



# Associations between the COVID-19 pandemic and women's fertility intentions: a multi-country, cross-sectional (I-SHARE) study

Min Zhao <sup>1,2,3</sup> Caitlin Alsandria O'Hara,<sup>4</sup> Norhafizah Bte Sahril,<sup>5</sup> Huijun Liu,<sup>6</sup> Kaiyan Pei,<sup>7</sup> Olena Ivanova,<sup>8,9</sup> Elin C Larsson,<sup>10,11</sup> Simukai Shamu,<sup>12</sup> Eneyi Kpokiri,<sup>13</sup> Amanda Cleeve,<sup>10,11</sup> Joseph D Tucker,<sup>13,14</sup> Kristien Michielsen,<sup>3</sup> Wei-Hong Zhang <sup>3,15</sup>

► Additional supplemental material is published online only. To view, please visit the journal online (<http://dx.doi.org/10.1136/bmjsh-2023-201819>).

For numbered affiliations see end of article.

## Correspondence to

Professor Wei-Hong Zhang, International Center for Reproductive Health, Ghent University, Gent 9000, Belgium; [weihong.zhang@ugent.be](mailto:weihong.zhang@ugent.be)

Received 7 February 2023  
Accepted 19 September 2023  
Published Online First  
19 October 2023



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**To cite:** Zhao M, O'Hara CA, Sahril NB, et al. *BMJ Sex Reprod Health* 2024;**50**:83–91.

## ABSTRACT

**Introduction** The COVID-19 pandemic, together with the subsequent social distancing measures, could lead to shifts in family and fertility planning. This study aimed to explore the associations between the COVID-19 pandemic and changes in fertility intentions among an international sample of reproductive-aged women.

**Methods** A multi-country, cross-sectional study based on data from 10672 women aged 18–49 years who participated in the International Sexual Health And REproductive Health (I-SHARE) study, which organised an international online survey between July 2020 and February 2021. Factors associated with changes in fertility intentions were explored using multinomial probit regression models. Cluster-robust standard errors were used to calculate model parameters.

**Results** Of 10672 included reproductive-aged women, 14.4% reported changing their fertility intentions due to the pandemic, with 10.2% postponement and 4.2% acceleration. Women who had ever been isolated/quarantined were more likely to postpone their fertility intentions (adjusted odds ratio (AOR)=1.41; 95% CI 1.18 to 1.69) compared with those who had not; women who lived with a steady partner were more likely to want children sooner (AOR=1.57; 95% CI 1.10 to 2.23) compared with those who did not; and those who reported a higher frequency of getting angry, feeling frustrated, or worrying about their finances were more likely to postpone their fertility intentions. The main findings were robust in the sensitivity analyses.

**Conclusions** Most women who changed fertility intentions because of the pandemic have postponed intentions to expand their

## WHAT IS ALREADY KNOWN ON THIS TOPIC

⇒ Studies in individual countries have suggested that the COVID-19 pandemic has contributed to the change in people's fertility intentions.

## WHAT THIS STUDY ADDS

⇒ Pandemic-induced isolation/quarantine and deteriorating mental health were associated with postponed fertility intentions, while living with a steady partner during social distancing measures was associated with accelerated women's fertility intentions.

## HOW THIS STUDY MIGHT AFFECT RESEARCH, PRACTICE OR POLICY

⇒ Changes in women's fertility intentions could cause uncertainty in fertility rates over the long term. Authorities should respond to the reproductive health needs of women during public health crises.

families. The pandemic-induced exposures were associated with these postponements.

## INTRODUCTION

The COVID-19 (coronavirus disease 2019) pandemic, together with the subsequent social distancing measures, caused drastic changes in the global economy as well as individual lifestyles, health and well-being.<sup>1</sup> These shifts have been accompanied by changes in family planning, including fertility plans.<sup>2</sup> Fertility intentions refer to the desire to have a

child, which is influenced by an individual's current situation.<sup>3</sup> Fertility intentions have been recognised as a fairly reliable predictor of individual fertility-related behaviour.<sup>4</sup> Given that shifting fertility intentions manifest as changes in fertility patterns,<sup>5</sup> the changes in fertility intentions as a result of the pandemic would impact society at large through shifts in social and economic stability as well as population and migration policy.

Thus far, studies have shown conflicting evidence regarding changes in fertility intentions related to COVID-19. Some studies in European countries (Italy, Poland, Germany, France, Spain), the UK and the United States (US) reported that 20% to 57.8% of respondents postponed fertility intentions, and 14.2% to 36.5% of respondents even abandoned their previous fertility plans because of the COVID-19 pandemic.<sup>6–9</sup> However, in the Italian and US studies, 10–20% of participants who did not previously intend to have children wanted a child sooner during the pandemic.<sup>7,8</sup>

Previous studies have provided clear evidence regarding the impact of living with a partner on fertility intentions, demonstrating that living with a partner is a prerequisite for having children.<sup>10,11</sup> Economic recessions are often accompanied by a decline in fertility, as income reductions lead to a postponement of fertility intentions among women until their financial situation improves.<sup>12,13</sup> Additionally, women with better mental well-being are unlikely to postpone their desire to have children and are more likely to have children sooner.<sup>14</sup> Recent studies have further examined the impact of COVID-19-induced changes in family relationships, financial status and mental health on fertility intentions,<sup>8,9,15–17</sup> highlighting the associations between COVID-19-related experiences and fertility intention shifts. Moreover, the COVID-19 pandemic, with its infections and associated isolation measures, may also contribute to changes in women's fertility intentions.

The International Sexual Health And REproductive Health (I-SHARE) consortium, comprising researchers from 30 countries worldwide, used a standardised survey instrument to investigate the effects of the first wave of COVID-19 on sexual and reproductive health (SRH).<sup>18</sup> This multi-country, cross-sectional study aimed to explore how fertility intentions have changed due to the COVID-19 pandemic, and identify factors associated with changes in fertility intentions among an international sample of women aged 18–49 years, with the hope of informing global health and demographic policy.

## METHODS

### Study design

This cross-sectional study was conducted in accordance with the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) guidelines.<sup>19</sup> The I-SHARE consortium convened a group

of SRH researchers to administer a common survey instrument in their respective countries as an online survey.<sup>18</sup> The online survey used social media, partner organisations, paid social media advertising, university websites, telephone interviews, and television or newspapers to recruit participants.<sup>20</sup> Individuals who agreed to answer the online questionnaire participated in the specific survey.

A more detailed description of the study methods, including the study protocol, questionnaire development, participant recruitment and data collection, is available elsewhere.<sup>18</sup> In summary, a total of 30 countries participated in the survey, which was distributed through local, regional and national networks between 20 July 2020 and 15 February 2021.<sup>20</sup> The majority of countries employed convenience sampling, while two countries (Denmark, Czech Republic) used representative samples, and six countries (Sweden, Botswana, Uganda, Lebanon, Kenya and Argentina) utilised online panels. This study examines the associations between the COVID-19 pandemic and fertility intentions, and therefore focuses on the subsample of 18–49-year-old women.

