treatment cycles between 1 January 2018 and 31 December 2021.

How to interpret Tables 53 to 59

- The following tables report on women who started their first ART ovarian stimulation cycle in Australia or New Zealand between 1 January 2018 and 31 December 2019, and reports on all subsequent ART treatments and outcomes until 31 December 2021. This allows for a minimum of two years and a maximum of four years of follow-up for each woman.

- Table 53 presents the number of complete cycles by the age-group of women who undertook their first ovarian stimulation cycle in 2018-2019. Figure 7 and Tables 54 to 59 present the cycle specific and cumulative live birth rates from *complete ART cycles*. A complete ART cycle is defined as an initiated ART ovarian stimulation cycle including all fresh and frozen/thaw embryo transfers associated with that ovarian stimulation. Ovarian stimulation cycles where no eggs are retrieved or embryos created are still counted as complete ART cycles.

- Complete ART cycles are not included in the tables if all eggs/embryos were frozen (freeze-all cycles) and the women did not return to transfer embryos in subsequent frozen/thaw cycles before 31 December 2021.

- Only the first live birth to a woman is counted. Any subsequent ART treatments by the same woman are not included.

- The *discontinuation rate* is the percentage of women who did not achieve a live birth and did not return for further ART treatment before 31 December 2021. For example, 30.8% of women who did not achieve a live birth by their second complete cycle did not return for a third cycle (Table 54).

- The *cycle specific live* birth rate is calculated as the percentage of women who had a live birth in a specific complete ART cycle after previous failed treatment attempts. For example, 19.8% of women who undertook a third complete ART cycle achieved a live birth in that cycle (Table 54).

- The *conservative cumulative live birth* rate assumes that women who discontinued treatment would have zero probability of achieving a live birth if they had continued with ART treatment. It is calculated as the cumulative probability of achieving a live birth for women who continued treatment up to a specific complete ART cycle. For example, 53.6% of women who commenced ART treatment in 2018-2019 and undertook three complete ART cycles, achieved a live birth (Table 54).

- The *optimal cumulative live birth rate* assumes that women who discontinued treatment had an equal chance of achieving a live birth as those who continued with ART treatment. For example, it assumes that the 30.8% of women who discontinued treatment after their second failed cycle, would have a 19.8% chance of having a baby in their third complete ART cycle, resulting in theoretical cumulative live birth rate of 63% after three complete ART cycles (Table 54).

Table 53: Number of complete cycles by women's age group for all women who started their first autologous fresh cycle (excluding freeze-all cycles[(a)]) between 1 January 2018 and 31 December 2019, Australia and New Zealand

Complete cycle number	Age group (years)[(b)]					
	< 30	30–34	35–39	40–44	≥ 45	All
			n			
One	1,487	3,270	3,266	1,542	204	9,769
Two	1,495	3,347	3,202	1,447	119	9,610
Three	813	1,953	2,017	958	75	5,816
Four	487	1,164	1,357	638	38	3,684
Five	286	780	944	424	15	2,449
Six	184	496	672	313	8	1,673
Seven	128	307	377	196	7	1,015
Eight	63	209	269	150	5	696
Nine	57	140	193	91	2	483
Ten or more	83	246	395	199	5	928
Total	**5,083**	**11,912**	**12,692**	**5,958**	**478**	**36,123**
			%			
One	29.3	27.5	25.7	25.9	42.7	27.0
Two	29.4	28.1	25.2	24.3	24.9	26.6
Three	16.0	16.4	15.9	16.1	15.7	16.1
Four	9.6	9.8	10.7	10.7	7.9	10.2
Five	5.6	6.5	7.4	7.1	3.1	6.8
Six	3.6	4.2	5.3	5.3	1.7	4.6
Seven	2.5	2.6	3.0	3.3	1.5	2.8
Eight	1.2	1.8	2.1	2.5	1.0	1.9
Nine	1.1	1.2	1.5	1.5	0.4	1.3
Ten or more	1.6	2.1	3.1	3.3	1.0	2.6
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 before 31 December 2021.

(b) Age at start of first autologous fresh ART treatment cycle (excluding freeze-all cycles) undertaken in 2018-2019.

Note: Women who started their first autologous fresh non-freeze-all ART treatment cycle between 1 January 2018 and 31 December 2019 were followed through subsequent fresh and thaw cycles, excluding freeze-all cycles, until 31 December 2021 or birth of a liveborn baby up to 31 October 2022.Totals and subtotals may not equal 100.0 due to rounding. Data should be interpreted with caution due to small numbers in certain cells.

