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Research Article

Do couples who use fertility treatments divorce more? Evidence from the US National Survey of Family Growth

Anna Barbuscia

Maria Sironi

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Do couples who use fertility treatments divorce more? Evidence from the US National Survey of Family Growth

Anna Barbuscia¹

Maria Sironi²

Abstract

BACKGROUND

Undertaking fertility treatment is a stressful process and may lead to couple instability, but high levels of couple satisfaction have usually been observed during or just after treatment. However, the evidence on divorce is scarce.

OBJECTIVES

We investigated the association between the use of a wide range of fertility treatments and marital dissolution in a representative sample of American women in their first marriage.

METHODS

We applied discrete-time event history analysis to data from the US National Survey of Family Growth (NSFG), collected from 2002 through 2013–2015, to compare divorce rates among women who experienced successful treatments or unsuccessful treatments and a natural birth or no birth within the marriage (N = 13,784).

RESULTS

Women who used fertility treatments had a lower risk of divorce up to 20 years after the marriage, compared to the other groups. The probability was especially low when the treatment was successful, but women who did not conceive after the treatment also showed a lower risk of divorce.

CONCLUSION

We found evidence that undertaking fertility treatment is associated with a lower risk of divorce, suggesting that it might strengthen couples' relationships. The sociodemographic characteristics of couples undertaking treatment partly explained the association, but we were not able to control for the quality of the relationship before the treatment, which is likely to play a role.

¹ Universidad del País Vasco (EHU/UPV), Ikerbasque, Institut National d'Etudes Démographiques (INED)
Email: anna.barbuscia@ehu.eus.

² Social Research Institute, University College London (UCL).

CONTRIBUTION

Our study contributes to knowledge about the consequences of fertility treatment by comparing the long-term risk of divorce of women who have experienced successful and unsuccessful treatments, childless women, and those who have had a natural birth. Furthermore, it is the first to examine this in the US context.

1. Introduction

The use of infertility treatments has steadily increased over the last few decades. It is estimated that around 15% of couples in the industrialized world experience infertility problems during their reproductive life, and an increasing proportion of these couples opts to undertake fertility treatment (WHO 2023; Boivin et al. 2007). More than 8 million children have been born worldwide with the aid of medically assisted reproduction since the first baby was conceived in vitro in 1978 (De Geyter et al. 2018; Präg and Mills 2017a). Fertility treatment imposes profound physical, psychological, and social strains on couples (Colpin 2002; Greil 1997; Greil, Slauson-Blevins, and McQuillan 2010; Greil, McQuillan, and Slauson-Blevins 2011; Schmidt et al. 2005), and this has raised concerns that it might negatively affect couple stability. Both the process of the treatment and its unpredictable outcome constitute stress-inducing factors that can cause anxiety and depression (Hammarberg, Astbury and Baker 2001; Verhaak et al. 2005; Tosi and Goisis 2021) and negatively affect the quality of the relationship, thus increasing the probability of couple separation (Cook et al. 1989; Kjaer et al. 2014; Martins et al. 2014). Many couples who have undertaken treatment mention how challenging the process is (Johansson et al. 2009; Kjaer et al. 2014; Sundby et al. 2007; Redshaw, Hockley, and Davidson 2007), in some cases with permanent consequences for individuals' and couples' wellbeing (Greil, McQuillan, and Slauson-Blevins 2011; Verhaak et al. 2007). However, studies have usually found the quality of relationships among couples who have undertaken fertility treatment to be good (Borneskog et al. 2012; Ulrich et al. 2004), both around and just after the treatment. In these studies, many respondents report that going through infertility and the treatment process strengthened their relationship and brought them closer to their partner (Peterson et al. 2011; Schmidt et al. 2005). Most of this evidence relies on self-reported measures of satisfaction with the couple relationship and focuses on the time around the treatment, while evidence about how this is related to the risk of couple dissolution over a longer time-span is scarce. This is crucial, however, as some consequences of the treatment might emerge years after the end of the process. Furthermore, even if infertility strengthens a relationship, couples who do not manage to conceive could be at higher risk of divorce because of the urge to reproduce. Existing

evidence on couple separation, based on Danish register data, does in fact suggest that the effect depends on whether the treatment is successful: couples who experience an unsuccessful treatment are more likely to separate up to 12 years after the end of the treatment than those who experience a successful treatment (Kjaer et al. 2014), but no difference has been found in the overall probability of couples undertaking treatment separating compared to the rest of the population (Martin et al. 2018).

In this study we examine the risk of divorce experienced by American women in their first marriage, comparing those who undertook fertility treatment to those who did not. A number of mechanisms might play a role in these associations. First, in the case of successful treatment, it is crucial to consider the well-established positive association between childbirth and couple stability (Lyngstad and Jalovaara 2010; Morgan and Rindfuss 1985; Waite and Lillard 1991). Second, couples who undertake fertility treatment are likely to represent a selected population characterized by relatively high relationship quality and couple stability when they start the treatment. Furthermore, they are a selected socioeconomic group due to the requirements for access to the treatments and the high financial cost. Important socioeconomic gradients exist in accessing treatment in terms of age, education, income, and employment status, especially in the United States (Adashi and Dean 2016; Barbuscia and Mills 2017; Chambers et al. 2014; Klemetti, Gissler, and Hemminiki 2004), and these characteristics are, in turn, all associated with marital stability (Amato 2010; De Graaf and Kalmijn 2006; Lyngstad and Jalovaara 2010, Jalovaara 2003; Blossfeld et al. 1995).

Studying whether and how the use of fertility treatments is associated with marital (in)stability is important for several reasons. Marital dissolution represents a crucial event for families and children's wellbeing. It is estimated that around 50% of all marriages in the United States end in divorce or separation, which means that many separated partners are exposed to the multidimensional consequences related to health, wellbeing, financial resources, and social networks (Amato 2000). In light of the increasing number of families that are formed with the aid of fertility treatments, it is necessary to improve our understanding of whether and to what extent undertaking a treatment might constitute a risk factor for marital stability.

Using retrospective data from the National Survey of Family Growth (NSFG) and discrete-time event history analysis, we study the association between fertility treatment, childbirth, and marital stability by examining the probability of dissolution of the first marriage of women aged 15–44 up to 20 years after the marriage. We look separately at successful and unsuccessful treatments, and control for demographic and socioeconomic characteristics that might be linked with both the use of fertility treatments and the risk of divorce. Throughout the text, we refer interchangeably to divorce and marital dissolution to indicate the end of first marriages through divorce or the end of cohabitation.

