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Fertility intentions among couples in Shanghai under COVID-19: A cross-sectional study

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Abstract

Objective: To evaluate fertility intensions among couples in Shanghai under the novel coronavirus infection (COVID-19) pandemic against the backdrop of persistently low fertility.

Methods: A cross-sectional study was carried out using data from studies conducted before the COVID-19 pandemic. Data were collected regarding sociodemographic characteristics, history of reproduction and gynecology, fertility intention before and after the COVID-19 pandemic, female psychological state, and the impact of the COVID-19 pandemic on daily life.

Results: Under the influence of COVID-19, 296/447 (66.2%) participants did not change their original fertility intention to have children, while 151/447 (33.8%) of participants were affected by the outbreak. Participants who believed in government and hospital control policies were less likely to change their intention to become pregnant ($P < 10^{-3}$, $P < 10^{-3}$). In contrast, concerns about the impact of COVID-19 on female and fetal health led participants to cancel their original pregnancy plans ($P < 10^{-3}$).

Conclusion: Three in ten couples of childbearing age, who originally expressed their intention of becoming pregnant, canceled their pregnancy plans after the COVID-19 outbreak. The COVID-19 outbreak has brought new challenges to people's physical and mental health. Effective policies and measures can help to improve people's fertility intentions with respect to having children.

KEYWORDS
COVID-19; Fertility intention; Government policy

1 | INTRODUCTION

Fertility intention is the expression of fertility desire based on an individual or family preference for children, taking into account various limitations such as the ideal number of children, gender, time, and interval of pregnancy.[1] As a systemic problem, fertility intentions are influenced by many factors including the economy, fertility policies, level of education, the environment, and public services.[2]

Despite the implementation of the two-child policy in 2015, the total number of annual births in China has not shown a clear trend of growth. According to the China Health Statistics Yearbooks of 2018 and 2019, the number of live births by pregnant women in China dropped from 18.47 million in 2016 to 17.58 million in 2017, and then fell to 13.62 million in 2018.[3,4] Against the background of rapid aging in China, the continuous low rate fertility of childbearing couples exacerbates health expenditure, increases the negative impact on economic growth, and hinders economic and social development to some extent.[5,6]

Since the end of 2019, a novel coronavirus infection (COVID-19) has exploded in the world. As of July 1, 2020, more than 10 million

patients have tested positive for COVID-19 across Asia, Europe, North America, South America, Africa, and Oceania, spanning 215 countries and regions. As a major public health emergency, COVID-19 not only threatens human life and health but also causes people to have depression, anxiety, and fear, which also greatly affects people's physical and mental health.[7,8]

During the pandemic, couples preparing for pregnancy are also in a state of collective anxiety and panic.[9] However, little attention has been paid to the fertility intentions and family-planning issues of these couples in the face of the COVID-19 pandemic. No relevant studies and effective guidelines have been reported on the SARS-COV, MERS-COV, or the COVID-19 pandemics. Therefore, the aim of the present study was to evaluate the impact of COVID-19 on the fertility intention of childbearing couples.

2 | MATERIALS AND METHODS

A single-center, cross-sectional study was performed in one of the pre-pregnancy clinical centers in Shanghai, China, with the objective of evaluating the effects and causes of COVID-19 on the fertility intention of childbearing couples.

Before the COVID-19 outbreak, a database on female fertility was established that constituted basic sociodemographic information and the reproductive intentions of participants at the time. These data have not been published in any journal. Based on information from this database, participants were selected according to the following criteria: planning to become pregnant in the next 12 months; age range of 20–49 years; no history of infertility; and consent to participate in the study. Couples who were pregnant were not eligible for inclusion.

Information was collected from each patient through a telephone questionnaire and included the following components: sociodemographic characteristics (e.g. age, body mass index [BMI, calculated as weight in kilograms divided by the square of height in meters], level of education, occupation, household annual income); history of reproduction and gynecology (e.g. number of pregnancies, pregnancy outcomes, medical history); the fertility intention before and after the COVID-19 pandemic; female psychological state (self-rating anxiety scale); and the impact of the COVID-19 pandemic on daily life (e.g. history of residence during the COVID-19 pandemic, the severity of economic distress due to work affected by the pandemic, and frequency of browsing news about COVID-19).