Table 54: Cycle-specific and cumulative live birth rates (complete cycle) for all women who started their first autologous fresh cycle in Australia and New Zealand during 2018-2019[(a)] and followed until 31 December 2021 or the first treatment-dependent live birth

Complete ART cycle number[(b)]	Number of women starting cycle	Number of live births[(c)]	Discontinuation rate[(d)]	Cycle specific live birth rate[(e)]	Conservative cumulative live birth rate[(f)]	Optimal cumulative live birth rate[(g)]
One	36,123	13,409	28.5%	37.1%	37.1%	37.1%
Two	16,241	4,328	30.8%	26.6%	49.1%	53.9%
Three	8,244	1,635	32.7%	19.8%	53.6%	63.0%
Four	4,450	760	31.6%	17.1%	55.7%	69.3%
Five	2,523	338	33.3%	13.4%	56.7%	73.4%
Six	1,457	162	34.0%	11.1%	57.1%	76.4%

(a) The first autologous fresh cycle is defined as the first initiated ovarian stimulation cycle undertaken by a woman in an Australian or New Zealand ART clinic.

(b) A complete ART cycle is defined as the initial ovarian stimulation cycle and subsequent frozen/thaw embryo transfers associated with that ovarian stimulation. Ovarian stimulation cycles where all eggs/embryos were frozen (freeze-all cycles) and no eggs/embryos were used in subsequent thaw cycles up until 31 December 2021 are not counted. Cycles with intended or actual egg retrieval but without ovarian stimulation are excluded from the analysis.

(c) 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.

(d) The discontinuation rate after a specific cycle is calculated as the number of women who did not return for a further ovarian stimulation cycle before 31 December 2021 divided by the number of women who did not have a live birth in that complete ART 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.

(e) The cycle-specific live birth rate for a specific complete ART cycle is calculated as the number of live births achieved from that specific complete ART cycle divided by the number of women who commenced at that cycle.

(f) The conservative cumulative live birth rate for a specific ART cycle is calculated as the number of women who achieved a live birth up to and including that complete ART cycle divided by the total number of women who commenced complete ART cycle 1.

(g) The optimal cumulative live birth rate is calculated by assuming that women who discontinued treatment would have had the same chance of a live birth in a particular cycle as those who continued.

Note: Further treatment cycles after the sixth 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.

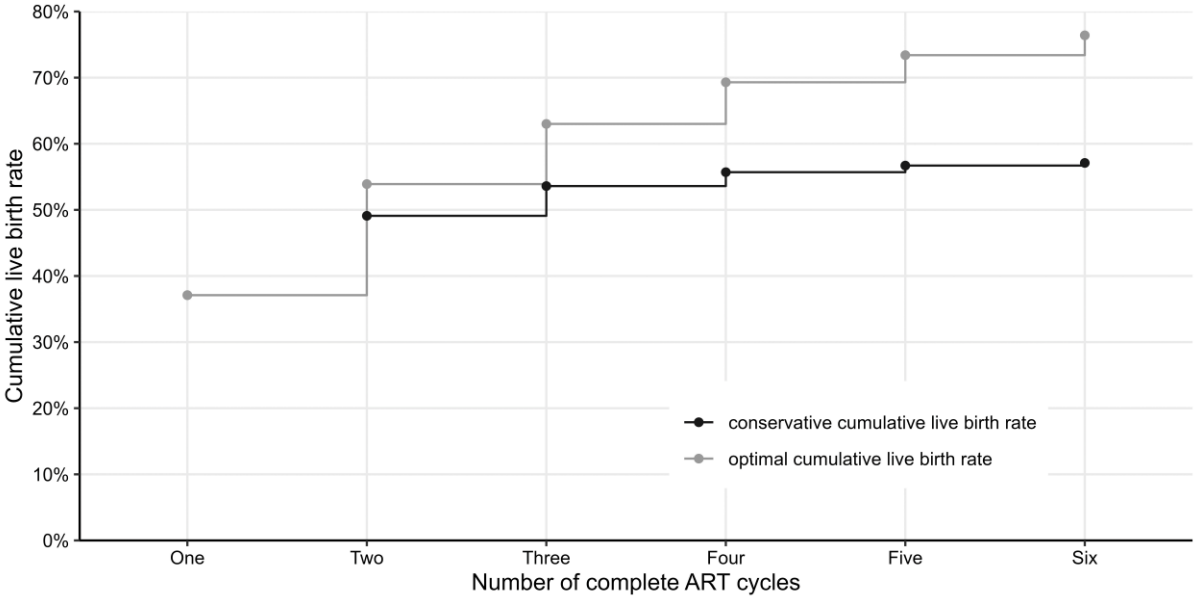


Figure 7: Cumulative live birth rates (complete cycle) for all women who started their first autologous fresh cycle in Australia and New Zealand during 2018-2019 and followed until 31 December 2021 or the first treatment-dependent live birth

Table 55: Cycle-specific and cumulative live birth rates (complete cycle) for women aged less than 30 who started their first autologous fresh cycle in Australia and New Zealand during 2018-2019[(a)] and followed until 31 December 2021 or the first treatment-dependent live birth

Complete ART cycle number[(b)]	Number of women starting cycle	Number of live births[(c)]	Discontinuation rate[(d)]	Cycle specific live birth rate[(e)]	Conservative cumulative live birth rate[(f)]	Optimal cumulative live birth rate[(g)]
One	5,083	2,572	30.5%	50.6%	50.6%	50.6%
Two	1,745	715	34.0%	41.0%	64.7%	70.8%
Three	680	251	30.3%	36.9%	69.6%	81.6%
Four	299	79	37.3%	26.4%	71.2%	86.5%
Five	138	27	35.1%	19.6%	71.7%	89.1%
Six	72	21	27.5%	29.2%	72.1%	92.3%

(a) The first autologous fresh cycle is defined as the first initiated ovarian stimulation cycle undertaken by a woman in an Australian or New Zealand ART clinic.

