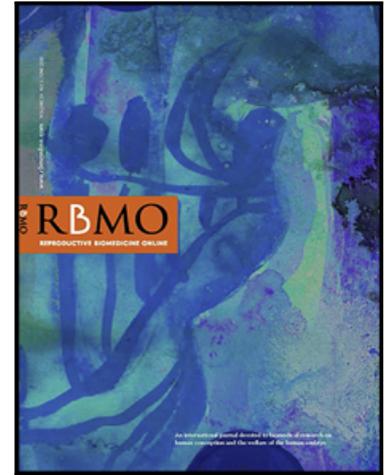# Journal Pre-proof

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Effectiveness of fertility health awareness strategies on fertility knowledge and childbearing: a randomized controlled trial

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Abstract

Research Question: What is the effect of Fertility Health Screening (FHS) and Fertility

Awareness Tools (FAT) on parenthood intentions, as measured by the wife's intended age at

first birth compared to no intervention, at six months post-randomization?

Design: This was an effectiveness-implementation hybrid type I trial with a multicenter three-

arm parallel group open-label randomized controlled trial (RCT). Married Singaporean

couples with wives aged between 25 and 34 years were randomized to FHS, FAT or no

intervention. The primary outcome was the wife's intended age at first birth. Secondary outcomes included fertility knowledge, attempts to conceive, pregnancy, and pursuing further fertility screening and/or treatment at six months post-randomization.

Results: A total of 778 couples were randomized to the FHS (n = 226), FAT (n = 238), and control (n = 314) groups, respectively. Both FHS and FAT did not result in a significant difference in the primary outcome of the wife's intended age at first birth at follow-up (0.07 years (95% CI: -0.17 to 0.32) and -0.01 years (95%CI: -0.25 to 0.23), respectively). However, both interventions significantly increased fertility awareness in both wives (mean increase in Cardiff Fertility Knowledge Score (CFKS) score = 0.38 (95% CI: 0.03 to 0.73) for FHS and 0.44 (95%CI: 0.10 to 0.79) for FAT and husbands (mean increase in CFKS score = 0.41 (95% CI: 0.04 to 0.78) for FHS and 0.71 (95% CI: 0.35 to 1.10) for FAT.

Conclusion: Both FHS and FAT did not significantly modify parenthood intentions at six months post-randomization.

Keywords: Fertility screening, education, age related fertility decline, intervention

Introduction

Since 1950, the global total fertility rate has more than halved (Bhattacharjee et al., 2024). In Singapore it has fallen below 1.0 for the first time in 2023 (Department of Statistics Singapore, 2024). The median age at marriage and first birth have been increasing, with more couples having no or only one child (Ministry of Social and Family Development, 2024), despite the implementation of marriage and parenthood measures (Government of Singapore, 2020).

From a medical perspective, public awareness of age-related fertility decline and limitations of assisted reproductive technology (ART) is low. Age-related female fecundity and ART success rates has been consistently overestimated in fertility awareness surveys (Chan et al., 2015; Kudesia et al., 2017; Lampic et al., 2006; Mortensen et al., 2012; Peterson et al., 2012; Sørensen et al., 2016; Strategy Group, Prime Minister's Office, 2022, 2017; Virtala et al., 2011). While fertility education in various forms is effective in increasing fertility awareness (Conceição et al., 2017; Daniluk and Koert, 2015; Maeda et al., 2016; Wojcieszek and Thompson, 2013), there is less evidence of its ability to modify childbearing decisions and behaviour (Maeda et al., 2016; Pedro et al., 2022). Providing age-related fertility information significantly reduced the ideal age at first childbirth and increased probability of marriage before age 30 among undergraduates in Singapore (Tan et al., 2023). However, this was measured immediately post-intervention, and the sustainability and translation to births is uncertain. Only one randomized controlled trial (RCT) found that online fertility education accelerated the timing of new births within 12 months partnered individuals, compared to receiving information on folic acid during pregnancy or governmental financial and social support during pregnancy and childbirth (Maeda et al., 2018).

Medical screening is another potential intervention. Women reported benefits of attending a fertility assessment clinic in decision-making six years later (Koert et al., 2022). Gaps remain in the understanding of the comparative effectiveness of these different types of interventions, especially their effect on parenthood intentions and/or outcomes. In addition, few studies measure fertility intentions, and most of those which do so evaluate outcomes immediately or shortly after the intervention (Fooladi et al., 2018; Kariman et al., 2016).

