


# Knowledge, anxiety levels and attitudes of infertile couples towards COVID-19 and its impact on self-funded fertility treatment: a cross-sectional questionnaire survey

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Submitted on May 15, 2021; resubmitted on October 13, 2021; editorial decision on October 19, 2021

**STUDY QUESTION:** What is the knowledge, anxiety levels and attitudes of infertile couples towards coronavirus disease 2019 (COVID-19) and its impact on undergoing self-funded treatment cycles?

**SUMMARY ANSWER:** In spite of a high level of awareness about COVID-19, anxiety levels were low and many participants wanted to continue fertility treatment during the pandemic.

**WHAT IS KNOWN ALREADY:** The COVID-19 pandemic has strained the already overburdened public health infrastructure in many of the resource-limited settings across the world. After an initial decision to suspend fertility treatments, regulatory authorities advocated phased resumptions of treatment. Owing to limited healthcare resources and the detrimental impact of COVID-19 on the economy and job losses, fertility services have been disproportionately affected. It is important to understand the perceptions of infertile couples, who are the key stakeholders in shared decision-making, especially for self-funded treatments, on the continuation of fertility treatment during the current COVID-19 pandemic.

**STUDY DESIGN, SIZE, DURATION:** This was a questionnaire-based cross-sectional study conducted among 502 participants (251 infertile couples) at a tertiary level infertility clinic between May 2020 and November 2020. The study recruitment period (6 months) coincided with the increase and peak of COVID-19 infection in India. The study included infertile couples who had attended the clinic either for assessment or fertility treatment.

**PARTICIPANTS/MATERIALS, SETTING, METHODS:** An interviewer administered the questionnaire survey, which was conducted in two stages for each participant. In the first stage, knowledge about COVID-19 and anxiety levels caused by the ongoing pandemic were assessed using a validated Generalized Anxiety Disorder-7 (GAD-7) tool. Following this, all the participants were provided with a COVID-19 information pamphlet. Subsequently, in the second stage, participants were administered another questionnaire to assess their attitudes towards fertility treatment and pregnancy during the COVID-19 pandemic.

**MAIN RESULTS AND THE ROLE OF CHANCE:** The results showed that the knowledge levels and awareness about COVID-19 was high among infertile couples attending the infertility clinic. The majority of the participants were aware of the mode of spread (87.6–93.4% correct answers to different questions), common symptoms (64.1–96.2%) and the importance of preventative measures (95.6–97.4%). Most of the participants (474/502; 94.4%) did not show anxiety when being assessed using GAD-7. A vast majority (96.5–99.2%) of the participants were in agreement with the need for following preventative measures for reducing the spread of COVID-19. About one-third of the participants wanted to delay the fertility treatment until the pandemic is over (166/502; 33.1%). Approximately 42.2% (212/502) of

the participants did not feel the need to suspend fertility treatment during the pandemic. Further analysis revealed that participants' education levels significantly influenced the desire to continue fertility treatment: participants with lower levels of education (below graduate) were less likely to continue fertility treatment (adjusted odds ratio 0.34, 95% CI, 0.12–0.98).

**LIMITATIONS, REASONS FOR CAUTION:** Questionnaire-based responses could have limited the ability of the interviewer to capture the entire range of thoughts and views of the participants on the COVID pandemic and their fertility treatments. Furthermore, a language barrier was encountered for some couples for which assistance from a translator was sought.

**WIDER IMPLICATIONS OF THE FINDINGS:** Given the impact of infertility and the associated stigma, public health policy makers, regulatory authorities and fertility societies should consider a way to sustain the treatment options and develop appropriate guidelines to continue treatment, particularly when much of the world is experiencing the second and third waves of the COVID pandemic.

**STUDY FUNDING/COMPETING INTEREST(S):** This study has not received any specific grant from funding agencies in the public, commercial or not-for-profit sectors. M.S.K. is an associate editor with *Human Reproduction Open*. The other authors have no competing interests to declare.

**TRIAL REGISTRATION NUMBER:** N/A.

**Key words:** coronavirus disease 2019 / COVID-19 pandemic / fertility treatment / self-funded cycles / anxiety / ART / attitude / stigma

## WHAT DOES THIS MEAN FOR PATIENTS?

The effects of the coronavirus disease 2019 (COVID-19) pandemic have been profound, especially in the low- and middle-income countries, requiring a major reorganization of healthcare services. The pandemic has posed immense financial and travel-related challenges for couples who have difficulty in having a baby and are seeking access to fertility services for consultation and treatment. We carried out a survey to understand the levels of knowledge, anxiety and attitudes towards the COVID-19 pandemic in infertile couples undergoing self-funded treatment. A total of 502 participants who attended our centre for evaluation or fertility treatment were individually surveyed. The results showed that the awareness level about COVID-19 was high and anxiety levels were low among those who participated in our study. Approximately 42.2% of the participants were willing to start or continue with fertility treatment during the pandemic, in spite of the risks associated with COVID-19. Education level had an influence on the decision to continue fertility treatment: those with a lower level were less willing to continue. So, it is important that the regulatory authorities identify ways to continue providing fertility services, especially for when new waves of infection occur.