Our study provides an important contribution to the existing literature by taking a long-term perspective on the association between fertility treatment and divorce risk and by comparing couples who do and do not undertake treatment, while considering important individual sociodemographic characteristics. Moreover, this is the first study to look at couples' stability after the use of fertility treatment in the US context. Most of the reviewed studies took place in the Scandinavian context, which is very specific as it is characterized by a wide availability of treatments at relatively low cost, mostly covered by the public health system. Hence, the results might not be generalizable to the US context, where fertility treatments are very expensive and are not (or only partially) financed by public health care systems (Präg and Mills 2017a), which means couples who access them might represent a more selected population.

2. Background

2.1 Fertility treatment and couple stability

The existing evidence on the wellbeing of couples undertaking fertility treatment suggests that the experience of the treatment can be either a challenge to couples' relationships and stability or a source of strength. First, infertility has been linked to high levels of distress, depression and anxiety symptoms, and low self-esteem (Verhaak et al. 2007; Johnson and Fledderjohann 2012; Klemetti et al. 2010; Greil 1997; for a review, see Greil, McQuillan, and Slauson-Blevins 2011), even after several years (Wirtberg et al. 2007). However, these effects have been shown to be significantly reduced when the infertility diagnosis is followed by a live birth (Verhaak et al. 2005; Baldur-Felskov et al. 2013; Tosi and Goisis 2021). Second, the treatment itself is a long, stressful process, which can lead to decreased levels of mental health (Greil, McQuillan, and Slauson-Blevins 2011; Hammarberg, Astbury, and Baker 2001). Interviewed couples refer to past treatments as an extremely challenging experience that affected their emotional wellbeing (Daniluk 2001; Schmidt et al. 2005) and "test people's relationship to the limit" (Redshaw, Hockley, and Davidson 2007). The potential negative effects of infertility and treatments on one or both partners' mental wellbeing might thus affect relationship quality and stability (Greil et al. 1997; Verhaak et al. 2007; Johansson et al. 2009; Kjaer et al. 2014). However, the literature on couples' relationships during and after treatment has provided mixed results. Verhaak and colleagues (2005) find that diagnosed infertility can be linked to lower marital satisfaction; Sundby et al. (2007) show that 10 years after in vitro fertilization (IVF) 17% of women declare having permanent problems resulting from infertility, and 70% say that infertility has influenced their relationship with their partner over many years. Respondents often mention how for years the focus of

conversations with their partner has been on having children, getting pregnant, and related topics.

A number of other studies have found good quality relationships and high marital satisfaction among couples both when starting (Borneskog et al. 2012) and after fertility treatment (Ulrich et al. 2004), even when it does not result in a live birth (Schmidt et al. 2005; Peterson et al. 2011; Wischmann et al. 2012). Some of these studies, mostly carried out on data from Scandinavian countries, report that the experience of infertility and the treatment process can bring overall marital benefits by improving communication between partners and bringing them closer together (Schmidt et al. 2005; Holter et al. 2006) up to 5 years after the treatment (Peterson et al. 2011). Respondents describe how the experience of infertility and the treatment forces partners to try to be close and support each other (Holter et al. 2006) and to talk about existential aspects of life and manage stressful situations, thus improving their mutual connection (Greil et al. 1997), and that the shared stress of experiencing infertility stabilizes the relationship (Repokari et al. 2007).

The evidence on couple separation is more limited. A few studies from Denmark show that women with fertility problems who do not succeed in having a child are more likely to divorce or end a cohabitation than women who are successful, up to 12 years after the medical assessment (Kjaer et al. 2014), although the risk of divorce is still lower compared to the overall Danish population. Martins et al. (2018), considering couples undertaking Assisted Reproductive Technology (ART) treatments, find an overall lower risk of couple dissolution over 16 years' follow-up compared to couple not undertaking any treatment, after adjusting for confounders. However, the risk is similar when only considering couples conceiving a child without ART.

In sum, while the literature suggests that fertility treatment is extremely stressful and potentially detrimental to a couple's relationship, most existing evidence shows high levels of marital satisfaction and low separation rates among couples who undertake treatment, and suggests that the whole process might even strengthen couple relationships. It is also important to consider that couples who start fertility treatment represent a selected group in terms of the quality and stability of the relationship before the treatment. They share a common desire to have a child, a stage in the life course that is usually associated with the highest level of marital satisfaction (Lawrence et al. 2008). Furthermore, less stable couples might split up before starting treatment because of unsuccessful attempts to conceive a baby or an infertility diagnosis. Hence, selection processes might be in place that explain high levels of relationship quality among couples that undertake fertility treatment.

2.2 Socioeconomic selection into fertility treatment

Couples who undertake fertility treatment also represent a selected group in terms of demographic and socioeconomic background. The high cost of treatments, and the relatively late age at which many couples start seeking medical help to conceive, mean that those who access the treatments are a selected group, not representative of the average population in terms of demographic and socioeconomic characteristics. While important differences exist in the utilization and selection of treatments across countries, especially in relation to regulations, public funding (Berg Brigham, Cadier, and Chevreul 2013; Präg and Mills 2017a), and cultural acceptance of the treatments (Präg and Mills 2017b), the literature has usually shown that individuals and couples who can access and afford the treatments tend to be older, highly educated, and have higher income than parents who conceive without any medical help (Carson et al. 2011; Barbuscia and Mills 2017; Chambers et al. 2014; Klemetti, Gissler, and Hemminiki 2004; Goisis et al. 2020).

In the United States, where in most states fertility treatments are not or are only partially covered by the public healthcare system (Adashi and Dean 2016), the cost of treatment ranges from around \$500 for intrauterine insemination to \$26,000–\$28,000 for IVF with donor eggs (a cycle of regular IVF costs on average between \$10,000 and \$12,000). It is also very difficult (and expensive) to obtain private health insurance that covers infertility testing and subsequent treatments when not required by state law (source: advancedfertility.com). Thus, previous findings have shown that important gradients exist in the use of fertility treatments (Adashi and Dean 2016; Chambers et al. 2014; Chandra, Copen, and Stephen 2014). The characteristics of parents using treatments might confound the association between the use of fertility treatment and couples' stability, as demographic and socioeconomic factors are important for marital stability (Amato 2000). Observed differences in divorce rates and timing might thus be due to the selected characteristics of treated individuals, rather than to the use of the treatment itself.

A rich literature has explored the determinants of divorce. Well-established factors that protect against divorce in the US are marrying at older ages (Amato 2000; Lyngstad and Jalovaara 2010), having high income, being employed, and achieving high education (Härkönen and Dronkers 2006; Orbuch et al. 2002; Teachman 2002; Boheim and Ermisch 2001; Harknett and Kuperberg 2011; Bramlett and Mosher 2002; Sayer and Bianchi 2000). On the other hand, premarital cohabitation and premarital birth have been associated with higher risk of divorce, likely due to a selection effect of couples that cohabit before marriage (Lillard, Brien, and Waite 1995; Lyngstad and Jalovaara 2010; Teachman 2003). Different probabilities of divorce have also been observed among different ethnic groups in the United States, with higher divorce rates among Blacks than Whites and Hispanics (Raley and Bumpass 2003). In sum, because of the demographic and socioeconomic selection of women and couples who use fertility treatments and in

light of the well-known association between these factors and the risk of divorce, the characteristics of women who undertake fertility treatment might all be linked with high marital stability.