Despite the biological realities, childbearing remains a personal decision that is affected by a combination of employment, financial, social, personal and psychological

factors (Kearney and White, 2016). We therefore designed two interventions incorporating fertility education, personalized fertility information, and behavioural change components anchored in behavioural change theories with very different resource implications. These two interventions (Fertility Health Screening (FHS) and Fertility Awareness Tools (FAT)) were compared to no intervention (control) for their effects on knowledge, attitudes and practice around childbearing. This was an effectiveness-implementation hybrid type I trial, which included understanding potential barriers and facilitators as a secondary aim to inform future implementation efforts(Chan et al., 2022). The implementation results are published separately (Zainal et al., 2025). Here we report the RCT results on effectiveness of the two interventions at six months post-randomization.

Materials and methods

Study design

This was a multicentre, three-arm parallel group open label effectiveness-implementation hybrid type I RCT to evaluate the effectiveness of FHS and FAT compared to no intervention (control). Hybrid studies assesses both effectiveness and implementation outcomes concurrently, and type I studies focus primarily on effectiveness while gathering information on implementation (Curran et al., 2012). The detailed trial protocol has been published previously (Chan et al., 2022). This study was approved by the SingHealth Centralized Institutional Review Board (2019/2095). All participants gave verbal consent to be enrolled into the RCT and those randomized to the FHS arm additionally gave written informed consent for the screening tests involved. This report follows the Consolidated Standards of Reporting Trials (CONSORT) 2010 guidelines (Schulz et al., 2010).

Participants

The inclusion criteria were 1) married heterosexual couples, 2) both partners were Singapore Citizens or permanent residents, 3) the wife was 25-34 years old at time of recruitment, and 4) both partners were agreeable and able to complete the study procedures. Exclusion criteria were 1) already had children, including from previous marriages, 2) currently pregnant, 3) currently undergoing or had previously undergone any fertility evaluation and/or treatment, 4) self-reported history of previous ectopic pregnancy in the wife, or 5) one or both partners unable to complete a self-administered questionnaire in English. Participants were recruited through various open recruitment strategies, including publicity within healthcare institutions (posters, emails to staff, and postings on institutional internal webpages) and to the public (newspaper articles, social media, posters in selected public venues (e.g. sports venues, community centres, libraries) and housing blocks, and outreach talks).

Interventions

The trial protocol contains detailed information about interventions, including intervention mapping steps for the behavioural change components (Chan et al., 2022). The components of both interventions are summarized here.

The FHS intervention comprised an Anti-Müllerian hormone test, semen analysis, consultation with a doctors, and standardized reproductive counselling by a trained nurse. The standardized reproductive counselling included a discussion of the couple's reproductive plans, education on age-related fertility decline and limitations of ART (reinforced with a printed fertility educational brochure (Supplementary file 1)), and advice on optimal reproductive timing and when to seek further help. The doctors followed an internally developed counselling guide to ensure standardized interpretations and recommendations

provided to couples based on their fertility screening results. The nurse also followed a standardized counselling guide (Supplementary file 2).

The FAT intervention comprised viewing an online video designed to deliver key fertility knowledge and promote positive attitude towards having children and timing to do so, completing an adapted tailored fertility communication tool in the form of a validated self-administered multifactorial questionnaire to help women make informed decisions about their lifestyle and/or seek medical advice (fertility status awareness tool (FertiSTAT) (Bunting et al., 2013), and downloading a copy of the fertility educational brochure (same as in FHS).

Both intervention groups also received an email with 3 key points on age-related fertility decline and limitations of ART at 4 months post-randomization to reinforce what was delivered in the main interventions. The control group received no intervention.

Data collection

All couples completed a self-administered baseline questionnaire sent via email before randomization (Supplementary file 3 and 4). The questionnaire collected information on their baseline fertility knowledge, parenthood intentions, conception efforts, attitudes and beliefs towards childbearing, lifestyle and medical history relevant to fertility and sociodemographic details. At 6 months, couples were sent a similar follow-up questionnaire to measure the changes in the primary and secondary outcomes (Supplementary file 5). Details of questionnaire design were described previously (Chan et al., 2022) but in brief, questions related to the primary outcome were adapted from the Swedish Fertility Awareness Questionnaire (Lampic et al., 2006), fertility knowledge was measured using the 13-item CFKS (Bunting et al., 2013), attitudes and beliefs rated on a 5-point Likert scale, and lifestyle and fertility-related medical history adapted from FertiSTAT (Bunting and Boivin, 2010).

Outcomes

Primary Outcome

Intended age at first birth was measured using the question "At what age do you plan to have your first child born?", which had the options "At ____ years old" and "no plans at the moment". Intended age was valid only if participants answered 'yes' to a previous question "Do you plan to have children at some point in your life?" (yes, no).

