



The parent trap: desire for multifetal gestation among patients treated for infertility

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Received: 17 February 2022 / Accepted: 25 April 2022 / Published online: 4 May 2022

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Abstract

Objective To evaluate predictors for patient preference regarding multifetal or singleton gestation among women presenting for infertility care.

Design Cross-sectional study.

Setting Academic university hospital-based infertility clinic.

Patient(s) Five hundred thirty-nine female patients with infertility who presented for their initial visit.

Main outcome measure(s) Demographic characteristics, infertility history, insurance coverage, desired treatment outcome, acceptability of multifetal reduction, and knowledge of the risks of multifetal pregnancies were assessed using a previously published 41-question survey. Univariate analysis was performed to assess patient factors associated with the desire for multiple births. Independent factors associated with this desire were subsequently assessed by multivariate logistic regression analysis.

Result(s) Nearly a third of women preferred multiples over a singleton gestation. Nulliparity, lower annual household income, older maternal age, marital status, larger ideal family size, openness to multifetal reduction, and lack of knowledge of the maternal/fetal risks of twin pregnancies were associated with pregnancy desire. Older age (OR (95% CI) 1.66 (1.20–2.29)), nulliparity (OR (95% CI) 0.34 (0.20–0.58)), larger ideal family size (OR (95% CI) 2.34 (1.73–3.14)), and lesser knowledge of multifetal pregnancy risk (OR (95% CI) 0.67 (0.55–0.83)) were independently associated with desire.

Conclusion(s) A large number of patients undergoing fertility treatment desire multifetal gestation. Although a lack of understanding of the risks associated with higher order pregnancies contributes to this desire, additional individual specific variables also contribute to this trend. Efforts to reduce the incidence of multiples should focus not only on patient education on comparative risks of multiples vs singleton pregnancies but also account for individual specific reservations.

Keywords Infertility · In vitro fertilization · Multiple births · Twins

Introduction

The increasing availability and use of assisted reproductive technologies (ART) have increased the number of twin births in the USA. In 2015, almost half of all multiple gestations resulting from ART in the USA occurred in women younger than 35 who had 2 fresh or frozen blastocysts transferred [1]. Rates of multifetal pregnancies in young in vitro fertilization (IVF) patients remained high in 2016 with nearly 17%

of women under 35 with a multifetal live birth [2]. Thankfully, the frequency of twin births in the USA has steadily declined since 2017 with a 3% decrease in twins from 2018 to 2019, reflecting a 5% decrease from a peak of 33.9% in 2014 [3]. A leading theory for this trend is the technological maturation of fertility treatments, resulting in fewer embryos transferred each cycle. This theory appears to be supported by the observed decline in rates of twins arising from IVF treatment, from 12.8% per autologous retrieval in women under 35 in 2017 to 7.3% per retrieval in the same age group in 2019 (SART success rate data). However, despite this decline, the current rate of twins in the total US birth population resulting from IVF treatment is 31.5% [4, 5]. Moreover, the annual rate of twins from ART across all age groups

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(4–9%) remains higher than the expected rate of twins in spontaneous conceptions (3.4%) [4, 5].

In the USA, physicians and patients often jointly decide how many embryos to transfer in IVF cycles. According to the American Society for Reproductive Medicine (ASRM), the optimal outcome of ART is to achieve a healthy singleton gestation [6]. In select groups of women and/or in those with chromosomally normal embryos, transfer of one embryo and then, sequentially if needed, transfer of a second frozen-and-thawed embryo dramatically reduces the rate of multiple births while achieving a live birth rate that is not substantially lower than the rate that is achievable with a double-embryo transfer (DET) [7–9]. Yet, many patients still elect for and desire placement of multiple embryos.

Twin and higher order pregnancies represent a serious complication of ART. Multifetal pregnancies have significant additional morbidity compared to singletons, including higher rates of preterm birth and perinatal complications including anemia, gestational diabetes, hypertensive disease of pregnancy, postpartum hemorrhage, and maternal mortality [3, 10–13]. These complications are amplified by advanced maternal age [14], which is important since childbearing is increasingly being delayed in many countries including the USA [15–17].