2.3 Childbearing and couple stability

Among the factors and life events that might affect marital stability, childbearing is crucial. The desire to have a child can be a reason for establishing a union in the first place (Berrington and Diamond 1999), and there is consistent evidence that having children substantially decreases the probability of union dissolution, at least when the number of children is small (Lyngstad and Jalovaara 2010; Morgan and Rindfuss 1985; Waite and Lillard 1991). Results vary across countries, but the literature seems to agree on the general stabilizing effect of the first child and young kids (Andersson 1997; Heaton 1991), while it is much weaker for subsequent births and when the children are older (Andersson 1997; De Graaf and Kalmijn 2006; Waite and Lillard 1991). On the contrary, evidence from different European countries shows that childless unions tend to be relatively unstable, and a larger fraction dissolve compared to unions with children (Andersson and Philipov 2002). Also, unintended pregnancies tend to increase the probability of couple dissolution (Guzzo and Hayford 2012). Part of the positive association between children and marital stability can also be attributed to selection (De Graaf and Kalmijn 2006), as the decision to have a child in the first place is dependent on marital stability. Children represent a long-term commitment to marriage; thus couples that face a relatively high likelihood of dissolution may delay (or even forego) making this commitment. However, the stabilizing effect of childbearing has been found to persist after selection is accounted for (Lillard and Waite 1993).

In light of the literature on the role of childbirth in marital stability, the association between fertility treatment and the risk of divorce is likely to differ depending on whether the treatment is successful (i.e., followed by a live birth) or not, as childbearing itself contributes to marital stability. In addition, births occurring after fertility treatment represent a special case of particularly desired children (Colpin 2002; Golombok et al. 1995), which may result in even greater satisfaction with parenthood (Gibson et al. 2000; Golombok et al. 1996). From a utility maximization perspective, fertility treatment represents a high investment in having a child together, and this may raise the opportunity cost of divorcing.

3. Data and variables

3.1 Sample

The National Survey of Family Growth (NSFG) is a cross-sectional survey that gathers information on family life, marriage and marital dissolution, pregnancy, infertility, contraceptive use, and the general and reproductive health of a nationally representative sample of women aged 15–44 in the United States. The survey, conducted by the Centers for Disease Control and Prevention’s (CDC) National Center for Health Statistics (NCHS), started in 1973. We used data which provide information about the use of fertility treatments, collected in 2002, between 2006 and 2010, between 2011 and 2013, and between 2013 and 2015. The survey also provides retrospective information on the respondents’ marital histories: the start and end (in the case of dissolution) dates of each marriage.³ We selected women who were married at least once; therefore our final sample consisted of 13,784 women (from an initial sample of 25,523). We excluded women who had only experienced cohabiting relationships, as important ethnic and socioeconomic gradients in entry into marriage exist in the United States (see, among others, Cherlin 2004). Using the retrospective information, we considered the date they entered their first marriage as the beginning of our observation period, and examined their risk of experiencing marital dissolution. The date of marital dissolution coincided with the date of divorce, or of the end of cohabitation if this occurred earlier or the couple did not eventually engage in a divorce. We chose to consider only first marriages: we excluded women who started treatment in subsequent marriages in order to have as homogeneous a sample as possible. Entering a second (or higher order) marriage might be associated with observable and unobservable characteristics that are, in turn, related to different odds of divorce. Therefore, our (retrospective) observation period went from the date of first marriage until the date of marital dissolution or of the interview. The average observation time was 93.4 months ($SD = 76.3$). The information about the date of marriage and divorce was provided by the NSFG in century months, as were the dates of other life events included in the dataset. As with all retrospective self-reported information, it is important to keep in mind the limitations due to potential imprecision and recall bias.

³ Because of an error in the collection of data for NSFG 2002, some women were not asked when their marriage ended. The error was not random (Kennedy and Bumpass 2008; Reinhold 2010) and could thus be correlated with the use of fertility treatments and the probability of having a child. To make sure that this did not affect our results, as a robustness check we ran all our main analyses on the sample excluding data from 2002. The results (available upon request) did not differ from those reported in the main text, so we decided to show the results based on the whole sample.

3.2 Use of fertility treatments

Information about the use of fertility treatments was provided by a series of questions in the survey section ‘Infertility services and reproductive health’. First, women were asked whether they or their partners had ever sought medical help to get pregnant; those who had were then asked to specify which kind(s) of treatment(s) they had undergone. The following treatments were included in the questionnaire: ovarian stimulating drugs, artificial insemination (IUI), in vitro fertilization (IVF, including Intra-Cytoplasmic Sperm Injection (ICSI) treatments), and other less common treatments of infertility such as uterine fibroid surgery or treatment for endometriosis. We considered as ‘treated’ those women who, after a first medical visit for help getting pregnant, undertook IVF, IUI, or used stimulating drugs not followed by any further treatment. In our sample 768 women received medical help to get pregnant and started one of the aforementioned treatments while in their first marriage: 97 of them underwent IVF or ICSI, 181 artificial insemination, and 490 used ovarian stimulating drugs without using any other treatments.

The variable indicating whether and when the respondent started a treatment was time-varying. Because we do not know the exact dates when women undertook the treatments, our variable took value 1 starting from the month in which she had the first medical visit to get pregnant and maintained value 1 in the following time periods. Thus, respondents were considered to be undertaking a fertility treatment after they had the first medical visit while in their first marriage. This represents a proxy for the actual time when women received treatments, as it is possible that some women only started the first treatment a while after their first visit. In the analyses reported below we do not distinguish between the different treatments, as separate models would lead to too small sample sizes. However, as a sensitivity analysis we ran the same models on different samples divided by the kind of treatment.⁴ The results (available upon request) showed no substantial differences depending on the fertility treatment used.

3.3 Successful vs. unsuccessful treatment

We considered a treatment successful when the respondent experienced a live birth after the beginning of the treatment, while still in the union. Because we do not know the exact dates when the women undertook the treatments, we cannot identify precisely which births were in fact the ‘result’ of treatment as it is relatively common that couples manage to conceive naturally after undertaking unsuccessful fertility treatments. As a robustness

⁴ Women who had more than one treatment were categorized according to the treatment that represented the ‘furthest step’ of treatment (e.g., women undertaking ovarian stimulating drugs followed by IVF, which is the usual procedure, would be in the IVF group).

check we ran different model specifications in which treatments were considered as successful only when a live birth occurred within a specified time period after the women first received medical advice to get pregnant, and the results were virtually identical. However, we considered the choice of the time limit to be extremely arbitrary. Furthermore, the majority of births occurred relatively soon after the beginning of treatments (as shown by the average time of successful treatments in Table A-2). Our variable indicating that the respondent had a successful treatment was time-varying, taking value 1 when a child was born after the beginning of a treatment and maintaining value 1 afterwards.

