Chances of Pregnancy After Dropping Out From Infertility Treatments: Evidence From A Social Survey in Japan

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Abstract

Background: Previous studies have examined the factors that predict whether a patient will discontinue infertility treatments. However, little is known about a patient's chances of pregnancy after dropping out.

Method: Drawing from a nationwide Internet survey in Japan with 1,930 respondents, we used data from 199 individuals (109 women and 90 men) who had undergone an infertility treatment. Besides conducting a descriptive analysis to examine the probability of pregnancy after the treatment, we estimated linear probability models to investigate the extent to which the probability of pregnancy was affected by dropping out after controlling for a couple's attributes.

Results: Among the 199 respondents who had experienced an infertility treatment, 91 (45.7% of the entire sample) became pregnant during the treatment, and 108 (54.3%) dropped out. Among these 108 dropouts, 66 (33.2%) eventually became pregnant. After controlling for a couple's attributes, we found that treatment discontinuation reduced the probability of pregnancy by 35.4% (standard error: 5.0%). A relatively limited reduction in the chances of pregnancy was also observed after a patient dropped out of any of the three treatment stages (timed intercourse, artificial insemination with the husband's semen, and *in vitro* fertilization).

Conclusions: The results suggest that dropping out from infertility treatments does not preclude any chance of a future pregnancy; in fact, the chances remain relatively high. Further analysis of a patient's chances of pregnancy after dropping out is required to evaluate the effectiveness of infertility treatments appropriately. Additionally, more follow-up attention should be provided to dropout patients.

Background

An increasing number of couples have been undergoing infertility treatments in recent years. In 2012, 0.9 million children were estimated to have been born using assisted reproductive technology (ART) [1], and the proportion of births through ART now exceeds 3% of all births in many industrialized countries [2]. Infertility treatment also influences a couple's lifestyle and well-being by affecting the timing of childbirth and the balance between childbearing and labor force participation [3, 4].

However, a substantial proportion of couples choose to discontinue treatment before childbirth [5–8]. Dropping out, which can occur at any treatment stage, inevitably affects treatment success rates, an essential factor that is considered when evaluating the treatment efficacy [6]. Correspondingly, many previous studies have examined and identified several factors that lead people to discontinue infertility treatment. Several identified predictors of discontinuation are related to patients, clinics, and their relationships, including the patients' physical and psychological burdens, their limited financial resources, inadequate organization of care, poor communication skills of staff, and negative interactions between the patients and staff [9–14]. Additionally, other studies have found that female age, duration of subfertility, other maternal conditions, and stressful life events were key factors in determining the success of the infertility treatment [15–18].

However, in comparison to these determinants of treatment failure and success, less is known about the chances of pregnancy after treatment discontinuation. This is, presumably, because clinics have limited information about patients who have dropped out of the treatment. Nevertheless, the possibility of pregnancy after treatment discontinuation cannot be excluded in advance and must be explicitly assessed for a more accurate evaluation of infertility treatments.

If the chances of pregnancy after treatment discontinuation are significant, it would imply that more attention should be given to patients who discontinue treatment. Indeed, a previous study that examined the long-term parenthood outcome after discontinuation of unsuccessful *in vitro* fertilization (IVF) treatment argued that “unsuccessful patients should not lose hope, because nearly half may subsequently succeed in having a child” [19]. It should be noted, however, that about half of the couples who achieved parenthood in this study did so through adoption. Moreover, the study did not examine the outcome of discontinuation at earlier treatment stages, that is, timed intercourse (TI) or artificial insemination with the husband’s semen (AIH).

The present study examined the largely understudied issue of the association between future pregnancy chances and dropping out of infertility treatments. Unlike most preceding studies, the data we collected for individuals who had experienced infertility treatment were obtained from a nationwide Internet survey. Using these data, we examined the probability of pregnancy after dropping out of infertility treatment, which were then divided into three stages: timed intercourse (TI), artificial insemination with the husband’s semen (AIH), and *in vitro* fertilization (IVF). We further investigated the factors that affected the patient’s decision to discontinue treatment and how the probability of pregnancy was associated with (i) a couple’s discontinuation experiences and (ii) a couple’s attributes.