Most physicians are acutely aware of the inherent risks of multiple gestation and of parturition involving multiple fetuses. However, patients may not be aware of these concerns and this lack of awareness may be associated with a desire for a twin or higher order pregnancy. Ryan et al. showed that patients who received educational information about the risks of twins were more likely to desire a singleton pregnancy and be open to the idea of elective single embryo transfer (eSET); 29% of patients reported a desire for twin pregnancy prior to receipt of education and 14% of patients continued this desire after an educational campaign [18]. Another study of US fertility patients in 2008–2009 similarly found increased knowledge about the risks of multiples to be associated with increased desire for singleton pregnancy with 20.4% of patients initially desiring a twin gestation and 12% preferring a twin gestation after receiving an educational handout [19]. International studies of infertility patients report similar trends in the desire for multiples and also support the relationship between increased knowledge and decreased desire for multiples [20–22]. Multiple patient-level variables have also been associated with desire for twins including desire to complete family building quickly, lower household income, younger age, nulliparity, duration of infertility, and previous fertility evaluation [19–23]. There have been inconsistent findings related to insurance coverage for IVF and desire for multiple pregnancy [19, 23]. Additionally, there appears to be no standard way in which knowledge of multifetal risk has been assessed. Some studies have focused on specific complications such

as preeclampsia, low birth weight, and postpartum depression when assessing infertility patient knowledge of risk of multiples [22]. Other studies have asked a single knowledge question (i.e., “Do you consider that babies of a multiple pregnancy are at increased risk compared with singletons?”) [24]. The lack of standardization of questions related to knowledge of multifetal risk makes it difficult to assess change in patient desires over time.

Since the most recent study of multifetal desire in US fertility patients in 2009, there have been advancements in techniques and technology that have improved implantation and live birth rates in patients undergoing ART. These improvements in success rates as well as IVF treatment in a fertility mandated context may result in altered desires for multifetal pregnancy. In this study, we examine factors contributing to the desire of infertile patients for multifetal pregnancy in an urban setting with mandated insurance coverage for infertility. We hypothesize that even though ART technology has improved, SET is encouraged, and insurance coverage for treatment is mandated, many infertile patients will still desire and prefer a multifetal pregnancy. Further, given that previous research has shown that knowledge of maternal and neonatal complications associated with twin pregnancies decreases but does not eliminate desire for twins, we hypothesize that not only lack of knowledge but also individual level factors related to concerns over incomplete family building will be associated with multifetal desire.

Materials and methods

Survey instrument

The 40-item digital survey was used with permission and minimally modified from a published survey developed at University of Iowa [23]. Utilizing this survey allows for the comparison of change in patient desire and related multifetal risk knowledge over time. The four knowledge questions utilized in the current study as well as in Ryan et al. were separately asked for twin or triplet knowledge and include knowledge related to the “greater chance of delivery before the due date,” “more risks to the mother’s health during pregnancy,” “greater chance of cerebral palsy and other long-term health problems,” and the greater probability that the babies “will die in the first year of life.”

Treatment outcomes were ranked in order of preference, specifically “no child,” “singleton pregnancy,” “twin pregnancy,” and “triplet pregnancy.” We ascertained baseline characteristics including age, gender, income, levels of previous education, previous children and obstetrical history, duration of infertility, previous assisted reproductive treatment, and insurance coverage for infertility. Using a series of true/false questions, we also assessed knowledge of the

complications of multiple births with questions regarding risks to the mother's health during pregnancy and delivery, risks of cerebral palsy and long-term health problems in the infant, and risk of death to the infant. Lastly, we inquired about openness to multifetal reduction.

Participants

This study was deemed exempt by the Institutional Review Board at Northwestern University. Between the months of February 2019 and November 2020, female patients with self-described infertility or a diagnosis of infertility and who presented to XXXX were asked to complete the questionnaire while awaiting their initial consultation with a physician or nurse practitioner, before any clinical counseling had occurred, or any educational materials related to multifetal pregnancy were provided. Due to the coronavirus disease 2019 (COVID-19) pandemic, we converted in person recruitment to an invitation electronic medical record messaging (MyChart). All patients received treatment in a location with state mandated infertility insurance coverage. The survey was administered via SurveyMonkey® (www.surveymonkey.com, Palo Alto, CA) and respondents' identities could not be discerned. No incentives were provided to the study participants. Patients could complete the survey with their partners. Patients seeking care for oncofertility and/or elective oocyte cryopreservation or who had already met with a fertility provider at our center were excluded. All survey results were pooled to minimize the likelihood of identifying individual participants by their demographics.

