

ORIGINAL ARTICLE



Effectiveness of a video-based education on fertility awareness: a randomized controlled trial with partnered women

Juliana Pedro^{a,b} , Joana Fernandes^a , Alberto Barros^{c,d} , Pedro Xavier^{d,e}, Vasco Almeida^f, Maria E. Costa^{a,b} , Lone Schmidt^g  and Mariana V. Martins^{a,b} 

^aFaculty of Psychology and Education Sciences, University of Porto, Porto, Portugal; ^bCentre for Psychology, University of Porto, Porto, Portugal; ^cDepartment of Genetics, Faculty of Medicine, Institute of Health Research and Innovation I3S, University of Porto, Porto, Portugal; ^dCentre for Reproductive Genetics A. Barros, Porto, Portugal; ^eDepartment of Gynaecology and Obstetrics, São João Hospital, University of Porto, Porto, Portugal; ^fFaculty of Sciences, University of Porto, Porto, Portugal; ^gDepartment of Public Health, University of Copenhagen, University of Copenhagen, Copenhagen, Denmark

ABSTRACT

Fertility awareness (FA) among young people is low. Fertility awareness interventions have been found to contribute to increase FA in the short-term. The long-term effectiveness of FA interventions on childless and presumed fertile people, committed in a heterosexual relationship and wishing to have children in the near future is not known. In a double-blind parallel randomized controlled trial conducted between 2016 and 2018, 652 childless partnered women were randomized to either watch a 5-min video about fertility (IG: 'Intervention Group') or to not receive any intervention (CG: 'Control Group'). Participants filled out an online questionnaire at the start of the study (and in the IG group immediately before intervention). They then completed the questionnaire after 1 month, 6 months and 1 year. The questionnaire assessed FA and intentions to adopt fertility-protective behaviours. In the IG, FA levels were found to increase at 1 month post-intervention. However, significant interaction effects between group and time were only found for four out of the seven FA variables at the 6-month and 1-year follow-up. No effects were found for: (i) intentions to adopt fertility-protective behaviours; or (ii) desired timing of pregnancy. These results suggest that the fertility video intervention seems to partially increase FA in the long term. Future studies should investigate the effectiveness of different intervention formats with a focus on overcoming high attrition rates.

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Introduction

The postponement of childbearing (Schmidt et al., 2012) and low fertility rates in developed countries (GBD 2017 Population and Fertility Collaborators, 2018) have been important themes in research and political agendas, and stimulated a large number of studies that show that young people do not have adequate knowledge about reproduction and fertility (Hammarberg et al., 2017; for a review see, Pedro et al., 2018). In 2017, the term 'fertility awareness' was defined in the International Glossary on Infertility and Fertility Care as 'The understanding of reproduction, fecundity, fecundability and related individual risk factors (e.g. advanced age, sexual health factors such as sexually transmitted infections and life style factors such as smoking, obesity) and non-individual risk factors (e.g. environmental and work place factors);

including the awareness of societal and cultural factors affecting options to meet reproductive family planning, as well as family building needs' (Zegers-Hochschild et al., 2017) addressing the importance of this issue in the reproductive field. Given that some fertility problems could potentially be avoided (e.g., avoiding risk factors such as having children after 35 years), health authorities and scientific associations have highlighted the need to focus on prevention of infertility and on the promotion of reproductive health (ESHRE, 2018).

It has been hypothesized that low education about fertility might contribute to uninformed decisions regarding postponement of childbearing and engagement in risky behaviours that might negatively affect fertility (Cooke et al., 2012). As such, efforts have been focussed on developing and testing interventions to

CONTACT Juliana Pedro ✉ juliana@fpce.up.pt Faculty of Psychology and Education Sciences, Porto University, R. Alfredo Allen, Porto 4200-135, Portugal

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increase fertility awareness (FA). The available research demonstrates an association between exposure to FA interventions and increase short-term FA levels, generally measured using knowledge-based questions (Anspach Will et al., 2017; Boivin et al., 2018; Conceição et al., 2017; Daniluk & Koert, 2015; García et al., 2016; Maeda et al., 2016; Stern et al., 2013; Williamson et al., 2014; Wojcieszek & Thompson, 2013). The long-term effects of these educational interventions on FA are not consistent, with one study reporting that knowledge levels returned to baseline at 6-month follow-up after an initial increase immediately post-intervention (Daniluk & Koert, 2015) and a second reporting a decrease in knowledge levels at a 2-year follow-up in comparison to immediately post-intervention (Maeda et al., 2018); however, knowledge levels at the 2-year follow-up were still higher than at baseline (Maeda et al., 2018). Even though some studies explored the effect of educational interventions on reproductive intentions (e.g. decreasing the intended age to have children), only few found an impact on decrease in the intended childbearing age (e.g. García et al., 2018) and on achieving a birth earlier compared with control group (Maeda et al., 2018). Intentions to change other risk behaviours (e.g., not smoking) have not yet been explored.