3.4 Control variables

We included a number of variables representing socioeconomic and demographic characteristics that might be associated both with the risk of divorce and with access to/use of fertility treatments: respondent's race and origin (non-Hispanic White, Hispanic White, non-Hispanic Black, Hispanic Black, and other), age at marriage, educational level (whether the respondent had a degree or equivalent, high school, or less than high school), mother's educational level (whether she attended some college or equivalent, finished high school, or did not finish high school), whether the respondent had any live birth before the beginning of the first marriage ('premarital birth'), and whether she cohabited with the partner before the marriage ('premarital cohabitation'). We also included cycle dummies to control for any changes in the pattern of divorce and the diffusion and cost of fertility treatments that may have occurred over the more than 10 years covered by this study. To disentangle the association between marital stability, the use of treatment, and childbearing, for all couples we created a variable indicating whether the respondent experienced any birth within the first marriage ('birth within 1st marriage'). When interacted with the variable on fertility treatment, it identified women who had a successful treatment, an unsuccessful treatment, a natural birth, or did not experience any birth and did not undertake any treatment (see next section).

4. Analytical strategy

The first step in our analysis was to show descriptive statistics of the sample, divided by whether the respondent received any fertility treatment while in her first marriage. We used two-tailed t-tests to study whether the differences between the two sub-samples were

significant.⁵ As a second step we looked at how the risk of divorce changed over time during the period of observation using Kaplan–Meier (KM) survival curves. We first compared women who undertook treatment and women who did not; we then divided treated women into successful and unsuccessful, and untreated women into those who had a natural birth and those who had no child during the marriage.

To examine the association between the use of fertility treatments, background factors, childbearing, and divorce, we implemented discrete-time event history analysis, which allowed us to model the risk of dissolution using time-varying covariates. Event-history analysis regresses the conditional probability of experiencing an event (divorce) at time t – provided that it has not happened before – on selected covariates. Data transformed to discrete-time format were analysed with logistic regression models using STATA. The unit of time on which our analysis is based was months; however, we created longer time intervals (5 and then 10 months) for the final part of the considered time period, to avoid periods with no events. Through the discrete time model, we could analyse how the probability of divorce was associated with having started a treatment/being in a treatment in each single month (see Allison 1982, 1984).

The first model specification shows the unadjusted association between the use of fertility treatment and risk of divorce in order to examine whether undertaking a treatment was overall linked with higher marital stability. To examine the extent to which the observed association was explained by selection, i.e., the selective characteristics of women who undertook fertility treatments were correlated with lower risk of divorce, Model (2) added socioeconomic confounders to the first model. In Model (3), we included the interaction terms between fertility treatment and childbirth, to explore the associations between both successful and unsuccessful treatments and the risk of divorce. By adding the interaction terms we were also able to compare women who experienced successful or unsuccessful treatments with both women who had a natural child and those who had no child and did not undertake any treatment during their first marriage. It is important to keep in mind that this last group of women may be very heterogeneous and there may be different reasons why the couples had no child within the marriage (e.g., not wanting children, sub-fecundity or infertility, low quality of couple relationship). Many of these reasons might themselves be related to low marital stability. Also, women in this group might have experienced childbirth before marriage, which, however, is captured by our control variable on premarital birth.

⁵ A logistic regression model was also performed to study the predictors of using a fertility treatment. Results are shown in Table A-1 in the Appendix.

5. Results

Table 1 shows the characteristics of our sample divided by whether or not the respondent received some fertility treatment while in her first marriage. The two sub-samples differed substantially, which suggests that the women who accessed fertility treatments were a selected group in terms of demographic and socioeconomic characteristics. Of the women who undertook fertility treatments, the great majority were non-Hispanic White (75%); less than 8% were Black (Hispanic and non-Hispanic), while that proportion was significantly higher (15.7%) among women who did not undertake any treatment. The average age at marriage was higher among women who used treatments (by approximately 1 year), but they were substantially less likely to have experienced a premarital birth (4% compared to almost 30% among women who did not undertake any treatment). Women who used fertility treatments were also more likely to have a higher level of education and to have a mother with a higher level of education, while they were less likely to have experienced a pre-marital childbirth and a pre-marital cohabitation. In terms of marriage outcomes, the overall proportion of respondents who experienced a divorce was lower among women who used a fertility treatment (16% compared to 44% in the rest of the population), and the average duration of marriage was longer (more than 122 months compared to approximately 84 months, see also Figure A-1 in the Appendix). Slightly less than half of the treatments (46.9%) resulted in a live birth.

In line with the average duration of marriage observed for the two subgroups, the survival curves shown in Figure 1.1 suggest that women who started a fertility treatment experienced lower risk of divorce during the whole period of observation than the rest of the women. However, important differences emerged when we further divided the two sub-samples by whether the woman experienced a childbirth within the marriage, which suggests that it might be important to consider successful and unsuccessful treatments separately, as well as women who experienced a natural birth and those who did not. Figure 1.2 shows that the risk of divorce was lowest among women who experienced a successful treatment, and highest among women who did not have any child and did not start a treatment within their first marriage. Survival curves for women who experienced an unsuccessful treatment and those who did have a natural child within their first marriage lie in the middle, suggesting that these two groups experienced a similar risk of divorce.

Table 1: Descriptive statistics of the sample, by use of fertility treatment

	Non-treated		Fertility treatment		Total
	Mean	SE	Mean (p-value)	SE	
Ethnicity (%)					
<i>White non-Hispanic</i>	55.5	0.004	75.4 (0.00)	0.011	56.6
<i>White Hispanic</i>	17.5	0.003	9.2 (0.00)	0.007	16.8
<i>Black non-Hispanic</i>	14.1	0.003	7.0 (0.00)	0.009	13.7
<i>Black Hispanic</i>	1.4	0.001	0.7 (0.03)	0.002	1.3
<i>Other</i>	11.4	0.003	7.5 (0.04)	0.008	11.1
Age at marriage	23.3	0.045	24.6 (0.00)	0.160	23.4
Premarital cohabitation (%)	55.7	0.004	51.4 (0.03)	0.020	55.5
Premarital birth (%)	27.4	0.004	4.2 (0.00)	0.008	26.1
Education (%)					
<i>College Degree or higher</i>	36.4	0.004	57.9 (0.00)	0.020	37.7
<i>Some college</i>	20.5	0.004	18.7 (0.00)	0.019	20.35
<i>High school</i>	43.1	0.003	23.3 (0.00)	0.006	41.9
Mother's education (%)					
<i>Some college or higher</i>	37.3	0.004	42.8 (0.00)	0.019	37.6
<i>High school</i>	32.2	0.004	39.5 (0.00)	0.019	32.7
<i>Less than high school</i>	29.5	0.004	17.1 (0.00)	0.010	28.8
Childbirth within 1 st marriage (%)	61.6	0.004	66.5 (0.02)	0.019	61.8
Divorce (%)	40.5	0.004	16.8 (0.00)	0.015	39.1
Duration of marriage (months)	84.3	0.669	124.4 (0.00)	2.64	86.5
Treatment success (%)			47.8		
Duration of marriage before treatment (months)			41.9		
Duration of treatment (months)			26.4		
N	13,016		768		13,784

Note: High education of the mother refers to some college or higher, middle education to high school degree, low education to less than high school degree. P-values indicate whether the difference is significant according to two-way t-test.