Based on whether the fertility intention of participants was affected by COVID-19, participants were divided into "affected" and "unaffected" groups.

Due to the limited evidence of relevant research, and based on our previous investigation, it was assumed that 40% of people's fertility intentions will be affected. With an allowable error of 5% and a two-sided 95% confidence interval (CI), a total sample size of 387 was required. In addition, a non-response rate of 10% was considered, which resulted in a sample size of 430.

All data were analyzed by IBM SPSS Version 21.0 (IBM Corp., Armonk, NY, USA). Fertility intention was treated as a binary outcome

and corresponding 95% CIs were calculated assuming a binomial distribution of the observed number of events. The Pearson χ^2 test was applied to study the difference between the two groups. Crude odds ratios (ORs) with 95% CIs were calculated using univariable conditional logistic regression analysis. Multivariable logistic regression analysis was performed to adjust for variables and corresponding ORs. All P values were estimated using two-sided tests, and the differences were considered statistically significant when $P < 0.05$.

The present study was approved by the institutional review board (GKLW2018-23, obtained in December 2018) of the International Peace Maternity and Child Health Hospital (IPMCH, Shanghai, China). Written informed consent was obtained from each subject before recruitment. It was guaranteed that participants had the right to refuse to take part in the research and quit the study at any point in time.

3 | RESULTS

During the recruitment phase, a total of 536 couples were selected for a telephone questionnaire survey because of their fertility intention to get pregnant. Of them, 44 (8.2%) couples who were worried about disclosing their privacy refused to participate in the investigation, 9 (1.7%) couples were excluded due to a history of infertility (1.7%), and 36 (6.7%) couples were pregnant before the COVID-19 outbreak. Finally, 447 couples were enrolled in the study, including 296 (66.2%) couples with unaffected fertility intentions and 151 (33.8%) couples whose fertility intention was affected by the COVID-19 pandemic (Fig. 1). Table 1 outlines the sociodemographic characteristics of all participants. The mean ± standard deviation (SD) age was 30.27 ± 3.41 years for women and 31.79 ± 3.97 years for men. More than 95% of participants were employed, and the largest percentage of households had an annual income of ¥200,000–¥300,000.

As shown in Table 2, regardless of whether in the "unaffected" group or the "affected" group, the proportion of participants whose occupation was affected by COVID-19 was less than 30%. In both groups, the proportion of affected household incomes was similar ("unaffected" group: 31.42%; "affected" group: 29.14%). Approximately 30% of participants left Shanghai during the epidemic. In terms of female psychological state, self-rating anxiety scale (SAS) results showed that no women are in a state of anxiety. About 90% of couples browsed news about COVID-19 1–3 times a day.

Figure 2 shows the frequency distribution of the reasons for the fertility intentions affected (Fig. 2A) and unaffected (Fig. 2B) by the COVID-19 pandemic. In the affected group, most women chose to "worry about being infected by COVID-19 at the antenatal visit" and "worry about being infected by COVID-19 in a public place" for different reasons. Moreover, some of the women were anxious about self-health (56.29%) and a fetus (25.17%) being more susceptible to COVID-19 after pregnancy. Only 4.64% of women thought unstable income had an impact on their fertility intention during the pandemic.

Regarding the affected group, most women believed in government control policy (88.9%) and hospital control measures (61.1%), which could protect them from the COVID-19 pandemic. Meanwhile,
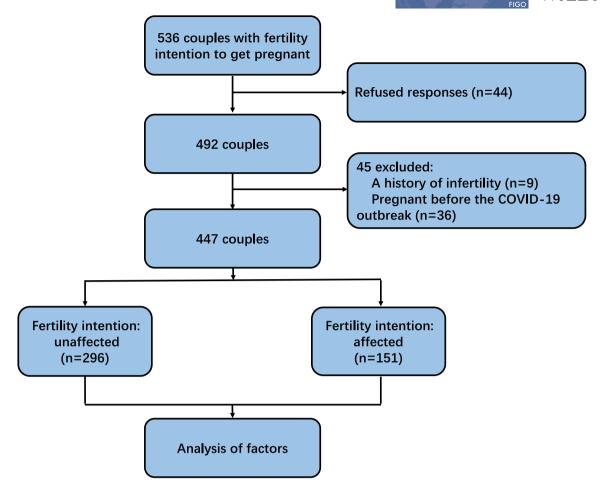
FIGURE 1 Flowchart.

