Live birth rates and birth outcomes by diagnosis using linked cycles from the SART CORS database

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Received: 27 June 2013 / Accepted: 29 August 2013 / Published online: 7 September 2013
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Abstract

Purpose This study uses linked cycles of assisted reproductive technology (ART) to examine cumulative live birth rates, birthweight, and length of gestation by diagnostic category.

Methods We studied 145,660 women with 235,985 ART cycles reported to the Society for Assisted Reproductive Technology Clinic Outcomes Reporting System during 2004–2010. ART cycles were linked to individual women by name, date of birth, social security number, partner's name, and sequence of ART treatments. The study population included the first four autologous oocyte cycles for women with a single diagnosis of male factor, endometriosis, ovulation disorders, diminished ovarian reserve, or unexplained infertility. Live birth rates were calculated per cycle, per cycle number (1–4), and cumulatively. Birthweight and length of gestation were calculated for singleton births.

Results Within each diagnosis, live birth rates were highest in the first cycle and declined with successive cycles. Women with diminished ovarian reserve had the lowest live birth rate

(cumulative rate of 28.3 %); the live birth rate for the other diagnoses were very similar (cumulative rates from 62.1 % to 65.7 %). Singleton birthweights and lengths of gestation did not differ substantially across diagnoses, ranging from 3,112 to 3,286 g and 265 to 270 days, respectively. These outcomes were comparable with national averages for singleton births in the United States (3,296 g and 271 days).

Conclusion Women with the diagnosis of diminished ovarian reserve had substantially lower live birth rates. However, singleton birthweights and lengths of gestation outcomes were similar across all other diagnoses.

Keywords Diagnosis · Assisted reproductive technology · Linked cycles · SART CORS · Birthweight · Gestational age

Capsule Cumulative live birth rate after 4 cycles of ART varied with infertility diagnosis while length of gestation and birthweight did not.

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Introduction

Patients beginning a course of assisted reproductive technology (ART) treatment need information about their potential for successful live birth of a healthy child. This success can be measured as the chance for live birth on a per cycle basis but it can also be measured as the likelihood of live birth following repeated treatments or it may be the number of treatment cycles needed to achieve a birth. Learning the potential for success with regard to diagnosis has value for both practitioners and patients.

Our understanding of live birth rates has historically been on a per cycle basis and success per cycle as a function of diagnosis and age group can be found at the Society for Assisted Reproductive Technology Clinic Outcome Reporting System (SART CORS) online database (www.sart.org). However, determining the chance of success with continued treatment according to patient characteristics has the advantage of allowing the patient and clinician to understand the overall likelihood of success. Studies suggest that children born through ART may have an increased risk of low

birthweight [1] and prematurity [2], even in singleton pregnancies. Some of this difference may be due to the use of fresh versus frozen embryos [3], levels of follicle stimulating hormone [4], or the use of intracytoplasmic sperm injection (ICSI) [5]. Less is known about whether diagnosis has a direct effect on length of gestation and birthweight. One study [6] reported an increase in low birthweight at term for patients with a diagnosis of male factor infertility.

Our previous studies used linked cycles of ART obtained from the SART CORS database to calculate pregnancy and live birth rates in Massachusetts [7, 8] and nationally [9]. In these studies we determined rates according to age, prior treatment, and use of autologous versus donor oocytes in fresh versus cryopreservation cycles. The current study used linked cycles of ART to extend our previous analyses by evaluating outcomes based on diagnosis, additional information on the characteristics of the diagnostic groups, and live birth and multiple rates with repeated cycles of ART treatment. In addition, we have evaluated the gestational age and birthweight of infants in singleton deliveries by diagnosis and cycle number.

Materials and methods

We used data from the national SART CORS database collected under the Fertility Clinic Success Rate Act of 1992 (Public Law 102–493). The study was approved by the Committee for the Protection of Human Subjects at Dartmouth College and Michigan State University.

ART cycles from the SART CORS database for 2004–2010 were linked by woman's date of birth, first and last names, and social security number (when present). Inter-clinic linkages also included partner's name and the sequence of ART treatments. Details of the linkage methodology have been reported previously [8, 9]. Identifying variables (including names, dates, and social security numbers) were removed to create a de-identified analytic file.