(b) A complete ART cycle is defined as the initial ovarian stimulation cycle and subsequent frozen/thaw embryo transfers associated with that ovarian stimulation. Ovarian stimulation cycles where all eggs/embryos were frozen (freeze-all cycles) and no eggs/embryos were used in subsequent thaw cycles up until 31 December 2021 are not counted. Cycles with intended or actual egg retrieval but without ovarian stimulation are excluded from the analysis.

(c) 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.

(d) The discontinuation rate after a specific cycle is calculated as the number of women who did not return for a further ovarian stimulation cycle before 31 December 2021 divided by the number of women who did not have a live birth in that complete ART 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.

(e) The cycle-specific live birth rate for a specific complete ART cycle is calculated as the number of live births achieved from that specific complete ART cycle divided by the number of women who commenced at that cycle.

(f) The conservative cumulative live birth rate for a specific ART cycle is calculated as the number of women who achieved a live birth up to and including that complete ART cycle divided by the total number of women who commenced complete ART cycle 1.

(g) The optimal cumulative live birth rate is calculated by assuming that women who discontinued treatment would have had the same chance of a live birth in a particular cycle as those who continued.

Note: Further treatment cycles after the sixth 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 56: Cycle-specific and cumulative live birth rates (complete cycle) for women aged 30-34 who started their first autologous fresh cycle in Australia and New Zealand during 2018-2019[(a)] and followed until 31 December 2021 or the first treatment-dependent live birth

Complete ART cycle number[(b)]	Number of women starting cycle	Number of live births[(c)]	Discontinuation rate[(d)]	Cycle specific live birth rate[(e)]	Conservative cumulative live birth rate[(f)]	Optimal cumulative live birth rate[(g)]
One	11,912	5,772	25.6%	48.5%	48.5%	48.5%
Two	4,570	1,727	29.7%	37.8%	63.0%	67.9%
Three	1,998	579	30.4%	29.0%	67.8%	77.2%
Four	988	271	31.1%	27.4%	70.1%	83.5%
Five	494	112	36.6%	22.7%	71.0%	87.2%
Six	242	46	36.7%	19.0%	71.4%	89.6%

(a) The first autologous fresh cycle is defined as the first initiated ovarian stimulation cycle undertaken by a woman in an Australian or New Zealand ART clinic.

(b) A complete ART cycle is defined as the initial ovarian stimulation cycle and subsequent frozen/thaw embryo transfers associated with that ovarian stimulation. Ovarian stimulation cycles where all eggs/embryos were frozen (freeze-all cycles) and no eggs/embryos were used in subsequent thaw cycles up until 31 December 2021 are not counted. Cycles with intended or actual egg retrieval but without ovarian stimulation are excluded from the analysis.

(c) 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.

(d) The discontinuation rate after a specific cycle is calculated as the number of women who did not return for a further ovarian stimulation cycle before 31 December 2021 divided by the number of women who did not have a live birth in that complete ART 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.

(e) The cycle-specific live birth rate for a specific complete ART cycle is calculated as the number of live births achieved from that specific complete ART cycle divided by the number of women who commenced at that cycle.

(f) The conservative cumulative live birth rate for a specific ART cycle is calculated as the number of women who achieved a live birth up to and including that complete ART cycle divided by the total number of women who commenced complete ART cycle 1.

(g) The optimal cumulative live birth rate is calculated by assuming that women who discontinued treatment would have had the same chance of a live birth in a particular cycle as those who continued.

Note: Further treatment cycles after the sixth 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 57: Cycle-specific and cumulative live birth rates (complete cycle) for women aged 35-39 who started their first autologous fresh cycle in Australia and New Zealand during 2018-2019[(a)] and followed until 31 December 2021 or the first treatment-dependent live birth

Complete ART cycle number[(b)]	Number of women starting cycle	Number of live births[(c)]	Discontinuation rate[(d)]	Cycle specific live birth rate[(e)]	Conservative cumulative live birth rate[(f)]	Optimal cumulative live birth rate[(g)]
One	12,692	4,326	26.7%	34.1%	34.1%	34.1%
Two	6,135	1,564	28.7%	25.5%	46.4%	50.9%
Three	3,261	653	30.9%	20.0%	51.6%	60.7%
Four	1,802	321	30.2%	17.8%	54.1%	67.7%
Five	1,034	158	33.4%	15.3%	55.3%	72.7%
Six	583	68	30.9%	11.7%	55.9%	75.8%

(a) The first autologous fresh cycle is defined as the first initiated ovarian stimulation cycle undertaken by a woman in an Australian or New Zealand ART clinic.