22.3% of women felt that their "own protective measures could block the COVID-19 infection."

In the present study, in terms of age, operation, level of education, and annual household income, there was no significant correlation between the affected and unaffected groups (Table 1). As Table 2 demonstrates, a small majority of participants were impacted by the pandemic in their lives or work. However, no major differences in these factors were found between the two groups. Women with a history of gynecological diseases were less likely to change their fertility intention compared to those without these factors ($P=0.01$; Table 3). As for the number of pregnancies, parity, and history of miscarriage, none of these differences were statistically significant. In Table 4, government and hospital prevention and control policies were protective factors for the fertility intention affected (government: $P<0.001$; hospital: $P<0.001$). However, couples who believed that the epidemic would affect their fetal health were more likely to cancel their pregnancy ($P<0.001$).

The results of the multivariable analysis are listed in Table 5. Hospital prevention and control measures were associated with a significantly lower risk of affected fertility intention (adjusted OR [aOR] 0.45, 95% CI 0.24–0.84). Moreover, government prevention and control policies were shown to protect couples from changing their fertility intention (aOR 0.09, 95% CI 0.05–0.16). Besides, couples who worried about personal and fetal health, and were more susceptible to

COVID-19 after pregnancy, were more likely to cancel their plans for bearing children during the pandemic (aOR 4.46, 95% CI 2.54–7.82). However, there were no significant associations between previous gynecological history and changes in fertility intention.

4 | DISCUSSION

In the present study, under the influence of the COVID-19 pandemic, 296 (66.2%) participants did not change their original fertility intention to have children, while 151 (33.8%) participants chose to cancel the pregnancy plan. As a reflection of reproductive behavior, to some extent, fertility intentions can provide a predictor for human fertility behavior.[10] Previous studies have shown that there are many factors that influence fertility intention, including policy, culture, family values, and personal economic level.[11-13] However, few writers have drawn on any research that deals with the influence of major public health emergencies on fertility intention. The results of the present study indicate that government control policies for COVID-19 could allow couples to maintain their fertility intention. In contrast, concerns about the impact of COVID-19 on female and fetal health led participants to cancel their recent pregnancy plans. Contrary to expectations, the present study did not find any significant association

TABLE 1 Demographic characteristics of all participants.[a]

	Fertility intentions after the COVID-19 outbreak (women)[b]			
	Unaffected (n = 296)	Affected (n = 59)	Univariate model	P value[c]
Age of women (years)				
20–24	5 (1.69)	3 (1.99)	1.11 [0.26–4.79]	0.565
25–29	124 (41.89)	67 (44.37)	Reference	
30–34	126 (42.57)	65 (43.05)	0.95 [0.63–1.46]	
35–39	36 (12.16)	16 (10.60)	0.82 [0.43–1.59]	
≥40	5 (1.69)	0	NA	
	30.38 ± 3.63	30.07 ± 2.95		
Age of men (years)				
20–24	7 (2.36)	1 (0.66)	0.26 [0.31–2.21]	0.262
25–29	83 (28.04)	45 (29.80)	Reference	
30–34	143 (48.31)	68 (45.03)	0.88 [0.55–1.39]	
35–39	50 (16.89)	34 (22.52)	1.25 [0.71–2.21]	
≥40	13 (4.39)	3 (1.99)	0.43 [0.12–1.57]	
	31.77 ± 4.16	31.82 ± 3.58		
Occupation, women				
Employed	262 (88.51)	136 (90.07)	Reference	0.872
Self-employed	19 (6.42)	8 (5.30)	0.81 [0.35–1.90]	
Unemployed	15 (5.07)	7 (4.64)	0.90 [0.36–2.26]	
Occupation, men				
Employed	276 (93.24)	143 (94.70)	Reference	0.69
Self-employed	19 (6.42)	8 (5.30)	0.81 [0.35–1.90]	
Unemployed	1 (0.34)	0	NA	
Level of education, women				
High school or lower	12 (4.18)	12 (8.39)	Reference	0.073
Junior college or university or above	275 (95.82)	131 (91.61)	0.48 [0.21–1.10]	
Level of education, men				
High school or lower	18 (6.27)	9 (6.29)	Reference	0.993
Junior college or university or above	269 (93.73)	134 (93.71)	1.00 [0.44–2.23]	
Annual household income (¥)				
100,000–200,000	38 (15.83)	18 (16.98)	0.95 [0.49–1.82]	0.130
200,000–300,000	104 (43.33)	52 (49.06)	Reference	
300,000–400,000	69 (28.75)	24 (22.64)	0.70 [0.39–1.23]	
400,000–500,000	10 (4.17)	9 (8.49)	1.80 [0.69–4.70]	
≥500,000	19 (7.92)	3 (2.83)	0.32 [0.09–1.12]	