First cycles were defined as not having prior fresh or frozen ART treatment, being the first cycle for that woman in the cohort of linked cycles, occurring between 2004 and 2009 (to allow time for additional cycles), and not being a frozen embryo transfer cycle (FET). Cycles after the first live birth (defined as having a length of gestation ≥ 154 days and birthweight ≥ 300 g) were excluded from the analysis. Only women with a single diagnosis at their last treatment cycle were included. Cycles were numbered in the order in which they occurred in the sequence of cycles regardless of whether they were fresh or FET cycles. Cycles were grouped into the following diagnostic categories based on the last treatment cycle: male factor, endometriosis, ovulation disorders (including polycystic ovarian syndrome: PCOS), diminished ovarian

reserve, and unexplained infertility. Due to low numbers, tubal factor diagnoses were not included in the analysis. We compared diagnostic groups for mean age, gravidity, and patient maximal follicle stimulating hormone (FSH) on day 3 or following a Clomid Challenge test. Cycle characteristics were compared across diagnoses including dose of FSH administered, number of oocytes retrieved, and number of embryos cryopreserved, percentage of cycles with cryopreservation, use of intracytoplasmic sperm injection (ICSI), and assisted hatching (AZH).

Analyses included only cycles using autologous eggs. Live birth rates per cycle for sequential cycles were determined separately for fresh cycles and for FET. We present results only for the first 4 cycles due to the low frequency of women with more than 4 cycles for several of the diagnoses.

Birthweight and length of gestation outcomes were determined for all deliveries from fresh cycles according to diagnosis. Length of gestation was defined as date of outcome minus date of retrieval plus 2 weeks. For plural births, the largest birthweight of the infants from the pair or set was used. Outcomes were further analyzed for singleton live births according to diagnosis and the cycle number.

Maternal demographic factors, reproductive history, ART-specific parameters, and ART treatment and pregnancy outcomes were compared across the five diagnostic categories using the chi-square test for categorical variables and analysis of variance for continuous variables. Differences in live birth rates across cycles for individual women were analyzed using Cochran-Mantel-Haenszel test. Data were analyzed by SAS software, version 9.2 (SAS Institute), and Excel (Microsoft).

Results

The study population included 209,070 fresh embryo transfer cycles and 26,915 FET cycles among 145,660 women having a single diagnosis. The distribution of the study population by diagnosis, cycle number, and embryo state are shown in Table 1. All women had a first fresh cycle so the number for fresh cycle 1 equals the number of women in that group. FET cycles are by definition not a first cycle of treatment with autologous eggs, so there is no first cycle in any group under this category.

Patient characteristics by diagnosis for women at cycle 1 are shown in Table 2. Patients with diminished ovarian reserve were older and had the highest mean maximal FSH and use of AZH, and, as expected, had the lowest number of oocytes retrieved and lowest number of embryos cryopreserved. The ovulatory dysfunction group, which included patients with polycystic ovarian syndrome, had the highest number of oocytes retrieved and the most embryos cryopreserved. Male factor patients had the highest use of ICSI.

Table 1 Distribution of study population cycles by diagnosis, cycle number, and embryo state

Embryo state and cycle number	Male factor	Endometriosis	Ovulatory dysfunction	Diminished ovarian reserve	Unexplained
Fresh cycles					
1	55,409	14,134	19,388	22,642	34,087
2	14,405	3,524	4,423	8,339	9,504
3	5,985	1,397	1,678	3,398	4,128
4	2,344	520	723	1,384	1,658
Total	78,143	19,575	26,212	35,763	49,377
FET Cycles					
1	—	—	—	—	—
2	7,471	1,621	3,244	1,035	4,012
3	2,685	612	1,389	502	1,539
4	1,081	243	535	252	694
Total	11,237	2,476	5,168	1,789	6,245

Live birth rates per cycle as a function of diagnosis and patient age are shown in Table 3. Patients with diminished ovarian reserve had lower rates per cycle for each age category for fresh cycles. Trends in FET cycles were less clear. Rates for cycles 1–4 in fresh cycles and cycles 2–4 for FET cycles for all ages combined according to diagnosis are shown in Table 4. All diagnoses had reduced live birth rates per cycle as number of fresh cycles increased. This was not consistently the case in repeated FET cycles, possibly due to lower numbers in these groups. Patients with a diagnosis of diminished ovarian reserve had the lowest live birth rates per cycle and cumulatively compared to other diagnoses. Two cumulative birth rates over 4 cycles are presented [9]; the conservative estimate assumes that women who did not return for a subsequent cycle would not have a live birth if they had returned; the optimistic estimate assumes that women who did not return would have a similar outcome to those who did return.