### Participants

Participants had to be aged 18 years or older, live in their respective participating countries, be able to read and understand questionnaires, have access to online surveys, and be willing to provide informed consent. Overall, 23 067 participants from 30 countries completed the survey. Based on the prespecified plan and considering the potential for greater heterogeneity, the I-SHARE group advised conducting multi-country studies with sample sizes of at least 200 participants (online supplemental table 1).<sup>18</sup> The eligibility criteria for participants included in this analysis were as follows: aged between 18 and 49 years, assigned female at birth, and answered the question regarding fertility intentions. The inclusion and exclusion processes are outlined in figure 1. Eventually, the

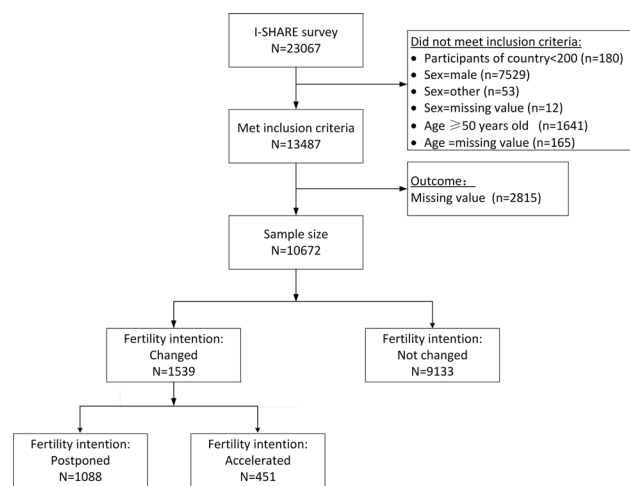


Figure 1 Flowchart of participants.

study included a total of 10 672 women of reproductive age from 24 countries.

### Measures

#### Dependent variable

The dependent variable for this study was fertility intentions, and participants were asked specifically about the pandemic-related changes to their fertility intentions with the question “Have you recently changed your mind about having a child soon because of COVID-19?”. The answer options were: (1) Yes, I have decided to postpone my decision to have a child in the near future (postponed); (2) Yes, I have decided I want to have a child sooner (accelerated); and (3) No, I have not changed my plans (not changed).

#### Independent variables

Key explanatory variables of interest included COVID-19 pandemic-induced exposures such as testing for COVID-19, isolation/quarantine, personal income loss, living together with a steady partner, and mental health during the pandemic.

Testing for COVID-19, assessed by the question “Were you ever tested for COVID-19?” with the following answer options: 1=no; 2=yes, always negative; 3=yes, positive at least once. Isolation/quarantine was assessed by the question “Were you ever in (self-)isolation/quarantine because of symptoms or because you were in close contact with someone with COVID-19 or because you returned from a country that had a large number of cases?” with the following answer options: 1=yes; 2=no. Personal income loss was assessed by the question “Have you personally experienced a loss of income?” with answer options: 1=yes; 2=no. Living together with a steady partner was assessed by the question “During the COVID-19 social distancing measures is/was your steady partner living with you in the same place?” with the following answer options: 1=no, s/he stays elsewhere; 2=yes, the whole time/part of the time.

The questionnaire covered four different mental health items: frequency of getting angry, frequency of feeling frustrated, frequency of feeling bored, and frequency of worrying about finances. Participants were asked about their mental health status during the COVID-19 social distancing measures compared with 3 months before the COVID-19 pandemic, assessed by the same question asked four times: “Does this happen more or less since the start of the COVID-19 social distancing measures?”. Response options for the four questions were the same: 1=same; 2=more (a lot more/more); 3=less (less/a lot less). The response options were redivided into two categories: 1=same or less; 2=more.

#### Confounding variables

Age was measured as a continuous variable in the questionnaire and was divided into two categories in this

study: 18–32 years old; 33–49 years old. Education was measured as: no formal education; some/completed primary education; some/completed secondary education; some college/university; completed college/university. These were combined into three categories for regression analysis: no formal education–secondary education; some college/university; completed college/university. Marital status was classified into four categories: single, no partner; not married, have a partner; legally married; widowed/divorced/other. Number of children was measured as a continuous variable in the questionnaire and was divided into three categories in this study: 0; 1;  $\geq 2$ . When asked about their religion, participants selected their religion from a list of country-specific options and then were classified into two groups: has no religious belief; has a religious belief.

In terms of country-level variables, the participating countries were recoded as<sup>21</sup>: sub-Saharan Africa (SSA); Latin America and the Caribbean (LAC); North America (NA); East Asia and the Pacific (EAP); Europe and Central Asia (ECA). Following the classification of World Bank income levels, participating countries were recoded as<sup>21</sup>: high-income countries; upper-middle-income countries; low- or low-middle-income countries. The minimum and maximum number of participants by country were reported.

### Statistical analysis

Descriptive statistics were used to summarise the participating countries and participants' sociodemographic characteristics. Due to significant variation among the participating countries, the analysis was performed at the individual level. The Bonferroni correction was applied to account for multiple hypothesis testing. The comparison of sociodemographic characteristics between participants in this study and all reproductive-aged women from the I-SHARE survey is shown in online supplemental table 2. The distribution of fertility intentions across country regions, country income levels and participants' sociodemographic characteristics are also described (online supplemental table 3).

In the multivariable analysis, multinomial probit regression was performed to examine the associations between fertility intentions and pandemic-induced exposures at the individual level.<sup>22</sup> For each independent variable we calculated the crude OR, the adjusted OR after controlling for all confounders, and the adjusted OR (AOR) after controlling for both confounders and independent variables (online supplemental table 4). Given the multi-country data used in this study, we adjusted the estimates to account for clustering of individuals within their respective countries.<sup>23</sup> The sensitivity analyses, which utilised country-cluster robust bootstrap estimation, are presented in online supplemental table 5, and countries or the country income level with more than 100 participants

are shown in online supplemental table 6. The associations between pandemic-induced exposures and fertility intentions for participants at different country income levels are shown in online supplemental table 7 and online supplemental table 8. All tests were two-tailed, the significance level was set at 0.05, and the analyses were performed using Stata 16.

## RESULTS

According to the flowchart of participants (figure 1), 10 672 women were enrolled in the study, with 10.2% having postponed fertility intention, 4.2% having accelerated fertility intention and 85.6% having not

changed their fertility intention due to the COVID-19 pandemic.