## Introduction

The world is experiencing an unprecedented public health crisis owing to the rapidly evolving coronavirus disease 2019 (COVID-19) pandemic. More than 103 million people have been diagnosed with COVID-19 and over 2.2 million deaths have been recorded within the year since the pandemic began ([Johns Hopkins Coronavirus Resource Center, 2021](#)). While the pandemic is stabilizing in some parts of the world, other regions across the world are experiencing the second and third waves of infection. However, the successful development and approval of several vaccines against severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), the virus causing COVID-19, has improved the prospects of returning to normalcy. It is predicted that the COVID-19 pandemic will have a long-lasting impact on the society. Drastic changes are likely to be seen in the way we travel and conduct day to day commercial or non-commercial activities, with social distancing becoming the new norm.

In the initial response to the evolving COVID-19 pandemic, health-care regulatory authorities recommended and implemented a moratorium on all the non-urgent medical interventions, including fertility treatment, to divert and deploy the available healthcare resources in the fight against the pandemic. With the infection rates plateauing in many countries, health authorities have allowed a gradual resumption of other health services after carefully considering local factors.

In the second week of March 2020, the European Society of Human Reproduction and Embryology (ESHRE) advised infertility patients to avoid pregnancy during the pandemic ([ESHRE News, 2021](#)). An updated recommendation also advised withholding ART treatment. Subsequently, the ESHRE COVID-19 working group and the American Society for Reproductive Medicine (ASRM) published guidelines for restarting ART treatment in a phased manner in areas with decreasing rates of infection ([ASRM, 2020](#); [ESHRE News, 2021](#)). Other fertility societies and regulatory authorities also developed guidelines for managing fertility treatment and pregnancy care during the COVID-19 pandemic ([COVID-19 \(coronavirus disease\)—Fertility and Pregnancy | Cochrane Gynaecology and Fertility, 2021](#); [lcmr.gov.in, 2021](#)). In later updates, the importance of reinitiating fertility treatment was highlighted owing to the negative impact of the time lag on treatment outcomes and possible psychological effects on anxious infertile couples ([ASRM, 2020](#); [ESHRE News, 2021](#)).

Infertile couples who are waiting for the resumption of fertility treatment may become stressed and worried about the uncertainty surrounding their treatment and the impact of COVID-19 on pregnancy ([Lambalk et al., 2020](#)). Recently, the International Federation of Fertility Societies/ESHRE issued a statement on COVID vaccination for women who are considering pregnancy to facilitate decision-making for couples planning to undergo fertility treatment ([COVID19 vaccination, 2021](#)).

In resource-limited areas across the world, the psychosocial impact of infertility is deep and access to fertility treatment is limited and often self-financed (van Balen and Bos, 2009; Patel *et al.*, 2018). Furthermore, the COVID-19 pandemic has strained the already overburdened public health infrastructure in many of these developing countries. Owing to limited healthcare resources and other factors, such as a declining economy and job losses, fertility services have been disproportionately affected. Hence, it is important to understand the views of infertile couples, who are the key stakeholders in a shared decision-making process, especially for self-funded cycles, on the continuation of fertility treatment during the current COVID-19 pandemic.

As the second most populous country in the world, there is widespread concern about the impact of the COVID-19 pandemic in India, with the second wave of COVID infections on the rise (Estate *et al.*, 2021). With the gradual resumption of healthcare services across the country, we planned this study to assess the knowledge of infertile couples about COVID-19 and their attitudes towards the infection/fertility treatment, which may influence their decision-making regarding the uptake of fertility treatment. In addition, we wanted to estimate the anxiety levels among the couples who were undergoing evaluation and treatment for infertility.

## Materials and methods

A cross-sectional study was conducted between May 2020 and December 2020 at Christian Medical College (CMC), Vellore, India, in a tertiary level infertility unit. The study recruitment period (June–November 2020, 6 months) coincided with the increase and peak of COVID-19 infection in India. Ethical approval for the study was obtained from the Institutional Review Board (IRB) of CMC, Vellore, India (expedited clearance dated 12 May 2020; IRB 12852).