Although the study findings are not free from limitations due to the use of self-reported experiences in infertility treatment, we expect our findings to have important implications for healthcare policy in advanced countries. This is especially the case in Japan, where 1 in 16.7 babies was born through ART in 2017 [20], still fewer than other advanced countries, and the total fertility rate dropped to 1.36 in 2019 after hovering slightly above 2.0 over the preceding seven years [21]. Additionally, the policy debate on public health insurance coverage for infertility treatment requires more information about the efficacy of the infertility treatment to evaluate whether financial support is necessary for subfertile couples.

Methods

Study sample

We collected data from 199 individuals who had experienced infertility treatment. To obtain their data, we randomly selected 2,135 individuals (both female and male) who were living with their spouses and had three or fewer children from the 4,527 respondents of the fourth wave of “the Japanese Longitudinal Survey on Employment and Fertility” (LOSEF) conducted in 2019. The LOSEF was a population-based, nationwide longitudinal survey targeting men and women aged between 20 and 59 years living in Japan in 2012. The survey has been conducted every two years since 2012. The survey respondents, chosen in 2012 from among the individuals publicly recruited by Intage, Inc., an Internet research company, were randomly stratified based on (1) age, gender, and regional information from the 2010 Census and (2) the employment-to-unemployment ratio from the Employment Status Survey 2007. We sent the questionnaire via the Internet to the abovementioned 2,135 individuals and received 1,930 responses in January and February, 2020. Thereafter, we used the data of 199 individuals (109 women and 90 men), 10.3% of the respondents, who reported that they had experienced infertility treatment. This survey protocol was approved by the Ethics Committee of Hitotsubashi University (reference number: 2019C008). All methods were performed in accordance with the guidelines and regulations presented by this committee and the Declaration of Helsinki. An English version of the questionnaire is provided as a supplementary file.

Measures

We considered whether a respondent (or his wife, if a respondent was male) became pregnant or had childbirth during each stage of the infertility treatment (TI, AIH, and IVF) or dropped out of it before becoming pregnant. We further considered, for each stage, whether a respondent who dropped out at the stage had become pregnant by 2020. For regression analyses, we additionally considered the wife's age at the first fertility clinic visit, the couple's educational attainment (college graduation or higher), whether they had had childbirth before the first fertility clinic visit, and the household expenditure as a proxy for household income. We also considered whether the couple was eligible for public financial support for infertility treatment, which required (i) the wife's age to be 42 years or below as of 2018, (ii) the couple's total annual income to be 7.3 million JPY or below, and (iii) their first fertility clinic visit to be in April 2004 or later. We further controlled for the respondents' gender.

Statistical analysis

For descriptive analysis, we examined the extent to which dropping out of infertility treatment reduced the chances of pregnancy. At each treatment stage, we divided the respondents into three groups: (1) those who became pregnant during the treatment, (2) those who dropped out of it and became pregnant or had childbirth after it, and (3) those who dropped out of it and did not become pregnant. We then compared the proportions of (2) to that of (1) to evaluate whether the pregnancy chances had declined after dropping out.

Following this descriptive analysis, we conducted two regression analyses. First, we estimated the linear probability model (LPM) [22, 23] to predict how a couple's attributes affected the probability of treatment discontinuation. Second, we estimated the LPM model to predict the probability of becoming pregnant by a binary variable of dropping out along with a couple's attributes. In both regression analyses, we estimated two types of regression models: first, we focused on infertility treatment as a whole and considered dropping out at any treatment stage; second, we considered dropping out at each treatment stage separately. Since the dependent variables were binary, an alternative approach would be to estimate probit models and calculate the effects of independent variables based on the regression analyses. We confirmed that this alternative approach produced similar results, which are available upon request.

Results

Descriptive analysis

Of the 1,930 survey respondents, 199 individuals answered that they had experienced an infertility treatment. Table 1 summarizes the key features of the study sample, which included 109 women and 90 men. Among them, 157 (78.9%) had at least one child or were currently pregnant (here and in the pages that follow, we use the terms *pregnant* and *pregnancy* for male respondents if their wives were pregnant) at the time of the survey. The wives' average current age was 42.2 years, while the husbands' average age was 44.1 years.