Secondary outcomes

Fertility knowledge was measured based on the percent of correct answers on the 13-item CFKS. Attempts to conceive was elicited with the question "Are you actively trying for a baby now?", pregnancy is self-reported pregnancy by at least 1 partner, and pursuing further fertility screening and/or treatment based on an affirmative answer to the questions "Have you consulted a doctor for a thorough fertility assessment (apart from any screening provided in this trial)?" and "Are you undergoing any fertility treatment now?", respectively.

As an exploratory analysis, we categorized the change in intended age at first birth into increased, decreased, no change, or missing, utilizing information from both the numeric response (age in years) and the option "no plans at the moment" to the primary outcome question (Table S1). In addition, we also created a composite 'proceptive behaviour' outcome of either decreased intended age at first birth, pregnant at 6 months post-randomization, or initiation in active conception efforts to capture overall change in procreative intention and efforts.

Sample size

Based on previous studies of fertility knowledge interventions which demonstrated 0 to -0.8 years decreases in a women's intended age at first birth (Daniluk and Koert, 2015; García et al., 2016; Maeda et al., 2016; Stern et al., 2013; Wojcieszek and Thompson, 2013), the planned sample size of 1200 (352 in each intervention arm and 496 in the control arm) was calculated based on a hypothesized difference of 0.5 years (SD = 2 years) in the wife's intended age at first birth, with 80% power at 2-sided 5% significance level, assuming comparisons of 2 intervention groups with control, accounting for 30% dropout and another 140 for a pilot phase.

Randomization and blinding

Stratified block randomization by the intervention arms to control group ratio of 5:5:7 and by the wife's age group (25-29 years and 30-34 years) was performed by a statistician independent of the study team. The list was uploaded to the Research Electronic Data Capture (REDCap) randomization module, thereby concealing allocation till the point of randomization. Clinical research coordinators enrolled participants and assigned them to the interventions.

Participants, research coordinators, and healthcare professionals administering the interventions could not be blinded due to the nature of the intervention. Only the study statistician was blinded to the allocation.

Study procedures

Couples who gave verbal consent were enrolled and sent the baseline questionnaires via email. Upon return of the completed questionnaires, they were randomized and informed of the group assignment. The interventions were administered to those randomized to FHS and FAT, and a reminder email sent to them at 4 months post-randomization. At 6 months

post-randomization, all participants were sent the follow up questionnaire via email. Couples

were compensated SGD20 and SGD80 for return of the baseline and follow-up

questionnaires, respectively, and those randomized to FHS received SGD50 for each visit.

Statistical methods

To determine the effect of the interventions compared to control, primary and

secondary outcomes at 6 months post-randomization were analyzed using linear, logistic or

multinomial regression as appropriate, controlling for baseline values of the corresponding

outcome. The estimated odds ratios and beta coefficients were reported along with their 95%

confidence intervals to assess the treatment effects of the two interventions compared to the

control group. We analyzed data for both husband and wife separately, except for pregnancy

at follow up (self-reported by at least one partner) and the composite outcome (using the

wife's response). All analyses were conducted on an intention-to-treat (ITT) and per-protocol

(PP) basis. To assess the potential for attrition bias, we also compared the characteristics of

couples who dropped out with those who completed the trial.

Results

A total of 1006 couples were assessed for eligibility between 21 January 2021 and 29

June 2023. 778 were eventually randomized and 637 completed the study per-protocol, with

the last follow up ending on 15 March 2024 (Figure 1). All couples were screened against the

eligibility criteria before enrollment. However, some became ineligible between giving

consent and randomization (e.g. became pregnant), were found to be ineligible incidentally

(e.g. had children before), or had previously unanticipated medical circumstances which

might affect fertility (e.g. husband taking risperidone). The study recruitment ended in June

2023 even though the target sample size of 1200 was not reached, due to difficulties in recruitment, partly due to the COVID-19 pandemic, so that the study could be completed within the stipulated timeline in agreement with the sponsor.

<u>ITT analysis</u>

Description of sample

The baseline characteristics of participants included in the ITT analysis are shown in Table 1. The characteristics of the couples were well-balanced among the 3 groups. A total of 137 couples (17.6%) did not complete the 6-month follow-up questionnaire. A greater proportion of dropouts were Malays or Indians, did not attend university, and had lower incomes (Table S2).

Primary Outcome: Intended Age at First Birth

The mean intended age at first birth for the wives at baseline was 31.2 years across all three arms. Neither intervention resulted in a significant change in the mean intended age at first birth at follow-up (beta = 0.07 years, 95% confidence interval (CI): -0.17 to 0.32) for FHS and (beta = -0.01 years, 95% CI: -0.25 to 0.23) for FAT (Table 2). When this was categorized into decreased, no change or increased, neither intervention was associated with a decrease compared to no change (OR = 0.54 (95% CI: 0.32 to 0.93) for FHS and OR = 0.89, 95% CI: 0.53 to 1.48) for FAT (Table 2). Similar trends were observed in the husbands.

