National Perinatal Epidemiology and Statistics Unit (NPESU)

Assisted Reproductive Technology in New Zealand 2018

October 2021

Foreword

The Advisory Committee on Assisted Reproductive Technology (ACART) presents this report, Assisted Reproductive Technology in New Zealand 2018, the tenth New Zealand-specific report based on the Australian and New Zealand Assisted Reproduction Database (ANZARD). The report provides a quantitative summary of the numbers, types and outcomes of assisted reproductive technology (ART) in Aotearoa New Zealand.

This report is provided to contribute largely to ACART's statutory role to monitor the outcomes of ART in Aotearoa New Zealand.

The Secretariat for ACART at the Ministry of Health continues to investigate how we might report on outcomes by ethnicity because we feel it would add value to the report, and is consistent with other reporting in Aotearoa New Zealand.

We trust that the report and associated ten years' of data trends obtained from these reports (in table form, available among the monitoring reports, at acart.health.govt.nz) will be useful to the sector including consumers, and researchers of ART health outcomes.

It is interesting to note the overall increase in use of ARTs, and in particular the increase in the percentage of frozen/thawed embryo transfer cycles that were cryopreserved using an ultra-rapid method between 2017 (68.3 percent) and 2018 (81.2 percent). The growth in use of this method over the ten years is indicative of ongoing technological advances in ART. It is important that research is enabled and supported in ART so these technological advances can progress safely. ACART expects to be able to consult on human reproductive research guidelines in the near future.

ACART thanks the Ministry of Health for procuring this report. We also thank the National Perinatal Epidemiology and Statistics Unit at the University of New South Wales for collaborating with ACART to develop the report.

Dr Kathleen Logan
Chair, Advisory Committee on Assisted Reproductive Technology
October 2021

Acknowledgments

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

We would like to thank all staff in the fertility centres for their efforts in compiling the data and providing additional information when requested. A list of all contributing fertility clinics can be found in Appendix A.

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
ICSI	intracytoplasmic sperm injection
IVF	in vitro fertilisation
NPESU	National Perinatal Epidemiology and Statistics Unit
OPU	oocyte pick-up
PGD	preimplantation genetic diagnosis
PGT	preimplantation genetic testing
SD	standard deviation
SET	single embryo transfer
UNSW	University of New South Wales

Symbols

–	not applicable

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Summary

Use of ART treatment cycles

There were 7,723 assisted reproductive technology (ART) treatment cycles reported from New Zealand fertility clinics in 2018. This represented 7.9 cycles per 1,000 women of reproductive age (15-44 years) in New Zealand. Women used their own oocytes/embryos (autologous) in 90.2% of treatments and 47.5% of autologous cycles involved frozen/thawed embryos.

Treatment outcomes and number of babies

Of all the ART treatments in 2018, 28.4% (2,194) resulted in a clinical pregnancy, 22.9% (1,767) resulted in a birth and 22.7% (1,755) in a live birth. There were 1,773 liveborn babies, of which 86.4% (1,532) were singletons at term (gestational age of 37-41 weeks) with normal birthweight (≥ 2,500 grams).

Women's age and parity

The average age of women undertaking autologous and oocyte/embryo recipient cycles was 35.6 years. For women undergoing oocyte/embryo recipient cycles, the mean age was 39.5 years, four years older than for autologous cycles (mean 35.3 years). Of all autologous and oocyte/embryo recipient cycles, one in five (20.7%) was undertaken by women aged 40 years or older. Where parity was known, 75.1% of autologous cycles were undertaken by nulliparous women compared with 78.5% for oocyte/embryo recipient cycles.

Autologous fresh cycles

The overall live birth rate per autologous fresh embryo transfer cycle was 29.2%. The highest live birth rate per autologous fresh embryo transfer cycle was in women aged less than 30 years (49.2%) and declined with an increase in women's age. Overall, 93.8% of autologous fresh embryo transfer cycles were single embryo transfer (SET) cycles, 6.2% were double embryo transfer (DET) cycles. The rates of clinical pregnancy and live birth were higher in blastocyst transfer cycles than in cleavage stage embryo transfer cycles regardless of a woman's age.

Autologous thaw cycles

The overall live birth rate per autologous thaw embryo transfer cycle was 33.4%. The highest live birth rate per embryo transfer cycle was in women aged less than 30 years (39.8%). Of the 3,217 frozen/thawed embryo transfer cycles 98.4% were SET cycles and 1.6% were DET cycles. The rates of clinical pregnancy and live birth were higher in blastocyst transfer cycles than in cleavage stage embryo transfer cycles regardless of age.

Births by plurality and maternal age

Of the 1,749 births following autologous and recipient cycles in 2018, 1.0% were multiple gestation births. The proportion of multiple gestation births was less than 3% in all age groups.

Cumulative live birth rates

ANZARD includes data items which make it possible to follow a woman from her first fresh ART treatment cycle through subsequent fresh and thaw cycles. There were 1,939 women identified as having their first fresh autologous cycle in 2016. These women were followed through their subsequent fresh and thaw cycles until 31st December 2018 or until they achieved a live birth (up to October 2019). For women identified in this cohort, the cumulative live birth rate was 27.6% after the first cycle, increasing to 42.9% after two cycles, 49.0% after three cycles, 51.9% after four cycles and 53.7% after five cycles.

1 Introduction

It is estimated that around 15% of couples at any given time experience infertility, representing the source of much personal suffering to millions around the world (World Health Organization, 2010). The common medical definition of 'infertility' is the failure to achieve a clinical pregnancy after 12 or more months of regular unprotected sexual intercourse (Zegers-Hochschild et al. 2017). Infertility is increasingly being overcome through advancements in fertility treatment, such as assisted reproductive technologies (ARTs). ARTs have evolved over the last four decades into a suite of mainstream medical interventions that have resulted in the birth of more than 8 million children worldwide (ESHRE, 2018).

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

The Fertility Society of Australia and New Zealand (FSANZ), in collaboration with the University of New South Wales (UNSW), is committed to providing informative annual statistics on ART treatments and is pleased to present the annual report on the use of ART in New Zealand in 2018.

Treatments covered in this report

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

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

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

Over the last 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 diagnosis (PGD) – when one or more cells are removed from the embryo and analysed for chromosomal disorders or genetic diseases
- Oocyte donation – when a woman donates her oocytes to others
- Oocyte/embryo recipient – when a woman receives oocytes or embryos from another woman
- Cryopreservation and storage of embryos that are not transferred in the initial fresh treatment cycle. Once thawed or warmed, the embryos can be transferred in subsequent treatment cycles. Cryopreservation techniques include both the traditional slow freezing method and a newer technique called 'vitrification'. Vitrification can be used to cryopreserve gametes and embryos, and uses an ultra-rapid temperature change with exposure to higher concentrations of cryoprotectants.
- Cryopreservation and storage of oocytes and embryos for fertility preservation
- Surrogacy arrangement – where a woman, known as the 'gestational carrier', agrees to carry a child for another person or couple, known as the 'intended parent(s)', with the intention that the child will be raised by the intended parent(s).

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

Data used in this report

This report provides information on ART and DI treatments and the resulting pregnancy and birth outcomes. The data presented in this report were supplied by eight fertility centres and compiled into the Australian and New Zealand Assisted Reproduction Database (ANZARD).

As a joint initiative of the NPESU and FSANZ, ANZARD was upgraded in 2009 to accommodate new ART treatment types and to transform ANZARD from a cycle-based data collection to a woman-based data collection (ANZARD 2.0). A more detailed description of ANZARD 2.0 can be found in Appendix B.