Educational videos have been proven to be effective in increasing knowledge about other health conditions as well as intentions to engage in protective behaviour and participation in health screening programmes, for example in breast cancer (Wang et al., 2008), HIV testing and other cancer screening (Tuong et al., 2014). This stimulus seems to be effective also in low-literacy populations (Abiodun et al., 2014; Borrayo, 2004). Studies testing the effectiveness of FA interventions have primarily used mixed samples of mainly university students (Conceição et al., 2017; Stern et al., 2013; Wojcieszek & Thompson, 2013) or oocyte donor candidates (García et al., 2016), participants who were currently enrolled in university studies and those who had finished their educational course (Anspach Will et al., 2017), participants who intended/did not intend to have children (e.g., García et al., 2016) and participants who were parents/currently childless (Maeda et al., 2018). Hence, there is a lack of research among a homogenous young, partnered adult group who wish to have children, and thus is expected to be closer to pursuing parenthood. In addition, few studies have used long-term follow-up designs (Daniluk & Koert, 2015; Maeda et al., 2018) or specific methodologies for assessing the effectiveness of interventions, such as randomized controlled trials.

To the best of our knowledge, none of the previous studies have explored the effectiveness of a video educational intervention in a randomized controlled trial on a sample of currently childless, partnered women of reproductive age who wish to have children in the near future.

The aim of this study was to test the effectiveness of a video fertility education tool on FA, intentions to adopt fertility-protective behaviours and desired timing of pregnancy. It was hypothesized that after the video, FA would increase, indicated by participants giving realistic estimates regarding the success of spontaneous pregnancy according to woman's age and treatment; and an increase in the known number of fertility risks and recognising the infertility definition. We also expected that intentions to adopt fertility-protective behaviours and intentions to desire a pregnancy sooner would increase for those in intervention group.

Materials and methods

Recruitment and participants

A prospective, two-arm, parallel group, double-blind randomized controlled trial was initiated in October 2016 (clinical trial NCT02813993). Between October 2016 and July 2018, we invited childless women to participate in the study through recruitment in gynaecology/fertility clinics and religious pre-marriage courses, and through online posts on social media. The inclusion criteria were: (i) being engaged in a heterosexual romantic relationship for at least 1 year; (ii) desire to have children; (iii) not aware of any fertility problem/not having tried to conceive for more than 12 months (or 6 months if the woman was ≥ 35 years old) previously and (iv) aged between 20 and 42 years.

Measures

Participants filled an online self-report questionnaire, including the following measures and items (see [Supplementary Material](#)).

Swedish FA questionnaire (Conceição et al., 2017; Lampic et al., 2006) assessed fertility knowledge including questions about women's fertility age-related decline and the chance of spontaneous pregnancy and fertility treatment success rates according to a woman's age. The answers were open and the participants were asked to write an estimation (in numbers) for each question. Correct answers were based on data reported in Lampic's (2006) original study and on the national (Portuguese) report on

medically assisted reproduction (Conselho Nacional de Procriação Medicamente Assistida, 2012).

Infertility risk factors assessed knowledge of health behaviours related to both male and female fertility, resulting in a final score (possible range 0–18). Participants indicated if certain behaviours are risk factors for infertility for women and men. The scale was originally developed by Ekelin et al. (2012) and used in a previous Portuguese study testing the effectiveness of a FA intervention (Conceição et al., 2017). Correct answers were based on published data (Ekelin et al., 2012; Homan & Norman, 2009).

Infertility definition assessed knowledge regarding the definition of infertility (Conceição et al., 2017). Participants answered eight true or false statements regarding the definition of infertility, resulting in a total score (range 0–8) based on the sum of correct answers. Answers were classified as correct or incorrect based on published data (Dunson et al., 2002; Zegers-Hochschild et al., 2017).

Questions about *intentions to adopt fertility-protective behaviours* were based on a previous study about fertility optimising behaviours (Fulford et al., 2013). We included a list of questions where participants were asked to rate the probability of engaging in specific strategies to increase their chances of achieving a pregnancy on a scale ranging from zero (not at all likely) to 5 (extremely likely). Five questions regarding changing lifestyle behaviours (e.g. not smoking) and two behaviours regarding the reproductive project (e.g., seeking specialized medical advice; having children earlier than planned) were included.

A question about *desired timing of pregnancy* assessed women's desired timing of pregnancy at the present moment. Participants selected a number on a continuous answer scale ranging from zero (I do not want to become pregnant now) to 10 (I want to become pregnant now) with a higher value meaning that women wanted to become pregnant sooner. This question was only relevant (only appeared in the online questionnaire) for participants who were not currently pregnant or already trying to conceive at follow-up.