Diminished ovarian reserve had lower cumulative live birth rates than the other diagnoses.

Table 5 presents birth outcome data for live births from fresh cycles by diagnosis. Multiple birth rates were lowest for women with the diagnosis of diminished ovarian reserve. Among singleton births, there were minimal differences in length of gestation and birthweight by diagnosis, which were statistically (but not clinically) significant. Length of gestation and birthweight did not differ substantially by cycle number for any diagnostic group.

Discussion

We have evaluated the live birth and delivery outcomes of repeat cycles of ART according to infertility diagnosis using national data from the SART CORS database. We have

Table 2 Characteristics of fresh autologous first cycles by diagnosis

Diagnosis	Male factor	Endometriosis	Ovulatory dysfunction	Diminished ovarian reserve	Unexplained
(N)	(55,409)	(14,134)	(19,388)	(22,642)	(34,087)
Woman's age (years, SD)	33.5±4.4	33.8±4.0	32.7±4.2	39.6±4.0	35.1±4.1
Gravidity (mean, SD)	0.58±1.0	0.58±0.9	0.68±1.1	1.12±1.4	0.79±1.1
Maximum FSH level (mIU/ml)	6.9±2.9	7.4±3.3	6.3±3.2	10.6±6.9	7.3±3.0
FSH Dosage (IU)	2,757±1,337	3,012±1,470	2,335±1,264	4,229±1,829	2,937±1,455
Number of oocytes retrieved (mean, SD)	14.4±7.8	12.8±7.3	16.8±9.2	8.1±6.0	13.4±7.4
Number of fresh embryos transferred (mean, SD)	2.3±0.8	2.4±0.8	2.2±0.8	2.7±1.2	2.4±0.9
Single embryo transferred (%)	9.0	8.0	10.3	16.1	9.9
Number of embryos cryopreserved (mean, SD)	4.6±3.7	4.7±3.7	5.7±4.7	3.6±3.0	4.5±3.6
Cycles with embryos cryopreserved (%)	43.8	42.1	53.4	14.6	43.3
Cycles with ICSI (%)	93.7	51.1	53.8	58.8	53.2
Cycles with AZH (%)	32.5	33.3	29.0	53.5	34.9

p-values across diagnoses are all <0.0001

Table 3 Live birth rates per cycle by diagnosis, embryo state, and woman's age

	Embryo state and woman's age	Male factor	Endometriosis	Ovulatory dysfunction	Diminished ovarian reserve	Unexplained
	Fresh cycles					
	<35 years	41.4	39.7	41.1	28.2	39.8
	35–37 years	32.5	31.0	34.5	21.6	32.4
	38–40 years	23.3	22.1	24.1	16.1	23.4
	41–42 years	11.8	9.9	13.0	9.8	12.7
	>42 years	5.3	3.4	4.7	3.3	4.8
	FET Cycles					
	<35 years	31.5	30.9	30.4	27.7	29.9
	35–37 years	27.3	24.9	22.0	23.8	24.3
	38–40 years	22.1	16.2	18.4	18.5	18.2
	41–42 years	13.5	19.1	12.2	14.7	19.2
	>42 years	15.4	0.0	18.2	6.8	0.0

p-values within diagnoses, across age groups are all <0.0001 for fresh and FET cycles

p-values across diagnoses for fresh cycles are <0.0001 for ages <35 to 42 years, and 0.02 for >42 years

p-values across diagnoses for FET cycles are all not significant, except for women ages 35–37 years (0.04)

demonstrated differences in per cycle and cumulative live birth rates as a function of diagnosis. It is reassuring that, although there is a decline in live birth rates with increasing cycle number, differences in length of gestation and birthweight by diagnosis were minimal.