Structure of this report

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

Chapter 2 – 'Overview of ART treatment in 2018', provides an outline of the numbers and outcomes of all ART treatments undertaken in New Zealand.

Chapter 3 – 'Autologous and donation/recipient cycles in 2018', presents data on women undergoing treatment, cycle types, and the outcomes of treatment.

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

Chapter 5 – ‘Preimplantation genetic testing in 2018’, includes information on the numbers of embryos that had cells removed and analysed for chromosomal disorders or genetic diseases before transfer.

Chapter 6 – ‘Donor insemination cycles in 2018’, presents data on DI cycles and their outcomes, including a description of pregnancy and perinatal outcomes.

Chapter 7 – ‘Trends in ART treatment and outcomes 2014-2018’, presents trends in ART treatment over the last five years of data collection in New Zealand.

Chapter 8 – ‘Cumulative success rates for women undertaking autologous treatment 2016-2018’, presents information on all women who started their first autologous fresh ART treatment cycle between 1st January 2016 and 31st December 2016.

Appendices – Appendix A lists the contributing fertility clinics. Appendix B provides an overview of the ANZARD 2.0 data collection that was used to prepare this report.

2 Overview of ART treatment in 2018

There were 7,723 assisted reproductive technology (ART) treatment cycles reported from New Zealand clinics in 2018. This represented 7.9 cycles per 1,000 women of reproductive age (15-44 years) in New Zealand (Statistics New Zealand, 2018). Of these, 90.2% of cycles were autologous cycles (where a woman used or intended to use her own oocytes or embryos).

There were, 6,966 autologous cycles in 2018. Of these, 3,660 (52.5%) were fresh cycles and 3,306 (47.5%) were thaw cycles. Other treatment cycles accounted for a small proportion of cycles comprising 6.3% oocyte recipient cycles, 0.5% embryo recipient cycles, 2.3% oocyte donation cycles and 0.7% surrogacy cycles.

Of all the ART cycles in 2018 in New Zealand, 2,194 (28.4%) resulted in a clinical pregnancy, 1,767 (22.9%) resulted in a birth and 1,755 (22.7%) resulted in a live birth. Of the 1,773 liveborn babies, 1,532 (86.4%) were singletons at term (gestational age of 37-41 weeks) with normal birthweight (≥ 2,500 grams).

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

Treatment type	Number of initiated ART cycles	Percent of treatment types	Number of clinical pregnancies	Number of live births	Number of liveborn babies	Number of liveborn singletons at term with normal birthweight
Autologous	6,966	90.2	1,999	1,599	1,615	1,399
Fresh	*3,660*	*47.4*	*654*	*524*	*533*	*455*
Thaw	*3,306*	*42.8*	*1,345*	*1,075*	*1,082*	*944*
Oocyte recipient	485	6.3	155	126	128	105
Embryo recipient	38	0.5	16	12	12	10
Oocyte donation	179	2.3	0	0	0	0
Surrogacy arrangement cycles	55	0.7	24	18	18	18
Commissioning cycles (a)?	*6*	*0.1*	*0*	*0*	*0*	*0*
Gestational carrier cycles (b)?	*49*	*0.6*	*24*	*18*	*18*	*18*
Total	**7,723**	**100.0**	**2,194**	**1,755**	**1,773**	**1,532**

(a) A variety of cycle types undertaken as part of surrogacy arrangements, e.g. cycles undertaken by intended parents or women donating their oocytes or embryos for use by the gestational carrier.
(b) A cycle undertaken by a woman who carries, or intends to carry, a pregnancy on behalf of the intended parents with an agreement that the child will be raised by the intended parent(s).

3 Autologous and donation/recipient cycles in 2018

This chapter presents data on initiated autologous cycles, oocyte donation cycles and oocyte/embryo recipient cycles.

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

A ‘donation cycle’ is defined as an ART treatment cycle in which a woman donates or intends to donate her oocytes or embryos to others. The use of donor sperm does not influence the donor status of the cycle.

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

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

3.1 Overview of autologous and recipient cycles

Age of women and their partners

The average age of women undertaking autologous and oocyte/embryo recipient cycles was 35.6 years (SD 4.6). For women undergoing oocyte/embryo recipient cycles, the mean age was 39.5 years (SD 4.5); an average four years older than women undertaking autologous cycles (mean 35.3 years; SD ??). Of all autologous and oocyte/embryo recipient cycles, one in five (20.7%) was undertaken by women aged 40 years or older (Table 2). The average age of partners was 38.1 years (SD 6.6), with one-third (33.1%) aged 40 years or older (Table 3). For 7.7% of autologous and oocyte/embryo recipient cycles, the partner's age was not stated, or no partner was involved.

Table 2: Number of autologous and recipient cycles by women's age group and treatment type, New Zealand, 2018

	Autologous							
	Fresh		Thaw		Oocyte/Embryo Recipient		All	
Age group (years)[(a)]	**n**	**%**	**n**	**%**	**n**	**%**	**n**	**%**
< 30	350	9.6	325	9.8	9	1.7	684	9.1
30-34	1,116	30.5	1,144	34.6	69	13.2	2,329	31.1
35-39	1,442	39.4	1,318	39.9	165	31.5	2,925	39.1
40-44	693	18.9	499	15.1	224	42.8	1,416	18.9
≥ 45	59	1.6	20	0.6	56	10.7	135	1.8
Total	**3,660**	**100.0**	**3,306**	**100.0**	**523**	**100.0**	**7,489**	**100.0**

(a) Age at start of treatment cycle.
Note: Data are collected for each treatment cycle. Therefore, some individuals may be counted more than once.

Table 3: Number of autologous and recipient cycles by partners' age group and treatment type, New Zealand, 2018

	Autologous							
	Fresh		Thaw		Oocyte/Embryo Recipient		All	
Age group (years)[(a)]	**n**	**%**	**n**	**%**	**n**	**%**	**n**	**%**
< 30	216	5.9	172	5.2	7	1.3	395	5.3
30-34	849	23.2	880	26.6	69	13.2	1,798	24.0
35-39	1,085	29.6	1,032	31.2	121	23.1	2,238	29.9
40-44	713	19.5	676	20.4	138	26.4	1,527	20.4
≥ 45	428	11.7	379	11.5	145	27.7	952	12.7
Not stated	369	10.1	167	5.1	43	8.2	579	7.7
Total	**3,660**	**100.0**	**3,306**	**100.0**	**523**	**100.0**	**7,489**	**100.0**

(a) Age at start of 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. Where parity was stated, 75.1% of autologous cycles compared with 78.5% of oocyte/embryo recipient cycles, were undertaken by nulliparous women (Table 4).

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

	Autologous							
	Fresh		Thaw		Oocyte/Embryo Recipient		All	
Parity	**n**	**%**	**n**	**%**	**n**	**%**	**n**	**%**
Nulliparous	707	19.3	529	16.0	62	11.9	1,298	17.3
Parous	172	4.7	237	7.2	17	3.3	426	5.7
Not stated	2,781	76.0	2,540	76.8	444	84.9	5,765	77.0
Total	**3,660**	**100.0**	**3,306**	**100.0**	**523**	**100.0**	**7,489**	**100.0**

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

Intracytoplasmic sperm injection (ICSI) procedures

Of the 3,140 autologous fresh cycles where fertilisation was attempted, 1,895 (60.4%) used ICSI procedures and 1,245 (39.6%) used IVF procedures.