Statistics

SPSS 23.0 was used for all analyses. Data were analyzed using 2-sided or Fisher's exact test and chi-square for categorical variables. Multivariable logistic regression analysis was used to assess independent demographic factors associated with the desire for multiple births. We considered $p < 0.05$ statistically significant.

Results

A total of 539 patients fully or partially completed the survey; sixteen participants failed to include their preference for ideal pregnancy outcome (singleton vs multiple pregnancy) and thus were excluded from group comparison analyses. The mean age of respondents was 35 years ($SD = 4.2$), and the mean age of partners was 36 years ($SD = 5.5$), a distribution that approximates the national averages for infertility patients [25]. Most women (90.5%, 488/539) were married, identified as Caucasian (30.4%, 164/539), and defined Christianity as their religious affiliation (54.5%, 294/539).

Fifty-nine percent chose not to respond to which ethnicity they most identified with, 4.3% identified as Asia, 2.8% identified as Black/African, 3.3% identified as Hispanic/Latino, and 0.2% identified as Native American. In addition, most completed a bachelor's degree or higher education (90.7%, 489/539) and had an annual family income of at least \$100,000 (78.9%, 425/539). More than half of respondents reported a close friend or relative with twins (60.5%, 326/539). Just over half of respondents (52.9%, 285/539) had full insurance coverage for an infertility evaluation while 39% (210/539) had known full insurance coverage for infertility treatment. A total of 61.4% (331/539) of patients reported a duration of infertility between 1 and 2 years and most patients (46.2%, 249/539) had not undergone any fertility treatments. A significant proportion of the respondents were nulliparous (49.2%, 265/539); 19.5% (105/539) had conceived children via fertility treatments, and 74% (399/539) had a history of abortion or miscarriage. Only a third of participants (33.8%, 182/539) would consider multifetal reduction (Table 1). When asked to rank preferred treatment outcomes, 29.7% (160/539) of patients listed twin, triplet, or quadruplet pregnancies as preferable to a singleton pregnancy while 67.3% (363/539) of patients listed singleton. Sixteen respondents omitted preference for singleton or multiple gestation and were omitted from group analyses.

Demographic variables (i.e., age, income, marital status, education, religious affiliation, and parity) and other fertility/reproductive-related variables (i.e., length of infertility, ideal family size, history of pregnancy loss, history of early labor, insurance coverage for fertility treatment or evaluation, prior infertility treatment, openness to multifetal reduction, knowing someone with twins, and knowledge about the risks of multifetal pregnancies) were included in chi-square analysis with desire for multifetal pregnancy. Examination of pairwise Bonferroni adjusted Z-test and Fisher's exact test results showed that among the demographic variables, older age, marital status, lower household income, and parity were associated with desire for multifetal pregnancy. Age was divided to 3 groups (i.e., women under 35, women 36–40, and women 41+); women who were 41 years or older 47.2% (25/53) were more likely to desire multifetal gestation versus women under 35 (28.6%, 76/266) or 36–40 years old (28.9%, 59/204) ($\chi^2 [n = 523] = 7.64$; $df = 2$, $p < 0.05$). Respondents who were unmarried (45.2%, 19/42) were more likely than married respondents (29.3%, 141/481) to desire multifetal gestation (Fisher's exact test, $p < 0.05$). Those with a household income of less than \$50,000 annually (69.6%, 16/23) were more likely to desire multifetal gestation than those with a household income of 50 k–100 k (32.1%, 26/81), 100 k–200 k (31.6%, 58/187), or > 200 k (25.4%, 59/232) ($\chi^2 [n = 523] = 19.53$; $df = 3$, $p < 0.001$). Finally, nulliparity was associated with greater desire for multiples (34.6%, 134/387) than those with parity ≥ 1 (19.1%, 26/136) (χ^2

Table 1 Demographic characteristics of our population and the desire for multifetal gestation