We studied four primary diagnoses reported to SART CORS, as well as a secondary analysis that included unexplained infertility. Characteristics of women with each diagnosis as entered in the first cycle of treatment were consistent with expectations. As previously reported [10], women with diminished ovarian reserve were older, had higher

maximum FSH levels, lower number of eggs retrieved, lower cryopreservation rate, and required more FSH during ovulation stimulation than women with other diagnoses. Women treated with ART for male factor infertility were generally younger and used ICSI for 93.7 % of cycles, compared to less than 60 % in the other groups. Unfortunately, as we have reported previously, the severity of the male factor infertility cannot be assessed from the SART CORS database [11]. Ovulatory dysfunction patients which include those with polycystic ovarian syndrome, had as expected a higher number of oocytes retrieved and cryopreserved, lower FSH levels,

Table 4 Live birth rates (%) by diagnosis, cycle number, and embryo state

Embryo state and cycle number	Male factor	Endometriosis	Ovulatory dysfunction	Diminished ovarian reserve	Unexplained
Fresh cycles					
1	42.7	43.0	44.1	18.9	42.0
2	36.0	33.1	38.6	14.0	33.2
3	34.8	32.2	35.7	12.7	30.2
4	33.9	28.8	32.9	10.9	28.3
FET Cycles					
1	—	—	—	—	—
2	34.8	34.2	33.0	24.0	33.1
3	30.3	28.4	30.7	18.9	28.5
4	28.7	30.0	27.9	15.5	26.7
Cumulative live birth/woman ^a					
Conservative estimate	64.0	61.2	65.7	28.3	62.1
Optimistic estimate	83.4	81.5	83.6	47.4	80.4

p-values across diagnoses are all <0.001

p-values within diagnoses across fresh cycles 1–4 are all <0.0001

p-values within diagnoses across FET cycles 2–4 are all <0.04

^a the cumulative rates are computed for the first 4 cycles only. The conservative estimate assumes that women who did not return for a subsequent cycle would not have a live birth if they had returned. The optimistic estimate (the product-limit or Kaplan-Meier estimate) assumes that women who did not return would have similar outcomes to women who did return

Table 5 Live birth outcomes from fresh, autologous cycles by diagnosis

Diagnosis	Male factor	Endometriosis	Ovulatory dysfunction	Diminished ovarian reserve	Unexplained
All deliveries (N)	(32,157)	(7,937)	(11,233)	(6,133)	(19,475)
Number live born	1.34±0.51	1.36±0.53	1.36±0.52	1.25±0.46	1.32±0.5
Singletons (%)	67.7	66.4	65.8	76.6	69.4
Singleton live births (N)	(21,759)	(5,273)	(7,394)	(4,699)	(13,515)
Length of gestation (days, mean, SD)	268±15	268±15	265±17	268±14	268±15
Cycle #					
1	268±15	268±15	266±17	268±14	268±15
2	268±16	268±15	265±18	268±15	269±15
3	268±16	268±14	266±15	270±13	268±15
4	269±14	265±18	264±18	269±15	269±16
Birthweight (grams, mean, SD)	3,254±591	3,241±587	3,198±637	3,242±581	3,253±584
Cycle #					
1	3253±587	3241±586	3199±633	3240±583	3246±582
2	3248±610	3230±578	3204±670	3240±590	3286±583
3	3276±594	3285±556	3206±629	3266±555	3249±591
4	3243±586	3189±619	3112±623	3267±551	3267±602

p-values across diagnoses are all <0.003, except birthweights in cycles 2–4, which were not significant

p-values within diagnoses across cycles are all not significant

and they required less follicle stimulating hormone for ovulation stimulation [12].

We conducted a secondary analysis comparing unexplained infertility to the other diagnoses. Unexplained infertility is defined as that the resulting diagnosis when testing reveals no cause of infertility following assessment of sperm parameters, functional ovulation, ovarian reserve, and internal anatomy issues such as tubal blockage [13]. Nevertheless, the diagnosis of unexplained infertility is assumed to be less accurate than the other diagnoses in our study. Unfortunately it may also be used as the default category in SART CORS, when, on validation, other diagnoses can be documented in the medical record (<http://www.cdc.gov/art/ART2009/appixa.htm>).