Educational video intervention

We developed our video using a multidisciplinary prevention educational strategy. Multidisciplinary prevention had been showed to be effective in primary prevention of health conditions such as osteoporosis (Brecher et al., 2002), obesity prevention (Sahota et al., 2001), compliance with medication in heart failure

patients (Gwadry-Sridhar et al., 2005). The video was developed in three phases: (i) literature review conducted to gather accurate, evidence-based information about fertility to include in the written script; (ii) review and discussion of the written script with the three fertility experts in the field; (iii) pre-test with one woman who was trying to conceive, two women and one man with no desire to conceive in the immediate future (more details in Pedro et al., 2019). The content of the video was determined by the agreement of fertility experts on the most important facts about fertility and informed by the instruments/items chosen to evaluate fertility knowledge levels.

The video, 'I want to be parent in the future: What should I know?', was 5 min in duration and composed of short clips of three experts (medical doctor, embryologist and psychologist) that provide evidence-based information about age-related fertility decline, infertility risk factors and pregnancy chances according to women's age and mode of conception (Table 1). Each topic was introduced using written text on screen: 'What is infertility?'; 'Is there treatment for Infertility?'; 'Emotional impact of infertility'; 'What can we do to protect your fertility?'. Additional textual and numerical information such as pregnancy success rates was provided on the screen to supplement and highlight the information delivered orally by the experts in the videos (e.g., when medical doctor says that tobacco consumption is a risk factor for infertility, the word 'tobacco' appears on the screen). The video is now available in the Portuguese National Literacy Library from the Portuguese Ministry of Health, on the following link: <https://biblioteca.sns.gov.pt/artigo/video-informativo-sobre-saude-reprodutiva-e-fertilidade/>

Randomization and procedure

Participants were allocated to the intervention group (educational video) or to the control group (no stimulus) automatically and invisibly through a random (1:1) equation set on *LimeSurvey*, an online survey tool on which the questionnaire was hosted. The embedded video was shown at the end of the questionnaire at T0 for those randomized for IG and did not appear for CG. In this way, both participants and the investigator were blind to the intervention. At the start of the study, participants were told that the purpose of the study was to explore the perceptions of fertility and reproductive desires among currently childless young adults at present and longitudinally. The experimental methods including the intervention video were not mentioned beforehand. Participants in IG and CG

Table 1. Content of the video 'I want to be parent in the future: What should I know?'.

Time	Written information	Oral information
↓	Do you want to have children in the near future? This video is for you In Portugal and in Europe, couples have been delaying the decision to have children. However, ... age increases the chance of: Miscarriage, Ectopic pregnancy, Downs syndrome, Low weight at birth	The postponement of pregnancy creates the potential risk of decreasing chances of achievement of a pregnancy and increases risk of maternal, foetal and infant complications (Physician)
↓	Age is important both for women and men, but especially important for woman (Physician) Chance of pregnancy within a year: 70–79% if the woman is 25–30 years old 50–59% if the woman is 35–40 years old What is infertility?	The inability to achieve a pregnancy within a year of unprotected sexual intercourse (without using contraception) (Physician)
0m00s	The causes of infertility can be: female, male, female and male, unknown Infertility affects 9% of couples in Portugal Is there treatment for Infertility? Hormonal stimulation Intra-uterine insemination In-vitro fertilization Intracytoplasmic sperm injection Chance of success with medically assisted reproduction (one treatment cycle): <ul style="list-style-type: none"> • 26% if the woman is 35 years old • 19% if the woman is 40 years old • 9% if the woman is 45 years old 	There are diverse types of treatments for infertility, from the simplest to the most complex (Biologist /Embryologist)
	Emotional impact of infertility	On average, the success of these treatments is around 20–30% (Biologist /Embryologist) People facing difficulties conceiving felt different and inadequate. Undergoing treatments is very demanding and is related to depression and anxiety (Psychologist)
	What can we you do to protect your fertility? Avoiding: stress, tobacco, alcohol, low weight and obesity, pollution, drugs, sexual transmitted infections (Psychologist/ physician)	
4m56s	Protect your fertility This information does not replace the consultation of a doctor Research Team: Juliana Pedro & Mariana V. Martins	Protect your fertility (Psychologist/ Physician/Biologist)

answered the same questionnaire. All women who provided their email address at T0 (baseline) were invited to complete the survey via email 1 month (T1), 6 months (T2) and at 1 year (T3).

Ethical approval

This study was approved by the Ethical Committee of the University of Porto Faculty of Psychology and Education Sciences (Reference number: 4-03/2016) and conducted according to the Declaration of Helsinki for Medical Research Involving Human Subjects.

Data analysis

Descriptive statistics were conducted to describe the sociodemographic characteristics of the participants. The study variables are expressed as mean ± standard deviation. Little Test and Student's *t*-tests and Chi-square tests were used to explore the missing

mechanism and attrition analyses. To examine the between-group balance of participants in the IG and CG at each time point, we compared T0 sociodemographic characteristics and reproductive-project variables. To explore the effect of the intervention on FA variables and desired timing of pregnancy, we conducted repeated measures mixed ANOVAs to analyse the interaction between groups (CG and IG) and time (T0, T1, T2, T3). Post hoc tests using Bonferroni correction were performed to analyse the main effects. Greenhouse correction was used when sphericity was violated (Field, 2013). All analyses were conducted in SPSS, v.24 (IBM Corp., 2016). For these analyses, only participants with complete data on all time points were included.