Table 2 summarizes the combination of infertility treatment and pregnancy in 199 individuals. Among 199 individuals who had an experience of infertility treatment, 91 (45.7%) became pregnant during the treatment, 108 (54.3%) dropped out, and 66 (33.2%) became pregnant after dropping out. We also found that 91, 55, and 53 individuals underwent TI, AIH, and IVF, respectively. Among the 91 individuals whose final treatment was TI, 39 (42.9%) became pregnant during the treatment, whereas 52 individuals (57.1%) dropped out of the treatment. Among these 52 dropouts, 38 individuals (41.8% of 91 individuals) became pregnant, almost the same number as those who became pregnant during the TI stage. We observed similar results for AIH; among 55 individuals whose final treatment was AIH, 22 (40.0%) became pregnant during the treatment, whereas 21 individuals (38.2% of the 55

individuals) became pregnant after dropping out of the treatment. Concerning IVF, the success rate was somewhat higher than that of TI and AIH; out of 53 individuals who underwent IVF, 30 (56.6%) became pregnant during the treatment and 23 (43.4%) dropped out. Unlike dropping out of TI and AIH, dropping out of IVF substantially reduced the pregnancy chances; only seven individuals (13.2% of 53 individuals) became pregnant among the 23 dropouts.

Regression analysis

Table 3 presents the estimation results of the LPM that explain the association between treatment discontinuation and a couple's attributes. We observed three key predictors after considering all the cases of treatment discontinuation. Specifically, we found that the probability of treatment discontinuation increased when a wife's age was higher at the first fertility-clinic visit. In contrast, it reduced when a wife's educational attainment was higher, and when a couple was eligible for financial support for infertility treatment. We obtained similar results, albeit not consistently significant, from the regression models that focused on dropouts from each of the treatment stages, as seen in the second to fourth columns.

Table 4 shows the estimation results of the LPM to predict the extent to which the probability of pregnancy was affected by treatment discontinuation after controlling for a couple's attributes. We observed that the probability of becoming pregnant was reduced by 35.4% (standard error [SE]: 5.0%) if the patient dropped out from any of the infertility treatments. This rate of reduction was somewhat higher, but not significantly, from what was implied by the ratio of the number of individuals who became pregnant after dropping out from any treatment stage (66) to the number of those who succeeded in pregnancy during the treatment (91), i.e., 27.5% (= 1−66/91), as seen in Table 3. When we examined dropouts from TI, AIH, and IVF separately, we found that dropping out reduced the probability of pregnancy by 25.8% (SE: 7.6%), 31.5% (SE: 9.1%), and 65.5% (SE: 11.6%), respectively. Since these magnitudes of reduction were well below 100%, this indicates that the probability of becoming pregnant remained relatively high even after treatment discontinuation, although the chances were reduced as the treatment proceeded from TI and AIH, on the one hand, to IVF on the other.

Discussion

We examined the association between an individual's chances of pregnancy and dropping out of infertility treatment. The novelty of this study is that it utilized information about pregnancy outcomes after treatment discontinuation as well as during the treatment.

The most notable finding in this study is that dropping out of infertility treatment did not preclude any chance of a future pregnancy. Our descriptive analysis showed that approximately one-third of the individuals who experienced an infertility treatment became pregnant after treatment discontinuation. It is reasonable that this rate was lower than the rate of becoming pregnant for those who continued the treatment (45.7%); however, it was not much lower than that. We also found that post-discontinuation pregnancy chances declined more for patients who had proceeded toward IVF, probably because such patients required assisted reproductive techniques more than others to become pregnant.

Our regression analyses, which controlled for a couple's attributes, confirmed that treatment discontinuation reduced the probability of becoming pregnant. A more important finding is that the reduction in the probability was relatively limited, even though the probability reduction rate increased as the recipients went through IVF, an observation consistent with the results of the descriptive analysis.

These findings, which suggest that couples do not need to give up on having a child after dropping out of infertility treatment, are consistent with the results of a previous study that focused on the outcomes of unsuccessful IVF [19]. The results were also reasonable given the fact that treatment discontinuation may not be due to a solid evidence of irreversible infertility. This is more likely in earlier treatment stages when the degree of infertility remains highly uncertain. Previous studies have demonstrated that patients may discontinue treatment for many reasons that are not directly related to infertility, including poor communication between the patients and staff as well as a couple's financial constraints [9–14].