All infertile couples who visited the Department of Reproductive Medicine at CMC Vellore, during the study period, either for outpatient evaluation or to undergo fertility treatment, including IVF, were eligible to participate in the study. Participants with suspected COVID-19 or those with diagnosed COVID-19 were excluded from the study. The details of the study were explained to the eligible couples, and all those who were willing to participate were recruited to the study after obtaining a written informed consent.

An interviewer administered questionnaire survey was conducted in two stages. Both stages of the interview were completed on the same day. During the first stage, knowledge about COVID-19 and their anxiety levels related to the ongoing pandemic were assessed. A validated tool (Generalized Anxiety Disorder-7, GAD-7) was used to measure anxiety levels. After completion of the first questionnaire, the participants were given a pamphlet containing general information about the COVID-19, as well as information on fertility treatment and pregnancy-related concerns during the COVID-19 medical crisis. Participants were given adequate time to go through the pamphlet and understand the contents. They were also provided with the opportunity to clarify any treatment or pregnancy-related queries with the treating clinicians. Each of the participants was advised to report back to the interviewer for the second stage of the interview after they had gone through the information pamphlet, understood the content and were comfortable to do so. The time taken by individual participants to attend the second stage of the interview varied, with an average

interval of 2–3 h. In the second stage, participants were administered another questionnaire by the same interviewer to assess their attitude regarding fertility treatment and pregnancy during the COVID-19 pandemic. Each individual participant was interviewed separately by clinicians working in the department. The questionnaire was administered, while the participants were waiting for their consultation. While administering the questionnaire, COVID-related social distancing rules, masks and other necessary precautions were followed as per the protocol laid down by the local government authorities. Owing to the COVID pandemic restrictions, we recruited eligible couples during their routine visits to the clinic for either investigations or treatment to avoid any additional visits for the purpose of the study. Only one or two randomly chosen eligible couples were interviewed per day to avoid overcrowding. The clinicians who conducted the survey were not involved in the treatment of the participating couples, to reduce both participant and assessor bias. Other clinical and demographic information were obtained from medical records and/or directly from the participants.

## Statistical methods

For continuous data, the descriptive statistics mean, SD and, for non-normally distributed interval and ordinal data, median (interquartile range [IQR]) was presented. For categorical data, the number of participants and proportions were presented. A statistical approach called the dyadic logistic multilevel modelling was used to analyse the couple data to assess partner, individual and couple characteristics that were related to the individual opinion. The dyadic regression model was performed to assess the demographic and treatment-related factors which influenced the participants' response on continuation of fertility treatment during the COVID-19 pandemic. For the regression modelling, relevant parameters, such as age, family income, education, duration of infertility, previous parity, reason for a visit and the type of planned treatment, for the couples were considered. All tests were two-sided at  $\alpha = 0.05$  level of significance. All analysis was carried out using Statistical Package for Social Sciences (SPSS) software Version 21.0 (IBM Corp, Armonk, NY, USA).

## Results

During the recruitment period, a total of 1313 couples visited the department for either evaluation or fertility treatment. Among those who were eligible, a total of 251 infertile couples who were willing to participate were included in the study and 502 participants were individually interviewed (researcher administered questionnaire). The demographic characteristics of the study population are summarized in Table 1. The mean age of female and male partners were 29.3 ( $\pm 4.5$ ) and 34.1 ( $\pm 4.8$ ) years, respectively. The majority of the participants had an undergraduate degree (45.4% females and 42.2% males). About 75% of the female participants were unemployed, while 25.1% of the male participants were semi-skilled workers.

The median duration of infertility was 3 years (IQR: 2, 6), as described in Table 2. A total of 53 couples (21.1%) visited the outpatient department for infertility evaluation, while the remaining 198 couples (78.9%) were planning to undergo fertility treatment. Among those who were planning to undergo fertility treatment, 37.9% were