The participants in this study had a mean age of 29.9 years and a median age of 28 years (IQR: 24–35); 47.2% were not married but had a steady partner; most of the participants (60.1%) had completed their college or university; more than half (52.0%) had a religious belief; and the majority of the participants (72.9%) had no children (table 1).

Table 2 shows the distribution of fertility intentions by pandemic-induced exposures. Participants with negative COVID-19 test results had a lower proportion of postponing fertility intention (9.4% vs 10.3%)

**Table 1** Characteristics of participating countries (n=24) and participants (n=10 672)

Parameter	n	%
<b>Characteristics of participating countries</b>		
Participating countries by region		
Sub-Saharan Africa (SSA)	3	15.4
Latin America and the Caribbean (LAC)	5	19.2
North America (NA)	2	7.7
East Asia and the Pacific (EAP)	3	15.4
Europe and Central Asia (ECA)	11	42.3
Participating countries by income level		
High-income countries	15	57.7
Upper-middle-income countries	8	30.8
Low- or low-middle-income countries	1	11.5
Number of participants by country (minimum–maximum)	13–2209	
<b>Characteristics of participants</b>		
Age (years)		
Mean (SD)	29.9 (7.8)	
Median (IQR)	28.0 (24.0–35.0)	
Marital status		
Single, no partner	2918	27.4
Not married, have a partner	5030	47.2
Legally married	2467	23.2
Widowed/divorced/other	239	2.2
Education		
No formal education	20	0.2
Some/completed primary education	599	5.8
Some/completed secondary education	1850	17.9
Some college/university	1662	16.0
Completed college/university	6217	60.1
Religion		
Has no religious belief	4211	48.0
Has a religious belief	4558	52.0
Number of children		
0	7779	72.9
1	1294	12.1
≥2	1597	15.0

**Table 2** Distribution of fertility intentions by pandemic-induced exposures (n=10 672)

Parameter	Fertility intentions				P value*
	Total n (column %)	Postponed n (row %)	Accelerated n (row %)	Not changed n (row %)	
Testing for COVID-19					<0.05
No	7092 (66.5)	732 (10.3)	275 (3.9)	6085 (85.8)	
Yes, always negative	3122 (29.3)	294 (9.4)	150 (4.8)	2678 (85.8)	
Yes, at least positive once	446 (4.2)	61 (13.7)	26 (5.8)	359 (80.5)	
Isolation/quarantine					<0.001
No	7968 (74.7)	744 (9.3)	316 (4.0)	6908 (86.7)	
Yes	2694 (25.3)	342 (12.7)	134 (5.0)	2218 (82.3)	
Personal income loss					<0.001
No	7180 (68.0)	605 (8.4)	274 (3.8)	6301 (87.8)	
Yes	3385 (32.0)	462 (13.6)	171 (5.1)	2752 (81.3)	
Living together with a steady partner					<0.001
No, s/he stays elsewhere	2443 (35.2)	225 (9.2)	79 (3.2)	2139 (87.6)	
Yes, the whole time/part of the time	4500 (64.8)	567 (12.6)	231 (5.1)	3702 (82.3)	
<b>Mental health compared with 3 months before COVID-19 measures</b>					
Frequency of getting angry					<0.001
Same or less	5930 (57.5)	487 (8.2)	244 (4.1)	5199 (87.7)	
More	4390 (42.5)	564 (12.8)	188 (4.3)	3638 (82.9)	
Frequency of feeling frustrated					<0.001
Same or less	4505 (43.6)	347 (7.7)	192 (4.3)	3966 (88.0)	
More	5828 (56.4)	704 (12.1)	244 (4.2)	4880 (83.7)	
Frequency of feeling bored					<0.001
Same or less	4728 (45.8)	406 (8.6)	193 (4.1)	4129 (87.3)	
More	5592 (54.2)	647 (11.6)	242 (4.3)	4703 (84.1)	
Frequency of worrying about finances					<0.001
Same or less	4993 (48.3)	352 (7.1)	190 (3.8)	4451 (89.1)	
More	5341 (51.7)	700 (13.1)	243 (4.5)	4398 (82.4)	

\*Compared using Bonferroni correction.

whereas those with positive test results had greater proportions of both postponing (13.7% vs 10.3%) and accelerating (5.8% vs 3.9%) fertility intention. A higher proportion of participants who had been isolated/quarantined reported postponed fertility intention (12.7% vs 9.3%) or accelerated fertility intention (5.0% vs 4.0%). Participants who experienced personal income loss were more likely to report both postponed (13.6% vs 8.4%) and accelerated fertility intentions (5.1% vs 3.8%). Participants who lived together with their steady partner were more likely to report both accelerated fertility intention (12.6% vs 9.2%) and postponed fertility intention (5.1% vs 3.2%).

Compared with participants with equal or fewer mental health issues, those who had more frequency of getting angry (12.8% vs 8.2%), more frequency of feeling frustrated (12.1% vs 7.7%), more frequency of feeling bored (11.6% vs 8.6%) and more frequency of worrying about their financial situation (13.1% vs

7.1%) during the COVID-19 social distancing measures were more likely to postpone fertility intentions.

In the multinomial probit regression analysis (table 3), after all variables are adjusted, the results show that participants who tested negative for COVID-19 were less likely to postpone fertility intentions (AOR=0.79; 95% CI 0.64 to 0.97) compared with those who did not test for COVID-19. Participants who had ever been isolated/quarantined were more likely to postpone fertility intentions (AOR=1.41; 95% CI 1.18 to 1.69) compared with those who had never been isolated or quarantined. When compared with those who did not experience a loss in personal income, the likelihood of postponing (AOR=1.29; 95% CI 1.12 to 1.49) or accelerating (AOR=1.22; 95% CI 1.06 to 1.40) fertility intentions increased among those who did. Participants who lived with their partner during the COVID-19 social distancing measures were more likely to accelerate (AOR=1.57; 95% CI 1.10 to 2.23)

**Table 3** Multinomial probit regression analysis of pandemic-induced exposures on fertility intentions compared with not changed (n=10 672)