	Total (<i>n</i> = 539)	Desires multifetal gestation (<i>n</i> = 160)	Desires singleton gestation (<i>n</i> = 363)	<i>p</i> value
Patient characteristics				
Maternal age (%)				0.02
< 35 years	51.9	47.5	52.3	
36–40 years	39	36.9	39.9	
41 + years	10.1	15.6	7.7	
Mean partner age (years)	36.4 ± 5.5	36.44 ± 5.8	36.39 ± 5.3	NS
Married	90.5	88.1	93.7	0.04
Religious (%)				NS
Christian	54.5	61.3	52.6	
Muslim	2.4	2.5	2.5	
Jewish	5.6	3.8	6.6	
None	26	23.8	27.8	
Other	9.8	8.8	10.5	
Annual family income (%)				< 0.001
< \$50,000	4.3	10	1.9	
\$50,000–100,000	15.2	16.3	15.2	
\$100,000–200,000	35.1	36.9	35.3	
> \$200,000	43.8	36.9	47.7	
Reported close friend/relative with twins (%)				NS
Yes	60.5	65.0	60.9	
No	37.5	35.0	39.1	
Level of education (%)				NS
High school	3.9	0.6	0.3	
Associate degree	3.3	5.6	3.3	
Bachelor's degree	36.5	2.8	5.0	
Master's degree	36.0	36.3	37.2	
Advanced degree (PhD, MD, JD)	18.2	40.0	43.0	
Parity (%)				< 0.001
Nulliparous	72.4	83.8	69.7	
Parity ≥ 1	25.6	16.3	30.3	
If parous, mean no. of children	1.7 ± 0.72	1.48 ± 0.78	1.71 ± 0.69	0.013
History of children conceived via fertility treatments				0.05
Yes	19.5	30.7	44.8	
No	80.5	69.3	55.2	
History of abortion or miscarriage or stillbirth				NS
Yes	74	80	71.9	
No	26	20	28.1	
History of preterm labor				NS
Yes	5.2	5.3	12.5	
No	94.8	94.7	87.5	
Mean ideal family size	2.5 ± 0.8			< 0.001
1	5.2	0.6	7.4	
2	52.7	48.8	56.2	
3	28.9	31.3	28.7	
≥ 4	11.1	19.4	7.7	
Insurance status (%)	97.6	99.4	99.7	NS
Insurance coverage for evaluation (%)				NS
Full coverage	52.9	51.6	55.2	
Partial coverage	18.2	17.6	19.1	

Table 1 (continued)

	Total (n = 539)	Desires multifetal gestation (n = 160)	Desires singleton gestation (n = 363)	p value
No coverage	4.1	6.3	3.3	
Unsure	22.3	24.5	22.4	
Insurance coverage for treatment (%)				NS
Full coverage	39.0	35.2	42.0	
Partial coverage	33.4	33.3	34.8	
No coverage	11.7	15.1	10.5	
Unsure	13.4	16.4	12.7	
Duration of infertility (yrs)				NS
< 1 year	18.9	20.6	18.2	
1–2 years	61.4	54.4	64.5	
2 years	19.7	25.0	17.4	
History of fertility treatments (%)				NS
None	46.2	55.0	48.4	
Clomid/letrozole	9.8	11.2	10.3	
IUI	2.6	2.6	2.9	
Gonadotropins	0.4	0.7	0.3	
IVF	7.4	7.3	8.5	
Clomid + IUI	10.8	11.2	12.0	
IUI + IVF	14.7	12.0	17.6	
Multifetal reduction (MR) (%)				<0.001
Open to MR	66.2	55.0	71.1	
Would not consider MR	33.8	45.0	28.9	

NS not significant

Table includes chi-square analysis only (without Fisher's exact test). Numbers may not total to 100% due to rounding and/or missing responses
Sixteen respondents omitted preference for singleton or multiple gestation

[$n = 259$] = 12.32; $df = 1$, $p < 0.001$). Desire for multiple pregnancy was not associated with level of education or religious affiliation.

Among fertility/reproductive-related variables, ideal family size and openness to multifetal reduction were associated with desire for multiples with those wanting ≥ 4 children (52.5%, 31/59) having a greater desire for multiples than those wanting 3 children (32.5%, 50/154), 2 children (27.7%, 78/282), or 1 child (3.6%, 1/28) ($\chi^2 [n = 523] = 24.41$; $df = 3$, $p < 0.001$). Those who were open to multifetal reduction were less likely to desire a multifetal pregnancy as the optimal outcome of ART (25.6%, 88/344) than those who would never consider multifetal reduction (40.9%, 72/176) (Fisher's exact test, $p < 0.001$). Finally, although not statistically significant, there was a trend that those with a history of children conceived via fertility treatments being less likely to prefer a multifetal gestation (22.1%, 23/104) as compared to respondents with no children from fertility treatment (34.2%, 52/152) (Fisher's exact test, $p = 0.05$); there was also a trend for greater duration of infertility to be associated with increased desire for twins among women with infertility duration of ≥ 2 years (38.8%, 40/103) compared

to those trying for 1–2 years (27.1%, 87/321) or less than a year (33.3%, 33/99) ($\chi^2 [n = 523] = 5.49$; $df = 2$, $p = 0.06$). History of pregnancy loss, early labor, and knowing someone with twins were not associated with desire for multifetal pregnancy.