Fertility awareness

Both interventions significantly increased fertility awareness compared to control in both wives (mean increase in correct answers on the CFKS = 2.91% (95% CI: 0.23% to 5.60%) for FHS and 3.42% (95% CI: 0.75% to 6.09%) for FAT) and husbands (mean

increase in correct answers on the CFKS = 3.18% (95% CI: 0.35% to 6.01%) for FHS and

5.49% (95% CI: 2.67% to 8.30%) for FAT (Table 2).

Conception efforts

At follow-up, neither intervention was associated with attempting to conceive or

becoming pregnant. Both interventions had similar odds of starting to conceive vs no change

(OR 1.23, 95% CI: 0.70 to 2.17). The odds of becoming pregnant were 1.07 (95% CI: 0.65 to

1.74) for FHS and 1.29 (95% CI: 0.80 to 2.07) for FAT. Similarly, the interventions were also

not significantly associated with the likelihood of couples pursuing further fertility screening

and/or treatment (OR = 0.67 (95% CI: 0.39 to 1.11) for FHS and 1.23 (95%CI: 0.78 to 1.95)

for FAT) (Table 2). Taken together, the proportion of couples who became pregnant, started

trying to conceive and/or had a decrease in intended age at first birth were similar across the

3 arms (45.4%, 41.3% and 49.2% for control, FHS and FAT, respectively).

PP analysis

The baseline characteristics of participants included in the PP analysis are shown in

Table S3. Overall, all the results of the PP analysis were similar to those of the ITT analysis

(Table S4).

Discussion

There was no difference in the wife's intended age at first birth in both FHS and FAT groups compared to control. However, fertility awareness was significantly increased in both intervention groups. Other secondary outcomes (attempts to conceive, pregnancy, and pursuing further fertility screening and/or treatment) were not significantly different between the groups.

There are several strengths to this study. To the best of our knowledge, this was the first RCT of interventions combining both personalized fertility information and behavioural change strategies (Chan et al., 2022). Next, we recruited married couples as a unit and administered the interventions to both partners, increasing the likelihood of desired childbearing outcomes. Finally, we assessed outcomes at 6-months to measure sustained effects, which hopefully are more likely to lead to actions.

There are also several limitations. Firstly, we did not reach the target sample size due to recruitment difficulties during the COVID-19 pandemic. This was compounded by higher-than-expected rates of missing data in the primary outcome, either due to choosing 'no plans at the moment' or omission of a numeric value. We addressed this by categorizing the primary outcome, which would utilize the option 'no plans at the moment', but we still did not detect a difference. Secondly, there was likely selection and attrition bias. Couples who enrolled in the study were likely those planning to have children, more interested in and open to fertility screening than their peers. Of note, the proportion of participants who were Chinese (86.4%) was higher than that in Singapore's general population of 74.1% (Department of Statistics Singapore, 2021). Furthermore, proportionately more Malays and Indians dropped out of the study. The results would therefore be more generalizable to Chinese than Malays and Indians. More research is needed to understand the ethnic differences in childbearing perspectives affecting acceptability of the interventions. Thirdly,

the primary outcome measurement might not be sensitive enough to pick up smaller differences (months). Other ways of probing fertility intentions could be explored in future. Fourthly, lack of blinding could have biased outcome assessment, but this was inevitable and unlikely as there was a lag of a few months between the intervention and outcome assessment. Lastly, the study was conducted during the COVID-19 pandemic, which might have moderated the intervention effects. For example, financial, employment and other stresses resulting from the pandemic might have nullified any effect the intervention had on increasing fertility intentions.

There remains little evidence of effective interventions for modifying parenthood intentions. Maeda *et al*. found that an online fertility brochure accelerated new births in partnered women. However, replication of the results is needed due to attrition in all study arms (Maeda et al., 2018). Kariman *et al*. found an increase in childbearing intention along with increases in knowledge, attitudes and perceived behavioural control after an intensive theory-based intervention (Kariman et al., 2020). However, the intervention is intensive, and implementation may be challenging. The interventions in these two studies were different from each other and mirror only part of the components in our interventions. The differences in results may therefore be explained by other factors such as differences in study population, context and measurement. Another cluster RCT is underway to evaluate an intervention comprising four 60-minute trainings based on TPB components in 30 Iranian couples in the pre-contemplation or contemplation stage of childbearing (Moridi et al., 2024). More research is needed to explore the role and optimal way to target behavioural constructs in addition to fertility awareness for optimizing fertility decision making.