(b) A complete ART cycle is defined as the initial ovarian stimulation cycle and subsequent frozen/thaw embryo transfers associated with that ovarian stimulation. Ovarian stimulation cycles where all eggs/embryos were frozen (freeze-all cycles) and no eggs/embryos were used in subsequent thaw cycles up until 31 December 2021 are not counted. Cycles with intended or actual egg retrieval but without ovarian stimulation are excluded from the analysis.

(c) 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.

(d) The discontinuation rate after a specific cycle is calculated as the number of women who did not return for a further ovarian stimulation cycle before 31 December 2021 divided by the number of women who did not have a live birth in that complete ART 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.

(e) The cycle-specific live birth rate for a specific complete ART cycle is calculated as the number of live births achieved from that specific complete ART cycle divided by the number of women who commenced at that cycle.

(f) The conservative cumulative live birth rate for a specific ART cycle is calculated as the number of women who achieved a live birth up to and including that complete ART cycle divided by the total number of women who commenced complete ART cycle 1.

(g) The optimal cumulative live birth rate is calculated by assuming that women who discontinued treatment would have had the same chance of a live birth in a particular cycle as those who continued.

Note: Further treatment cycles after the sixth 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 58: Cycle-specific and cumulative live birth rates (complete cycle) for women aged 40-44 who started their first autologous fresh cycle in Australia and New Zealand during 2018-2019[(a)] and followed until 31 December 2021 or the first treatment-dependent live birth

Complete ART cycle number[(b)]	Number of women starting cycle	Number of live births[(c)]	Discontinuation rate[(d)]	Cycle specific live birth rate[(e)]	Conservative cumulative live birth rate[(f)]	Optimal cumulative live birth rate[(g)]
One	5,958	738	31.9%	12.4%	12.4%	12.4%
Two	3,555	319	32.8%	9.0%	17.7%	20.2%
Three	2,175	152	35.9%	7.0%	20.3%	25.8%
Four	1,297	87	31.7%	6.7%	21.8%	30.8%
Five	826	41	30.7%	5.0%	22.4%	34.2%
Six	544	27	36.8%	5.0%	22.9%	37.5%

(a) The first autologous fresh cycle is defined as the first initiated ovarian stimulation cycle undertaken by a woman in an Australian or New Zealand ART clinic.

(b) A complete ART cycle is defined as the initial ovarian stimulation cycle and subsequent frozen/thaw embryo transfers associated with that ovarian stimulation. Ovarian stimulation cycles where all eggs/embryos were frozen (freeze-all cycles) and no eggs/embryos were used in subsequent thaw cycles up until 31 December 2021 are not counted. Cycles with intended or actual egg retrieval but without ovarian stimulation are excluded from the analysis.

(c) 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.

(d) The discontinuation rate after a specific cycle is calculated as the number of women who did not return for a further ovarian stimulation cycle before 31 December 2021 divided by the number of women who did not have a live birth in that complete ART 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.

(e) The cycle-specific live birth rate for a specific complete ART cycle is calculated as the number of live births achieved from that specific complete ART cycle divided by the number of women who commenced at that cycle.

(f) The conservative cumulative live birth rate for a specific ART cycle is calculated as the number of women who achieved a live birth up to and including that complete ART cycle divided by the total number of women who commenced complete ART cycle 1.

(g) The optimal cumulative live birth rate is calculated by assuming that women who discontinued treatment would have had the same chance of a live birth in a particular cycle as those who continued.

Note: Further treatment cycles after the sixth 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 59: Cycle-specific and cumulative live birth rates (complete cycle) for women aged 45 or more who started their first autologous fresh cycle in Australia and New Zealand during 2018-2019[(a)] and followed until 31 December 2021 or the first treatment-dependent live birth

Complete ART cycle number[(b)]	Number of women starting cycle	Number of live births[(c)]	Discontinuation rate[(d)]	Cycle specific live birth rate[(e)]	Conservative cumulative live birth rate[(f)]	Optimal cumulative live birth rate[(g)]
One	478	1	50.5%	0.2%	0.2%	0.2%
Two	236	3	44.2%	1.3%	0.8%	1.5%
Three	130	0	50.8%	0.0%	0.8%	1.5%
Four	64	2	50.0%	3.1%	1.3%	4.6%
Five	31	0	48.4%	0.0%	1.3%	4.6%
Six	16	0	31.3%	0.0%	1.3%	4.6%

(a) The first autologous fresh cycle is defined as the first initiated ovarian stimulation cycle undertaken by a woman in an Australian or New Zealand ART clinic.

(b) A complete ART cycle is defined as the initial ovarian stimulation cycle and subsequent frozen/thaw embryo transfers associated with that ovarian stimulation. Ovarian stimulation cycles where all eggs/embryos were frozen (freeze-all cycles) and no eggs/embryos were used in subsequent thaw cycles up until 31 December 2021 are not counted. Cycles with intended or actual egg retrieval but without ovarian stimulation are excluded from the analysis.

(c) 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.

(d) The discontinuation rate after a specific cycle is calculated as the number of women who did not return for a further ovarian stimulation cycle before 31 December 2021 divided by the number of women who did not have a live birth in that complete ART 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.