**Table I** Baseline demographic characteristics of the study population.

| Parameters                     |                     | Number of couples (n = 251) | Percentage (%) |
|--------------------------------|---------------------|-----------------------------|----------------|
| Place                          | Tamil Nadu          | 203                         | 80.9           |
|                                | Other Indian states | 43                          | 17.1           |
|                                | Foreign nationals   | 5                           | 2.0            |
| Family income, INR (per month) | <20 000             | 150                         | 59.8           |
|                                | 20 000–50 000       | 73                          | 29.1           |
|                                | >50 000             | 28                          | 11.2           |
|                                |                     | Number of participants      | Percentage (%) |
| Female partner's education     | Primary             | 11/251                      | 4.4            |
|                                | Secondary           | 34/251                      | 13.5           |
|                                | Higher secondary    | 41/251                      | 16.3           |
|                                | Graduate            | 114/251                     | 45.4           |
|                                | Post graduate       | 51/251                      | 20.3           |
| Male partner's education       | Primary             | 14/251                      | 5.6            |
|                                | Secondary           | 38/251                      | 15.1           |
|                                | Higher secondary    | 36/251                      | 14.3           |
|                                | Graduate            | 106/251                     | 42.2           |
|                                | Post graduate       | 57/251                      | 22.7           |
| Female partner's occupation    | Unemployed          | 189/251                     | 75.3           |
|                                | Unskilled           | 3/251                       | 1.2            |
|                                | Semiskilled         | 3/251                       | 1.2            |
|                                | Skilled             | 2/251                       | 0.8            |
|                                | Clerical            | 5/251                       | 2.0            |
|                                | Semiprofessional    | 14/251                      | 5.6            |
|                                | Professional        | 35/251                      | 13.9           |
| Male partner's occupation      | Unemployed          | 8/251                       | 3.2            |
|                                | Unskilled           | 40/251                      | 15.9           |
|                                | Semiskilled         | 63/251                      | 25.1           |
|                                | Skilled             | 14/251                      | 5.6            |
|                                | Clerical            | 31/251                      | 12.4           |
|                                | Semiprofessional    | 39/251                      | 15.5           |
|                                | Professional        | 56/251                      | 22.3           |

INR, Indian Rupee.

scheduled for IVF, while the remainder would undergo alternate fertility treatments such as ovulation induction, ovarian stimulation with IUI or fertility enhancing surgery (such as laparoscopic cystectomy and laparoscopic ovarian drilling) (Table II).

Knowledge levels of the participants about COVID-19 symptoms (64.1–96.2%) and the mode of spread (87.6–93.4%) were high (Table III). Most of the participants were aware of the highly infectious nature of the disease (94%), the susceptibility of elderly (93.4%) and the importance of preventative measures (95.6–97.4%). For questions related to pregnancy and continuation of fertility treatment during the COVID-19 pandemic, the responses were mixed. While 46.4% of participants believed that pregnancy needs to be avoided during the pandemic, 52.4% of the participants thought that fertility treatment should be continued.

Anxiety levels were assessed among participants using the GAD-7 scale and the vast majority of the participants (94.4%) did not show anxiety (GAD score < 5) (Supplementary Table S1). While 23

participants showed mild anxiety (4.6%), 3 (0.6%) participants showed moderate levels and 2 showed severe levels of anxiety (0.3%). Anxiety levels were compared between the male and female participants and there was no significant difference between sexes (Supplementary Table SII). Among the 28 participants who had varying levels of anxiety, 19 reported that their daily activities were affected to some extent by anxiety (Supplementary Table SIII). Four participants found it very difficult to perform their daily activities because of their severe anxiety levels.

In the second stage of the study, attitudes towards the COVID-19 pandemic and fertility-related issues were assessed using the Likert scale (Table IV). A vast majority (96.5–99.2%) of the participants were in agreement with the need for following preventative measures for reducing the spread of COVID-19 infection with social distancing, wearing face masks and self-isolating in the event of contracting the infection. About 52.2% agreed or strongly agreed that pregnancy should be avoided during the COVID-19 pandemic, while

**Table II Clinical characteristics of the study population.**

| Parameters                                   |                             | Number of couples (n = 251)      | Percentage (%) |
|--|-----------------------------|----------------------------------|----------------|
| Type of infertility                          | Primary                     | 199                              | 79.3           |
|  | Secondary                   | 52                               | 20.7           |
| Duration of infertility (years) <sup>a</sup> |                             | 3                                | 2.6            |
| Couples with previous child                  |                             | 21                               | 8.4            |
| H/o fertility treatment                      |                             | 119                              | 47.4           |
| Reason for present visit                     | Evaluation                  | 53                               | 21.1           |
|  | Treatment                   | 198                              | 78.9           |
| Type of treatment (n = 198)                  | OI                          | 58                               | 29.3           |
|  | COS + IUI                   | 35                               | 17.7           |
|  | IVF                         | 75                               | 37.9           |
|  | Fertility enhancing surgery | 10                               | 5.1            |
|  | Fertile period              | 20                               | 10.1           |
|  |                             | Number of participants (n = 502) | Percentage (%) |
| Previous medical illness <sup>b</sup>        | Diabetes                    | 24                               | 4.8            |
|  | Hypertension                | 6                                | 1.2            |
|  | Thyroid disease             | 34                               | 6.8            |
|  | Heart disease               | 0                                | 0              |
|  | Bronchial asthma            | 4                                | 0.8            |

COS, controlled ovarian stimulation; OI, ovulation induction.