Parameter	Fertility intentions	
	Postponed	Accelerated
	AOR (95% CI)	AOR (95% CI)
Age (years)	1.53 (1.31 to 1.80)***	1.34 (1.18 to 1.53)***
Age <sup>2</sup> (years)	0.99 (0.99 to 1.00)***	1.00 (0.99 to 1.00)***
Marital status		
Single†	1	1
Not married, have a partner	0.94 (0.71 to 1.25)	1.03 (0.74 to 1.42)
Legally married	1.27 (0.95 to 1.70)	0.98 (0.70 to 1.39)
Education		
No formal education–secondary education	1	1
Some college/university	1.17 (0.81 to 1.69)	1.11 (0.61 to 2.01)
Completed college/university	1.08 (0.88 to 1.32)	1.26 (0.84 to 1.88)
Religion		
Has no religious belief	1	1
Has a religious belief	1.38 (1.16 to 1.63)***	1.53 (1.16 to 2.02)**
Number of children		
0	1	1
1	1.25 (0.86 to 1.80)	0.75 (0.56 to 1.00)*
≥2	0.67 (0.53 to 0.85)***	0.39 (0.29 to 0.52)***
Testing for COVID-19		
No	1	1
Yes, always negative	0.79 (0.64 to 0.97)*	1.11 (0.92 to 1.33)
Yes, at least positive once	1.05 (0.47 to 2.35)	1.45 (0.74 to 2.83)
Isolation/quarantine		
No	1	1
Yes	1.41 (1.18 to 1.69)***	1.20 (0.99 to 1.46)
Personal income loss		
No	1	1
Yes	1.29 (1.12 to 1.49)***	1.22 (1.06 to 1.40)**
Living together with a steady partner		
No, s/he stay elsewhere	1	1
Yes, the whole time/part of the time	1.20 (0.83 to 1.72)	1.57 (1.10 to 2.23)*
<b>Mental health compared with 3 months before COVID-19 measures</b>		
Frequency of getting angry		
Same or less		
More	1.30 (1.18 to 1.43)***	0.98 (0.87 to 1.09)
Frequency of feeling frustrated		
Same or less	1	1
More	1.21 (1.04 to 1.41)*	0.99 (0.83 to 1.18)
Frequency of feeling bored		
Same or less	1	1
More	1.09 (0.99 to 1.19)	1.10 (0.87 to 1.39)
Frequency of worrying about finances		
Same or less	1	1
More	1.43 (1.16 to 1.75)***	1.20 (0.98 to 1.47)

Adjusted for all variables; 95% CI in parentheses.

\*p&lt;0.05, \*\*p&lt;0.01, \*\*\*p&lt;0.001.

†Single: including no partner, widowed, divorced, other.

AOR, adjusted odds ratio.

their fertility intentions compared with those who did not.

In terms of mental health, participants who reported increased frequency of getting angry (AOR=1.30; 95% CI 1.18 to 1.43), increased frequency of feeling frustrated (AOR=1.21; 95% CI 1.04 to 1.41) or increased frequency of worrying about their financial situation (AOR=1.43; 95% CI 1.16 to 1.75) were more likely to postpone their fertility intentions. The associations between pandemic-induced exposures and fertility intentions were robust in the sensitivity analyses (online supplemental tables 5 and 6).

## DISCUSSION

The associations between the COVID-19 pandemic and reproductive-aged women's fertility intentions are investigated in this multi-country, cross-sectional study. Fewer than a third of those who changed their fertility intentions decided they wanted a child sooner, implying that many women may be postponing plans to expand their families, with long-term implications for the total fertility rate. This study expands the literature by using a multi-country approach to explore pandemic-related factors that contributed to the postponement or acceleration in women's fertility intentions.

A relationship between COVID-19-related experiences and changes in fertility intentions is observed in this study. Women who received negative COVID-19 test results were less likely to postpone their fertility intentions. Similarly, women who were quarantined due to COVID-19 were more likely to postpone their fertility intentions. Underlying reasons explaining this trend may be the fear of the effect of COVID-19 infection on complications during pregnancy, as women may avoid conceiving in such circumstances.<sup>2</sup> In addition, women who lived with their partners during COVID-19 social distancing measures were more likely to accelerate their fertility intentions compared with women who did not change their fertility intentions. This may be due to the fact that the COVID-19 social distancing measures allowed women to spend more time with their partners, improving the quality of their relationships and encouraging them to expand their families.<sup>15 24</sup>

The economic recession brought on by the COVID-19 pandemic was a crucial factor for fertility intentions among our respondents. Women in our study who lost personal income during the pandemic were more likely to postpone their desire to have children. This is consistent with the findings of Italian and Polish studies in which women who postponed or even abandoned their intention to have children cited reduced income as a major concern.<sup>8 9</sup> In contrast, a US study showed that women who were financially insecure reported newly considering pregnancy.<sup>25</sup> The current study also found that women who lost personal income were significantly more likely to want a child

sooner. This may be explained by such women using this period to have children, as the barriers to childbearing diminished, and the available time for childbearing and childcaring increased.<sup>26</sup> Evidently a loss in personal income may influence fertility intentions bidirectionally.

Another important topic was the mental health deterioration in association with pandemic-related social distancing measures. Our findings are in favour of the mental health burden produced by the COVID-19 pandemic having negative associations with fertility decisions.<sup>27 28</sup> Women who had a higher frequency of getting angry, frustrated, or worried about finances during the pandemic were more likely to postpone their desire to have children. This study supports the need to learn more about how the pandemic affects mental health and fertility decisions concomitantly.

This study is not without shortcomings. Because the participants were mostly recruited through convenience sampling with no quota set, and those individuals who did not have access to or could not use electronic devices were also not represented, this study was deficient in representativeness. Additionally, the study's findings may be primarily driven by high-income countries, given that only a small number of participants were from low- or low-middle-income countries, and the majority were from high-income countries, resulting in limited generalisability. Furthermore, the number of participants varied widely between countries or regions, making it impractical to conduct inter-country or inter-regional comparisons for this study.

## CONCLUSIONS

In this large, diverse, cross-sectional study of reproductive-aged women, few women wanted a child sooner following the outbreak of COVID-19 and there was substantial uncertainty about whether their intentions would change as the crisis continued. In the context of the pandemic, the COVID-19-related experiences, personal income loss, living together with a steady partner, and mental health among women might influence the fertility rate over the long term. Future research could further investigate specific factors related to the pandemic that influence the decision to postpone or accelerate fertility plans, as well as whether fertility intention patterns differ across countries and regional groups.

### Author affiliations

<sup>1</sup>Department of Infectious Disease, Xi'an Jiaotong University Second Affiliated Hospital, Xi'an, Shaanxi, People's Republic of China

<sup>2</sup>School of Public Health, Xi'an Jiaotong University Health Science Center, Xi'an, Shaanxi, People's Republic of China

<sup>3</sup>International Center for Reproductive Health, Faculty of Medicine and Health Sciences, Ghent University, Ghent, Belgium

<sup>4</sup>Department of Obstetrics and Gynaecology, National University Hospital, Singapore

<sup>5</sup>Institute for Public Health, Ministry of Health Malaysia, Putrajaya, Malaysia

<sup>6</sup>School of Public Policy and Administration, Xi'an Jiaotong University, Xi'an, Shaanxi, People's Republic of China

<sup>7</sup>Social Medicine Center, National Research Institute for Family Planning, Beijing, People's Republic of China

<sup>8</sup>Division of Infectious Diseases and Tropical Medicine, University of Munich, Munich, Germany

<sup>9</sup>German Centre for Infection Research, Partner Site Munich, Munich, Germany

<sup>10</sup>Department of Global Public Health, Karolinska Institute, Stockholm, Sweden

<sup>11</sup>Department of Women's and Children's Health, Karolinska Institute, Stockholm, Sweden

<sup>12</sup>Foundation for Professional Development, Health Systems Strengthening, Pretoria, South Africa

<sup>13</sup>Department of Clinical Research, London School of Hygiene & Tropical Medicine, London, UK

<sup>14</sup>The University of North Carolina at Chapel Hill School of Medicine, Chapel Hill, North Carolina, USA

<sup>15</sup>School of Public Health, Université Libre de Bruxelles, Brussels, Belgium

**Acknowledgements** This study was carried out as part of the I-SHARE study. We thank the I-SHARE consortium for initiating, designing and conducting this multi-country survey. All members have made outstanding contributions to this survey.