Table 5: Number of autologous and recipient cycles with fertilisation attempted by treatment type and procedure, New Zealand, 2018

	Autologous				Oocyte/Embryo Recipient			
	Fresh[(a)]		Thaw[(b)]		Fresh[(a)]		Thaw[(b)]	
Procedure	**n**	**%**	**n**	**%**	**n**	**%**	**n**	**%**
IVF	1,245	39.6	1,197	37.2	69	40.1	129	37.4
ICSI[(c)]	1,895	60.4	2,020	62.8	103	59.9	216	62.6
Total	**3,140**	**100.0**	**3,217**	**100.0**	**172**	**100.0**	**345**	**100.0**

(a) Fresh cycles where fertilisation was attempted.
(b) Thaw cycles where embryos were transferred.
(c) Mixed IVF/ICSI cycles were classed as ICSI cycles.

Number of embryos transferred

Of the 5,368 fresh and thawed autologous and recipient embryo transfer cycles, 96.9% were single embryo transfer (SET) cycles and 3.1% were double embryo transfer (DET) cycles. In women aged under 35, 98.7% of embryo transfer cycles were SET cycles and 1.3% were DET cycles. In women aged 35 or older, 95.7% of cycles were SET cycles and 4.3% were DET cycles (Table 6).

Table 6: Number of embryo transfer cycles by number of embryos transferred per cycle and women's age group, New Zealand, 2018

	Number of embryos transferred							
	One		Two		Three or more		All	
Age group (years)[(a)]	n	%	n	%	n	%	n	%
<30	453	99.3	3	0.7	0	0.0	456	100.0
30-34	1,646	98.6	24	1.4	0	0.0	1,670	100.0
35-39	2,094	97.7	50	2.3	0	0.0	2,144	100.0
40-44	934	91.9	81	8.0	1	0.1	1,016	100.0
≥45	74	90.2	8	9.8	0	0.0	82	100.0
Total	**5,201**	**96.9**	**166**	**3.1**	**1**	**0.0**	**5,368**	**100.0**

(a) Age at start of a treatment cycle.

Stage of embryo development

Of the 5,368 embryo transfer cycles, 85.4% involved the transfer of blastocysts (day 5-6 embryos) with the remaining transfers involving cleavage stage embryos (day 2-4 embryos). Of autologous cycles, blastocyst transfers made up 98.7% of thaw cycles compared with 59.1% of fresh cycles (Table 7).

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

	Autologous				Oocyte/embryo recipient			
	Fresh		Thaw		Fresh		Thaw	
Type and procedure	n	%	n	%	n	%	n	%
Cleavage embryo	734	40.9	41	1.3	1	10.0	8	2.3
Blastocyst	1,062	59.1	3,176	98.7	9	90.0	337	97.7
Total	**1,796**	**100.0**	**3,217**	**100.0**	**10**	**100.0**	**345**	**100.0**

Transfer of cryopreserved embryos

Embryos created in a fresh cycle can be cryopreserved by either slow freezing or ultra-rapid cryopreservation (vitrification) methods. Slow frozen and vitrified embryos can be thawed/warmed and then transferred in subsequent cycles. Of the 3,562 frozen/thawed embryo transfer cycles, 81.2% involved the transfer of vitrified embryos.

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

	Autologous				Oocyte/embryo recipient			
	Cleavage embryo		Blastocyst		Cleavage embryo		Blastocyst	
Type and procedure	**n**	**%**	**n**	**%**	**n**	**%**	**n**	**%**
Slow frozen embryo	41	100.0	578	18.2	4	50.0	45	13.4
Vitrified embryo[(a)]	0	0.0	2,598	81.8	4	50.0	292	86.6
Total	**41**	**100.0**	**3,176**	**100.0**	**8**	**100.0**	**337**	**100.0**

(a) Ultra-rapid cryopreservation.

3.2 Autologous fresh cycles

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

The overall live birth rate per autologous fresh embryo transfer cycle was 29.2%. The highest live birth rate per embryo transfer cycle was in women aged less than 30 years (49.2%). This rate declined with advancing women's age (Table 9).

Table 9: Outcomes of autologous fresh cycles by women's age group, New Zealand, 2018

	Age group (years) [a]					
Stage/outcome of treatment	**< 30**	**30-34**	**35-39**	**40-44**	**≥ 45**	**All**
Initiated cycles	350	1,116	1,442	693	59	3,660
Freeze-all cycles	179	459	440	131	4	1,213
Cycles with OPU	329	1,049	1,318	594	35	3,325
Embryo transfers	132	502	756	391	15	1,796
Clinical pregnancies	70	213	297	74	0	654
Live births	65	180	235	44	0	524
Live births per initiated cycle (%)	*18.6*	*16.1*	*16.3*	*6.3*	*0.0*	*14.3*
Live births per initiated cycle (excluding freeze-all) (%)	*38.0*	*27.4*	*23.5*	*7.8*	*0.0*	*21.4*
Live births per embryo transfer cycle (%)	*49.2*	*35.9*	*31.1*	*11.3*	*0.0*	*29.2*
Live births per clinical pregnancy (%)	*92.9*	*84.5*	*79.1*	*59.5*	-	*80.1*

(a) Age at start of a treatment cycle.
(b) Freeze-all cycles are fresh ART treatment cycles where all oocytes or embryos are cryopreserved, and an embryo transfer does not take place.

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

Overall, 93.8% of autologous fresh embryo transfer cycles were SET cycles and 6.2% were DET cycles. Overall, the live birth rate per embryo transfer cycle was 30.2% for SET cycles and 14.4% for DET cycles (Table 10).

Table 10: Outcomes of autologous fresh embryo transfer cycles by women's age and number of embryos transferred, New Zealand, 2018

	Age group (years)[a]							
	< 35		**35-39**		**≥ 40**		**All**	
Stage/outcome of treatment	**SET[b]**	**DET[c]**	**SET[b]**	**DET[c]**	**SET[b]**	**DET[c]**	**SET[b]**	**DET[c][d]**
Embryo transfer cycles	620	14	727	29	337	68	1,684	112
Clinical pregnancies	279	4	286	11	60	14	625	29
Live births	242	3	231	4	35	9	508	16
Clinical pregnancies per embryo transfer cycle (%)	*45.0*	*28.6*	*39.3*	*37.9*	*17.8*	*20.6*	*37.1*	*26.1*
Live births per embryo transfer cycle (%)	*39.0*	*21.4*	*31.8*	*13.8*	*10.4*	*13.2*	*30.2*	*14.4*

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

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

The rates of clinical pregnancy and live birth were higher in blastocyst transfer cycles than in cleavage stage embryo transfer cycles regardless of a woman's age (Table 11). Overall, the live birth rate for blastocyst transfer cycles (36.8%) was 18 percentage points higher than for cleavage stage embryo transfer cycles (18.1%).

Table 11: Outcomes of autologous fresh embryo transfer cycles by women's age and stage of embryo development, New Zealand, 2018

	Age group (years)[a]							
	< 35		35-39		≥ 40		All	
Stage/outcome of treatment	**CL[b]**	**BL[c]**	**CL[b]**	**BL[c]**	**CL[b]**	**BL[c]**	**CL[b]**	**BL[c]**
Embryo transfer cycles	189	445	302	454	243	163	734	1,062
Clinical pregnancies	61	222	78	219	31	43	170	484
Live births	51	194	62	173	20	24	133	391
Clinical pregnancies per embryo transfer cycle (%)	*32.3*	*49.9*	*25.8*	*48.2*	*12.8*	*26.4*	*23.2*	*45.6*
Live births per embryo transfer cycle (%)	*27.0*	*43.6*	*20.5*	*38.1*	*8.2*	*14.7*	*18.1*	*36.8*

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

3.3 Autologous thaw cycles

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

The overall live birth rate per autologous thaw embryo transfer cycle was 33.4%. The highest live birth rate per embryo transfer cycle (39.8%) and the highest live birth rate per clinical pregnancy (83.0%) was in women aged less than 30 years (Table 12). It is important to note that embryos thawed during a thaw cycle were created during an earlier initiated fresh cycle, therefore a women's age at the start of a thaw cycle is older than her age at the start of the initiated fresh cycle.