<sup>a</sup> Presented as median, interquartile range.

<sup>b</sup> Calculated per individual (n = 502).

**Table III Assessment of participants' knowledge regarding the COVID-19 pandemic.**

| Questions   |   | Yes (%)    | No (%)     | Don't know (%) |
|---|---|------------|------------|----------------|
| Modes of spread   | Close contact with infected person  | 469 (93.4) | 33 (6.6)   | 0 (0)          |
|   | Touching surfaces contaminated by respiratory secretions of infected people | 440 (87.6) | 37 (7.4)   | 25 (5.0)       |
| Complaints  | Fever with or without chills  | 482 (96.0) | 20 (4.0)   |                |
|   | Cough   | 483 (96.2) | 19 (3.8)   |                |
|   | Breathing difficulty  | 479 (95.4) | 23 (4.6)   |                |
|   | Loss of smell   | 322 (64.1) | 180 (35.9) |                |
| Everyone positive for COVID-19 will develop severe symptoms         | 174 (34.7)  | 299 (59.6) | 29 (5.8)   |                |
| Patients without obvious symptoms can spread the disease            | 410 (81.7)  | 67 (13.3)  | 25 (5.0)   |                |
| COVID-19 is a highly infectious disease                             | 472 (94.0)  | 22 (4.4)   | 8 (1.6)    |                |
| Elderly are at higher risk for developing severe disease            | 469 (93.4)  | 18 (3.6)   | 15 (3.0)   |                |
| Preventative measures can largely reduce the spread of COVID-19     | 489 (97.4)  | 10 (2.0)   | 3 (0.6)    |                |
| Isolating patients with COVID-19 can prevent its spread             | 480 (95.6)  | 14 (2.8)   | 8 (1.6)    |                |
| Pregnancy should be avoided during the COVID-19 pandemic            | 233 (46.4)  | 188 (37.5) | 81 (16.1)  |                |
| Fertility treatments should be avoided during the COVID-19 pandemic | 162 (32.3)  | 263 (52.4) | 77 (15.3)  |                |

COVID-19, coronavirus disease 2019.

**Table IV** Assessment of attitude towards the COVID-19 pandemic and fertility treatment (during the COVID-19 pandemic) using the Likert scale.

|   | Strongly agree (%) | Agree (%)  | Neither agree nor disagree (%) | Disagree (%) | Strongly disagree (%) |
|---|--------------------|------------|--------------------------------|--------------|-----------------------|
| Spread of COVID-19 can be decreased by preventative measures  | 385 (76.7)         | 113 (22.5) | 2 (0.4)                        | 2 (0.4)      | 0 (0)                 |
| Should follow social distancing (wearing mask, gloves)  | 419 (83.5)         | 80 (15.9)  | 2 (0.4)                        | 1 (0.2)      | 0 (0)                 |
| Will you isolate yourself in case you develop COVID 19?   | 429 (85.5)         | 55 (11.0)  | 11 (2.2)                       | 4 (0.8)      | 3 (0.6)               |
| Pregnancy should be avoided during the COVID-19 pandemic  | 154 (30.7)         | 108 (21.5) | 90 (17.9)                      | 136 (27.1)   | 14 (2.8)              |
| Fertility treatments should be avoided during the COVID-19 pandemic   | 118 (23.5)         | 96 (19.1)  | 76 (15.1)                      | 166 (33.1)   | 46 (9.2)              |
| Delaying fertility treatments may compromise chances of getting pregnant  | 80 (15.9)          | 182 (36.3) | 71 (14.1)                      | 148 (29.5)   | 21 (4.2)              |
| Deferment of fertility treatments owing to inconvenience caused by travel restrictions and additional screening | 34 (6.8)           | 104 (20.7) | 64 (12.7)                      | 258 (51.4)   | 42 (8.4)              |
| Routine screening for COVID-19 prior to fertility treatments  | 245 (48.8)         | 143 (28.5) | 34 (6.8)                       | 68 (13.5)    | 12 (2.4)              |
| Termination of fertility treatment in case of developing COVID-19   | 209 (41.6)         | 181 (36.1) | 29 (5.8)                       | 71 (14.1)    | 12 (2.4)              |
| Delay of fertility treatment until pandemic is settled  | 42 (8.4)           | 124 (24.7) | 50 (10.0)                      | 220 (43.8)   | 66 (13.1)             |

COVID-19, coronavirus disease 2019.