**Contributors** W-HZ was the guarantor of the study. W-HZ designed the study and supervised the data analysis. MZ performed the data analysis. CAO'H, NBS and JDT provided input on the statistical analyses. MZ and CAO'H prepared the draft of the manuscript. NBS, OI, ECL, KP, SS, HL, EK, AC and W-HZ revised drafts of the manuscript and provided advice. KM and JDT were the coordinators for the multi-county survey. The I-SHARE consortium conducted field testing, translation, ethical review applications and survey implementation in 30 countries. All contributing authors reviewed, provided input and approved the final manuscript.

**Funding** MZ was supported by a research training programme PhD scholarship provided by the China Scholarship Council (No. 202006280097) during the conduct of the study.

**Competing interests** None declared.

**Patient and public involvement** Patients and/or the public were not involved in the design, or conduct, or reporting, or dissemination plans of this research.

**Patient consent for publication** Not applicable.

**Ethics approval** This study involves human participants and ethical approval was obtained from Ghent University (BC-07988) and the University of North Carolina at Chapel Hill (295989) for secondary data analysis. Participants gave informed consent to participate in the study before taking part.

**Provenance and peer review** Not commissioned; externally peer reviewed.

**Data availability statement** Data are available upon reasonable request. The authors have affirmed their willingness to provide all anonymized participant data that form the foundation of the analysis, results, and conclusions presented in this paper. Data are available from Prof. Wei-Hong Zhang who can be contacted on [Weihong.zhang@ugent.be](mailto:Weihong.zhang@ugent.be). The survey protocol and final survey instrument are available at <https://sti.bmj.com/content/97/2/88.long>.

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## ORCID iDs

Min Zhao <http://orcid.org/0000-0002-2997-2431>

Wei-Hong Zhang <http://orcid.org/0000-0003-0380-770X>

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Country	Potential participants (n)	participants (n)
Argentina	845	533
Australia	561	318
Botswana	344	211
Canada	163	103
China	827	0
Colombia	2452	1168
Czech	1862	533
Denmark	1001	186
France	1593	1152
Germany	612	471
Italy	329	173
Kenya	243	0
Latvia	1176	695
Luxembourg	568	201
Malaysia	499	133
Mexico	1673	841
Moldova	244	114
Nigeria	231	13
Panama	960	395
Portugal	3323	2209
Singapore	566	111
Spain	295	24
Sweden	1307	473
Uganda	212	60
Uruguay	696	385
USA	305	170
Egypt	31	0
Lebanon	54	0
Mozambique	66	0
South Africa	29	0
Total	23067	10672

Supplementary table 2 Comparison of characteristics between participants in this study (n=10672) and all reproductive-aged women from the I-SHARE survey (n=13562)

Characteristics	Participants		All reproductive-aged women		P value
	n=10672	col %	n=13562	col %	
<b>Age</b>					
Mean (SD)	29.9 (7.8)		30.3 (8.0)		<0.001
<b>Marital status</b>					
Single, no partner	2918	27.4	3697	27.3	<0.001
Not married, have a partner	5030	47.2	5849	43.3	
Legally Married	2467	23.2	3650	27.0	
Widowed/divorced/other	239	2.2	327	2.4	
<b>Education</b>					
No formal education	20	0.2	39	0.3	>0.05
Some/completed primary education	599	5.8	675	5.2	
Some/completed secondary education	1850	17.9	2408	18.3	
Some college/university	1662	16.0	2107	16.1	
Completed college/university	6217	60.1	7884	60.1	
<b>Religion</b>					
Has no religious belief	4211	48.0	5144	45.8	p<0.01
Has a religious belief	4558	52.0	6082	54.2	
<b>Number of children</b>					
0	7779	72.9	9273	68.4	<0.001
1	1294	12.1	1988	14.6	
>=2	1597	15.0	2299	17.0	

Supplementary table 3 Distribution of participants' fertility intentions across country region, country income level, and socio-demographic characteristics (n=10672)

	Fertility intentions								P value*
	Total		Postponed		Accelerated		Not Changed		
	n	col %	n	row %	n	row %	n	row %	
<b>Age (years)</b>									
Mean (SD)	29.9	7.8	29.6	5.8	29.9	6.2	30.0	8.1	>0.05
<b>Marital status</b>									<0.05
Single <sup>†</sup>	3157	29.6	218	6.9	104	3.3	2835	89.8	
Not married, have a partner	5030	47.2	521	10.4	237	4.7	4272	84.9	
Legally married	2467	23.2	347	14.0	108	4.4	2012	81.6	
<b>Education</b>									<0.001
No formal education-secondary education	2469	23.9	214	8.7	86	3.5	2169	87.8	
Some college/university	1662	16.0	158	9.5	53	3.2	1451	87.3	
Completed college/university	6217	60.1	677	10.9	292	4.7	5248	84.4	
<b>Religion</b>									<0.001
Has no religious belief	4211	48.0	329	7.8	136	3.2	3746	89.0	
Has a religious belief	4558	52.0	568	12.5	237	5.2	3753	82.3	
<b>Number of children</b>									<0.05
0	7779	72.9	743	9.6	365	4.6	6671	85.8	
1	1294	12.1	233	18.0	51	3.9	1010	78.1	
>=2	1597	15.0	112	7.0	35	2.2	1450	90.8	
<b>Country region</b>									<0.05
Sub-Saharan Africa (SSA)	284	2.7	73	25.7	22	7.7	189	66.6	
Latin America and the Caribbean (LAC)	3322	31.0	402	12.1	129	3.9	2791	84.0	
North America (NA)	273	2.6	24	8.8	13	4.8	236	86.4	
East Asia and the Pacific (EAP)	562	5.3	49	8.7	43	7.7	470	83.6	
Europe and Central Asia (ECA)	6231	58.4	540	8.7	244	3.9	5447	87.4	
<b>Country income level</b>									<0.001
High-income countries	7204	67.5	605	8.4	287	4.0	6312	87.6	
Upper-middle-income countries	3395	31.8	464	13.7	158	4.6	2773	81.7	
Low or low-middle-income countries	73	0.7	19	26.0	6	8.2	48	65.8	

\* Compared using Bonferroni correction.