A priori calculation of sample size in Gpower (Faul et al., 2007) indicated that a total of 24 women would be necessary to detect large effects (Cohen's $d = 0.75$) (80% power, 95% CI).

Results

Participant characteristics

From the 652 women assessed for eligibility, 210 were randomized and answered the baseline questionnaire (T0) of which 106 received the intervention and 104 were in the control group (Figure 1). At T1, 56 IG and

47 CG participants did not answer. At T2 and T3, 77 and 71 completed the questionnaire respectively. The number of women who participated in all time points (T0, T1, T2, T3) was 48 (IG = 21; CG = 27).

Table 2 presents the baseline characteristics. The mean age of participants was 28 ± 3.92 years old and they had been in a committed relationship for an

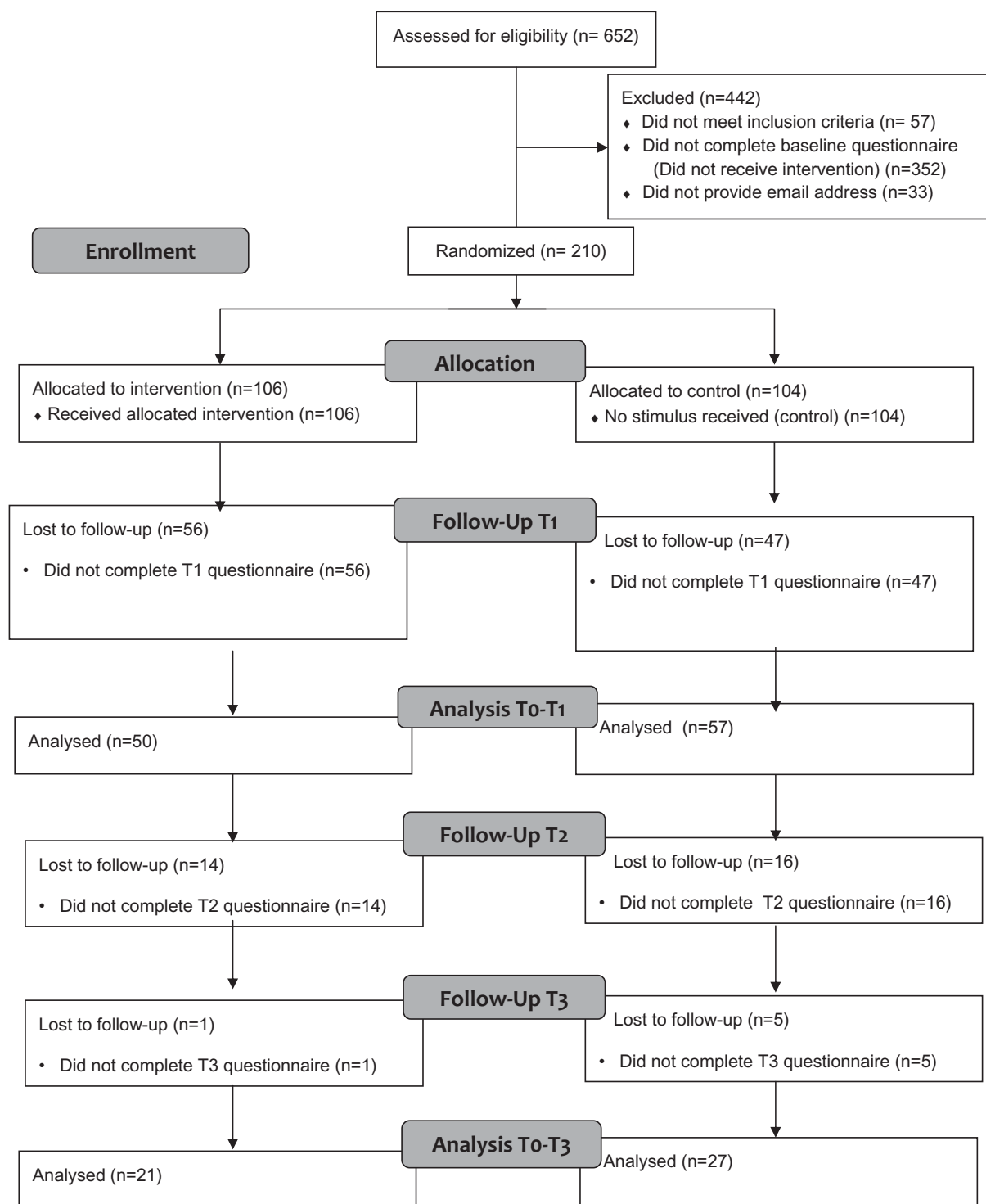


Figure 1. CONSORT flow chart of participants. T1, 1 month after the intervention; T2, 6 months after the intervention; T3, 1 year after the intervention.