**Table V** Dyadic logistic multilevel model to analyse couple data with possible covariates for individuals agreeing to continue fertility treatments during the COVID-19 pandemic.

| Variables                                    | Levels                   | Continue treatment<br>n = 290<br>(%) | Discontinue treatment<br>n = 212<br>(%) | Univariate<br>OR (95% CI) | P value | Multivariate<br>aOR (95% CI) | P value |
|--|--------------------------|--------------------------------------|---|---------------------------|---------|------------------------------|---------|
| Age (years) <sup>a</sup>                     |                          | 31.7 (5.5)                           | 31.8 (5.4)                              | 1.02 (0.95, 1.08)         | 0.65    | 1.01 (0.94, 1.08)            | 0.77    |
| Family income,<br>INR (per month)            | >50 000                  | 28 (9.7)                             | 28 (13.2)                               | 0.31 (0.07, 1.39)         | 0.13    | 0.24 (0.06, 1.15)            | 0.07    |
|  | ≤50 000 (Ref)            | 262 (90.3)                           | 184 (86.8)                              |                           |         |                              |         |
| Education                                    | Below graduate           | 90 (31.0)                            | 82 (38.7)                               | 0.49 (0.18, 1.32)         | 0.16    | 0.34 (0.12, 0.98)            | 0.04*   |
|  | Graduate and above (Ref) | 200 (69.0)                           | 130 (61.3)                              |                           |         |                              |         |
| Duration of infertility (years) <sup>b</sup> |                          | 3 (2.0, 6.1)                         | 3 (2.0, 6.0)                            | 1.05 (0.92, 1.21)         | 0.43    | 1.11 (0.95, 1.30)            | 0.20    |
| Previous child                               | No                       | 269 (92.8)                           | 191 (90.1)                              | 0.98 (0.18, 5.38)         | 0.97    | 0.98 (0.18, 5.45)            | 0.96    |
|  | Yes (Ref)                | 21 (7.2)                             | 21 (9.9)                                |                           |         |                              |         |
| Reason for visit                             | Treatment                | 231 (79.7)                           | 165 (77.8)                              | 1.70 (0.54, 5.37)         | 0.37    | 1.44 (0.42, 4.90)            | 0.56    |
|  | Evaluation (Ref)         | 59 (20.3)                            | 47 (22.2)                               |                           |         |                              |         |
| Treatment type                               | ART                      | 85 (36.8)                            | 65 (39.4)                               | 0.93 (0.33, 2.57)         | 0.88    | 0.67 (0.20, 2.25)            | 0.52    |
|  | Non ART (Ref)            | 146 (63.2)                           | 100 (60.6)                              |                           |         |                              |         |

aOR, adjusted odds ratio; adjusted for age, family income, education, duration of infertility, previous parity, reason for visit and the type of treatment planned; INR, Indian Rupee; IQR, interquartile range; Ref, reference.

<sup>a</sup>Presented as mean, SD.<sup>b</sup>Presented as median, IQR.

\*Statistically significant.

17.9% provided an equivocal (neither agree nor disagree) response. When asked about the continuation of fertility treatment during the COVID-19 pandemic, 42.3% of participants did not feel the need to suspend fertility treatment during the pandemic, while 15.1% of the participants were equivocal in their response. More than three-quarters of the participants (77.3–77.7%) were in favour of routine screening for the COVID-19 infection during fertility treatment and termination of treatment in the event of contracting the infection. Approximately one-third of the participants wanted to delay the fertility treatment until the pandemic is over (33.1%). Differences in the male and female partners' responses on attitudes towards the COVID-19 pandemic were evaluated and no significant difference was found for any assessment questions on attitudes (Supplementary Table SIV).

Influences of demographic or treatment-related factors on the participants' response to continuation of fertility treatment during the COVID-19 pandemic were explored (Table V). Only the education level of the participants significantly influenced the desire to continue fertility treatment. Participants with lower levels of educational qualifications (below graduate level) were less likely to continue fertility treatment during the pandemic compared to those with higher levels (graduate and above) (adjusted odds ratio 0.34, 95% CI, 0.12–0.98;  $P=0.04$ ). Other factors, such as age, family income, duration of infertility, previous child and treatment type, did not significantly impact the fertility treatment decision.