Knowledge of maternal and perinatal/neonatal risks for twin and triplet pregnancies in comparison with singleton pregnancies was also queried. The vast majority of respondents were knowledgeable of preterm labor (twin 95.2%, triplet 96.1%) and maternal morbidity (twin 82.3%, triplet 92.3%) as an adverse outcome risk of twin and triplet pregnancies. Participants were less knowledgeable of the risks of cerebral palsy (twin 46.7%, triplet 65.5%) and of the increased infant mortality (twin 28.7%, triplet 48%) associated with multifetal gestation for both twin and triplet pregnancies (see Table 2). There were significant group differences with respect to the desire of singleton or multifetal gestation and knowledge of risks associated with such pregnancies. Respondents that desired multifetal gestation as their ideal pregnancy outcome were less knowledgeable than their counterparts who desired singleton pregnancy for all four risks, preterm labor, maternal morbidity, cerebral palsy,

Table 2 Patient knowledge of maternal and neonatal risks of multifetal gestation

	Desires multifetal gestation (<i>n</i> = 160) (%)	Desires singleton gestation (<i>n</i> = 363) (%)	<i>p</i> value
Correct knowledge of twin birth outcomes			
Increased risk of preterm delivery	91.1	97.0	0.004
Increased maternal risk	72.6	86.5	<0.001
Increased risk of cerebral palsy	35.7	51.4	0.001
Increased risk of infant mortality	21.7	31.8	0.02
Correct knowledge of triplet birth outcomes			
Increased risk of preterm delivery	92.4	97.8	0.003
Increased maternal risk	87.3	94.5	0.005
Increased risk of cerebral palsy	56.7	69.3	0.006
Increased risk of infant mortality	40.1	51.5	0.02

and infant mortality, when asked about twin birth outcomes and when asked about triplet birth outcomes (Table 2). Respondents who got all 4 questions correct about twin risks (17.9%, 21/117) were less likely to desire multiples than those who got none (61.5%, 8/13), one (28/68, 41.2%), or two (34.8%, 65/187) answers correct ($\chi^2 [n = 519] = 21.16$; $df = 4$, $p < 0.001$). Respondents who got no questions correct for triplet risk had a greater desire for multiples (71.4%, 5/7) than those who got one (46.7%, 14/20), two (36.4%, 48/132), three (28.6%, 36/126), or four (24.2%, 54/223) questions correct ($\chi^2 [n = 518] = 15.80$; $df = 4$, $p < 0.01$).

Finally, binomial logistic regression was conducted to examine the ability of variables significantly associated with desire for multiples in chi-square analysis to predict desire for multifetal gestation. Due to limited variability in knowledge related to the maternal and fetal risks of triplets and expected multicollinearity between knowledge of risks of twins and triplets, only knowledge of risks related to twin pregnancies was included in the model. Evaluation of the overall model for desire for multifetal pregnancy which included age, income, marital status, parity, ideal family size, openness to multifetal reduction, and twin knowledge was significant ($\chi^2 [n = 539] = 80.59$; $df = 7$, $p < 0.001$). The goodness-of-fit statistic was not significant ($p = 0.676$), suggesting a good model fit. The odds of desiring multiples was related to older age [odds ratio [OR] 1.66, 95% confidence interval [CI] 1.20–2.29, Wald $\chi^2 (1) = 9.497$, $p < 0.01$], nulliparity [odds ratio [OR] 0.34, 95% confidence interval [CI] 0.20–0.58, Wald $\chi^2 (1) = 15.77$, $p < 0.001$], larger ideal family size [odds ratio [OR] 2.34, 95% confidence interval [CI] 1.73–3.14, Wald $\chi^2 (1) = 31.17$, $p < 0.001$], and lesser knowledge of the maternal/fetal risks of twin pregnancies [odds ratio [OR] 0.67, 95% confidence interval [CI] 0.55–0.83, Wald $\chi^2 (1) = 14.47$, $p < 0.001$] (see Table 3). Nagelkerke R^2 , a measure of strength of association between the predictors and the dependent variable, was 0.20 for the entire model.