[a]Values are given as number (percentage), mean ± standard deviation, or odds ratio [95% confidence interval].
[b]The sum does not necessarily equal the sample size for all variables because of missing data.
[c]Pearson's χ^2 test.

between the participants' daily life and their economic conditions, and their reproductive intentions.

In terms of sociodemographic factors, the observed difference between the affected group and the unaffected group in the present study was not significant. According to the results, 30% of the participants were affected by COVID-19 in all aspects of life. Furthermore, about 70% of participants were off work within 1 month during the outbreak. The decrease in income did not significantly affect the

fertility intention to have childbirth. It seems possible that these results are due to the intrinsic characteristic of the Chinese who are used to saving money for use in emergencies.[14] In addition, based on the government's timely disclosure of epidemic data, some participants felt anxious about the COVID-19 epidemic.[15,16]

The study found that participants who were more concerned about their own health and that of their fetus were more likely to cancel their pregnancy, which may be related to the unknown impact of

TABLE 2 Occupation and life affected by the COVID-19 outbreak.[a]

	Fertility intentions after the COVID-19 outbreak (women)[b]			
	Unaffected (n = 296)	Affected (n = 151)	Univariate model	P value[c]
Occupations were affected by the COVID-19 outbreak, women				
No	236 (79.73)	113 (74.83)	Reference	0.073
Yes, a little	47 (15.88)	23 (15.23)	1.02 [0.59–1.77]	
Yes, a lot	13 (4.39)	15 (9.93)	2.41 [1.11–5.24]	
Occupations were affected by the COVID-19 outbreak, men				
No	225 (76.01)	116 (76.82)	Reference	0.479
Yes, a little	58 (19.59)	25 (16.56)	0.84 [0.50–1.41]	
Yes, a lot	13 (4.39)	10 (6.62)	1.49 [0.64–3.51]	
Downtime affected by the COVID-19 outbreak, women				
No	52 (17.57)	19 (12.58)	Reference	0.351
≤1 month	192 (64.86)	97 (64.24)	1.38 [0.78–2.47]	
1–2 months	40 (13.51)	26 (17.22)	1.78 [0.87–3.66]	
2–3 months	12 (4.05)	9 (5.96)	2.05 [0.75–5.64]	
Downtime affected by the COVID-19 outbreak, men				
No	32 (10.81)	13 (8.61)	Reference	0.819
≤1 month	222 (75.00)	114 (75.50)	1.26 [0.64–2.50]	
1–2 months	31 (10.47)	19 (12.58)	1.51 [0.64–3.57]	
2–3 months	11 (3.72)	5 (3.31)	1.12 [0.32–3.86]	
Whether to leave Shanghai during the COVID-19 outbreak, women				
No	209 (70.61)	96 (63.58)	Reference	0.131
Yes	87 (29.39)	55 (36.42)	1.38 [0.91–2.09]	
Whether to leave Shanghai during the COVID-19 outbreak, men				
No	209 (70.61)	99 (65.56)	Reference	0.276
Yes	87 (29.39)	52 (34.44)	1.26 [0.83–1.92]	
Whether household income was affected by the COVID-19 outbreak				
No	203 (68.58)	107 (70.86)	Reference	0.875
Yes, a little [d]	75 (25.34)	35 (23.18)	0.89 [0.56–1.41]	
Yes, a lot [e]	18 (6.08)	9 (5.96)	0.95 [0.41–2.18]	
Female SAS [f]				
Score < 50	296 (100)	151 (100)	Reference	/
Score ≥ 50	0 (0)	0 (0)	/	
Frequency of browsing news about COVID-19				
>4 times a day	8 (2.70)	0	NA	0.117
1–3 times a day	266 (89.86)	138 (91.39)	Reference	
1–3 times a week	22 (7.43)	13 (8.61)	0.99 [0.69–1.42]	

Abbreviation: SAS, self-rating anxiety scale.