## Discussion

The current study findings suggest that knowledge levels and awareness about COVID-19 were very high among infertile couples attending the infertility clinic. This could possibly be a result of the massive and sustained information campaign run by the government and other agencies. The vast majority of the participants were in agreement about the need for adhering to preventative measures to curb the spread of infection by SARS-CoV-2. In spite of the perceived COVID-19 risks around fertility treatment, the questionnaire survey revealed that ~42% of the participants did not feel the need to suspend fertility treatment during the COVID pandemic while 15% remained ambivalent. Only the education level of the participants significantly influenced the decision to continue fertility treatment during the pandemic. Only a small number of participants displayed some level of anxiety, with a significant majority only having had mild levels of anxiety.

A cross-sectional online survey from the UK evaluated the impact of closure of fertility clinics in April 2020 on patients ( $n=450$ ) undergoing fertility treatment (Boivin *et al.*, 2020). The investigators reported that patients considered suspension of fertility treatment as having a negative impact on their lives and would lead to an increase in pre-existing difficulties caused by fertility issues. The majority of the participants in the study expressed that they were worried, anxious and frustrated because of the uncertainties arising out of the COVID pandemic. Another online survey conducted in Canada in April 2020 evaluated the views and emotional reactions of women ( $n=181$ ) whose fertility treatment was postponed or discontinued owing to the COVID pandemic (Marom Haham *et al.*, 2021). The investigators of this study reported that 43% of the participants disagreed with the guidelines and the majority (82%) wanted to continue their treatment

if given the choice, with 60% of the participants reporting anxiety. The decision to suspend treatment was associated with significant psychological distress, and this was not associated with any particular patient characteristics. Similarly, the psychological distress of patients whose fertility treatment was delayed as a result of the COVID-19 pandemic was investigated among 787 patients (response rate of 42.7%) in a single-centre cross-sectional study from the USA (Lawson *et al.*, 2021). This survey, conducted in April/May 2020, used the Patient Health Questionnaire-8 and the GAD-7 scale to estimate depressive symptoms and anxiety among participants and found that more than half of the participants were experiencing moderate to severe anxiety (69–74%) and symptoms of depression (77%). Age, duration of infertility, social support and coping strategies were significantly associated with depressive symptoms. Compared to these three studies investigating psychological stress, (Boivin *et al.*, 2020; Lawson *et al.*, 2021; Marom Haham *et al.*, 2021), the anxiety levels that were observed in our study were much lower (5.6%). This could be related to the differences in time periods of the COVID pandemic when the studies were conducted. While the studies by Boivin *et al.* (2020), Marom Haham *et al.* (2021) and Lawson *et al.* (2021) were all conducted in the initial phase of the pandemic when fertility services were closed and no particular timeline for resumption of treatment was in place, our study coincided with the gradual resumption of fertility services. Another reason for the contradictory findings could be differences in demographic, clinical and sociocultural factors between the study populations. The anxiety caused by uncertainty is likely to be lower when assessed following a resumption of fertility services.

With regards to the issue of discontinuation of fertility treatments, a cross-sectional online questionnaire study from the USA conducted in April 2020 reported a small number of participants (6%) who were willing to suspend fertility treatment, including IVF, during the COVID pandemic (Vaughan *et al.*, 2020). However, in our study, a comparatively higher number of participants (47.6%) were willing to suspend fertility treatment during the COVID pandemic. The dissimilarities in the study findings could possibly be attributed to differences in the available information on the unfolding medical crisis. A sudden cancellation of fertility services and limited information about the enormity of the COVID pandemic crisis may have influenced the US participants' attitudes towards suspending their fertility treatment: The current study period coincided with the peak of the COVID pandemic and probably the participants were more aware of the risks involved in continuing the fertility treatment.

In the South Asian subcontinent, infertility is associated with social stigma and infertile couples often face harassment and ostracism. While the women are mostly blamed and bear the brunt of social isolation and abuse, in some cases men also face ridicule and humiliation (Mosallanejad *et al.*, 2013). While the psychosocial ramifications of infertility in the South Asian continent are significant, providing access to fertility treatment is lower down the priority list for health policy makers owing to limited healthcare resources. There is very limited public funding and insurance coverage for fertility treatment in India, therefore most of the treatments are self-funded. The COVID pandemic and its negative impact on the economy have further complicated the fertility treatment plans of many infertile couples. Treatment cancellation and delays caused directly by the COVID pandemic, as well as the indirect impact of financial constraints owing to salary cuts and job losses, have increased the psychological stress. The country-specific