<sup>†</sup> Single: including, no partner, widowed, divorced, other.

Supplementary table 4 The multinomial probit regression analysis of pandemic-induced exposures on fertility intentions compared with not changed (n=10672)

	Fertility intentions					
	Postponed			Accelerated		
	Model 1 OR (95% CI)	Model 2 AOR (95% CI)	Model 3 AOR (95% CI)	Model 1 OR (95% CI)	Model 2 AOR (95% CI)	Model 3 AOR (95% CI)
<b>Testing for COVID-19</b>						
No	1	1	1	1	1	1
Yes, always negative	0.94 (0.78 to 1.14)	0.88 (0.75 to 1.03)	0.79 (0.64 to 0.97) *	1.13 (0.94 to 1.36)	1.08 (0.92 to 1.26)	1.11 (0.92 to 1.33)
Yes, at least positive once	1.30 (0.82 to 2.06)	1.26 (0.68 to 2.31)	1.05 (0.47 to 2.35)	1.37 (0.86 to 2.19)	1.55 (0.86 to 2.80)	1.45 (0.74 to 2.83)
<b>Isolation/quarantine</b>						
No	1	1	1	1	1	1
Yes	1.30 (1.11 to 1.53) **	1.29 (1.05 to 1.58) *	1.41 (1.18 to 1.69) ***	1.22 (1.04 to 1.42) *	1.28 (1.04 to 1.57) *	1.20 (0.99 to 1.46)
<b>Personal income loss</b>						
No	1	1	1	1	1	1
Yes	1.51 (1.35 to 1.69) ***	1.54 (1.35 to 1.74) ***	1.29 (1.12 to 1.49) ***	1.30 (1.15 to 1.47) ***	1.29 (1.08 to 1.53) **	1.22 (1.06 to 1.40) **
<b>Living together with a steady partner</b>						
No, s/he stays elsewhere	1	1	1	1	1	1
Yes, the whole time/part of the time	1.33 (0.93 to 1.89)	1.13 (0.77 to 1.66)	1.20 (0.83 to 1.72)	1.41 (1.08 to 1.84) *	1.51 (1.08 to 2.11) *	1.57 (1.10 to 2.23) *
<b>Mental health compared with three months before COVID-19 measures</b>						
<b>Frequency of getting angry</b>						
Same or less	1	1	1	1	1	1
More	1.43 (1.30 to 1.58) ***	1.51 (1.37 to 1.67) ***	1.30 (1.18 to 1.43) ***	1.10 (1.02 to 1.19) *	1.09 (1.01 to 1.19) *	0.98 (0.87 to 1.09)
<b>Frequency of feeling frustrated</b>						
Same or less	1	1	1	1	1	1
More	1.42 (1.27 to 1.59) ***	1.49 (1.29 to 1.73) ***	1.21 (1.04 to 1.41) *	1.06 (0.93 to 1.21)	1.12 (0.96 to 1.30)	0.99 (0.83 to 1.18)
<b>Frequency of feeling bored</b>						

Same or less	1	1	1	1	1	1
More	1.27 (1.14 to 1.42) ***	1.33 (1.19 to 1.49) ***	1.09 (0.99 to 1.19)	1.09 (0.93 to 1.28)	1.13 (0.93 to 1.37)	1.10 (0.87 to 1.39)
<b>Frequency of worrying about finances</b>						
Same or less	1	1	1	1	1	1
More	1.65 (1.39 to 1.95) ***	1.70 (1.46 to 1.98) ***	1.43 (1.16 to 1.75) ***	1.23 (1.10 to 1.38) ***	1.21 (1.09 to 1.35) ***	1.20 (0.98 to 1.47)

Model 1: Crude odd ratios.

Model 2: After controlling for confounding variables (age, age<sup>2</sup>, relationship status, education, religion, number of children), the above key explanatory variables were tested individually.

Model 3: After controlling for confounding variables (age, age<sup>2</sup>, relationship status, education, religion, number of children), the above key explanatory variables were tested simultaneously.

OR: odd ratios; AOR: Adjusted odd ratios.

95% confidence intervals in brackets

\* p < 0.05, \*\* p < 0.01, \*\*\* p < 0.001.

Supplementary table 5 The multinomial probit regression analysis of pandemic-induced exposures on fertility intentions compared with not changed, using bootstrap estimation (n=10672)

	Fertility intentions	
	Postponed AOR (95% CI)	Accelerated AOR (95% CI)
<b>Age (years)</b>	1.53 (1.31 to 1.80) ***	1.34 (1.17 to 1.54) ***
<b>Age<sup>2</sup> (years)</b>	0.99 (0.99 to 1.00) ***	1.00 (0.99 to 1.00) ***
<b>Marital status</b>		
Single <sup>†</sup>	1	1
Not married, have a partner	0.94 (0.70 to 1.27)	1.03 (0.73 to 1.44)
Legally Married	1.27 (0.95 to 1.70)	0.98 (0.68 to 1.43)
<b>Education</b>		
No formal education-secondary education	1	1
Some college/university	1.17 (0.79 to 1.72)	1.11 (0.59 to 2.11)
Completed college/university	1.08 (0.83 to 1.39)	1.26 (0.82 to 1.92)
<b>Religion</b>		
Has no religious belief	1	1
Has a religious belief	1.38 (1.14 to 1.66) ***	1.53 (1.14 to 2.06) **
<b>Number of children</b>		
0	1	1
1	1.25 (0.85 to 1.82)	0.75 (0.55 to 1.00)
>=2	0.67 (0.54 to 0.84) ***	0.39 (0.28 to 0.55) ***
<b>Testing for COVID-19</b>		
No	1	1
Yes, always negative	0.79 (0.63 to 0.99) *	1.11 (0.90 to 1.37)
Yes, at least positive once	1.05 (0.44 to 2.48)	1.45 (0.69 to 3.06)
<b>Isolation/quarantine</b>		
No	1	1
Yes	1.41 (1.15 to 1.72) ***	1.20 (0.99 to 1.46)
<b>Personal income loss</b>		
No	1	1
Yes	1.29 (1.11 to 1.51) **	1.22 (1.05 to 1.41) **
<b>Living together with a steady partner</b>		
No, s/he stay elsewhere	1	1
Yes, the whole time/part of the time	1.20 (0.85 to 1.68)	1.57 (1.08 to 2.28) *
<b>Mental health compared with three months before COVID-19 measures</b>		
<b>Frequency of getting angry</b>		
Same or less	1	1
More	1.30 (1.17 to 1.44) ***	0.98 (0.87 to 1.09)
<b>Frequency of feeling frustrated</b>		
Same or less	1	1
More	1.21 (1.02 to 1.44) *	0.99 (0.82 to 1.20)
<b>Frequency of feeling bored</b>		
Same or less	1	1

More	1.09 (0.98 to 1.21)	1.10 (0.82 to 1.48)
<b>Frequency of worrying about finances</b>		
Same or less	1	1
More	1.43 (1.17 to 1.75) ***	1.20 (0.97 to 1.49)

<sup>†</sup>Single: including, no partner, widowed, divorced, other.