Figure 1.1: Marriage survival over time, by use of fertility treatment. Kaplan–Meier estimates

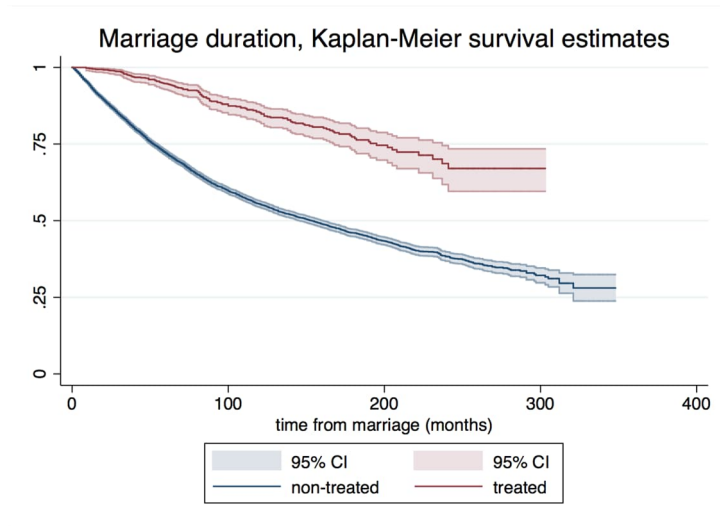
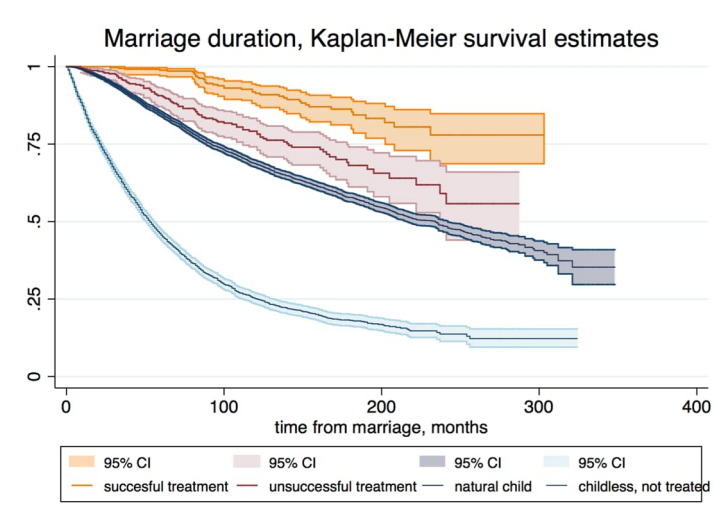


Figure 1.2: Marriage survival over time, by use of fertility treatment and childbirth within the marriage. Kaplan–Meier estimates



These descriptive findings give us some insight into the relationship between fertility treatment and risk of marital dissolution. However, they do not take into account any confounders that could be correlated with the probability of accessing a treatment and with the probability of divorce. Table 2 shows the results of discrete-time event history models and reports the odds ratios. In Model (1), the variable ‘treated’ shows the unadjusted association between having used a fertility treatment and the risk of experiencing divorce. The coefficient indicates that starting a fertility treatment was associated with substantially lower odds of divorce (OR=0.49, $p < 0.001$). After adjusting for demographic and socioeconomic characteristics in Model (2) the association was reduced (OR = 0.6, $p < 0.001$); however, it remained negative and significant. This result suggests higher marital stability among couples that used fertility treatments compared to couples that did not. It also shows that the lower odds of divorce observed among couples that undertook treatment were only partially explained by their demographic and socioeconomic characteristics. The association of individual controls with the probability of divorce went in the expected direction, with lower odds of divorce associated with high education of the respondent (OR = 0.79, $p < 0.001$) and age at marriage (OR = 0.93, $p < 0.001$), and higher odds of divorce among Blacks (OR = 1.36, $p < 0.001$), and those who experienced premarital cohabitation (OR = 1.19, $p < 0.001$) and childbirth (OR = 1.47, $p < 0.001$). Also, high maternal education was associated with higher probability of divorce (OR = 1.39, $p < 0.001$). It is possible that having a highly educated mother is a proxy for the fact that the respondent grew up in a less traditional environment, likely linked to a higher acceptance of divorce. The results from Model (2) partially suggest that part of the low risk of divorce observed among couples who undertake treatment was explained by their selective demographic characteristics and socioeconomic background. However, while an older age at marriage and more advantageous socioeconomic characteristics were associated with a lower probability of divorce, as we expected, the association between the use of fertility treatments and marital stability was not fully explained by such characteristics.

The association between the use of fertility treatments and the odds of divorce varied consistently depending on whether or not the treatment was successful. If the treatment was followed by a live birth, the odds of divorce were 48% lower than for women who had a natural birth (the reference category) (OR = 0.52, $p < 0.001$, Model 3). An unsuccessful treatment was associated with higher odds of divorce than a successful treatment, but was still lower than in the reference group, although the association was less significant (OR = 0.75, $p = 0.023$). Not having a child within the marriage and not undertaking any treatment, on the other hand, was associated with a substantial and significant increased risk of divorce compared to both having a natural child and conceiving a child through fertility treatment.