Table 12: Outcomes of autologous thaw cycles by women's age group, New Zealand, 2018

	Age group (years) [a]					
Stage/outcome of treatment	**<30**	**30-34**	**35-39**	**40-44**	**≥ 45**	**All**
Initiated cycles	325	1,144	1,318	499	20	3,306
Embryo transfers	319	1,118	1,282	479	19	3,217
Clinical pregnancies	153	535	514	141	2	1,345
Live births	127	440	404	103	1	1,075
Live births per initiated cycle (%)	*39.1*	*38.5*	*30.7*	*20.6*	*5.0*	*32.5*
Live births per embryo transfer cycle (%)	*39.8*	*39.4*	*31.5*	*21.5*	*5.3*	*33.4*
Live births per clinical pregnancy (%)	*83.0*	*82.2*	*78.6*	*73.0*	*50.0*	*79.9*

(a) Age at start of a treatment cycle.

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

Of the 3,217 autologous thaw embryo transfer cycles, 98.4% were SET cycles and 1.6% were DET cycles. In total, there were 1,345 clinical pregnancies and 1,075 live births. DET cycles had a higher percentage of live births per embryo transfer cycle (34.6%) than SET cycles (33.4%) (Table 13).

Table 13: Outcomes of autologous thaw embryo transfer cycles by women's age and number of embryos transferred, New Zealand, 2018

	Age group (years) [a]							
	<35		**35-39**		**≥ 40**		**All**	
Stage/outcome of treatment	**SET[b]**	**DET[c]**	**SET[b]**	**DET[c]**	**SET[b]**	**DET[c]**	**SET[b]**	**DET[c]**
Embryo transfer cycles	1,424	13	1,261	21	480	18	3,165	52
Clinical pregnancies	679	9	508	6	134	9	1,321	24
Live births	560	7	401	3	96	8	1,057	18
Clinical pregnancies per embryo transfer cycle (%)	*47.7*	*69.2*	*40.3*	*28.6*	*27.9*	*50.0*	*41.7*	*46.2*
Live births per embryo transfer cycle (%)	*39.3*	*53.8*	*31.8*	*14.3*	*20.0*	*44.4*	*33.4*	*34.6*

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

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

The rates of clinical pregnancy and live birth were higher for blastocyst transfer cycles than for cleavage stage embryo transfer cycles for women regardless of age. Overall, the rate of live birth for blastocyst transfer cycles (33.6%) was 11 percentage points higher than for cleavage stage embryo transfer cycles (22.0%) (Table 14).

Table 14: Outcomes of autologous thaw embryo transfer cycles by women's age and stage of embryo development, New Zealand, 2018

	Age group (years) [a]							
	<35		35-39		≥ 40		All	
Stage/outcome of treatment	**CL[b]**	**BL[c]**	**CL[b]**	**BL[c]**	**CL[b]**	**BL[c]**	**CL[b]**	**BL[c]**
Embryo transfer cycles	14	1,423	17	1,265	10	488	41	3,176
Clinical pregnancies	4	684	4	510	2	141	10	1,335
Live births	4	563	4	400	1	103	9	1,066
Clinical pregnancies per embryo transfer cycle (%)	*28.6*	*48.1*	*23.5*	*40.3*	*20.0*	*28.9*	*24.4*	*42.0*
Live births per embryo transfer cycle (%)	*28.6*	*39.6*	*23.5*	*31.6*	*10.0*	*21.1*	*22.0*	*33.6*

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

3.4 Donation and recipient cycles

Oocyte donation cycles

Of the 179 cycles where the intention was to donate oocytes to a recipient, all but seven cycles proceeded to OPU with 172 (96.1%) of these cycles resulting in oocytes being donated. The average age of women donating oocytes was 31.9 years with 32.4% of oocyte donation cycles undertaken by women aged 35 or older (Table 15).

Table 15: Number of oocyte donation cycles by donor's age group, New Zealand, 2018

Age group (years)[(a)]	Initiated cycles (number)	Cycles with OPU performed (number)	Cycles with OPU performed (percent)	Cycles with oocytes donated (number)	Cycles with oocytes donated (percent)
< 30	50	50	100.0	50	100.0
30-34	71	67	94.4	67	94.4
35-39	55	53	96.4	53	96.4
≥40	3	2	66.7	2	66.7
Total	179	172	96.1	172	96.1

(a) Age at start of a treatment cycle.

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

There were 523 oocyte/embryo recipient cycles in 2018, the majority of which were oocyte recipient cycles (92.7%). Of the 485 cycles involving donated oocytes, 64.5% were thaw cycles (Table 16). Of the 308 thaw oocyte recipient cycles that proceeded to embryo transfer, 39.9% resulted in a live birth, nearly 10 percentage points higher than the live birth rate per embryo transfer for fresh oocyte recipient cycles (30.0%). The live birth rate per embryo transfer for embryo recipient cycles was 32.4%.

Table 16: Outcomes of oocyte/embryo recipient cycles by treatment type, New Zealand, 2018

Stage/outcome of treatment	Oocyte recipient		Embryo recipient	All
	Fresh	Thaw		
Initiated cycles	172	313	38	523
Embryo transfers	10	308	37	355
Clinical pregnancies	4	151	16	171
Live births	3	123	12	138
Live births per initiated cycle (%)	*1.7*	*39.3*	*31.6*	*26.4*
Live births per embryo transfer cycle (%)	*30.0*	*39.9*	*32.4*	*38.9*
Live births per clinical pregnancy (%)	*75.0*	*81.5*	*75.0*	*80.7*

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

The clinical pregnancy and live birth rates of recipient cycles varied by recipient's age group. The overall live birth rate per initiated cycle was 26.4%. Across the five age categories, live birth rates per initiated cycle ranged between 20.6% and 33.3% (Table 17). Recipients aged less than 30 had the highest live birth rate per oocyte/embryo recipient cycle (33.3%). This rate compares to live birth rates from autologous fresh and thaw cycles for women of the same age group of 18.6% and 39.1% respectively (Tables 9 and Table 12).

Table 17: Outcomes of oocyte/embryo recipient cycles by recipient's age group, New Zealand, 2018

	Age group (years)[a]					
Stage/outcome of treatment	**< 30**	**30-34**	**35-39**	**40-44**	**≥ 45**	**All**
Initiated cycles	9	69	165	224	56	523
Embryo transfers	5	50	106	146	48	355
Clinical pregnancies	5	28	40	75	23	171
Live births	3	21	34	64	16	138
Live births per initiated cycle (%)	*33.3*	*30.4*	*20.6*	*28.6*	*28.6*	*26.4*
Live births per embryo transfer cycle (%)	*60.0*	*42.0*	*32.1*	*43.8*	*33.3*	*38.9*
Live births per clinical pregnancy (%)	*60.0*	*75.0*	*85.0*	*85.3*	*69.6*	*80.7*

(a) Age at start of a treatment cycle.

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

The overall live birth rate per embryo transfer cycle was 38.9%. Across age categories, the live birth rate per initiated cycle ranged between 22.2% and 29.5% for women aged less than 40, with the highest live birth rate in the 30 to 34 years old age group (Table 18).