(e) The cycle-specific live birth rate for a specific complete ART cycle is calculated as the number of live births achieved from that specific complete ART cycle divided by the number of women who commenced at that cycle.

(f) The conservative cumulative live birth rate for a specific ART cycle is calculated as the number of women who achieved a live birth up to and including that complete ART cycle divided by the total number of women who commenced complete ART cycle 1.

(g) The optimal cumulative live birth rate is calculated by assuming that women who discontinued treatment would have had the same chance of a live birth in a particular cycle as those who continued.

Note: Further treatment cycles after the sixth 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 ART Units

Australian Capital Territory

IVF Australia Canberra, Deakin (Dr Frank Quinn)

COMPASS Fertility, Barton (Dr Nicole Sides)

Genea Canberra, Deakin (A/Prof Mark Bowman)

New South Wales

Adora Fertility, Sydney, Surry Hills (Dr Paul Atkinson)

City Fertility Centre – Sydney, Liverpool (Dr Devora Lieberman)

City Fertility Centre – Sydney City (Dr Devora Lieberman)

Connect IVF – Sydney (Dr Julie Lukic)

Demeter Fertility, Liverpool (Dr David Knight)

Fertility First, Hurstville (Dr Anne Clark)

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

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

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

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

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

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

Genea – Sydney (A/Prof Mark Bowman)

Hunter IVF (IVF Australia), New Lambton Heights (Dr Frank Quinn)

IVF Australia – Eastern Sydney, Alexandria (Dr Frank Quinn)

IVF Australia – North Shore, Greenwich (Dr Frank Quinn)

IVF Australia – Western Sydney, Westmead (Dr Frank Quinn)

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

Monash IVF – Parramatta, Parramatta (Dr Kim Matthews)

Monash IVF – Penrith, Kingswood (Dr Kim Matthews)

Monash IVF – Sydney City (Dr Kim Matthews)

Reproductive Medicine Albury, Albury (Dr Kim Matthews)

Royal Hospital for Women – Fertility & Research Centre, Randwick (Prof William Ledger)

The Fertility Centre – Liverpool, Liverpool (Dr Frank Quinn)

The Fertility Centre – Wollongong, Wollongong (Dr Frank Quinn)

Westmead Fertility Centre, Westmead (Dr Howard Smith)

Northern Territory

Repromed Darwin, Tiwi (Dr Juliette Koch)

Queensland

Adora Fertility, Brisbane (Dr Paul Atkinson)

CARE Fertility, Greenslopes (Dr Clare Boothroyd)

CARE Fertility, Toowoomba (Dr Clare Boothroyd) – now closed

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)

City Fertility Centre – Toowoomba (Dr Andrew Davidson)

Coastal IVF, Maroochydore (Dr Paul Stokes)

Fertility Solutions Sunshine Coast, Buderim (Dr James Orford)

Fertility Solutions Bundaberg, Bundaberg (Dr James Orford)

Life Fertility Clinic, Spring Hill (Dr Glenn Sterling)

Monash IVF Gold Coast, Southport (Dr Irving Korman)

Monash IVF Rockhampton, Rockhampton (Dr David Shaker)

Monash IVF Townsville (Dr David Shaker)

Monash IVF Auchenflower, Auchenflower (Dr John Chenoweth) – now closed

QFG Sunshine Coast (Prof Hayden Homer)

QFG Cairns, Cairns (Prof Hayden Homer)

QFG Gold Coast, Benowa (Prof Hayden Homer)

QFG Mackay, North Mackay (Prof Hayden Homer)

QFG Toowoomba, Toowoomba (Prof Hayden Homer)

QFG Townsville, Hyde Park (Prof Hayden Homer)

QFG, Spring Hill (Prof Hayden Homer)

The Fertility Centre, Springwood (Prof Hayden Homer)

South Australia

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 Manuela Toldeo)

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)

City Fertility Centre Notting Hill (Dr David Wilkinson)

Genea Melbourne, Melbourne (A/Prof Mark Bowman)

Melbourne IVF Mt Waverley, Mt Waverley (Dr Lyndon Hale) – now closed

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, East Melbourne (Dr Lynn Burmeister)

Reproductive Services, Parkville (Dr Lyndon Hale) – now closed

Western Australia

Adora Fertility, Perth, Craigie (Dr Paul Atkinson)

Concept Fertility Centre, Subiaco (Dr Lucy Williams)

Fertility Great Southern, Denmark (Dr Jay Natalwala) – now closed

Fertility North, Joondalup (Dr Vince Chapple)

Fertility Specialists of WA, Applecross (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, Auckland (Dr Simon Kelly)

Fertility Associates Christchurch, Christchurch (Dr Sarah Wakeman)

Fertility Associates Hamilton, Hamilton (Dr VP Singh)

Fertility Associates Dunedin, Dunedin (A/Prof Wayne Gillet)

Fertility Associates Wellington, Wellington (Dr Andrew Murray)

Fertility Plus, Auckland (Professor Cindy Farquhar)

Repromed Auckland, Auckland (Dr Devashana Gupta)

Appendix B: Data used in this report

The data presented in this report are supplied by 93 ART Units in Australia and New Zealand and are compiled into ANZARD 3.0. ANZARD 3.0 includes autologous treatment cycles, treatment involving donated oocytes or embryos, and treatment involving surrogacy arrangements. ANZARD 3.0 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 3.0 also collects data on artificial insemination cycles using donated sperm (DI) from ART Units. The outcomes of pregnancies, births and babies born following ART and DI treatments are also maintained in ANZARD 3.0. This includes the method of birth, birth status, birthweight, gestational age, plurality, perinatal mortality and selected information on maternal morbidity.