Table 2: Odds of experiencing divorce and use of fertility treatment. Estimates from discrete-time event history analysis

	Model(1) OR/(95% CI)	Model(2) OR/(95% CI)	Model(3) OR/(95% CI)
Fertility treatment	0.48 (.40–.57)	0.58 (.48–.69)	
<i>Treated # child (ref: natural birth)</i>			
Successful treatment			0.52 (.41–.67)
Unsuccessful treatment			0.75 (.58–.96)
No treatment, no childbirth			1.29 (1.20–1.37)
<i>Ethnicity (Ref: White)</i>			
White Hispanic		0.74 (.68–.80)	0.75 (.68–.81)
Black		1.36 (1.26–1.48)	1.38 (1.27–1.49)
Black Hispanic		1.17 (.93–1.45)	1.16 (.93–1.45)
Other		0.72 (.64–.79)	0.72 (.65–.79)
<i>Education (Ref: High school)</i>			
College Degree		0.79 (.73–.85)	0.78 (.72–.84)
Some college		1.12 (1.04–1.20)	1.12 (1.04–1.20)
Age at marriage		0.92 (.91–.93)	0.92 (.91–.93)
Premarital birth		1.47 (1.38–1.58)	1.39 (1.29–1.48)
Premarital cohabitation		1.19 (1.12–1.27)	1.19 (1.12–1.26)
<i>Mother's education (Ref: less than high school)</i>			
Some college		1.13 (1.05–1.22)	1.12 (1.03–1.20)
High school		1.07 (1.00–1.15)	1.06 (.98–1.14)
<i>Year (Ref: 2002)</i>			
2006–2010	0.98 (.91–1.04)	1.00 (.94–1.07)	1.01 (.94–1.08)
2011–2013	1.09 (1.01–1.19)	1.13 (1.04–1.22)	1.13 (1.04–1.22)
2013–2015	1.08 (.99–1.17)	1.15 (1.05–1.26)	1.15 (1.06–1.25)
N	13,784	13,784	13,784

Notes: Discrete-time models provide estimates for each time-interval; however, such estimates are not shown in the table. 95% confidence intervals in parentheses.

These results show that the experience of a treatment followed by a live birth was associated with higher marital stability compared to both an unsuccessful treatment and

remaining childless. However, couples who experienced an unsuccessful treatment did not experience the highest risk of divorce among the considered sub-groups: while an unsuccessful treatment was linked to higher odds of divorce than experiencing a successful treatment, it was still associated with lower odds of divorce than not having any child and having a natural birth within the first marriage. Successful treatments tend to be longer than unsuccessful ones, which might indicate that successful couples had greater perseverance and availability of resources. To address the potential selection of couples who had successful treatments we ran the same analysis on women who were treated and included length of the treatment as a confounder, obtaining almost identical results (available upon request).

To check the robustness of our results, we performed a number of sensitivity analyses. First, we estimated Kaplan–Meier survival curves on sub-samples of women to compare women with more similar backgrounds and to try to better disentangle the relationship between sociodemographic background, the use of fertility treatments, and the risk of divorce. Results for women older than 30 years (Figure A-2) and highly educated women (Figure A-3) confirm that the risk of divorce was significantly lower for couples undertaking treatment, even when compared to couples with similar characteristics. Because fertility treatments are often undertaken by couples after a period of attempting to achieve a pregnancy, it is possible that the observed lower risk of divorce is partly due to the fact that these couples are also selected in terms of quality of relationship, as they have already survived the initial years when the risk of divorce is higher. In fact, on average couples started treatment 42 months after getting married, which is past the peak of divorce observable in the first years after marriage (see Figure A-1 in the Appendix). For this reason, we also estimated survival curves considering only couples who remained married for at least 4 years (the average time after which couples undertake treatment, Figure A-4). In addition, we restricted the sample of treated couples to those who started treatment at least 4 years after marriage (Figure A-5). Again, the results confirmed that even in these sub-samples, the risk of divorce was significantly lower for couples undertaking fertility treatment. Finally, because married couples who do not conceive a child within a few years of first marriage in the United States might represent an especially selected group with a higher probability of divorce, we ran analyses excluding this subsample (results available upon request).

Overall, the results from the sensitivity analyses show that although it is likely that part of the lower risk of divorce observed among couples who undertook fertility treatment might be due to their selective background, this does not explain all the observed associations.

6. Discussion

Despite the rapid increase in the use of fertility treatments in recent decades, our knowledge about the implications for couples' stability is still limited. While it is well-established that the experience of infertility and the treatment itself are extremely stressful for both members of the couple (Greil 1997; Greil, Slauson-Blevins, and McQuillan 2010), which might lead to lower couple satisfaction and higher instability (Cook et al. 1989; Kjaer et al. 2014), the empirical evidence usually shows high levels of relationship quality during or just after the treatment (Ulrich et al. 2004; Schmidt et al. 2005). However, most existing studies focus on self-reported measures regarding the quality of the relationship over a short time span around the treatment, and do not consider the interplay of multiple factors such as whether the treatment was successful or not, and individual background characteristics. These are crucial issues, as both the selective characteristics of individuals undertaking treatment (Adashi and Dean 2016; Barbuscia and Mills 2017; Carson et al. 2011) and the experience of childbearing (Lyngstad and Jalovaara 2010; Morgan and Rindfuss 1985; Waite and Lillard 1991) are themselves predictors of marital stability.

In this study we used retrospective data on a representative sample of American women aged 18–44 to study the association between the use of fertility treatments and the risk of marital dissolution up to 20 years after the marriage, and how this association depends on the success of the treatment and is confounded by individual demographic and socioeconomic characteristics. Using discrete-time event history analysis, we found that undertaking fertility treatment was associated with lower risk of experiencing divorce amongst women in their first marriage. The association was particularly strong when the treatment was successful – when it resulted in a live birth – but even unsuccessful treatments were associated with lower risks of divorce compared to women who did not undertake any treatment and did not give birth to a child naturally during the marriage. Our results are in line with previous evidence about high relationship quality among couples that undertake fertility treatments. However, the finding of relatively high stability among couples who experienced an unsuccessful treatment is more surprising and suggests that good relationship quality translates into high stability even though the 'reproductive urge' is not satisfied through the treatment. These results are an important contribution to the literature as no previous research has examined couples' stability following fertility treatments in the long-term, including both successful and unsuccessful treatments and comparing couples who did and did not undertake treatment. Also, to the best of our knowledge, no study had previously analysed data from the United States on this topic.

The sub-sample of women using fertility treatments differed consistently from the rest of the sample: on average they were older, had a higher educational level, and were

less likely to have experienced premarital cohabitation or birth. This is in line with previous findings, and likely reflects the high costs of fertility treatment in the United States. As expected, these selective characteristics are also associated with higher marital stability. However, they only marginally explained the difference in the risk of divorce experienced by women who undertook a treatment and those who did not. Nor was this relative stability entirely explained by the experience of childbearing, as we found that an unsuccessful treatment was linked to higher marital stability than not undertaking treatment. This last result was rather unexpected, since theoretical considerations and previous empirical findings suggest that unsuccessful treatments have a detrimental effect on couples' relationships.