The results of this study have two important practical implications. First, the observation that a substantial proportion of patient dropouts eventually had a child suggests the need for more follow-up research to evaluate the infertility treatment's efficacy more precisely. Especially in the case of TI, the treatment may have a favorable impact on the patients' behavior even after its discontinuation, as patients may have learned to have intercourse at the proper time in a woman's cycle.

The second implication, related to the first, is that more follow-up attention should be provided to patients after treatment discontinuation. Dropping out from infertility treatment does not always imply that the couple has given up on conceiving; on the contrary, they often succeed in conceiving without having further medical support from infertility experts. Medical recommendations, professional counseling, and sustained communication with infertility clinics that they left may be helpful for couples who want a child even after dropping out.

Besides these key findings, our regression results confirmed that a wife's lower age at the initial clinic visit tended to encourage the couple to stay in the infertility treatment; this is consistent with the results of previous studies [15–18]. The results showed that a wife's higher educational attainment also reduced the probability of dropping out, an indication of the importance of considering socioeconomic factors as predictors of treatment discontinuation. Additionally, the negative association between dropping out and eligibility for public financial support for infertility treatment underscores the importance of financial resources in influencing the demand for infertility treatment, as suggested by previous studies that discussed the impact of infertility insurance mandates on the demand for infertility treatment in the United States [24–26].

This study has several limitations. First, it depended on information about experiences with the infertility treatment and pregnancy that were self-reported by a relatively small number of respondents. Moreover, these experiences were retrospectively evaluated by the respondents in 2020 (the survey time), a delay that can be assumed to increase measurement errors and estimation biases. Second, we could not obtain information about the duration of each respondent's infertility treatment or their reasons for discontinuing treatment, although both these factors were likely to affect their pregnancy chances after dropout. We also had no information about the psychological impact of treatment failure on the respondents [27], which may affect post-discontinuation outcomes. Third, we should be cautious in generalizing the results obtained from the social survey in Japan to other countries, given the well-established fact that Japanese women tend to start infertility treatment at older ages compared to other advanced countries [1], and the level of fertility knowledge in Japan is the lowest among advanced countries [28].

Conclusions

Despite these limitations, this study underscored the importance of following up on couples who have dropped out of infertility treatment at any stage. Their chances of becoming pregnant after dropping out should be considered when evaluating the effectiveness of infertility treatments. Additionally, they should receive more pregnancy-related attention after treatment discontinuation.

List Of Abbreviations

AIH
artificial insemination with husband's semen; ART:assisted reproductive technology; IVF:*in vitro* fertilization; LPM:linear probability model; SE:standard error; TI:timed intercourse.

Declarations

Ethics approval and consent to participate

This survey protocol was approved by the Ethics Committee of Hitotsubashi University (reference number: 2019C008). All methods were performed in accordance with the guidelines and regulations presented by this committee and the Declaration of Helsinki. Written consent was obtained from all the participants.

Consent for publication

Not applicable.

Availability of data and materials

The datasets used and/or analyzed during the current study are available from the corresponding author upon reasonable request.

Competing interests

The authors declare no competing interests.

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Authors' contributions

MH, EU, and NM organized this research project and conceptualized and designed the study. EU and NM conducted data collection, while EU and MH performed the analysis. TO prepared the initial manuscript, and MH, EU, and NM significantly contributed to revising it. All authors have read and approved the final manuscript.

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Tables

Table 1. Key features of the study sample

	M	(*SD*)
Wife's age at the survey time (years)	42.2	(6.6)
Husband's age at the survey time (years)	44.1	(7.1)
Wife's age at the first fertility clinic visit (years)	32.4	(5.5)
Household expenditure (monthly, thousand JPY)	273.1	(348.6)
	n	**(%)**
Dropout in any fertile treatment stage	108	(54.2)
Became pregnant/had childbirth during or after fertility treatment	157	(78.9)
Wife graduated from college or above	81	(40.7)
Husband graduated from college or above	129	(64.8)
Eligible for public financial support	55	(27.6)
Having had childbirth before first fertility clinic visit	43	(21.6)
Female respondent	109	(54.8)
N	199	

Table 2. Pregnancy chances during infertility treatment and after dropout

Final treatment	**Total**		**Pregnant**		**Dropout**					
			during treatment		**Total**		**Pregnant/childbirth**		**Not pregnant**	
	n	**(%)**	***n***	**(%)**	***n***	**(%)**	***n***	**(%)**	***n***	**(%)**
TI[a]	91	(100)	39	(42.9)	52	(57.1)	38	(41.8)	14	(15.4)
AIH[b]	55	(100)	22	(40.0)	33	(60.0)	21	(38.2)	12	(21.8)
IVF[c]	53	(100)	30	(56.6)	23	(43.4)	7	(13.2)	16	(30.2)
Total	199	(100)	91	(45.7)	108	(54.3)	66	(33.2)	42	(21.1)

[a] Timed intercourse.