Data validation

Most ART Units 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 ART Unit staff.

The Reproductive Technology Accreditation Committee (RTAC) of the Fertility Society of Australia and New Zealand (FSANZ) also plays a role in ensuring the quality of ANZARD 3.0 data. ANZARD submissions from ART Units are audited by certifying bodies according to the RTAC Code of Practice. This includes selected records against ART Unit files in their annual inspections. All ART cycles and DI undertaken in Australia and New Zealand must be reported to ANZARD as part of their accreditation by the RTAC of the FSANZ.

Data presentation

Chapters 2 to 7 of this report present information on ART and DI treatment cycles that took place in ART Units in Australia and New Zealand in 2021 and the resulting pregnancies and births. The babies included in this report were conceived following treatment cycles undertaken in 2021 and were born in either 2021 or 2022 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 2021.

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 2018-2019.

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 ART Unit 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. ART Unit staff invest great effort in validating such information by obtaining medical records from clinicians or hospitals.

Note that some contributing ART Units may have closed or changed their name since 2021. The medical director listed is based on information provided by the FSANZ at the time this report was prepared.

Appendix C: ANZARD 3.0 data items

Variable	Data domain
PATIENT AND INTENDING PARENT (S) DETAILS	
ANZARD Unit identifier	3-digit code for ART Units provided by NPESU. May consist of more than one ART Unit
ART unit identifier	3-digit code for ART Units provided by RTAC. A facility with a laboratory collecting or preparing human gametes and/or embryos for therapeutic service, possibly across a range of sites of clinical activity.
Sex (at birth) of the intending parents	1=a female-male couple 2=a single female 3=a female-female couple 4=a single male 5= a male-male couple
Unit patient ID/medical record number	ART Unit-issued unique patient identifier.
Female patient first two letters of first name	First two letters of female patient first name.
Female patient first two letters of surname	First two letters of female patient surname.
Female patient date of birth	DD/MM/YYYY.
Female patient height	Female patient height (in centimetres) at the time of treatment
Female patient weight	Female patient weight (in kilograms) at the time of treatment
Male intending parent first two letters of first name	First two letter of male intending parent's first name
Male intending parent first two letters of surname	First two letters of male intending parent's surname
Male intending parent date of birth	DD/MM/YYYY.
Non-patient female intending parent date of birth	DD/MM/YYYY.
Second male intending parent date of birth	DD/MM/YYYY.
Postcode	Postcode of patient residential area.
CYCLE DETAILS	
Cycle ID	Unique cycle identifier, allocated by the ART Unit.
Cycle date	DD/MM/YYYY Cycle date is coded by: 1. The first date where FSH/stimulation drug was administered 2. The date of last menstrual period (LMP) for unstimulated cycles (including natural fresh cycles, thaw cycles and donor insemination) 3. The date of oocyte/embryo thawing for lab-only cycles
Cycle type	1=Autologous: female-male couple, single female, female-female couple 2=Non-autologous: female-female couple 3=Non-autologous: oocyte/embryo donation 4=Non-autologous: oocyte recipient 5=Non-autologous: embryo recipient 6=Surrogacy – intending parent(s): Oocyte/embryo provision 7=Surrogacy – gestational carrier: Transfer (or thawing with the intention of transfer) of embryos to a gestational carrier 8=Lab-only cycle
Surrogacy arrangement	No – if cycle is not part of a surrogacy arrangement. Yes – if cycle is part of a surrogacy arrangement.