The interventions in our study increased fertility awareness, consistent with other studies (Conceição et al., 2017; Fooladi et al., 2018; García et al., 2016; Maeda et al., 2016; Pedro et al., 2022). Since knowledge is a prerequisite (though not a sufficient condition) for

intention and subsequently behaviour, it would still be valuable to implement interventions that increase fertility awareness. They can support informed decision making and may modify short-term fertility intentions (Dougall et al., 2013; Everywoman, 2013; Harper et al., 2017). Various implementation approaches have been explored, from simple information brochures, websites, videos, to counselling (Conceição et al., 2017; Daniluk and Koert, 2015; Fooladi et al., 2018; García et al., 2016; Maeda et al., 2016; Pedro et al., 2022; Wojcieszek and Thompson, 2013). With technology, this can be delivered in a more personalized and acceptable way at scale, such as using chatbots (Maeda et al., 2020). Tailored fertility education, giving additional focus on questions women got wrong in the pre-test, has been found to be more effective than non-tailored education or controls in increasing fertility knowledge (García et al., 2016). There are also arguments to tailor fertility education to different groups based on their reproductive intentions (Grace et al., 2022). Implementation feasibility would also influence the most appropriate approach.

Interestingly, while women were on average almost 30 years old in our study, and the intended age at first birth about 31 years, yet about 60% had not started procreative efforts. This suggests that couples underestimated the time it takes to conceive, which warrants continued research to improve ways of addressing, including designing and testing theory-based interventions.

In conclusion, both FHS and FAT, which incorporate generic and personalized fertility information and behavioural change components, significantly improved fertility knowledge at six months post-randomization. However, parenthood intentions, efforts and pregnancy rates were not (yet) significantly improved. We will be reporting the within-trial implementation outcomes and potential barriers and facilitators to implementing these interventions separately, and tracking actual births at two years post-randomization using administrative data.

Role of the Funder

The funder is apprised in the study design, interpretation of data and writing of report together with the study investigators, and involved in the decision to submit reports for publication.

Disclosures

All authors declare no conflict of interest.

CRediT Authorship Contribution Statement

SL Chan: Conceptualization & methodology, data curation & validation, project administration, supervision, writing (original draft and review & editing)

J Thumboo: Conceptualization & methodology, supervision, writing (review & editing)

J Boivin: Conceptualization & methodology, writing (review & editing)

SJ Zhan: Formal analysis, writing (review & editing)

SE Saffari: methodology, formal analysis, writing (review & editing)

SR Yeo: Conceptualization, writing (review & editing)

JKY Chan: Supervision, writing (review & editing)

CW Ku: Supervision, writing (review & editing)

KH Chua: Resources, investigation, supervision, writing (review & editing)

SL Yu: Resources, investigation, supervision, writing (review & editing)

Data sharing statement

The data underlying this article cannot be shared publicly for the privacy of individuals that participated in the study. The data will be shared on reasonable request to the corresponding author.