AOR: Adjusted odd ratios. 95% confidence intervals in brackets

\* p < 0.05, \*\* p < 0.01, \*\*\* p < 0.001.



Supplementary table 6 The multinomial probit regression analysis of pandemic-induced exposures on fertility intentions compared with not changed, removing Nigeria, Spain, and Uganda samples (n=10575)

	Fertility intentions	
	Postponed AOR (95% CI)	Accelerated AOR (95% CI)
<b>Age (years)</b>	1.54 (1.31 to 1.81) ***	1.34 (1.18 to 1.53) ***
<b>Age<sup>2</sup> (years)</b>	0.99 (0.99 to 1.00) ***	1.00 (0.99 to 1.00) ***
<b>Marital status</b>		
Single <sup>†</sup>	1	1
Not married to have a partner	0.96 (0.72 to 1.26)	1.03 (0.74 to 1.42)
Legally Married	1.29 (0.96 to 1.72)	0.97 (0.68 to 1.39)
<b>Education</b>		
No formal education-secondary education	1	1
Some college/university	1.16 (0.81 to 1.67)	1.11 (0.61 to 2.01)
Completed college/university	1.08 (0.88 to 1.32)	1.26 (0.84 to 1.88)
<b>Religion</b>		
Has no religious belief	1	1
Has a religious belief	1.38 (1.16 to 1.63) ***	1.53 (1.16 to 2.01) **
<b>Number of children</b>		
0	1	1
1	1.25 (0.86 to 1.80)	0.74 (0.55 to 0.99) *
>=2	0.67 (0.53 to 0.85) ***	0.40 (0.30 to 0.53) ***
<b>Testing for COVID-19</b>		
No	1	1
Yes, always negative	0.79 (0.64 to 0.97) *	1.12 (0.93 to 1.35)
Yes, at least positive once	1.05 (0.47 to 2.35)	1.48 (0.76 to 2.88)
<b>Isolation/quarantine</b>		
No	1	1
Yes	1.41 (1.18 to 1.69) ***	1.18 (0.97 to 1.44)
<b>Personal income loss</b>		
No	1	1
Yes	1.29 (1.12 to 1.49) ***	1.20 (1.05 to 1.37) **
<b>Living together with a steady partner</b>		
No, s/he stay elsewhere	1	1
Yes, the whole time/part of the time	1.19 (0.83 to 1.72)	1.56 (1.09 to 2.23) *
<b>Mental health compared with three months before COVID-19 measures</b>		
<b>Frequency of getting angry</b>		
Same or less	1	1
More	1.31 (1.18 to 1.44) ***	0.96 (0.86 to 1.07)
<b>Frequency of feeling frustrated</b>		
Same or less	1	1
More	1.20 (1.03 to 1.41) *	1.00 (0.85 to 1.19)
<b>Frequency of feeling bored</b>		
Same or less	1	1
More	1.09 (0.99 to 1.19)	1.11 (0.88 to 1.41)
<b>Frequency of worrying about finances</b>		
Same or less	1	1
More	1.43 (1.16 to 1.75) ***	1.21 (0.98 to 1.48)

Note: Nigeria and Uganda are also low- or low-middle-income countries.

† Single: including no partner, widowed, divorced, other.

AOR: Adjusted odd ratios. 95% confidence intervals in brackets.

\*  $p < 0.05$ , \*\*  $p < 0.01$ , \*\*\*  $p < 0.001$ .

Supplementary table 7 The multinomial probit regression analysis of pandemic-induced exposures on fertility intentions compared with not changed, stratified by country income level (n=10672)

	Fertility intentions			
	High-income countries		Upper-middle-income and Low or low-middle-income countries	
	Postponed AOR (95% CI)	Accelerated AOR (95% CI)	Postponed AOR (95% CI)	Accelerated AOR (95% CI)
<b>Age (years)</b>	1.55 (1.24 to 1.94) ***	1.28 (1.11 to 1.47) ***	1.49 (1.27 to 1.75) ***	1.66 (1.31 to 2.11) ***
<b>Age<sup>2</sup> (years)</b>	0.99 (0.99 to 1.00) ***	1.00 (0.99 to 1.00) ***	0.99 (0.99 to 1.00) ***	0.99 (0.99 to 1.00) ***
<b>Marital status</b>				
Single <sup>1</sup>	1	1	1	1
Not married, have a partner	0.90 (0.62 to 1.32)	1.01 (0.65 to 1.55)	1.08 (0.75 to 1.55)	0.99 (0.61 to 1.63)
Legally Married	1.19 (0.79 to 1.80)	0.83 (0.49 to 1.41)	1.65 (1.15 to 2.37) **	2.36 (1.78 to 3.13) ***
<b>Education</b>				
No formal education-secondary education	1	1	1	1
Some college/university	1.11 (0.73 to 1.71)	1.07 (0.59 to 1.96)	0.82 (0.75 to 0.91) ***	0.73 (0.35 to 1.51)
Completed college/university	1.03 (0.84 to 1.27)	1.35 (0.93 to 1.94)	0.93 (0.64 to 1.36)	0.64 (0.37 to 1.11)
<b>Religion</b>				
Has no religious belief	1	1	1	1
Has a religious belief	1.26 (1.04 to 1.53) *	1.42 (1.03 to 1.95) *	1.59 (1.43 to 1.77) ***	2.03 (1.38 to 3.00) ***
<b>Number of children</b>				
0	1	1	1	1
1	1.43 (1.03 to 1.98) *	0.89 (0.67 to 1.19)	0.81 (0.45 to 1.47)	0.42 (0.34 to 0.53) ***
>=2	0.63 (0.47 to 0.84) **	0.46 (0.33 to 0.66) ***	0.68 (0.52 to 0.89) **	0.22 (0.14 to 0.33) ***
<b>Testing for COVID-19</b>				
No	1	1	1	1
Yes, always negative	0.87 (0.73 to 1.03)	1.15 (0.92 to 1.42)	0.65 (0.47 to 0.90) *	1.01 (0.63 to 1.62)