Variable	Data domain
Fertility preservation	1=No – cycle is not being undertaken for fertility preservation purposes 2=Yes – cycle is being undertaken for fertility preservation purposes
Reason for fertility preservation	1=Medical reason – cancer diagnosis 2=Medical reason – other 3=Non-medical reason
Period of infertility	DD/MM/YYYY The month and year that the female intending parent started trying to conceive (applies to female-male couples only)
Any pregnancies ≥ 20 weeks	No – if the female patient has had no previous pregnancy of 20 complete weeks or more Yes – if the female patient has had a pregnancy of 20 complete weeks or more by ART or by a different partner.
ART treatment being undertaken for reasons other than to treat clinical infertility	No – ART treatment being undertaken to treat clinical infertility Yes – ART treatment being undertaken for reasons other than to treat clinical infertility
Cause of infertility: tubal disease	No – in the opinion of the treating clinician or ART Unit the, cause of infertility is not due to tubal disease. Yes – in the opinion of the treating clinician or ART Unit the, cause of infertility is due to tubal disease.
Cause of infertility: endometriosis	No – in the opinion of the treating clinician or ART Unit the, cause of infertility is not due to endometriosis. Yes – in the opinion of the treating clinician or ART Unit the, cause of infertility is due to endometriosis.
Cause of infertility: other female factors	No – in the opinion of the treating clinician or ART Unit the, cause of infertility is not due to other female factors. Yes – in the opinion of the treating clinician or ART Unit the, cause of infertility is due to other female factors.
Polycystic ovarian syndrome	1=No – the treating clinician or ART Unit does not consider that the female intending parent has PCOS 2=Yes – the treating clinician or ART Unit considers that the female intending parent has PCOS, regardless of whether it is contributing to infertility 3=Unknown – the treating clinician or ART Unit has not assessed the female intending parent for PCOS
Cause of infertility: male factor	No – in the opinion of the treating clinician or ART Unit the, cause of infertility is not due to male factors. Yes – in the opinion of the treating clinician or ART Unit the, cause of infertility is due to male factors.
Primary cause of male factor infertility diagnosis	1=Idiopathic 2=Genetic – Klinefelter 3=Genetic – Y deletion 4=Genetic – other aneuploidies, single gene 5=Testis damage – cancer treatment 6=Testis damage – other 7=Gonadotrophin deficiency 8=Vasectomy 9=Congenital absence of the vas deferens/cystic fibrosis 10=Obstructive disorder (other) 11=Erectile dysfunction 12=Ejaculatory disorders
Cause of infertility: unexplained	No – in the opinion of the treating clinician or ART Unit, the cause of infertility is not unexplained in the intending parents Yes – in the opinion of the treating clinician or ART Unit, the cause of infertility is unexplained in the intending parents.
Ovarian stimulation via follicle stimulating hormone (FSH)	No – FSH was not administered Yes – FSH administered. Does not include clomiphene or hCG alone unless FSH was also given.

Variable	Data domain
First ever FSH stimulated cycle for OPU	No – not the patient's first ever FSH stimulated cycle Yes – the current cycle is the patient's first ever FSH stimulated cycle with the intention of OPU.
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. DD/MM/YYYY.
Number of eggs retrieved	Number of eggs retrieved at OPU.
In-vitro maturation (IVM)	Whether IVM took place during the treatment cycle 1=No 2=Yes
Source of sperm	1=a male intending parent 2=a sperm donor outside of the intending parents
Site of sperm used	Site of sperm extraction: ejaculated, epididymal (whether by open biopsy or by PESA), testicular or other.
Sperm quality	The concentration of sperm
DONATION AND RECIPIENT DETAILS	
Age of oocyte/embryo donor	Completed age at time of OPU.
Number of fresh eggs donated	Number of fresh eggs donated to someone else.
Number of fresh eggs received	Number of fresh eggs received from someone else.
Number of fresh embryos donated	Records the number of fresh embryos donated to another patient/couple
Number of fresh embryos received	Records the number of fresh embryos that a patient/couple received from another patient/couple.
OOCYTE CRYOPRESERVATION DETAILS	
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.
Initial cryopreservation date of thawed/warmed oocytes	DD/MM/YYYY.
FERTILISATION DETAILS	
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.
Number of eggs fertilised normally	Number of eggs fertilised normally.
Intrauterine insemination date	Date of intrauterine insemination procedure (using donated sperm only) DD/MM/YYYY.
Assisted hatching	No – assisted hatching not performed. Yes – where assisted hatching in any form has been performed on any of the embryos (transferred or not).
PRE-IMPLANTATION GENETIC TESTING	
Number of embryos biopsied for invasive PGT	Number of embryos biopsied for invasive PGT
Number of embryos biopsied for non-invasive PGT	Number of embryos biopsied for non-invasive PGT
Number of invasive PGT embryos transferred	Number of invasive PGT embryos transferred
Number of non-invasive PGT embryos transferred	Number of non-invasive PGT embryos transferred

Variable	Data domain
Number of embryos thawed that had invasive PGT performed in a previous cycle	Number of embryos thawed that had invasive PGT performed in a previous cycle
Number of embryos thawed that had non-invasive PGT performed in a previous cycle	Number of embryos thawed that had non-invasive PGT performed in a previous cycle
Primary reason for PGT	1=Aneuploidy screening 2=Single gene variation 3=Chromosomal structural rearrangements (e.g. translocations) 4=Other
EMBRYO CRYOPRESERVATION DETAILS	
Number of cleavage-stage embryos slow frozen	Number of cleavage-stage embryos frozen by slow freezing method in this cycle.
Number of cleavage-stage embryos vitrified	Number of cleavage-stage 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 slow frozen cleavage embryos thawed	Number of slow frozen cleavage embryos thawed for use in the cycle
Number of vitrified cleavage embryos warmed	Number of vitrified cleavage embryos warmed for use in the cycle
Number of slow frozen blastocysts thawed	Number of slow frozen blastocysts thawed for use in the cycle
Number of vitrified blastocysts warmed	Number of vitrified blastocyst embryos for use in the cycle
Freezing date of thawed/warmed embryos	Initial cryopreservation date of thawed/warmed embryos.
EMBRYO TRANSFER DETAILS	
Embryo transfer date	DD//MM/YYYY Data embryo transfer occurred.
Number of cleavage-stage embryos transferred	Number of cleavage-stage embryos transferred.
Number of blastocysts transferred	Number of blastocyst stage embryos transferred.
Transferred embryos fertilised via ICSI	No – no transferred embryos were fertilised by ICSI. Yes – any embryos transferred were fertilised by ICSI.
PREGNANCY DETAILS	
Clinical pregnancy	A pregnancy that fulfils at least 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–Neither ectopic nor heterotopic e–Ectopic h–Heterotopic
Elective termination of pregnancy	No–pregnancy not terminated. Yes–pregnancy is terminated.
Selective reduction performed	No–If no selective reduction has been performed. Yes–If selective reduction has been performed due to fetal abnormality/other reasons.