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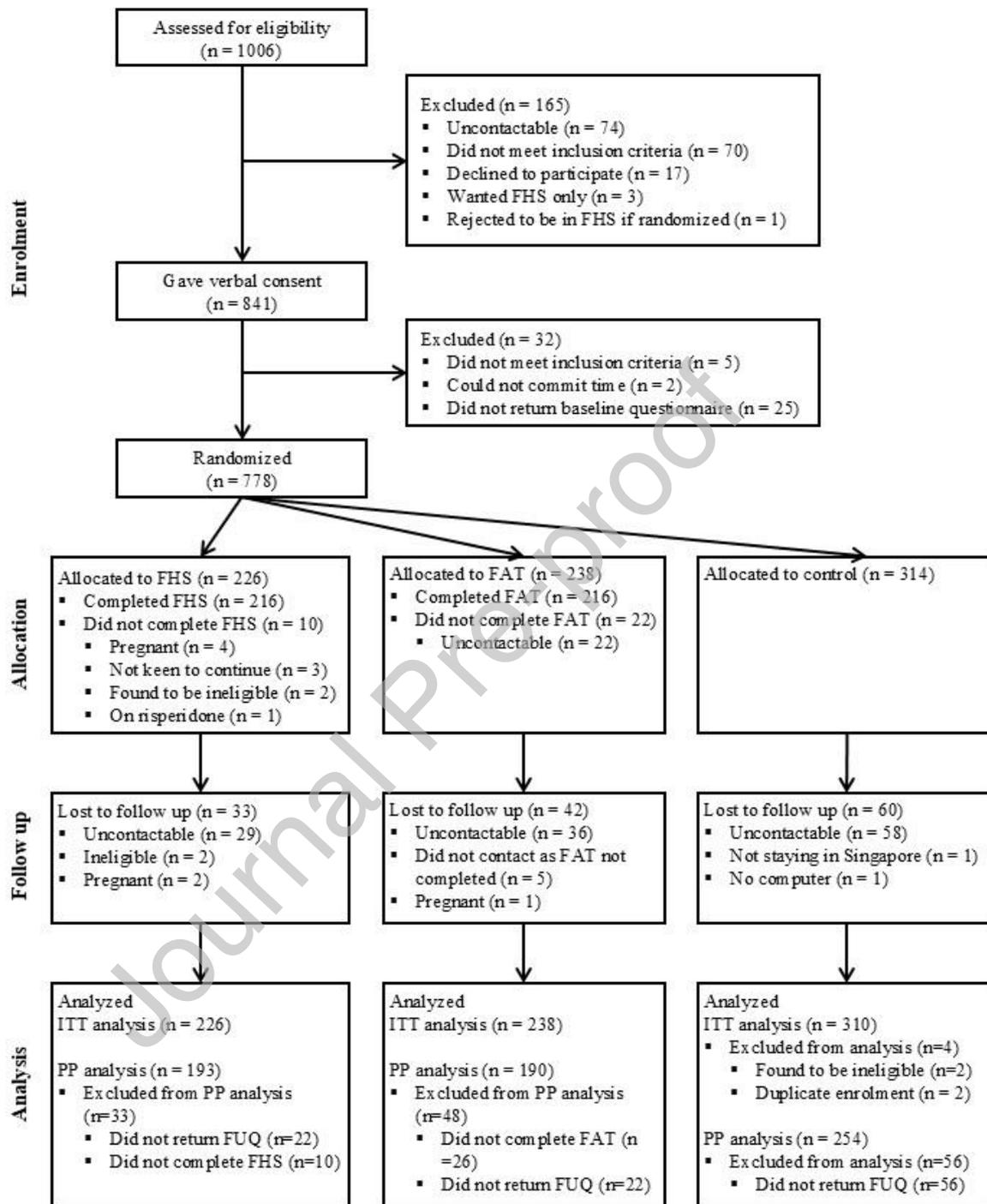
Legend to figure

Figure 1   CONSORT diagram

FAT: fertility awareness tools, FHS: fertility health screening, FUQ: follow up questionnaire, ITT: intention to treat, PP: per protocol

There were couples ineligible at various points in the process as they were found to have evidence of fertility issues at those points in the trial. 1 couple in the FHS group discontinued as the husband was on risperidone, which could affect fertility.

Tables

Table 1   Baseline characteristics for participants included in the intention to treat analyses