Table 18: Outcomes of oocyte/embryo recipient cycles by donor's age group, New Zealand, 2018

	Age group (years)[a]				
Stage/outcome of treatment	**< 30**	**30-34**	**35-39**	**≥ 40**	**All[b]**
Initiated cycles	132	217	171	3	523
Embryo transfers	86	152	116	1	355
Clinical pregnancies	41	82	48	0	171
Live births	36	64	38	0	138
Live births per initiated cycle (%)	*27.3*	*29.5*	*22.2*	*0.0*	*26.4*
Live births per embryo transfer cycle (%)	*41.9*	*42.1*	*32.8*	*0.0*	*38.9*
Live births per clinical pregnancy (%)	*87.8*	*78.0*	*79.2*	-	*80.7*

(a) Age at start of treatment cycle.
(b) Includes 0 cycles where donor's age was not stated.

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

There were 2,170 clinical pregnancies following autologous and recipient embryo transfer cycles in 2018. Four out of five clinical pregnancies (80.6%) resulted in a birth and 19.3% resulted in early pregnancy loss (less than 20 weeks gestation or less than 400 grams birthweight). The outcomes of 0.1% clinical pregnancies were not known because women could not be followed up or contacted by fertility centres.

Early pregnancy loss

Of the 418 early pregnancy losses, 90.7% were miscarriages, 4.1% were due to termination of pregnancy, and 5.3% were ectopic/heterotopic pregnancies. Pregnancies following SET resulted in a lower rate of early pregnancy loss (19%) than pregnancies following DET (34.5%).

Table 19: Early pregnancy losses by pregnancy outcome and treatment type, New Zealand, 2018

	Autologous							
	Fresh		Thaw		Oocyte/embryo recipient		All	
	n	%	n	%	n	%	n	%
Early pregnancy loss	126	19.3	261	19.4	31	18.1	418	19.3
Miscarriage	*115*	*17.6*	*238*	*17.7*	*26*	*15.2*	*379*	*17.5*
Termination	*5*	*0.8*	*11*	*0.8*	*1*	*0.6*	*17*	*0.8*
Ectopic or heterotopic pregnancy	*6*	*0.9*	*12*	*0.9*	*4*	*2.3*	*22*	*1.0*
Birth	528	80.7	1082	80.4	126	81.3	1,749	80.6
Not stated	0	0.0	2	0.1	1	0.6	3	0.1
Total	**654**	**100.0**	**1,345**	**100.0**	**171**	**100.0**	**2,170**	**100.0**

Birth outcomes and treatment type

There were 1,749 women who gave birth to at least one baby of 20 weeks or more gestation or at least 400 grams birthweight following embryo transfer cycles. Of these, 99.3% (1,737) gave birth to at least one liveborn baby (live birth) (Table 20).

Table 20: Births by birth outcome and treatment type, New Zealand, 2018

	Autologous							
	Fresh		Thaw		Oocyte/embryo recipient		All	
	n	%	n	%	n	%	n	%
Live birth	524	99.2	1075	99.4	138	99.3	1,737	99.3
< 37 weeks	*48*	*9.1*	*85*	*7.9*	*15*	*10.8*	*148*	*8.5*
≥ 37 weeks	*476*	*90.2*	*990*	*91.5*	*123*	*88.5*	*1,589*	*90.9*
Gestational age unknown	*0*	*0.0*	*0*	*0.0*	*0*	*0.0*	*0*	*0.0*
Stillbirth[(a)]	3	0.6	3	0.3	1	0.7	7	0.4
Not stated	1	0.2	4	0.4	0	0.0	5	0.3
Total	**528**	**100.0**	**1,082**	**100.0**	**139**	**100.0**	**1,749**	**100.0**

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

Births by plurality and maternal age

The average age of women at the time of birth was 35.6 years. Of the 1,749 autologous and recipient births, 1.0% were multiple gestation births (Table 21).

Table 21: Births by plurality and maternal age, New Zealand, 2018

	Age group (years)[a]								
	< 35			35-39			≥ 40		
	One embryo	Two embryos	All	One embryo	Two embryos	All[b]	One embryo	Two embryos	All[b]
				n					
Singleton	723	7	730	697	7	704	280	17	297
Multiple	4	2	6	5	0	5	4	3	7
Twin	*4*	*2*	*6*	*5*	*0*	*5*	*4*	*3*	*7*
Higher order multiple	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*
Total	**727**	**9**	**736**	**702**	**7**	**709**	**284**	**20**	**304**
				%					
Singleton	99.4	77.8	99.2	99.3	100.0	99.3	98.6	85.0	97.7
Multiple	0.6	22.2	0.8	0.7	0.0	0.7	1.4	15.0	2.3
Twin	0.6	22.2	0.8	0.7	0.0	0.7	1.4	15.0	2.3
Higher order multiple	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
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.

Gestational age of babies

The average gestational age of babies born following autologous and recipient embryo transfer cycles was 38.6 weeks (Table 22). One in ten babies (9.6%) were preterm (less than 37 weeks gestation); the average gestational age of ART singletons was 38.7 weeks, while the average gestational age for ART twins was 35.4 weeks.

Table 22: Babies by gestational age and plurality, New Zealand, 2018

Gestational age (weeks)	Singletons		Twins		Higher order multiples		Total	
Mean (SD)	38.7 (2.1)		35.4 (1.8)		-		38.6 (2.2)	
	n	**%**	**n**	**%**	**n**	**%**	**n**	**%**
≤ 27	16	0.9	0	0.0	0	0.0	16	0.9
28-31	10	0.6	2	5.6	0	0.0	12	0.7
32-36	113	6.5	28	77.8	0	0.0	141	8.0
≥ 37	1,591	91.9	6	16.7	0	0.0	1,597	90.4
Not stated	1	0.1	0	0.0	0	0.0	1	0.1
Total	**1,731**	**100.0**	**36**	**100.0**	**0**	**0.0**	**1,767**	**100.0**

Birth outcomes

The average birthweight for liveborn babies to women who had autologous and recipient embryo transfer cycles was 3,391 grams. Of all liveborn babies, 6.7% were low birthweight (less than 2,500 grams) (Table 23). The average birthweight was 3,413 grams and 2,310 grams for liveborn ART singletons and twins, respectively. Low birthweight was reported for 5.4% of liveborn singletons following SET and 6.5% of liveborn singletons following DET.

Table 23: Liveborn babies by birthweight group and plurality, New Zealand, 2018

	Singletons				
Birthweight (grams)	**SET[a]**	**DET[b]**	**Twins**	**Higher order multiples**	**Total**
			n		
< 1,000	8	0	0	0	8
1,000-1,499	10	1	2	0	13
1,500-1,999	18	0	5	0	23
2,000-2,499	55	1	17	0	73
< 2,500	91	2	24	0	117
2,500-2,999	234	2	7	0	243
3,000-3,499	566	18	3	0	587
3,500-3,999	542	3	0	0	545
≥ 4,000	235	5	0	0	240
Not stated	21	1	2	0	24
Total	**1,689**	**31**	**36**	**0**	**1,756**
			%		
< 1,000	*0.5*	*0.0*	*0.0*	0	*0.5*
1,000-1,499	*0.6*	*3.2*	*5.6*	0	*0.7*
1,500-1,999	*1.1*	*0.0*	*13.9*	0	*1.3*
2,000-2,499	*3.3*	*3.2*	*47.2*	0	*4.2*
< 2,500	5.4	6.5	66.7	0	6.7
2,500-2,999	13.9	6.5	19.4	0	13.8
3,000-3,499	33.5	58.1	8.3	0	33.4
3,500-3,999	32.1	9.7	0.0	0	31.0
≥ 4,000	13.9	16.1	0.0	0	13.7
Not stated	1.2	3.2	5.6	0	1.4
Total	**100.0**	**100.0**	**100.0**	**-**	**100.0**

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

5 Preimplantation genetic testing in 2018

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 preimplantation genetic diagnosis (PGD) and preimplantation genetic screening (PGS). The indication for PGT is not recorded in ANZARD. In 2018, PGT was performed in 515 cycles, representing 7.5% of cycles in which embryos were created or thawed. Among the 515 PGT cycles, 195 (37.9%) were part of a freeze-all cycle. Of the 320 PGT cycles (excluding freeze-all cycles), 261 (81.6%) had embryos transferred, resulting in 130 (40.6%) clinical pregnancies and 119 (37.2%) live births.