Table 2. Sociodemographic characteristics of participants at T0 and differences in participants' characteristics between those lost to follow-up and T1, T2, T3 participants.

	All T0 participants (n = 210)	T0 participants lost at T1 (n = 103)	T1 participants (n = 107)	T0 participants lost at T2 (n = 133)	T2 participants (n = 77)	T0 participants lost at T3 (n = 139)	T3 participants (n = 71)
Age (mean \pm SD) ^a	28.17 \pm 3.92	27.72 \pm 3.98	28.61 \pm 3.84	27.74 \pm 3.96	29.91 \pm 3.77*	27.63 \pm 4.05	29.24 \pm 3.45**
Relationship length (months) (mean \pm SD) ^a	74.59 \pm 41.20	69.80 \pm 39.65	79.11 \pm 42.29	70.68 \pm 40.98	81.29 (40.98)	72.46 \pm 40.30	78.91 \pm 42.93
Education							
Basic school	4 (2%)	3 (3%)	1 (1%)*, c	3 (2%)	1 (1%)	3 (2%)	1 (1%)
Secondary/technical courses	31 (15%)	22 (21%)	9 (8%)	24 (18%)	7 (9%)	26 (19%)	5 (7%)
High school	175 (83%)	78 (76%)	97 (91%)	106 (80%)	69 (90%)	110 (79%)	65 (92%)
Desire to have children							
Yes, within next year	38 (18%)	21 (20%)	17 (16%)	27 (20%)	11 (14%)	30 (22%)	8 (11%)*, c
Yes, within next 3 years	118 (56%)	50 (49%)	68 (64%)	68 (51%)	50 (65%)	67 (48%)	51 (72%)
Yes, in the future	48 (23%)	28 (27%)	20 (19%)	35 (26%)	13 (17%)	38 (27%)	10 (14%)
I am not sure	6 (3%)	4 (4%)	2 (2%)	3 (2%)	3 (4%)	4 (3%)	2 (3%)
Actively trying to conceive							
Yes	44 (21%)	18 (18%)	26 (24%)	28 (21%)	16 (21%)	29 (21%)	15 (21%)
No	166 (79%)	85 (83%)	81 (76%)	105 (79%)	61 (79%)	110 (79%)	56 (79%)
Group							
Control Group	104 (50%)	47 (46%)	57 (53%)	63 (47%)	41 (53%)	68 (49%)	36 (51%)
Intervention Group	106 (50%)	56 (54%)	50 (47%)	70 (66%)	36 (47%)	71 (51%)	35 (49%)

^at-test; ^bchi-square; ^cchi-square Fisher exact.* $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$.

average of 6 years. The majority (83%) had a high school education and 19% reported that they wanted to have children in the next year, 56% in the next 3 years, 23% in the long-term, while 3% said they were unsure. Around 21% were actively trying to conceive at T0.

Preliminary missing data analyses with Little test ($\chi^2 = 1991.158$, $df = 1960$, $p = 0.307$) and absence of correlations > 0.40 between missing and study variables (Collins et al., 2001), indicated that missing items were completely random (MCAR). *t*-test and Chi-square tests conducted to explore differences between women who did not answer in T1, T2, T3 and participants who answered at each time period (Table 1) showed no significant differences between those who answered at T1 ($n = 107$) and those lost to follow-up at T1 ($n = 103$); between those who answered at T2 ($n = 77$) and those lost to follow-up at T2 ($n = 133$); and those who answered at T3 ($n = 71$) and those lost to follow-up in T3 ($n = 139$) with regards to relationship length, reproductive status (currently trying to conceive or not), desire to have children and intervention group. Those who did not respond at T1 were less educated compared to those who responded, and the T2 and T3 participants were older than those lost to follow-up. Baseline characteristics at each time point were similar between the IG and CG groups, except for higher education levels in women in the IG compared with CG ($p < 0.05$; see Supplemental Table S1).

Baseline FA and effect of intervention on FA levels

Mean levels of pre-intervention FA are presented in Table 3. Women estimated that the chance of conception during 1 year of trying was $83.35 \pm 14.42\%$ for a 25–30-year-old woman (only 9% of participants provided an answer in the correct range) and $62.48 \pm 19.58\%$ for a 35–40-year-old woman (19% of participants answered in the correct range). On average, women estimated that the chance of success of conception using treatment would be $59.34 \pm 20.92\%$ for a 35-year-old woman (10.5% of participants provided an answer in the correct range), 43.92 ± 18.89 for a 40-year-old woman (11.4% of participants answered in the correct range) and $30.74 \pm 18.64\%$ for a 45-year-old woman (16.7% answered in the correct range). The knowledge regarding infertility risk factors (10.94 ± 4.31 ; possible range: 0–18) and regarding infertility definition (5.51 ± 1.08 ; possible range: 0–8) was moderate.