Variable	Data domain
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.
BIRTH DETAILS	
Number of babies born	Include all liveborn and stillborn babies after 20 weeks gestation or at least 400 grams birthweight.
Caesarean birth	No–other. Yes–birth by planned or emergency caesarean section.
Baby 1 outcome	Liveborn, stillborn or neonatal death.
Baby 1 sex	Male or female.
Baby 1 birthweight	Weight in grams.
Baby 1 abnormality	Describes any known congenital malformation.
Baby 1 date of neonatal death	Date of neonatal death.
Baby 2 outcome	Liveborn, stillborn or neonatal death.
Baby 2 sex	Male or female.
Baby 2 weight	Weight in grams.
Baby 2 abnormality	Describes any known congenital malformation.
Baby 2 date of neonatal death	Date of neonatal death.
Baby 3 outcome	Liveborn, stillborn or neonatal death.
Baby 3 sex	Male or female.
Baby 3 weight	Weight in grams.
Baby 3 abnormality	Describes any known congenital malformation.
Baby 3 date of neonatal death	Date of neonatal death.
Baby 4 outcome	Liveborn, stillborn or neonatal death.
Baby 4 sex	Male or female.
Baby 4 weight	Weight in grams.
Baby 4 abnormality	Describes any known congenital malformation.
Baby 4 date of neonatal death	Date of neonatal death.
TREATMENT COMPLICATIONS	
Admitted with ART morbidity	No – patient was not admitted to hospital with any 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.
Ovarian hyperstimulation syndrome (OHSS)	No – OHSS did not occur Yes – OHSS occurred
Morbidity information and detail	Describes any information related to the female patient's hospital admission or cause of morbidity
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.

ART Unit: a facility with a laboratory collecting or preparing human gametes and/or embryos for therapeutic service, possibly across a range of sites of clinical activity. Where the collection of gametes/embryos takes place at a different site to the preparation, the two sites are considered to be a single ART Unit.

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 is 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 reveals 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.

Cycle: when a medical procedure is attempted or takes place, or when certain laboratory procedures are undertaken. This is further broken down to specific terms, 'treatment cycles' and 'lab-only cycles.' Please refer to the glossary for definitions of these specific terms.

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 female patient who is not an intending parent, intends to donate or donates her oocytes/embryos to others, or where a female intending parent provides oocytes/embryos to a female partner who is also an intending parent. A donation cycle may result in the donation of either oocytes or embryos to a recipient(s). 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.

Lab-only cycle: where there is no patient under monitoring or receiving treatment in the cycle and no intention to transfer an embryo in the cycle and only laboratory procedures are performed.

Live birth: according to the World Health Organization (WHO) definition, a live birth is defined as "the complete expulsion or extraction from the mother of a baby, irrespective of the duration of the pregnancy, which, 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" (AIHW 2022). 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.

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 PGT for aneuploidies (PGT-A); PGT for monogenic/single gene defects (PGT-M); and PGT for chromosomal structural rearrangements (PGT-SR).

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 female patient who is an intending parent receives oocytes/embryos from another individual/couple who is not an intending parent, or where a female intending parent receives oocytes/embryos from a female partner who is also an intending parent, to achieve a pregnancy.

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

Singleton: refers to the birth of only one child during a single birth event.

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 female patient, known as the ‘gestational carrier’ or ‘surrogate’ agrees to carry a child for another person or couple, known as the ‘intending parent(s)’, with the intention that the child will be raised by the intending parent(s). The oocytes and/or sperm used to create the embryo(s) in the surrogacy cycle can be either from the intending 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 or lab-only cycles.

Treatment cycle: involves an attempted/actual medical procedure being carried out on a female patient and includes the following scenarios:

- ovarian stimulation with the intention of oocyte collection in autologous or donation cycle
- attempted/actual oocyte collection, whether in a stimulated or unstimulated, autologous or donation cycle
- attempted/actual oocyte thaw with the intention of fertilisation and embryo transfer
- attempted/actual embryo thaw with the intention of embryo transfer
- insemination of donated sperm as part of an intrauterine insemination (IUI) cycle.

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 **111,253** ART cycles reported from Australian and New Zealand fertility clinics in 2021, resulting in **20,440** liveborn babies.