Table 24: Number of cycles with PGT by type of embryo, New Zealand, 2018

	Stage of treatment			
Type of embryo	**Number of cycles with fresh or thawed embryos**	**Number of cycles with PGT**	**Number of embryo transfers following PGT**	**Number of live births following PGT**
Fresh	3,203	217	10	4
Freeze-all cycles	*1,079*	*195*	*n.a*	*n.a*
Thaw	3,656	298	251	115
Total	**6,859**	**515**	**261**	**119**

n.a.: not applicable
PGT: Preimplantation genetic testing

6 Donor insemination cycles in 2018

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

In 2018, there were 411 DI cycles reported, which included 2 (<1%) undertaken with controlled ovarian hyperstimulation and 409 (99.5%) undertaken in unstimulated cycles. Of all DI cycles, 19.2% resulted in a clinical pregnancy and 16.1% resulted in a live birth (Table 25). There were two multiple births following DI cycles in 2018. The average age of women who had a DI cycle was 35 years. The clinical pregnancy rate and live birth rate were highest in women aged less than 30 years. The live birth rate decreased with advancing woman's age. Of the DI cycles in women aged under 35 years, 21.4% resulted in a live birth, compared with 4.4% of DI cycles in women aged 40 years or older (Table 25).

Table 25: Outcomes of DI cycles by women's age group, New Zealand, 2018

	Age group (years)[a]				
	< 30	**30-34**	**35-39**	**≥ 40**	**Overall**
DI cycles	57	135	151	68	411
Controlled ovarian hyperstimulation	*2*	*0*	*0*	*0*	*2*
Unstimulated cycles	*55*	*135*	*151*	*68*	*409*
Clinical pregnancies	14	31	30	4	79
Live births	13	28	22	3	66
Clinical pregnancies per DI cycle (%)	*24.6*	*23.0*	*19.9*	*5.9*	*19.2*
Live births per DI cycle (%)	*22.8*	*20.7*	*14.6*	*4.4*	*16.1*
Live births per clinical pregnancy (%)	*92.9*	*90.3*	*73.3*	*75.0*	*83.5*

(a) Age at start of treatment cycle.
DI: Donor sperm insemination

Clinical pregnancies

Of the 79 clinical pregnancies following DI cycles, 13 (16.5%) ended in early pregnancy loss. Of the 66 live births, 64 (97.0%) were singleton births and 2 (3.0%) were twin births.

Perinatal outcomes of babies

There were 68 babies born to women who had DI treatment, all of which were liveborn. Of these, 9 were born preterm (less than 37 weeks gestation). The mean birthweight of liveborn babies was 3,391 grams (SD 559). There were 7 liveborn babies (10.3%) born with low birthweight (less than 2,500 grams).

7 Trends in ART treatment and outcomes 2014-2018

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

In 2018, 7,723 initiated fresh or thaw ART treatment cycles were undertaken in New Zealand. This was an increase of 6.2% compared to 2017 and an increase of 31.1% from 2014 (Table 26). Between 2014 and 2018, the live birth rates per initiated cycle ranged from 22.1% to 23.2%. The live birth rate per initiated cycle (excluding freeze-all) has been relatively stable between 24% and 27% since 2014 (Table 26).

Table 26: Number of fresh and thaw cycles by stage/outcome of treatment, New Zealand, 2014-2018

Stage/outcome of treatment	2014	2015	2016	2017	2018
Initiated cycles[(a)]	5,891	6,242	6,705	7,273	7,723
Cycles with OPU[(b)]	3,230	3,397	3,404	3,488	3,502
Freeze-all	480	542	766	986	1,213
Embryo transfers	4,597	4,821	4,884	5,055	5,416
Clinical pregnancies	1,655	1,766	1,924	2,060	2,194
Live births	1,302	1,401	1,556	1,625	1,755
Clinical pregnancies per initiated cycle (%)	*28.1*	*28.3*	*28.7*	*28.3*	*28.4*
Clinical pregnancies per embryo transfer (%)	*36.0*	*36.7*	*39.4*	*40.8*	*40.5*
Live births per initiated cycle (%)	*22.1*	*22.4*	*23.2*	*22.3*	*22.7*
Live births per initiated cycle (excluding freeze-all[(c)]) (%)	*24.1*	*24.6*	*26.2*	*25.8*	*27.0*
Live births per embryo transfer (%)	*28.3*	*29.1*	*31.9*	*32.1*	*32.4*

(a) Included autologous cycles, oocyte donation cycles, oocyte/embryo recipient cycles, and surrogacy cycles.
(b) Cycles with OPU included 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, and an embryo transfer does not take place.

8 Cumulative success rates for women undertaking autologous treatment 2016-2018

This section presents information on all women who started their first autologous fresh ART treatment cycle between 1st January 2016 and 31st December 2016. Women were followed from the start of their first autologous fresh cycle through subsequent fresh and thaw cycles, excluding freeze-all cycles, until 31st December 2018 or until they achieved a live birth (a birth of at least one liveborn baby) up to and including 31st October 2019. This longitudinal perspective provides a measure of the outcomes of successive ART treatment cycles undertaken by the same woman up to her first birth following ART treatment. These women might have had additional treatment cycles after 2018 and their treatment information and resulting outcomes will be captured in subsequent annual reports. Therefore, in this dynamic cohort of women undergoing their first autologous fresh ART treatment between 1st January 2016 and 31st December 2016, the cumulative success rates may increase over time as women return for treatment at a later date.

ART treatment cycles presented in Tables 27 to 32 include all initiated autologous fresh and thaw cycles, excluding freeze-all cycles. Cycles which were cancelled at any stage and did not proceed to oocyte collection or embryo transfer are included. Donor sperm insemination cycles, oocyte/embryo recipient cycles, oocyte/embryo donation cycles, surrogacy arrangement cycles and gamete intrafallopian transfer (GIFT) cycles are not included. A pregnancy that ends before 20 weeks gestation or a stillbirth are not counted as a live birth.

Table 27 presents the number of cycles by women's age group. Tables 28 to 32 present cycle-specific live birth rates, non-progression rates and cumulative live birth rates for all age groups and women aged under 30 years, between 30-34 years, between 35-39 years and over 40 years. Only the first five cycles are presented due to the small number of women undertaking six or more treatment cycles between 1st January 2016 and 31st December 2018.

Definitions and calculations

- The cycle-specific live birth rate for a specific number of cycles is calculated as the number of live births resulting from the specific number of cycles divided by the number of women who undertook that cycle number. For instance, in Table 28, the cycle-specific live birth rate of 21.6% for cycle number three represents the proportion of women who undertook a third cycle and achieved a live birth in that cycle.
- The non-progression rate for a specific cycle is calculated as the number of women who did not return for further ART treatment cycles before 31st December 2018 divided by the number of women who did not have a live birth in that cycle. For example, the non-progression rate of 32.2% for a third cycle represents the proportion of women who did not achieve a live birth in their third cycle and did not progress to a fourth cycle (Table 28). The reasons surrounding a woman's or couple's choice to not return to or progress with further treatment, include poor prognosis, natural pregnancy, migration, financial, psychological, and other unrelated reasons; these are not collected by ANZARD.