guidelines issued by fertility societies suggested a gradual and judicious resumption of fertility treatment depending upon the local prevalence of COVID-19, government regulations and availability of resources ([lcmr.gov.in](http://lcmr.gov.in), 2021). Since most of the IVF clinics are located in larger cities, for many infertile couples a resumption of their fertility treatment entailed additional travel, staying in paid accommodations and an increased duration of stay because of quarantine restrictions, further increasing the indirect cost and risk of infection by SARS-CoV-2. A cross-sectional study from a tertiary centre in North India evaluated the apprehension and anxiety levels among infertile couples waiting for the resumption of their fertility treatment during the COVID pandemic (Gupta et al., 2021). They conducted an online questionnaire-based survey and analysed responses from 170 participants between June and August 2020. The authors reported that while 90% of the participants were worried about the delay in their fertility treatment, 64% of them did not want to avoid pregnancy during the COVID pandemic, which is in agreement with the current study finding. Among the subset of women who were waiting for the resumption of IVF, a large majority (85%) expressed a desire to go ahead with embryo transfer during the COVID pandemic. The authors suggested that the infertile couples were more worried about the delay in fertility treatment and its likely impact on their chances of success rather than the risk of COVID-19 (Gupta et al., 2021).

The current study is one of the largest studies exploring the attitudes of infertile couples towards the COVID pandemic and issues related to their fertility treatment in a resource-limited setting. Instead of self-administered or postal questionnaires, the study involved interviewer-administered questionnaires, which eliminated the missing or invalid responses. The interviewers were not involved in the treatment of the participating couples, thereby minimising bias. A validated anxiety questionnaire suitable for the Indian setting (De Man et al., 2021) was used in this study. Some limitations of the study need to be acknowledged. A language barrier was encountered by some couples for which assistance from a translator was sought. However, we had provided the information pamphlet and the questionnaire in four different languages to mitigate this limitation and facilitate the survey. Furthermore, questionnaire-based responses could have limited the ability of the interviewer to capture the entire range of thoughts and views of the participants on the COVID pandemic and their fertility treatments.

The current survey was undertaken and completed during the peak and post-peak phase of the first wave of the COVID pandemic in India. During this period, there was some relaxation of the stringent lockdown policies, which were originally introduced during the start of the pandemic. In addition, regulatory policies on complete suspension of elective treatments (such as fertility services) were changed gradually to facilitate the initiation of fertility treatments. It has to be noted that the impact of the more recent, second wave of the COVID pandemic in India was more catastrophic than the first wave and the healthcare system was stretched to the limits in many places. It is possible that if a similar survey was carried out during the second wave, the results might have been different compared to the current study findings. In spite of the uncertainties and changes over the past year, the information gained from our survey helped to tailor the fertility treatments according to the needs and concerns of the couples visiting the clinic, as fertility services resumed gradually. In addition, while making a conscious effort to reduce the number of hospital visits during

treatment, liberal use of tele-consultation, triaging of ART for certain group of couples (e.g. diminished ovarian reserve, advancing age) and encouragement for self-administration of hormone injections during treatment were some of the interventions employed by the unit to facilitate continuation of fertility treatment during the COVID pandemic.

Overall, this study showed high levels of COVID-19 awareness among infertile couples and low levels of anxiety related to COVID-19 in the context of fertility treatments. Adherence to COVID-19 preventative norms helped in implementing secure measures in the fertility clinic without much coercion. In spite of the pandemic and its associated risks, this study showed the willingness of infertile couples to initiate/continue fertility treatment and lack of the need to delay or stop the treatment. Given the psychosocial impact of infertility and the associated stigma, public health policy makers, regulatory authorities and fertility societies should consider a way to sustain the treatment options and develop appropriate guidelines to continue treatment, particularly when much of the world is experiencing second and third waves of the COVID pandemic.

## Supplementary data

Supplementary data are available at *Human Reproduction Open* online.

## Data availability

The data underlying this article cannot be shared publicly due to privacy concerns of the individuals that participated in the study. The data will be shared on reasonable request to the corresponding author subject to local regulatory approvals.

## Acknowledgements

We thank the couples who were willing to participate in the study.

## Authors' roles

M.S.K. conceived the hypothesis. P.C., A.P., S.S., S.R.N. and T.J. helped in data collection and data entry. T.J. and R.K. performed the analysis along with inputs from A.P. and A.T.K. M.S.K. drafted the manuscript which was improved by A.P. and A.T.K. All the authors appraised and approved the manuscript.

## Funding

This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

## Conflict of interest

M.S.K. is an associate editor with *Human Reproduction Open*. He was not involved in the editorial or peer review process for the manuscript.



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