Yes, at least positive once	1.21 (0.40 to 3.67)	1.48 (0.55 to 3.97)	0.72 (0.29 to 1.83)	1.34 (0.82 to 2.19)
<b>Isolation/quarantine</b>				
No	1	1	1	1
Yes	1.41 (1.12 to 1.78) **	1.22 (0.95 to 1.55)	1.38 (1.01 to 1.89) *	1.18 (0.74 to 1.88)
<b>Personal income loss</b>				
No	1	1	1	1
Yes	1.30 (1.04 to 1.61) *	1.20 (1.06 to 1.36) **	1.11 (0.90 to 1.36)	1.23 (0.79 to 1.92)
<b>Living together with a steady partner</b>				
No, s/he stay elsewhere	1	1	1	1
Yes, the whole time/part of the time	1.53 (1.11 to 2.10) **	2.10 (1.63 to 2.69) ***	0.91 (0.67 to 1.22)	0.59 (0.49 to 0.73) ***
<b>Mental health compared with three months before COVID-19 measures</b>				
<b>Frequency of getting angry</b>				
Same or less	1	1	1	1
More	1.36 (1.22 to 1.52) ***	0.92 (0.82 to 1.03)	1.16 (0.97 to 1.40)	1.35 (1.08 to 1.69) **
<b>Frequency of feeling frustrated</b>				
Same or less	1	1	1	1
More	1.27 (1.06 to 1.52) **	1.14 (0.97 to 1.34)	0.99 (0.89 to 1.10)	0.57 (0.45 to 0.73) ***
<b>Frequency of feeling bored</b>				
Same or less	1	1	1	1
More	1.02 (0.90 to 1.16)	1.12 (0.83 to 1.51)	1.16 (0.97 to 1.39)	0.97 (0.66 to 1.43)
<b>Frequency of worrying about finances</b>				
Same or less	1	1	1	1
More	1.49 (1.17 to 1.89) **	1.27 (1.04 to 1.55) *	1.14 (0.99 to 1.30)	0.94 (0.57 to 1.54)

<sup>†</sup>Single: including no partner, widowed, divorced, other.

AOR: Adjusted odd ratios. 95% confidence intervals in brackets.

\* p < 0.05, \*\* p < 0.01, \*\*\* p < 0.001.

Supplementary table 8 The multinomial probit regression analysis of pandemic-induced exposures on fertility intentions compared with not changed, examining the effects of country income level (n=10672)

	Fertility intentions	
	Postponed	Accelerated
	AOR (95% CI)	AOR (95% CI)
<b>Age (years)</b>	1.52 (1.30 to 1.77) ***	1.33 (1.18 to 1.51) ***
<b>Age<sup>2</sup> (years)</b>	0.99 (0.99 to 1.00) ***	1.00 (0.99 to 1.00) ***
<b>Marital status</b>		
Single <sup>i</sup>	1	1
Not married to have a partner	0.96 (0.74 to 1.26)	1.03 (0.75 to 1.42)
Legally Married	1.31 (0.97 to 1.76)	0.98 (0.70 to 1.39)
<b>Education</b>		
No formal education-secondary education	1	1
Some college/university	1.03 (0.78 to 1.35)	1.05 (0.62 to 1.76)
Completed college/university	1.03 (0.86 to 1.25)	1.25 (0.86 to 1.83)
<b>Religion</b>		
Has no religious belief	1	1
Has a religious belief	1.31 (1.13 to 1.53) ***	1.50 (1.13 to 1.99) **
<b>Number of children</b>		
0	1	1
1	1.23 (0.85 to 1.78)	0.75 (0.58 to 0.98) *
>=2	0.65 (0.53 to 0.81) ***	0.39 (0.29 to 0.52) ***
<b>Country income level</b>		
Upper-middle-income and Low or low-middle-income countries	1	1
High-income countries	0.27 (0.19 to 0.37) ***	0.32 (0.19 to 0.53) ***
<b>Testing for COVID-19</b>		
No	1	1
Yes, always negative	0.65 (0.48 to 0.89) **	1.05 (0.73 to 1.53)
Yes, at least positive once	0.74 (0.31 to 1.74)	1.30 (0.71 to 2.39)
<b>Testing for COVID-19 X Country income level</b>		
No	1	1
Yes, always negative	1.34 (0.96 to 1.89)	1.08 (0.70 to 1.66)
Yes, at least positive once	1.67 (0.41 to 6.79)	1.16 (0.36 to 3.72)
<b>Isolation/quarantine</b>		
No	1	1
Yes	1.36 (0.99 to 1.87)	1.13 (0.74 to 1.72)
<b>Isolation/quarantine X Country income level</b>		
No	1	1
Yes	1.04 (0.71 to 1.52)	1.09 (0.67 to 1.76)
<b>Personal income loss</b>		
No	1	1
Yes	1.09 (0.92 to 1.29)	1.15 (0.80 to 1.66)
<b>Personal income loss X Country income level</b>		
No	1	1
Yes	1.20 (0.92 to 1.55)	1.05 (0.71 to 1.54)
<b>Living together with a steady partner</b>		
No, s/he stay elsewhere	1	1
Yes, the whole time/part of the time	0.90 (0.75 to 1.08)	1.01 (0.63 to 1.63)
<b>Living together with a steady partner X Country income level</b>		

No, s/he stay elsewhere	1	1
Yes, the whole time/part of the time	1.70 (1.21 to 2.38) **	1.93 (1.17 to 3.17) **
<b>Mental health compared with three months before COVID-19 measures</b>		
<b>Frequency of getting angry</b>		
Same or less	1	1
More	1.16 (0.96 to 1.41)	1.26 (1.04 to 1.51) *
<b>Frequency of getting angry X Country income level</b>		
Same or less	1	1
More	1.17 (0.93 to 1.47)	0.74 (0.60 to 0.92) **
<b>Frequency of feeling frustrated</b>		
Same or less	1	1
More	0.98 (0.88 to 1.09)	0.51 (0.40 to 0.66) ***
<b>Frequency of feeling frustrated X Country income level</b>		
Same or less	1	1
More	1.29 (1.05 to 1.58) *	2.23 (1.62 to 3.08) ***
<b>Frequency of feeling bored</b>		
Same or less	1	1
More	1.06 (0.97 to 1.16)	1.10 (0.87 to 1.40)
<b>Frequency of worrying about finances</b>		
Same or less	1	1
More	1.18 (0.99 to 1.41)	0.96 (0.60 to 1.53)
<b>Frequency of worrying about finances X Country income level</b>		
Same or less	1	1
More	1.26 (0.95 to 1.67)	1.30 (0.79 to 2.14)

<sup>†</sup>Single: including no partner, widowed, divorced, other.

AOR: Adjusted odd ratios. 95% confidence intervals in brackets.

\* p < 0.05, \*\* p < 0.01, \*\*\* p < 0.001.