In sum, in this study we did not find any evidence of fertility treatments having a detrimental effect on couples' stability. To the contrary, we observed high marital stability amongst couples who undertake fertility treatment. These findings might support the idea that going through a fertility treatment can strengthen a couple's relationship and lead to lower risk of divorce. However, it is important to highlight that our results are based on cross-sectional data and retrospective information on marriage and divorce dates and the use of fertility treatments. Therefore, we are not able to argue any causal effect of the treatments. Couples who choose to start a fertility treatment are likely to be relatively stable in the first place: before undertaking fertility treatment the partners have usually tried to conceive naturally for some time. On top of a strong desire for parenthood, starting a treatment therefore shows that the couple did not separate after their failed attempts. The relative stability of couples who experience an unsuccessful treatment might then be partly explained by these selection processes. With no information available on relationship satisfaction with the partner or fertility intentions we could not address this question, but acknowledge that in future research it will be important to analyse the role of selection into treatments in terms of couple stability. However, results from sensitivity analyses show that a lower risk of divorce was also observed when only considering couples who started the treatment shortly after marriage, or only those marriages that lasted for at least a few years. Among couples that did undertake treatment, it is also important to note that those who experienced a successful treatment might be even more selected than those who experienced an unsuccessful treatment, both in terms of socioeconomic characteristics and perseverance in the treatment. Last, in a context like the United States, where childbearing is the norm, couples that chose not to have children during their first marriage might represent a selected part of the population (Guzzo and Hayford 2012). For instance, in our sample a large proportion of these couples had cohabited and had a premarital birth (see Table A-2), factors that are themselves related to higher risk of divorce (Lillard and Waite 1993). The group of women who did not have children and did not undertake any treatment while in their first marriage may thus represent very heterogeneous situations: couples who did not want children, couples who

tried to conceive without managing to and that for different reasons could not access fertility treatments, couples who had – intentionally or otherwise – children before getting married. These different situations might be related to very different levels of couple stability.

This study has some limitations. First, as mentioned, the cross-sectional nature of the data used consistently limits our ability to examine the effect of fertility treatment on couple stability, as the observed outcome might be a result of the interaction of a number of processes, including selection into the treatment and childbearing. Also, the lack of precise information about the order of fertility treatments undertaken, their duration, and when they were undertaken, means that we are not able to know whether a childbirth was the direct consequence of treatment. It is relatively common that women conceive ‘naturally’ after unsuccessful treatments; however, our data did not allow us to distinguish between these births and those resulting from the treatments. In light of our research questions and the mechanisms we explore, we do not consider this to be a crucial issue in the association between undertaking fertility treatment and couple stability. Because all of the information was reported retrospectively, it is also important to keep in mind that there is a risk of imprecision and recall bias. Second, because of the relatively small sample sizes, we were not able to distinguish between different kinds of treatments. This is an important issue, as different treatments vary in terms of length, intensity, and cost, and this might change their association with couples’ wellbeing and marital stability. However, in the sensitivity analyses we ran the same models separately for the different treatments, with virtually identical results. Future research should take these differences into account.

It is also important to note that our decision to consider only marital relationships makes the results specific to married couples, who represent a selected subsample of individuals in the United States and are not representative of the general population. However, despite the relatively liberal eligibility criteria for access to treatment, married couples still represent the great majority of people who use the treatments. Last, it is worth considering that during the relatively long period of time covered (retrospectively) by our sample, important changes occurred in the United States concerning both marriage and divorce, and the accessibility and use of medically assisted reproduction. Despite these changes, the United States remains a context where marriage is relatively normative (e.g., Cherlin 2004), especially among the White population that is the main user of fertility treatments. Divorce is common, but its prevalence was relatively stable over the time-period considered (CDC.gov). Meanwhile, there has been a strong increase in couples using fertility treatments. However, the financial coverage of treatments remains limited, despite the progressive increase in the number of states enacting infertility mandates, including the coverage of medically assisted reproduction (Chandra, Copen, and Stephen 2014; Crawford et al. 2016). Thus, undertaking treatment remains very

expensive and only accessible to a selected part of the population (Bitler and Schmidt 2012).

Despite these limitations, this study provides an important contribution to our knowledge about the outcomes of families created with the aid of fertility treatments. Although undertaking fertility treatment is likely to be a stressful experience, our findings show that there might also be positive aspects in terms of marital stability, as couples who undertake treatment show a lower probability of divorce in the years during and after the treatment. Our findings point to the need to analyse further the consequences of fertility treatment, including its positive aspects. Although the cross-sectional structure of the data and the retrospective reconstruction of marital histories and fertility treatment processes mean that the NSFG is not the ideal data source to study the effect of fertility treatments on couple stability, this is the first study to explore the consequences of fertility treatments for couples in the United States. This is an increasingly important question that has already been addressed in the European context (Kjaer et al. 2014; Martins et al. 2014; 2018) – which, however, is very different in terms of fertility treatment accessibility and use. Future research on this topic could reach a better understanding of the role played by the selection of couples into treatments in terms of the quality of couple relationships and the desire to have a child.

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Appendix

Figure A-1: Average duration of marriage, by fertility treatment

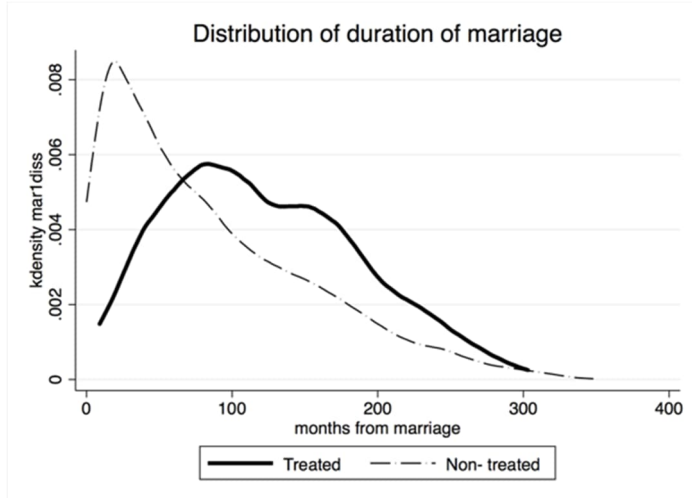
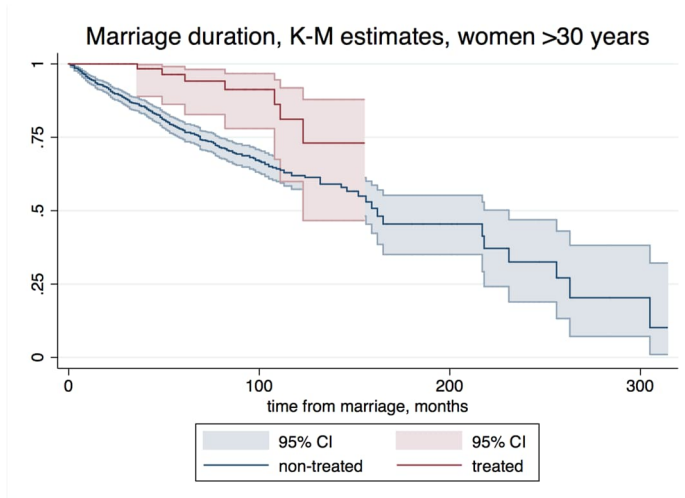
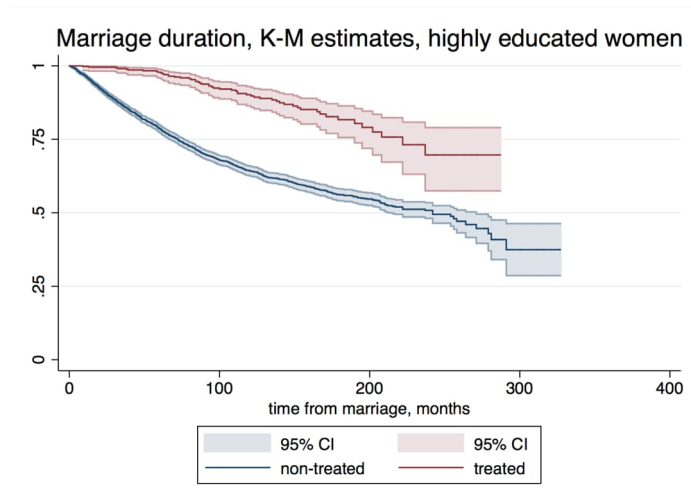