Table 3 Desire for multiple births, in multivariate logistic regression analysis

Patient factor	Odds ratio (95% CI) ^a	<i>p</i> value
Older age	1.66 (1.20–2.29)	<0.01
Nulliparity	0.34 (0.20–0.58)	<0.001
Larger ideal family size	2.34 (1.73–3.14)	<0.001
Lesser twin knowledge	0.67 (0.55–0.83)	<0.001

^aOdds ratios were adjusted with the following variables in the model: age by 3 groups (<35, 36–40, 41+ years old), annual household income (<50 k, 50–100 k, 100–200 k, >200 k \$), marital status, parity, ideal family size, openness to multifetal reduction, time attempting conceptions, and knowledge of the maternal/fetal risks of twin pregnancies. Annual income, marital status, openness to multifetal reduction, and time attempting conceptions were not independent risk factors for the desire for multifetal pregnancy

Discussion

The goal of assisted reproductive treatment is the birth of a healthy child which is best achieved by a singleton pregnancy. Historically however, a substantial number of patients seeking care for infertility in the USA and internationally have reported multiple gestation as their ideal treatment outcome [20–26]. Despite increasing rates of live birth from ART, state-mandated infertility insurance coverage for the majority of our study population, and reformed national guidelines on embryo transfer, results of the current study show higher rates of desire for multiples (29.7%) than those seen in studies published over a decade ago (20.4–29.0%) [18, 19, 23]. Though much has changed in the field of reproductive medicine, the desire for multiples has not.

Although a lack of understanding of the risks associated with twin pregnancies continues to contribute to desire for multiples, it appears that additional individual specific variables also contribute to this trend. It is well

known that women who desire parenthood but who fear being unable to complete their family building dream are at risk for depression and anxiety [27, 28]. Factors that women may perceive as barriers to reaching their ideal family size (such as advancing age, nulliparity, larger ideal family size) may reinforce their desire for multiples as a way to achieve their family building goals efficiently. Further, medical counseling regarding the risks associated with multifetal pregnancy, comparability of live birth rates from SET vs DET, and the ability to perform sequential embryo transfer may be ineffective in changing desire for multifetal gestation for women who worry that they may be unable to return for sequential SET after the birth of a child due to concerns related to an uncertain future (e.g., insurance, job, finances, partner, or health changes) or who otherwise desire to quickly finish family building. For some women, it may be a fear of having no children and not the desire for multiples which drives the desire for DET as these women believe they could cope better with two babies versus no baby [29]. Further, given that 36% of women in our study who reported a desire for multiples answered ≥ 3 of 4 questions about medical risks in twin pregnancies correctly, a two-pronged patient approach which addresses (1) educational efforts to reduce desire for twins and (2) acceptance of SET in the context of unchanged desire for twins is needed to reduce rates of twin pregnancies from IVF.

Previous research finds that patients with greater knowledge of the general medical risks of multifetal pregnancies [18, 19, 30], who are knowledgeable about the comparable live birth rates between SET and DET [20], who have realistic expectations about the specific odds of medical and psychological risks associated with multifetal pregnancy [22, 31], and who are aware that the financial costs of multiples are greater are less likely to desire multifetal pregnancies. Still, even after education, 25% of subjects reported that they would continue to choose DET over SET if the pregnancy rates were equivalent, despite the tenfold higher twin rate [18]. Risk education counseling presented to patients should therefore include medical and psychological risks (e.g., postpartum depression, divorce) [32, 33], be specific about the odds of experiencing these negative outcomes, and assess patients' realistic expectations related to experiencing risky outcomes and understanding of comparable SET and DET success rates.

Previous research with infertility patients in the USA shows that increased education about treatment recommendations which are inconsistent with patients' desires (e.g., delayed care during the COVID pandemic) increases acceptance of treatment recommendations (i.e., to delay care) for many but not all patients; it does not change patients' treatment desires (e.g., to continue treatment despite the pandemic) nor overall level of distress associated with treatment

recommendations [34]. Thus, acceptance of SET for risk knowledgeable patients who continue to desire multiples should include exploration of individual factors related to continued multifetal desire as well as the provision of emotional support for those distressed by SET clinic policy mandates.