As we have previously reported, the cumulative live birth rate differed by diagnosis and reached a plateau at approximately cycle 4; rates for diminished ovarian reserve were significantly lower than other diagnoses [9]. In fresh cycles within each diagnostic group, the live birth rate per cycle declined with increasing cycle number whereas pregnancy rates after FET remained consistent despite increasing cycle number. The overall live birth rate per cycle was lower for each diagnosis in frozen versus fresh cycles. The decline in success with increasing cycle number has several possible explanations. Patients who conceive in the first cycle are no longer in the pool of patients available to undergo cycle 2 (and so forth). This results in a greater proportion of patients who will not conceive in the cohort for each successive cycle. Unfortunately, the SART CORS database does not contain

the nuanced information that would be necessary to address additional reasons for the decline in success with increasing cycles.

Most studies of length of gestation and birth weight after ART have focused on factors other than the infertility diagnosis. A growing body of literature suggests that cycles of frozen embryo transfer may have better birth outcomes than fresh embryo transfer [3, 14]. Calhoun et al. [4] have shown differences in prematurity by FSH levels, although high FSH levels were not a risk factor for prematurity in their study. Our study showed minimal differences in length of gestation and birthweight by diagnosis. Nationally, singleton birthweight and length of gestation averages 3,296±560 g and 271±16.8 days (calculated from reported weeks), respectively [15]. Mean outcomes of singleton birth in our study, regardless of diagnostic category, were within these ranges. Ovulatory dysfunction patients averaged slightly shorter gestations (by 3 days) and lower birthweights (by 55 g) than the other groups. Previous studies have shown that polycystic ovarian syndrome patients have increased obstetric complications including higher rates of preeclampsia and gestational diabetes compared to other diagnoses [16] which may explain some of these differences. Prior studies in non-ART populations have also suggested that time-to-pregnancy can affect birth outcome [17]. Hypothetically, the longer it takes a woman to achieve pregnancy the more intractable her infertility might be. It is reassuring that we did not find any differences in length of gestation or birthweight as a function of cycle of treatment.

This study has several limitations. Validation studies performed by CDC and SART indicate that there is some error in the entry of diagnosis (<http://www.cdc.gov/art/ART2009/appixa.htm>). The error rate for diagnosis entries in 2009 was 15.5 %, with 40 % of these errors being the overuse of the category “other”, a category not used in our analysis. The category of “unexplained” was also overused, and as a result we used this category only for a secondary analysis. Another error identified at validation was entry of a single diagnosis when more than one diagnosis was found in the medical record. There are also inherent limitations in the way diagnosis is entered into SART CORS, with alternative criteria possible at different clinics. Some diagnoses, such as ovulatory disorder, also include more than one category. While these inconsistencies are a concern, the finding that our diagnostic criteria matched expected information is reassuring. The other limitation is inconsistency in the source of birth outcome data reported to SART. Birth data are reported by the ART patient or sought from the obstetric provider, and this information may not be obtained until months after the delivery. In linking the SART CORS database to vital records in Massachusetts [18] we have recently demonstrated very high rates of agreement for mothers’ race/ethnicity (95.3 %), plurality of the live birth (99.5 %), live birth/fetal death status (99.9 %), birth date within 1 day (94.9 %), and birthweight within 50 g (86.7 %). These findings add confidence to the validity of the SART CORS outcome data.

In summary, we have shown that diagnosis has an effect on per cycle and cumulative live birth rates but no clinically significant differences in length of gestation and birthweight. It is also reassuring that the risk of prematurity and low birth weight does not increase with increasing number of cycles of treatment.

Acknowledgements SART wishes to thank all of its members for providing clinical information to the SART CORS database for use by patients and researchers. Without the efforts of our members, this research would not have been possible.