  The cumulative live birth rate for a specific cycle is calculated as the total number of live births following this cycle and all previous cycles divided by the total number of women who started their first autologous fresh ART treatment cycle between 1st

January 2016 and 31st December 2016. For example, the cumulative live birth rate of 49.0% for the third cycle represents the proportion of women who started ART treatment in 2016 and achieved a live birth following their first three cycles (Table 28).Note that only the first birth to a woman is counted in cumulative live birth rates.

Table 27: Number of cycles by women's age group for all women who started their first autologous fresh cycle (excluding freeze-all cycles[a]) between 1st January 2016 and 31st December 2016, New Zealand

	Age group (years)[b]				
Cycle number	**< 30**	**30-34**	**35-39**	**≥ 40**	**All**
			n		
One	127	287	284	147	845
Two	79	180	192	96	547
Three	33	82	101	40	256
Four	14	37	49	20	120
Five or more	15	50	86	20	171
Total	**268**	**636**	**712**	**323**	**1,939**
			%		
One	47.4	45.1	39.9	45.5	43.6
Two	29.5	28.3	27.0	29.7	28.2
Three	12.3	12.9	14.2	12.4	13.2
Four	5.2	5.8	6.9	6.2	6.2
Five or more	5.6	7.9	12.1	6.2	8.8
Total	**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 cryopreserved, and an embryo transfer does not take place.
(b) Age at start of first autologous fresh ART treatment cycle undertaken in 2016.

Note: Women who started their first autologous fresh ART treatment cycle between 1st January 2016 and 31st December 2016 were followed through subsequent fresh and thaw cycles (excluding freeze-all cycles) until 31st December 2018 or birth of a liveborn baby up to and including 31st October 2019. Totals and subtotals may not equal 100.0 due to rounding. Data should be interpreted with caution due to small numbers in certain cells.

Table 28: Cycle-specific and cumulative live birth rates for all women who started their first autologous fresh cycle (excluding freeze-all cycles[f]) between 1st January 2016 and 31st December 2016, New Zealand, 2016-2018

Cycle Number[a]	Number of women starting cycle	Number of women who had a live birth[b]	Cycle-specific live birth rate (%)[c]	Number of women who did not progress to next treatment	Non-progression rate (%)[d]	Cumulative live birth rate (%)[e]
One	1,939	535	27.6	310	22.1	27.6
Two	1,094	297	27.1	250	31.4	42.9
Three	547	118	21.6	138	32.2	49.0
Four	291	57	19.6	63	26.9	51.9
Five	171	34	19.9	48	35.0	53.7

(a) Cycle one represents a woman's first autologous (excluding freeze-all) fresh ART treatment cycle between 1st January 2016 and 31st December 2016. Cycles two to five could be either a fresh or thaw cycle (excluding freeze-all cycles) undertaken by a woman until 31st December 2018 or birth of a liveborn baby up to and including 31st October 2019.
(b) A live birth is the birth of one or more liveborn infants, with the birth of twins or higher order multiples counted as one live birth.
(c) The cycle-specific live birth rate is calculated as the number of live births resulting from a specific 'cycle number' divided by the number of women who undertook that same 'cycle number'.
(d) The non-progression rate for a specific 'cycle number' is calculated as the number of women who did not return for further ART treatment cycles before 31st December 2018 divided by the number of women who did not have a live birth in that 'cycle number'.
(e) The cumulative live birth rate for a specific 'cycle number' is calculated as the total number of live births following this 'cycle number' and all previous cycles divided by the total number of women who started their first autologous fresh ART treatment cycle between 1st January 2016 and 31st December 2016.
(f) Freeze-all cycles are fresh ART treatment cycles where all oocytes or embryos are cryopreserved, and an embryo transfer does not take place.

Note: Further treatment cycles after the fifth 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 and measures of statistical variance are not supplied.

Table 29: Cycle-specific and cumulative live birth rates for women aged less than 30 years who started their first autologous fresh cycle (excluding freeze-all cycles[f]) between 1st January 2016 and 31st December 2016, New Zealand, 2016-2018

Cycle number[a]	Number of women starting cycle	Number of women who had a live birth[b]	Cycle-specific live birth rate (%)[c]	Number of women who did not progress to next treatment	Non-progression rate (%)[d]	Cumulative live birth rate (%)[e]
One	268	94	35.1	33	19.0	35.1
Two	141	51	36.2	28	31.1	54.1
Three	62	22	35.5	11	27.5	62.3
Four	29	7	24.1	7	31.8	64.9
Five	15	6	40.0	5	55.6	67.2

(a) Cycle one represents a woman's first autologous (excluding freeze-all) fresh ART treatment cycle between 1st January 2016 and 31st December 2016. Cycles two to five could be either a fresh or thaw cycle (excluding freeze-all cycles) undertaken by a woman until 31st December 2018 or birth of a liveborn baby up to and including 31st October 2019.
(b) A live birth is the birth of one or more liveborn infants, with the birth of twins or higher order multiples counted as one live birth.
(c) The cycle-specific live birth rate is calculated as the number of live births resulting from a specific 'cycle number' divided by the number of women who undertook that same 'cycle number'.
(d) The non-progression rate for a specific 'cycle number' is calculated as the number of women who did not return for further ART treatment cycles before 31st December 2018 divided by the number of women who did not have a live birth in that 'cycle number'.
(e) The cumulative live birth rate for a specific 'cycle number' is calculated as the total number of live births following this 'cycle number' and all previous cycles divided by the total number of women who started their first autologous fresh ART treatment cycle between 1st January 2016 and 31st December 2016.
(f) Freeze-all cycles are fresh ART treatment cycles where all oocytes or embryos are cryopreserved, and an embryo transfer does not take place.

Note: Further treatment cycles after the fifth 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 and measures of statistical variance are not supplied.

Table 30: Cycle-specific and cumulative live birth rates for women aged 30-34 years who started their first autologous fresh cycle (excluding freeze-all cycles[f]) between 1st January 2016 and 31st December 2016, New Zealand, 2016-2018

Cycle number[a]	Number of women starting cycle	Number of women who had a live birth[b]	Cycle-specific live birth rate (%)[c]	Number of women who did not progress to next treatment	Non-progression rate (%)[d]	Cumulative live birth rate (%)[e]
One	636	230	36.2	57	14.0	36.2
Two	349	121	34.7	59	25.9	55.2
Three	169	44	26.0	38	30.4	62.1
Four	87	29	33.3	8	13.8	66.7
Five	50	10	20.0	13	32.5	68.2

(a) Cycle one represents a woman's first autologous (excluding freeze-all) fresh ART treatment cycle between 1st January 2016 and 31st December 2016. Cycles two to five could be either a fresh or thaw cycle (excluding freeze-all cycles) undertaken by a woman until 31st December 2018 or birth of a liveborn baby up to and including 31st October 2019.
(b) A live birth is the birth of one or more liveborn infants, with the birth of twins or higher order multiples counted as one live birth.
(c) The cycle-specific live birth rate is calculated as the number of live births resulting from a specific 'cycle number' divided by the number of women who undertook that same 'cycle number'.
(d) The non-progression rate for a specific 'cycle number' is calculated as the number of women who did not return for further ART treatment cycles before 31st December 2018 divided by the number of women who did not have a live birth in that 'cycle number'.
(e) The cumulative live birth rate for a specific 'cycle number' is calculated as the total number of live births following this 'cycle number' and all previous cycles divided by the total number of women who started their first autologous fresh ART treatment cycle between 1st January 2016 and 31st December 2016.
(f) Freeze-all cycles are fresh ART treatment cycles where all oocytes or embryos are cryopreserved and an embryo transfer does not take place.