Table 3. Intervention group (IG) and control group (CG) fertility awareness responses at T0, T1, T2, T3 (N = 48; CG = 27, IG = 21).

Variable, mean (SD)	Correct answer	Total sample (T0)	Intervention group (IG)				Control group (CG)				ANOVA (time × group)			Group			Time			Pairwise comparisons
			T0	T1	T2	T3	T0	T1	T2	T3	F	p	Eta ²	F	p	Eta ²	F	p	Eta ²	
Awareness of fertility issues																				
A woman and a man who regularly have unprotected intercourse during a period of 1 year:																				
How large is the chance that she will become pregnant if she is 25-30 years old?	70–79%	83.35 ± 19.42	85.14 ± 12.29	77.86 ± 21.01	73.43 ± 23.97	71.43 ± 18.65	75.93 ± 23.90	82.00 ± 22.30	78.30 ± 22.79	79.96 ± 23.17	4.72	0.006	0.093	0.146	0.704	0.003	2.08	0.117	0.043	IG: T0 > T3* CG: n.s.
How large is the chance that she will become pregnant if she is 35-40 years old?	50–59%	62.48 ± 19.58	64.29 ± 14.26	53.95 ± 19.57	54.81 ± 21.37	50.48 ± 19.68	55.00 ± 24.30	58.52 ± 21.74	54.82 ± 21.37	60.19 ± 20.78	4.76	0.006	0.094	0.131	0.720	0.003	1.92	0.138	0.040	IG: T0 > T3* CG: n.s.
Couples that undergo infertility treatment (one cycle):																				
What is the chance, on average, of becoming pregnant at age 35?	20–31%	59.34 ± 20.92	59.29 ± 20.81	46.67 ± 20.15	50.00 ± 22.69	47.48 ± 17.66	53.89 ± 21.23	59.81 ± 19.89	50.19 ± 23.64	52.22 ± 21.94	3.07	0.033	0.063	0.440	0.511	0.009	2.00	0.120	0.042	n.s.
What is the chance, on average, of becoming pregnant at age 40?	14-24%	43.92 ± 18.89	44.29 ± 17.27	30.10 ± 16.41	35.38 ± 21.24	34.05 ± 15.94	40.37 ± 19.51	41.11 ± 15.46	36.67 ± 20.94	40.19 ± 21.28	3.01	0.033	0.061	0.675	0.416	0.014	2.82	0.041	0.058	CG:n.s. IG: T0 > T1*
What is the chance, on average, of becoming pregnant at age 45?	4–14%	30.74 ± 18.64	29.52 ± 17.24	19.24 ± 13.90	24.10 ± 18.89	21.76 ± 12.62	26.85 ± 17.98	26.48 ± 15.86	26.70 ± 21.21	27.74 ± 18.72	1.64	0.189	0.034	0.647	0.425	0.014	1.63	0.186	0.034	n.s.
Infertility risk factors (range 0–18)		10.94 ± 4.31	10.67 ± 3.69	14.24 ± 3.56	13.38 ± 3.65	13.62 ± 3.20	11.41 ± 4.35	13.07 ± 3.83	12.89 ± 3.93	12.74 ± 4.21	1.50	0.226	0.031	0.222	0.639	0.005	11.57	0.000	0.201	CG:n.s. IG: T0 < T1 < T2 > T3*
Infertility Definition (range 0–8)		5.51 ± 1.08	5.33 ± 0.91	5.67 ± 1.43	5.67 ± 1.24	5.44 ± 1.36	5.89 ± 1.22	5.89 ± 1.28	5.81 ± 1.21	5.44 ± 1.31	0.85	0.468	0.018	0.640	0.428	0.014	1.54	0.208	0.032	n.s.

Significant interaction effects (group \times time) were found for all FA variables tested at pre-test (T0) and post-test (T1) (infertility definition, infertility risk factors, chance of pregnancy using fertility treatment if the woman is 35, 40 and 45 years old and chance of spontaneous pregnancy if the woman is 25–30 and 35–40) (data not shown). When looking at intervention effects over time (Table 3), the repeated measures ANOVA analyses revealed significant interaction effects between group (video vs no stimulus) and time for four out of seven variables tested. These effects were found for knowledge of the chance of pregnancy at age 25–30 ($F(2.49, 114.97) = 4.72, p = 0.006; \eta^2 = 0.093$) and 35–40 years old ($F(2.54, 116.94) = 4.76, p = 0.006; \eta^2 = 0.094$). Main effects of time and group were not significant. For these two variables, pairwise comparisons using Bonferroni correction indicated that, in IG, the chance of pregnancy was significantly lower at T3 than at T0; this difference was not significant in the CG. Interaction effects between exposure to video and time were found also for knowledge regarding the chance of pregnancy with fertility treatments at age 35 ($F(2.85, 130.87) = 3.07, p = 0.033; \eta^2 = 0.063$) and 40 years old ($F(3, 138) = 3.01, p = 0.033; \eta^2 = 0.061$). A main effect of time was found for knowledge of chance of pregnancy with fertility treatments at age 40 ($F(3, 138) = 2.82, p = 0.041; \eta^2 = 0.058$); pairwise comparisons indicated differences in participants' answers only between T0 and T1 for the IG and not for CG. Interaction effects were not found for knowledge regarding the chance of pregnancy with fertility treatments at age 45, infertility risk factors and infertility definition. A main effect of time was found for infertility risk factors ($F(1, 46) = 11.57, p < 0.001; \eta^2 = 0.201$) but the interaction effect was not significant.