References

1. Schieve LA, Meikle SF, Ferre C, Peterson HB, Jeng G, Wilcox LS. Low and very low birth weight in infants conceived with use of assisted reproductive technology. *N Engl J Med*. 2002;346(10):731–7.
2. Reddy UM, Wapner RJ, Rebar RW, Tasca RJ. Infertility, assisted reproductive technology, and adverse pregnancy outcomes: executive summary of a national institute of child health and human development workshop. *Obstet Gynecol*. 2007;109(4):967–77.
3. Kalra SK, Ratcliffe SJ, Coutifaris C, Molinaro T, Barnhart KT. Ovarian stimulation and low birth weight in newborns conceived through in vitro fertilization. *Obstet Gynecol*. 2011;118(4):863–71.
4. Calhoun KC, Fritz MA, Steiner AZ. Examining the relationship between ovarian reserve, as measured by basal FSH levels, and the risk of poor obstetric outcome in singleton IVF gestations. *Hum Reprod*. 2011;26(12):3424–30.
5. Kallen B, Finnstrom O, Nygren K-G, Olausson PO. In vitro fertilization (IVF) in Sweden: infant outcome after different IVF fertilization methods. *Fertil Steril*. 2005;84(3):611–7.
6. Schieve LA, Ferre C, Peterson HB, Macaluso M, Reynolds MA, Wright VC. Perinatal outcome among singleton infants conceived through assisted reproductive technology in the United States. *Obstet Gynecol*. 2004;103(6):1144–53.
7. Stern JE, Brown MB, Luke B, Wantman E, Lederman A, Hornstein MD, et al. Cycle 1 as predictor of assisted reproductive technology treatment outcome over multiple cycles: an analysis of linked cycles from the society for assisted reproductive technology clinic outcomes reporting system online database. *Fertil Steril*. 2011;95(2):600–5. doi:10.1016/j.fertnstert.2010.06.009.
8. Stern JE, Brown MB, Luke B, Wantman E, Lederman A, Missmer SA, et al. Calculating cumulative live-birth rates from linked cycles of assisted reproductive technology (ART): data from the Massachusetts SART CORS. *Fertil Steril*. 2010;94(4):1334–40. doi:10.1016/j.fertnstert.2009.05.052.
9. Luke B, Brown MB, Wantman E, Lederman A, Gibbons W, Schattman GL, et al. Cumulative birth rates with linked assisted reproductive technology cycles. *N Engl J Med*. 2012;366(26):2483–91. doi:10.1056/NEJMoa1110238.
10. Ramaho de Caraho B, Sobrinho DBG, Vieira ADD, Resende MPS, Barbosa ACP, Silva AA, et al. Ovarian reserve assessment for infertility investigation. *ISRN Obstet Gynecol*. 2012;2012:576385.
11. Nangia AK, Luke B, Smith JF, Mak W, Stern JE, Group SW. National study of factors influencing assisted reproductive technology outcomes with male factor infertility. *Fertil Steril*. 2011;96(3):609–14. doi:10.1016/j.fertnstert.2011.06.026.
12. Qiao J, Feng HL. Extra- and intra-ovarian factors in polycystic ovary syndrome: impact on oocyte maturation and embryo developmental competence. *Hum Reprod Update*. 2011;17(1):17–33. doi:10.1093/humupd/dmq032.
13. Quaas A, Dorkas A. Diagnosis and treatment of unexplained infertility. *Obstet Gynecol*. 2008;1(2):69–76.
14. Maheshwari A, Bhattacharya S (2013) Elective frozen replacement cycles for all: ready for prime time? *Hum Reprod*. 2013;28(1):6–9. doi:10.1093/humrep/des386.
15. Martin JA, Hamilton BE, Ventura SJ, Osterman MJK, Kirmeyer S, Mathews TJ, et al. Births: final data for 2009. *Natl Vital Stat Rep*. 2011;60(1):1–70.
16. Boomsma CM, Eijkemans MJC, Hughes EG, Visser GHA, Fauser BCJM, Macklon NS. A meta-analysis of pregnancy outcomes in women with polycystic ovary syndrome. *Hum Reprod Update*. 2006;12(6):673–83.
17. Axmon A, Hagmar L. Time to pregnancy and pregnancy outcome. *Fertil Steril*. 2005;84(4):966–74.
18. Luke B, Cabral H, Cohen BB, Hoang L, Plummer KM, Kotelchuck M. Comparison of measures in SART database and Massachusetts vital statistics. *Fertil Steril*. 2012;98:S76–7.