Figure A-2: Marriage survival over time, by use of fertility treatment, women aged 30 years or older. Kaplan–Meier estimates



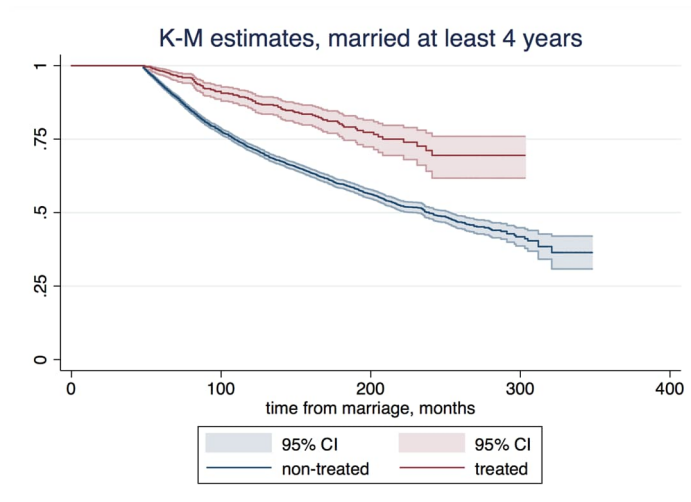
Note: The analysis was performed on a subsample of 1.456 women, of which 75 undertook fertility treatment

Figure A-3: Marriage survival over time, by use of fertility treatment, women with tertiary education. Kaplan–Meier estimates



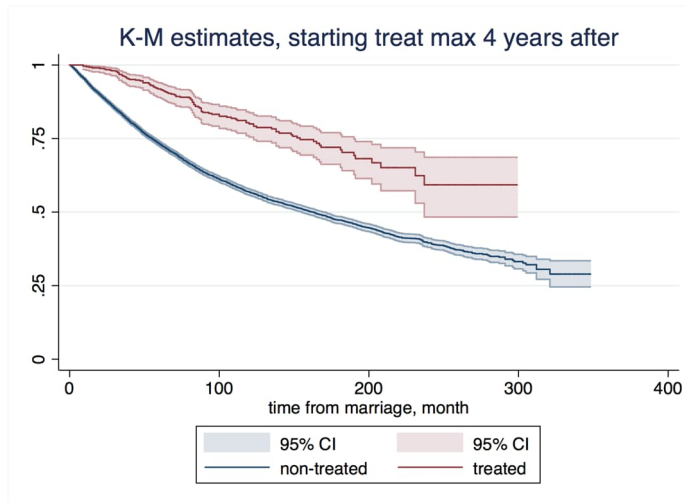
Note: The analyses were performed on a subsample of 5,195 women, of which 445 undertook fertility treatment

Figure A-4: Marriage survival over time, by use of fertility treatment, women whose marriage lasted at least 4 years. Kaplan–Meier estimates



Note: The analysis was performed on a subsample of 8,553 women, of which 676 undertook fertility treatment

Figure A-5: Marriage survival over time, by use of fertility treatment, women who started the treatment within 4 years from the marriage. Kaplan–Meier estimates



Note: The subsample of women undertaking fertility treatment numbered 510 women.

Table A-1: Individual determinants of probability to undertake fertility treatment, estimates from logistic regression model

	OR/se
<i>Ethnic background (ref: White)</i>	
Black	0.57 (0.093)
Other	0.67 (0.106)
<i>Education (ref: high school)</i>	
Some college	1.91 (0.393)
College Degree	2.73 (0.574)
<i>Mother's education (ref: Less than high school)</i>	
High school	1.40 (0.172)
Some college	1.09 (0.136)
Premarital cohabitation	0.88 (0.078)
Age at marriage	1.04 (0.013)
Premarital birth	0.16 (0.032)
<i>Year of interview (ref: 2002)</i>	
2006–2010	1.14 (0.109)
2013–2015	1.03 (0.126)
Observations	11,498

Note: SE in parentheses

Table A-2: Descriptive characteristics of the sample divided by whether the respondent experienced no birth, a natural birth, an unsuccessful or a successful treatment

	Non-treated		Fertility treatment		Total
	<i>No child</i>	<i>child</i>	<i>unsuccessful</i>	<i>successful</i>	
Ethnicity (%)					
<i>White</i>	71.9	73.7	81.8	87.8	73.7
<i>Black</i>	18.7	13.9	10.1	4.5	15.3
<i>Other</i>	9.2	12.3	0.08	0.07	10.9
Age at marriage	24.3	22.5	24.6	24.2	23.3
Premarital cohabitation (%)	60.3	51.03	49.8	46.8	54.3
Premarital birth (%)	38.2	20.1	8.3	0.0	25.8
Education (%)					
<i>College degree</i>	50.1	47.5	40.9	35.1	47.9
<i>Some college</i>	14.3	17.2	5.8	3.4	15.4
<i>High school</i>	35.5	35.2	53.2	61.4	36.5
Mother's education (%)					
<i>Some College</i>	39.8	34.4	40.3	43.0	36.7
<i>High school</i>	33.9	32.0	38.1	40.9	33.1
<i>Less than high school</i>	25.2	32.9	20.9	14.9	29.3
Divorce (%)	52.0	32.6	22.1	9.7	38.8
Duration of marriage (months)	42.7	110.7	110.7	136.1	86.6
Duration of marriage before treatment (months)			50.3	34.1	42.7
Duration of treatment (months)			22.3	30.9	26.4
N	4,182	6,703	325	288	11,498