[a]Values are given as number (percentage) or odds ratio [95% confidence interval].

[b]The sum does not necessarily equal the sample size for all variables because of missing data.

[c]Pearson's χ^2 test.

[d]It slightly affects daily life. Existing income can still maintain daily life.

[e]It seriously affects daily life. Existing income cannot maintain daily life.

[f]SAS scores in the range of 50–59 are classified as mild anxiety, 60–69 as moderate anxiety, and> 69 as severe anxiety.
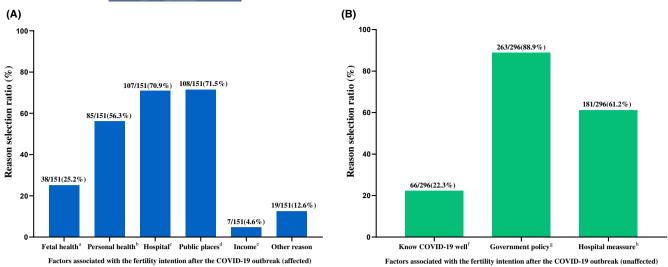
COVID-19 on pregnant women and their unborn children. A recent study[17] has established that COVID-19 is transmitted through respiratory droplets, body contact, and aerosols, and there is evidence of human-to-human transmission. So far, no direct studies have shown that COVID-19 can be vertically transmitted from a mother to her baby.[18] There is also no relevant literature indicating that women are more susceptible to COVID-19 infection after pregnancy, or more severe adverse outcomes after being infected with the virus.[19] In the

(A)

(B)

FIGURE 2 (A) Factors associated with fertility intention after the COVID-19 outbreak (affected). [a]Worried about the fetus being affected by COVID-19 after pregnancy. [b]Worried about own health being more susceptible to COVID-19 after pregnancy. [c]Worried about being infected by COVID-19 at antenatal visit. [d]Worried about being infected by COVID-19 in public places. [e]Income is affected by COVID-19 outbreak. (B) Factors associated with the fertility intention after the COVID-19 outbreak (unaffected). [f] Know how to protect self from COVID-19 infection. [g]Believe in government prevention and control policy. [h]Believe in hospital prevention and control measures.

face of inadequate knowledge of COVID-19, couples tend to be more conservative in canceling their plans for pregnancy.

With regard to reasons associated with fertility intention after the COVID-19 outbreak, effective prevention and control policies by governments and hospitals are protective factors for affecting fertility intention. This may be related to the decision made by the Chinese government in response to the COVID-19 outbreak: (1) the Chinese government quickly made corresponding policies after the outbreak of

the new coronavirus epidemic[20]; (2) controlling the number of people infected with the epidemic in a short time; and (3) compared with other regions, the mortality rate due to COVID-19 was at a lower level.[21] In accordance with the present results, previous studies have demonstrated that policy and politics cannot be disconnected from public health.[22] Similarly, as a place for obstetric examinations and deliveries, the hospital's control measures are more relevant to the health of pregnant women. Appropriate measures for isolation and disinfection

TABLE 3 Reproductive and medical history of all women.[a]

	Fertility intentions after the COVID-19 outbreak (women)[b]			
	Unaffected (n = 296)	Affected (n = 151)	Univariate model	P value[c]
Number of pregnancies				
0	214 (72.30)	102 (67.55)	Reference	0.573
1	66 (22.30)	40 (26.49)	1.27 [0.80–2.01]	
≥2	16 (5.41)	9 (5.96)	1.18 [0.50–2.76]	
Parity				
Childless	266 (89.86)	134 (88.74)	Reference	0.714
≥1 child	30 (10.14)	17 (11.26)	1.13 [0.60–2.11]	
Previous miscarriage				
No	237 (80.07)	115 (76.16)	Reference	0.339
Yes	59 (19.93)	36 (23.84)	1.26 [0.79–2.01]	
Previous medical problems[d]				
No	213 (71.96)	125 (82.78)	Reference	0.013
Yes	83 (28.04)	26 (17.22)	0.53 [0.33–0.87]	

[a]Values are given as number (percentage) or odds ratio [95% confidence interval].
[b]The sum does not necessarily equal the sample size for all variables because of missing data.
[c]Pearson's χ^2 test.
[d]Medical problems: leiomyoma, ovarian cysts, endometrial polyps, endometriosis, polycystic ovarian syndrome and other gynecological diseases; mycoplasma, chlamydia, and other lower genital tract infections.