Effect of intervention on intentions to adopt fertility-protective behaviours and desired timing of pregnancy

Supplementary Table S2 presents the results for the effect of the intervention on intentions to adopt fertility-protective behaviours. The analyses showed non-significant main effects (time and group) and no interaction effects (group \times time) in the intentions to adopt fertility-protective behaviours related to lifestyle and related to the reproductive project (seeking specialized medical advice; having children earlier than planned) both from T0 to T3 ($n = 28$ analysed; CG = 13, IG = 15). No significant interaction effects ($F(2.06, 51.62) = 0.373, p = 0.697$) and no main effect of group ($F(1, 25)$

$= 0.091, p = 0.895$) were found among those who were not yet pregnant/had not delivered a child/were not currently trying to conceive) from T0 to T3; however a main effect of time was found ($F(2.06, 51.62) = 0.353, p = 0.019$).

Discussion

This study seems to indicate that this video intervention may partially increase FA in the long term (i.e. 1-year post-intervention). Our results showed that, in general, pre-intervention FA levels were low to moderate. About 9% provide correct answers regarding the chance of spontaneous pregnancy at 25–30 years old, and 19% at 35–40 years old, which is a smaller proportion compared to Lampic et al.'s (2006) results (17 and 27%, respectively), suggesting that women in our sample were less knowledgeable. Women's estimation of chances of success with fertility treatment at age 45 are 'optimistic' at 30%, when evidence shows that rates are between 4 and 14% (Conselho Nacional de Procriação Medicamente Assistida, 2012). This is consistent with previous studies showing that young people had unrealistic beliefs about success rates of medically-assisted reproduction treatments (Daniluk & Koert, 2013, 2015; Fotopoulou et al., 2015; Holton et al., 2016; Maheshwari et al., 2008). These results might indicate the lack of access to family planning services or preconception appointments as well as the influence of social media depictions of successful pregnancies in older women without an awareness of the use of egg donation in many cases. Furthermore, contrary to the findings of a recent systematic review (Pedro et al., 2018), women in our sample reported moderate knowledge regarding infertility risk factors. It might be that health campaigns targeted adolescents and young adults in schools and universities regarding risk factors for other health conditions (such as cancer, cardiac diseases, diabetes); in this way, they might be more aware to these common risk factors (tobacco use, nutrition) compared with our sample, slightly older and not currently engaged in educational settings.

Results showed that 1 year later, FA levels remained significantly higher than before the intervention in only four of seven FA variables tested. This result should be interpreted with caution, due to the small sample size available. Previous studies have found a decrease in FA levels at follow-up. Daniluk and Koert (2015) found a decrease in FA levels 6 months after exposure to the online educational intervention compared with the post-test; Maeda et al. (2018) found

also a decrease in FA levels 2 years later (compared with post-test) although the levels remained significantly higher than at study inclusion. In our study, knowledge regarding age-related fertility decline seemed to be retained at follow-up but knowledge about fertility risk factors was not, which is consistent with the Daniluk and Koert (2015) study. The selective retention of specific topics 1 year after exposure to the intervention could indicate that women are more receptive to particular fertility topics. It may be that anxiety plays a role in the retention of fertility information. For example, information about infertility risk factors and infertility definition might increase anxiety, as suggested by a previous study (Maeda et al., 2016); whilst information about age-related fertility decline and chance of pregnancy might not, given our sample characteristics (i.e. partnered young women who may see themselves pursuing a pregnancy in the near future). More studies are needed to evaluate the effect of educational interventions using long-term follow-up designs and exploring the effect that particular topics have on emotional responses and on help-seeking behaviours (medical/non-medical). Previous research has shown that receiving personalized fertility information was perceived as a trigger to act on their reproductive plans (Sylvest et al., 2018).