Characteristic	Control (n = 310)		FHS (n = 226)		FAT (n = 238)	
	Husband	Wife	Husband	Wife	Husband	Wife
Age, mean (SD)	31.3 (3.3)	29.8 (2.3)	31.4 (3.2)	29.6 (2.3)	31.4 (3.3)	29.7 (2.4)
Ethnicity, n (%)						
Chinese	262 (84.5)	265 (85.5)	201 (88.9)	204 (90.3)	198 (83.2)	207 (87.0)
Malay	23 (7.4)	23 (7.4)	4 (1.8)	6 (2.7)	20 (8.4)	13 (5.5)
Indian	15 (4.8)	13 (4.2)	15 (6.6)	10 (4.4)	13 (5.5)	12 (5.0)
Others	10 (3.2)	9 (2.9)	6 (2.7)	6 (2.7)	23 (3.0)	6 (2.5)
Religion, n (%)						
No religion	95 (30.6)	82 (26.5)	78 (34.5)	71 (31.4)	76 (31.9)	73 (30.7)
Christianity	80 (25.8)	87 (28.1)	63 (27.9)	62 (27.4)	68 (28.6)	62 (26.1)
Buddhism	65 (21.0)	76 (24.5)	42 (18.6)	53 (23.5)	46 (19.3)	59 (24.8)
Islam	30 (9.7)	29 (9.4)	11 (4.9)	9 (4.0)	18 (7.6)	17 (7.1)
Others	40 (12.9)	36 (11.6)	32 (14.2)	31 (13.7)	30 (12.6)	27 (11.3)
Missing	0	0	1 (0.4)	0	0	0
Highest education level – University and above, n (%)	257 (82.9)	269 (86.8)	193 (85.4)	203 (89.8)	200 (84.0)	213 (89.5)
Working full time n (%)	297 (95.8)	289 (93.2)	216 (95.6)	214 (94.7)	230 (96.6)	220 (92.4)
Occupational type, n (%)						
Professionals	176 (56.8)	177 (57.1)	127 (56.2)	131 (58.0)	139 (58.4)	141 (59.2)
Legislators, senior officials and managers	28 (9.0)	28 (9.0)	19 (8.4)	23 (10.2)	27 (11.3)	25 (10.5)
Associate professionals & technicians	23 (7.4)	17 (5.5)	17 (7.5)	8 (3.5)	12 (5.0)	11 (4.6)
Others*	72 (23.2)	73 (23.5)	58 (25.7)	57 (25.2)	56 (23.5)	47 (19.7)
Missing	11 (3.5)	15 (4.8)	5 (2.2)	7 (3.1)	4 (1.7)	14 (5.9)
Monthly income (SGD), n (%)						
<$2999	32 (10.3)	27 (8.7)	13 (5.8)	28 (12.4)	20 (8.4)	19 (8.0)
$3000 - $3999	42 (13.5)	38 (12.3)	32 (14.2)	39 (17.3)	35 (14.7)	51 (21.4)
$4000 - $4999	46 (14.8)	87 (28.1)	52 (23.0)	62 (27.4)	46 (19.3)	71 (29.8)
$5000 - $6999	98 (31.6)	89 (28.7)	63 (27.9)	57 (25.2)	78 (32.8)	55 (23.1)
≥$7000	86 (27.7)	58 (18.7)	63 (27.9)	38 (16.8)	58 (24.4)	33 (13.9)
Missing	6 (1.9)	11 (3.5)	3 (1.3)	2 (0.9)	1 (0.4)	9 (3.8)
Length of marriage (years), median (range)	1.33 (-0.03 – 9.35)		1.18 (-0.25 – 11.4)		1.24 (-0.25 – 11.4)	

Living in same flat or house, n (%)	287 (92.6)	205 (90.7)	221 (92.9)
Housing type†, n (%)			
HDB 1 – 3 room	35 (11.3)	31 (13.7)	31 (13.0)
HDB 4 room	105 (36.6)	92 (44.9)	89 (40.3)
HDB 5 room / executive	81 (28.2)	42 (20.5)	61 (27.6)
Private flat/condominium/landed property	66 (21.3)	40 (17.7)	40 (16.8)

FAT: fertility awareness tools, FHS: fertility health screening, HDB: Housing Development Board. PSLE: Primary School Leaving Examination, SD: standard deviation, SGD: Singapore dollars

*Clerical support workers, services & sales workers, craftsman & related trade workers, plant & machine operators & assemblers, and cleaners, laborers & related workers. †If both partners living in same flat or house. The HDB provides public housing in Singapore. The number of rooms correlate with the size of the flat and the number of bedrooms (Housing & Development Board, n.d.).

Table 2   Childbearing timing, fertility awareness and conception efforts in intention to treat analyses

Characteristic	Control (n = 310)		FHS (n = 226)		FAT (n = 238)	
	Husband	Wife	Husband	Wife	Husband	Wife
No plan to have children <u>at any point</u>, n (%)						
Baseline	7 (2.3)	11 (3.5)	6 (2.7)	6 (2.7)	3 (1.3)	7 (2.9)
Follow up	15 (4.8)	7 (3.1)	9 (4.0)	7 (3.1)	7 (2.9)	10 (4.2)
Intended age at first birth (years), mean (SD) [valid n*]						
Baseline	32.8 (3.0) [235]	31.2 (2.4) [242]	32.8 (2.9) [184]	31.2 (2.3) [194]	32.9 (3.3) [203]	31.2 (2.5) [203]
No plans at the moment, n (%)	68 (21.9)	57 (18.4)	36 (15.9)	26 (11.5)	32 (13.4)	28 (11.8)
Follow-up	33.0 (3.3) [201]	31.6 (2.4) [209]	32.9 (3.1) [157]	31.6 (2.4) [157]	33.1 (3.3) [164]	31.5 (2.5) [167]
No plans at the moment, n (%)	40 (12.9)	28 (9.0)	26 (11.5)	25 (11.1)	25 (10.5)	18 (7.6)
Difference	0.04 (1.56) [177]	0.16 (1.18) [186]	0.27 (1.97) [143]	0.24 (1.01) [148]	0.08 (1.57) [149]	0.16 (1.21) [156]
Beta† (95% CI)	Ref	Ref	0.21 (-0.17 – 0.58)	0.07 (-0.17 – 0.32)	0.04 (-0.32 – 0.41)	-0.01 (-0.25 – 0.23)
Change in intended age at first birth‡, n (%)	n = 241	n = 234	n = 181	n = 181	n = 188	n = 183
Increased	67 (27.8)	65 (27.8)	53 (29.3)	50 (27.6)	65 (34.6)	62 (33.9)
No change	117 (48.5)	116 (49.6)	83 (45.9)	105 (58.0)	75 (39.9)	86 (47.0)