TABLE 4 Reasons for fertility intentions affected by COVID-19.[a]

	Fertility intentions after the COVID-19 outbreak (women)[b]			
	Unaffected (n = 296)	Affected (n = 151)	Univariate model	P value[c]
Personal and fetal health[d]				
No	230 (77.70)	57 (37.75)	Reference	<0.001
Yes	66 (22.30)	94 (62.25)	5.75 [3.75–8.82]	
Government prevention and control policy[e]				
No	33 (11.15)	108 (71.52)	Reference	<0.001
Yes	263 (88.85)	43 (28.48)	0.05 [0.03–0.08]	
Hospital prevention and control measures[f]				
No	115 (38.85)	107 (70.86)	Reference	<0.001
Yes	181 (61.15)	44 (29.14)	0.26 [0.17–0.40]	

[a]Values are given as number (percentage) or odds ratio [95% confidence interval].
[b]The sum does not necessarily equal the sample size for all variables because of missing data.
[c]Pearson's χ^2 test.
[d]Concerns about the impact of COVID-19 on female and fetal health.
[e]Believe in government prevention and control policy.
[f]Believe in hospital prevention and control measures.

in hospitals can greatly reduce the incidence of infection.[23] Therefore, no matter the government or hospital, strong prevention and control policies can make participants change their fertility intentions with a lower probability of failure.

As China enters the post-epidemic era, people are paying more attention to the impact of the COVID-19 epidemic on the economy, culture, and lifestyle, among which the birth rate and fertility intention are also important aspects. According to the present study, in the context of the COVID-19 outbreak that is yet to be effectively brought under control, one-third of the couples of childbearing age in Shanghai have canceled their fertility intention to have children. The COVID-19 pandemic offers the chance to adjust

TABLE 5 Multivariable logistic regression analysis

	AOR [95% CI]	P value
Personal and fetal health[a]		
No	Reference	<0.001
Yes	4.46 [2.54–7.82]	
Government prevention and control policy[b]		
No	Reference	<0.001
Yes	0.09 [0.05–0.16]	
Hospital prevention and control measures[c]		
No	Reference	0.006
Yes	0.45 [0.25–0.79]	

Abbreviations: AOR, adjusted odds ratio; CI, confident interval.
[a]Concerns about the impact of COVID-19 on female and fetal health.
[b]Believe in government prevention and control policy.
[c]Believe in hospital prevention and control measures.

existing policies, helping the government to develop more effective measures on public health to improve people's fertility intention to have children.

The present study has some limitations. First, due to the single-center study, the results of the study may lead to "Berkson's bias." In future investigations, a population-based study would be conducted to avoid this bias. Second, some experimental results may not show a significant correlation due to the small sample size. Third, the cross-sectional survey based on questionnaires is more about the fertility intention of couples, rather than their fertility behavior. Follow-up studies should draw more accurate conclusions based on their reproductive behaviors.

In conclusion, because of the pandemic, about one-third of the participants changed their original fertility intention to have a child. In addition, they made these decisions taking into account the control measures of the government and hospitals as well as considering the health of individuals and fetuses. To change the current situation of low rates of fertility, it is considered necessary to make targeted adjustments with the factors affecting the fertility intention of reproductive couples.

AUTHOR CONTRIBUTIONS

JZ and LC conceived of the study, participated in its design, supervised the study, and critically revised the manuscript. CZ and JW performed the investigation and wrote the manuscript. YL and LY contributed to data collection. CH participated in the statistical analysis. All authors read and approved the final version of the manuscript.

ACKNOWLEDGMENTS

CONFLICTS OF INTEREST

The authors have no conflicts of interest.

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