From a societal level, efforts to reduce twin pregnancies should also be directed towards nationally mandated fertility treatment coverage to aid in the reduction of at least some of the financial stress which could be driving desire for twins and lack of acceptance of SET. Although neither income nor insurance coverage for fertility care was independently predictive of desire for multiples in the present study, this may be due to the overrepresentation of higher income families with insurance coverage in our sample population; lowest income level in our study was however related to multifetal desire in chi-square analysis. Multiple studies in other settings have identified income and/or insurance coverage for fertility treatment as predictors of desire for multifetal pregnancy and/or multiple embryo transfer [35–37], though inconsistent findings between mandates and rates of multifetal pregnancies are also reported [38, 39]. It should be noted that state mandates for fertility treatment do not mean that treatment is free, that a patient has unlimited access to covered IVF, or that everyone living in the state will have mandated coverage (e.g., if their employer provides out of state insurance). Patients without insurance coverage for fertility treatment or who can only afford out of pocket costs for one (covered or uncovered) cycle of IVF may desire and have higher multiple embryo transfer rates as they may perceive multifetal pregnancy as a cost-effective way to maximize their per-cycle success rates and/or to achieve their ideal family size. The relationship between lower income and desire for twins in chi-square analysis in the present study may also help to explain the greater desire for multifetal pregnancy in unmarried women in our study as unmarried women were overrepresented in lower income brackets (e.g., income < 50 k / < 100 k: unmarried women = 16.7%/52.3% versus married women = 3.3%/17.0%) ($p < 0.001$); unmarried women were also significantly older than married women ($p < 0.001$) and thus may be motivated for twins due to fear of advancing age and change of sequential reproduction as well as the ability to pay for treatment.

Efforts to reduce multifetal pregnancies from IVF should also focus on encouragement of physicians to adhere to medical society and ethical guidelines regarding embryo transfer. Studies show that reproductive endocrinologists may fail to follow SET recommendations because of patient requests or desire for higher and more competitive pregnancy rates [40, 41]. It is unclear if physician acquiescence to patient requests is driven by focus on reproductive autonomy, concern related to negative patient feedback, belief that patients will be open to multifetal reduction, lower clinic pregnancy

success rates with SET vs DET, and/or some other factors. However, reproductive autonomy needs to be balanced against maternal and fetal risks and fear of negative patient feedback, though understandable, should never outweigh ethical standards.

There are several limitations to this study. A main limitation is that it was conducted in a single fertility center. Our cohort was a demographically homogenous sample which also made assessment of group differences by racial/ethnic groups and other demographic characteristics challenging. However, this study adds to the literature by directly examining infertility patient desires for multiples among a large cohort of current infertility patients seeking care in a state with mandated insurance coverage. Another limitation is the possible introduction of selection bias as women completing the survey were explained the general purpose of the study and then chose to respond to this questionnaire. Despite the risk of selection bias, results of this study are consistent with historical studies of desire for multifetal pregnancy and show that despite knowledge of risks many IVF patients continue to desire a twin or higher order pregnancies. It was also difficult to calculate an exact response rate for this study due to the COVID-19 pandemic as recruitment for the survey initially was performed in-person before initial consultation with a physician and then was subsequently converted to an electronic medical record messaging (MyChart). Despite this, the large sample size for the study provides a diverse understanding of patient desires for multiples. Similarly, due to the large sample size in the present study, we were able to conduct regression analysis which provides insight into which unique patient variables could be utilized to identify patients at greater risk of desire for twins. Lastly, another strength of this study was the use of previously published survey [23] which allowed for comparison of desire for twins over time.

Over 10 years have passed since the last published study on desire for twins in infertility patients in the USA. It is clear that many patients continue to desire for multiples despite continued expansion of insurance mandates, advances in the efficacy of ART, and knowledge about the risks of multifetal pregnancies. It is also clear that efforts solely focused on reducing desire for twins are an inefficient strategy to effectively reduce twin pregnancies that are motivated by patient anxiety related to real or theoretical barriers to growing their families. Many patients' convictions towards multiples are deep and unaffected by communication of medical risks. The results of this study emphasize the need for restructuring clinical counseling from a generalized informational campaign that focuses on comparative risks of multiples vs singleton pregnancies to include a more patient-centered approach that accounts for individual specific reservations and promotes patient acceptance of SET, even for those who may still desire multiples.

Funding This work was supported by grants from XXXX and XXXX.

Declarations

Conflict of interest The authors declare no competing interests.

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