Decreased	57 (23.7)	53 (22.6)	45 (24.9)	26 (14.4)	48 (25.5)	35 (19.1)
OR of decrease compared to no change/increase⌐ (95% CI)	Ref	Ref	1.07 (0.68 – 1.67)	0.57 (0.34 – 0.95)	1.11 (0.71 – 1.72)	0.81 (0.50 – 1.30)
OR of decrease compared to no change⌐ (95% CI)	Ref	Ref	1.11 (0.69 – 1.80)	0.54 (0.32 – 0.93)	1.31 (0.81 – 2.13)	0.89 (0.53 – 1.48)
CFKS, mean % correct (SD) [valid n*]						
Baseline	50.2 (17.8) [310]	54.8 (16.8) [310]	52.3 (15.7) [226]	55.7 (16.9) [226]	50.3 (16.8) [238]	57.6 (16.7) [238]
Follow up	54.5 (17.6) [256]	60.4 (16.8) [254]	58.5 (16.4) [193]	63.9 (16.6) [193]	60.1 (18.4) [197]	65.1 (17.6) [197]
Difference	3.7 (14.8) [256]	5.3 (14.9) [254]	6.1 (16.7) [193]	7.8 (16.1) [193]	9.1 (19.4) [197]	7.7 (17.4) [197]
Beta† (95% CI)	Ref	Ref	**3.18 (0.35 – 6.01)**	**2.91 (0.23 – 5.60)**	**5.49 (2.67 – 8.30)**	**3.42 (0.75 – 6.09)**
Attempting to conceive, n (%)	n = 193	n = 190	n = 144	n = 146	n = 149	n = 143
Stopped (yes to no)	7 (3.6)	9 (4.7)	7 (4.9)	8 (5.5)	11 (7.4)	5 (3.5)
No change	155 (80.3)	150 (78.9)	110 (76.4)	110 (75.3)	114 (76.5)	110 (76.9)
Started (no to yes)	31 (16.1)	31 (16.3)	27 (18.8)	28 (19.2)	24 (16.1)	28 (19.6)
OR of started compared to no change/stopped⌐ (95% CI)	Ref	Ref	1.21 (0.68 - 2.13)	1.22 (0.69 – 2.14)	1.00 (0.56 – 1.79)	1.25 (0.71 – 2.20)
OR of started compared to no change⌐ (95% CI)	Ref	Ref	1.23 (0.69 – 2.17)	1.23 (0.70 – 2.17)	1.05 (0.59 – 1.89)	1.23 (0.70 – 2.17)
Pregnant, n (%) [valid n*]	44 (17.7) [248]		35 (18.7) [187]		42 (21.8) [193]	
OR (95% CI)	Ref		1.07 (0.65 – 1.74)		1.29 (0.80 – 2.07)	
Pursued further fertility screening and/or treatment, n (%) [valid n*]	44 (17.2) [256]	48 (18.9) [254]	25 (13.0) [193]	26 (13.5) [193]	35 (17.8) [197]	44 (22.3) [197]
OR (95% CI)	Ref	Ref	0.72 (0.42 – 1.21)	0.67 (0.39 – 1.11)	1.04 (0.64 – 1.69)	1.23 (0.78 – 1.95)
Composite outcome (pregnant, started trying to conceive or decrease in intended age at first birth), n (%) [valid n]	108 (45.4) [238]		76 (41.3) [184]		90 (49.2) [183]	

*Non-missing responses. †From linear regression, adjusted for baseline values. ‡Categorization shown in Table S1. ⌐Among those with non-missing values

CFKS: Cardiff Fertility Knowledge Score, CI: confidence interval, FAT: fertility awareness tools, FHS: fertility health screening, OR: odds ratio, SD: standard deviation

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Key Message

FHS and FAT were two versions of multicomponent interventions incorporating fertility education, personalized fertility information and behavioural change strategies. Both FHS and FAT, while able to increase fertility awareness at 6 months post-randomization, were insufficient to modify parenthood intentions.

<u>Vitae</u>

Dr Sze Ling Chan is a senior research fellow at the SingHealth Health Services Research Centre and an adjunct assistant professor at Health Services & Systems Research, Duke-NUS medical school. She has extensive experience in health services research, with a focus in pharmacoepidemiology and implementation science.