To the best of our knowledge, this is the first RCT study to explore the effect of a video-based FA intervention on intentions to adopt fertility-protective behaviours. Results showed no differences between the IG and CG on the intentions to adopt fertility-protective behaviours such as not smoking or not drinking alcohol or seeking specialized medical care. These findings might reflect that knowledge on its own is not sufficient to stimulate action regarding health behaviours. Rather, health-based behaviour change depends on perceived susceptibility and severity of the disease, benefits and barriers of preventive behaviours, cues to action and self-efficacy (Champion & Skinner, 2008; HBM, Hochbaum et al., 1952). It might be that our video did not create a sufficient perceived threat of infertility or strategies to overcome fertility problems, indicating that future fertility education tools need to be specific about the health-based behaviours desired, with emphasis on strategies for and benefits of change (Whittingham et al., 2008). Evaluating the effect of FA interventions on these variables (self-efficacy, barriers and benefits) and exploring the role of moderators/mediators could provide relevant information on how to best target and tailor fertility educational efforts. In a previous study, the provision of fertility information was found to increase

the perception of infertility as a threat (Boivin et al., 2018) and this perceived threat of infertility was associated with higher intentions to anticipate childbirth (Pedro et al., 2020). In addition, few women in our sample were engaged in behaviours that are considered risk factors for infertility (e.g. smoking), which might result in lack of perceived susceptibility for infertility in the present and future.

Our study showed that the educational video intervention did not have an effect on the desired timing of pregnancy. The 1-year follow-up period might be too short to detect changes in reproductive decisions and behaviour. For example, as more than half of our sample stated that they desired to have children in the next 3 years or in longer-term suggests that a longer follow-up period is necessary to measure this variable. Only one study has explored this outcome and found partnered women in the IG accelerated child-bearing in comparison to those CG (Maeda et al., 2018). In addition, the high attrition rates in long-term follow-up designs as shown in our study and also in Maeda et al.'s (2018) study imposes serious barriers to effectively test behaviours over time. Although no significant differences were found regarding age between IG and CG in each time point, participants lost at follow-up were significantly younger than those who participated at all time points, which might have introduced some bias to the results.

A limitation of our study was the high attrition rate, which had an impact on statistical power, thus we cannot assume the generalizability of the results. However, analysing only the available data might be a better option than using imputed data, in the case of MCAR (which we found for our sample) (Higgins et al., 2011). In addition, we found that attrition did not affect the balance between IG and CG, suggesting that differences between groups were not associated with attrition. However, we must consider that those lost at follow-ups were younger and may perceive themselves as having a longer reproductive lifespan and being more distant from the parenthood project, which may partially explain their lack of interest in continuing in the study. In addition, participants recruited online may feel less committed and tend to participate less in follow-up, however we do not have available data to test this theory. In addition, the CG did not receive any stimulus, which might suggest that those in the IG experienced a higher 'benefit' for participating. Future studies should explore the reasons for high attrition rates more extensively as well as the effect of an FA video with other intervention

formats such as pamphlets or personalized oral information provided in-person.

Conversely, this study has several strengths that should be highlighted. Very few randomized controlled trials have been conducted to evaluate the effectiveness of FA interventions (for a review see García et al., 2018) and from those only two had long-term follow-up (García et al., 2016; Stern et al., 2013). This is the first RCT study testing the effectiveness of a video educational intervention focussed on currently childless, partnered women who wish to have children. This educational video was developed using evidence-based knowledge and was reviewed by a multidisciplinary team specialized in reproductive health and infertility. Low FA might be a factor contributing to higher risk of not fulfilling parenthood desires, which has been related to poor mental health outcomes (sustained child wish) (Gameiro et al., 2014), which means that this group would benefit from fertility education. In this sense, the results of this study might be an opportunity to reflect on fertility education tools, formats and ideal timing to receive fertility education. Previous studies delivering general information regarding fertility also found a decrease in fertility knowledge over time (e.g., Daniluk & Koert, 2015; Maeda et al., 2018), indicating that delivering general information rather than personalized fertility information targeted to their individual circumstances and desires might not be the most effective strategy for all populations. Since previous studies found that fertility education should be targeted according to participants characteristics (Pedro et al., 2018), personalized and face-to-face education interventions (e.g., Stern et al., 2013) and delivered by trained healthcare professionals (Delbaere et al., 2020) might result in high engagement and less attrition in fertility education studies, and suggested as the best way to manage emotional reactions to this sensible topic. Introducing fertility education in school curricula (Harper et al., 2017) might also have an impact on raising FA and result in higher engagement in reproductive planning. Future studies should explore the role of moderating variables to know to whom and in what circumstances what strategies work better. In summary, people's low FA and postponement of family formation in high-income countries is of public health concern. Given the importance of this issue for reproductive health, an effort should be made by educators, professionals and academics to develop and test different educational interventions to promote fertility awareness and informed fertility decision-making and reproductive planning.

Trial registration

Trial registered at ClinicalTrials.gov: Couples Fertility and Pregnancy Awareness (CFPA) (number NCT02813993).

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ORCID

Juliana Pedro  <https://orcid.org/0000-0003-1959-4921>
Joana Fernandes  <https://orcid.org/0000-0003-3256-8277>
Alberto Barros  <https://orcid.org/0000-0002-8700-3698>
Maria E. Costa  <https://orcid.org/0000-0002-9573-5784>
Lone Schmidt  <https://orcid.org/0000-0002-9518-1734>
Mariana V. Martins  <http://orcid.org/0000-0001-6489-0290>

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