Note: Further treatment cycles after the fifth 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 and measures of statistical variance are not supplied.

Table 31: Cycle-specific and cumulative live birth rates for women aged 35-39 years who started their first autologous fresh cycle (excluding freeze-all cycles[f]) between 1st January 2016 and 31st December 2016, New Zealand, 2016-2018

Cycle number[a]	Number of women starting cycle	Number of women who had a live birth[b]	Cycle-specific live birth rate (%)[c]	Number of women who did not progress to next treatment	Non-progression rate (%)[d]	Cumulative live birth rate (%)[e]
One	712	176	24.7	108	20.1	24.7
Two	428	109	25.5	83	26.0	40.0
Three	236	40	16.9	61	31.1	45.6
Four	135	19	14.1	30	25.9	48.3
Five	86	16	18.6	24	34.3	50.6

(a) Cycle one represents a woman's first autologous (excluding freeze-all) fresh ART treatment cycle between 1st January 2016 and 31st December 2016. Cycles two to five could be either a fresh or thaw cycle (excluding freeze-all cycles) undertaken by a woman until 31st December 2018 or birth of a liveborn baby up to and including 31st October 2019.
(b) A live birth is the birth of one or more liveborn infants, with the birth of twins or higher order multiples counted as one live birth.
(c) The cycle-specific live birth rate is calculated as the number of live births resulting from a specific 'cycle number' divided by the number of women who undertook that same 'cycle number'.
(d) The non-progression rate for a specific 'cycle number' is calculated as the number of women who did not return for further ART treatment cycles before 31st December 2018 divided by the number of women who did not have a live birth in that 'cycle number'.
(e) The cumulative live birth rate for a specific 'cycle number' is calculated as the total number of live births following this 'cycle number' and all previous cycles divided by the total number of women who started their first autologous fresh ART treatment cycle between 1st January 2016 and 31st December 2016.
(f) Freeze-all cycles are fresh ART treatment cycles where all oocytes or embryos are cryopreserved, and an embryo transfer does not take place.

Note: Further treatment cycles after the fifth 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 and measures of statistical variance are not supplied.

Table 32: Cycle-specific and cumulative live birth rates for women aged 40 years and over who started their first autologous fresh cycle (excluding freeze-all cycles[f]) between 1st January 2016 and 31st December 2016, New Zealand, 2016-2018

Cycle number[a]	Number of women starting cycle	Number of women who had a live birth[b]	Cycle-specific live birth rate (%)[c]	Number of women who did not progress to next treatment	Non-progression rate (%)[d]	Cumulative live birth rate (%)[e]
One	323	35	10.8	112	38.9	10.8
Two	176	16	9.1	80	50.0	15.8
Three	80	12	15.0	28	41.2	19.5
Four	40	2	5.0	18	47.4	20.1
Five	20	2	10.0	6	33.3	20.7

(a) Cycle one represents a woman's first autologous (excluding freeze-all) fresh ART treatment cycle between 1st January 2016 and 31st December 2016. Cycles two to five could be either a fresh or thaw cycle (excluding freeze-all cycles) undertaken by a woman until 31st December 2018 or birth of a liveborn baby up to and including 31st October 2019.
(b) A live birth is the birth of one or more liveborn infants, with the birth of twins or higher order multiples counted as one live birth.
(c) The cycle-specific live birth rate is calculated as the number of live births resulting from a specific 'cycle number' divided by the number of women who undertook that same 'cycle number'.
(d) The non-progression rate for a specific 'cycle number' is calculated as the number of women who did not return for further ART treatment cycles before 31st December 2018 divided by the number of women who did not have a live birth in that 'cycle number'.
(e) The cumulative live birth rate for a specific 'cycle number' is calculated as the total number of live births following this 'cycle number' and all previous cycles divided by the total number of women who started their first autologous fresh ART treatment cycle between 1st January 2016 and 31st December 2016.
(f) Freeze-all cycles are fresh ART treatment cycles where all oocytes or embryos are cryopreserved, and an embryo transfer does not take place.

Note: Further treatment cycles after the fifth 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 and measures of statistical variance are not supplied.

Appendix A: Contributing fertility clinics

Fertility Associates, Auckland (Dr Simon Kelly)

Fertility Associates Christchurch, Christchurch (Dr Sarah Wakeman)

Fertility Associates Hamilton, Hamilton (Dr VP Singh)

Fertility Associates Otago, Dunedin (Associate Professor Wayne Gillett)

Fertility Associates Wellington, Wellington (Dr Andrew Murray)

Fertility Plus, Auckland (Dr Cindy Farquhar)

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

Repromed Auckland, Auckland (Dr Guy Gudex)

Appendix B: Data used in this report

The data presented in this report are supplied by eight fertility clinics in New Zealand and are compiled into ANZARD 2.0. ANZARD 2.0 includes autologous treatment cycles, treatment involving donated oocytes or embryos and treatment involving surrogacy arrangements. ANZARD 2.0 collects data on the use of ART techniques such as ICSI, oocyte/embryo freezing methods, PGD and cleavage stage/blastocyst transfers. In addition to ART procedures, ANZARD 2.0 also collects data from fertility centres about artificial insemination cycles using donated sperm (DI). The outcomes of pregnancies, births and babies born following ART and DI treatments are also maintained in ANZARD 2.0. This includes the method of birth, birth status, birthweight, gestational age, plurality, perinatal mortality, and selected information on maternal morbidity.

This report presents information on ART and DI treatment cycles that took place in fertility clinics in New Zealand in 2018, and the resulting pregnancies and births. The babies included in this report were conceived through treatment cycles undertaken in 2018 and were born in either 2018 or 2019.

Data validation

Most fertility centres have computerised data information management systems and provide the National Perinatal Epidemiology and Statistics Unit (NPESU) with high-quality data. All data processed by NPESU undergo a validation process, with data queries being followed up with fertility centre staff. In 2018, information relating to pregnancy and birth outcomes was provided for all New Zealand-based cycles.

The Reproductive Technology Accreditation Committee of the Fertility Society of Australia and New Zealand? also plays a role in ensuring the quality of ANZARD 2.0 data by validating selected records against clinic files in their annual inspections.

Data presentation

Data presented in Chapters 2 to 6 are for treatment cycles and not patients. It is possible for an individual woman to undergo more than one treatment cycle in a year or experience more than one pregnancy. This means that information reported about patient characteristics, such as age, parity, and cause of infertility, is based on calculations in which individuals may be counted more than once.

The rates of clinical pregnancy and live birth in Chapters 2 to 6 were measured per initiated cycle. Where the number of initiated cycles was not available, the rates were measured per embryo transfer cycle.

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

Data limitations

Follow-up of pregnancy and birth outcomes is limited because the ongoing care of pregnant patients is often carried out by non-ART practitioners. The method of follow-up varies by fertility centre and includes follow-up with the patient or clinician, or the use of routine data sourced from a health department. In a small proportion of cases this information is not

available. For pregnancies in which there is successful follow-up, data are limited by the self-reported nature of the information. Fertility centre staff invest significant effort in validating such information by obtaining medical records from clinicians or hospitals. Data about previous ART treatment and history of pregnancies are, in some cases, reported by patients.

Glossary

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

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

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

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

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

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

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

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

Cleavage stage embryo: an embryo comprising about 8 cells usually developed by 2 or 4 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.

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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.

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

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

Preterm: a gestation of less than 37 weeks.

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

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

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

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

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

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

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

Note: The International Committee Monitoring Assisted Reproductive Technologies (ICMART) has published an ART glossary for the terms used in ART data collections (Zegers-Hochschild et al. 2009). However, the terminology used in this report may differ from that in the ICMART glossary.

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