[b] Artificial insemination with husband's semen.

[c] *In-vitro* fertilization.

Table 3. The associations with the probability of dropout from infertility treatment: linear probability models

Dependent variable: a binary variable of dropout

Final treatment stage	All			TI[a]			AIH[b]			IVF[c]		
	Coef.		(SE[d])	Coef.		(SE)	Coef.		(SE)	Coef.		(SE)
Wife's age at the first fertility clinic visit (years)	0.022	***	(0.006)	0.032	***	(0.011)	0.031	***	(0.009)	0.022		(0.014)
Wife graduated from college or above	–0.161	**	(0.070)	–0.150		(0.107)	–0.317	**	(0.145)	–0.127		(0.135)
Husband graduated from college or above	–0.054		(0.075)	–0.211		(0.109)	0.111		(0.131)	0.083		(0.177)
Having had childbirth before the initial clinic visit	0.113		(0.081)	0.092		(0.111)	0.092		(0.137)	–0.486	***	(0.144)
Household expenditure (monthly, million JPY)	–0.020		(0.087)	0.070		(0.092)	–0.104		(0.211)	–0.191	*	(0.092)
Eligible for public financial support for infertility treatment	–0.196	**	(0.075)	–0.167		(0.106)	–0.218		(0.153)	–0.297	*	(0.138)
Female respondent	0.039		(0.071)	0.039		(0.108)	0.262		(0.143)	–0.028		(0.148)
R^2	0.136			0.190			0.270			0.237		
N	199			91			55			53		

[a] Timed intercourse.

[b] Artificial insemination with husband's semen.

[c] *In-vitro* fertilization.

[d] Robust standard error.

*** $p < 0.001$, ** $p < 0.01$, * $p < 0.05$.

Table 4. The associations between dropout from infertility treatment and pregnancy chances: linear probability models

Dependent variable: a binary variable of becoming pregnant

Final treatment stage	All			TI[a]			AIH[b]			IVF[c]		
	Coef.		(SE[d])	Coef.		(SE)	Coef.		(SE)	Coef.		(SE)
Dropout	–0.354	***	(0.050)	–0.258	***	(0.076)	–0.315	***	(0.091)	–0.655	***	(0.116)
Wife's age at the first fertility clinic visit (years)	–0.018	***	(0.005)	–0.014		(0.010)	–0.021	**	(0.008)	–0.011		(0.010)
Wife graduated from college or above	–0.069		(0.055)	–0.126		(0.084)	–0.151		(0.119)	0.091		(0.103)
Husband graduated from college or above	–0.058		(0.052)	–0.065		(0.080)	–0.106		(0.095)	0.047		(0.087)
Having had childbirth before the first fertility clinic visit	0.024		(0.067)	0.045		(0.079)	–0.274		(0.144)	0.054		(0.063)
Household expenditure (monthly, million JPY)	0.027		(0.064)	–0.004		(0.096)	–0.029		(0.174)	–0.012		(0.050)
Eligible for public financial support for infertility treatment	0.077		(0.049)	0.087		(0.069)	0.187		(0.110)	–0.088		(0.057)
Female respondent	0.054		(0.051)	0.102		(0.071)	0.038		(0.109)	0.008		(0.101)
R^2	0.311			0.252			0.412			0.613		
N	199			91			55			53		

[a] Timed intercourse.

[b] Artificial insemination with husband's semen.

[c] *In-vitro* fertilization.

[d] Robust standard error.

*** $p < 0.001$, ** $p < 0.01$, * $p < 0.05$.

Supplementary Files

This is a list of supplementary files associated with this preprint. Click to download.

- Questionnaire20210115R3.docx