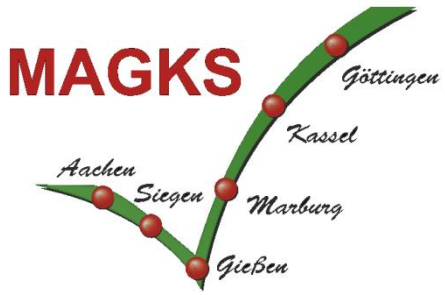

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The Impact of the COVID-19 Pandemic on Marriage and Childbirth: Survey-based Evidence from Iran*

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Abstract

With a representative survey of 1,214 participants conducted in early 2022, this study investigates the impact of the COVID-19 pandemic on marriage and childbirth in Iran. The results of the empirical investigation using logistic regressions suggest that the experience of unemployment due to the pandemic is positively associated with marriage during the pandemic and the experience of losing a close relative or family member is negatively associated with marriage. In addition, concern about the persistence of the pandemic and vaccination status show negative associations with childbirth during the pandemic. We found heterogenous effects depending on gender, location, and social class; for example, the negative effects of the concern about a prolonged pandemic and vaccination status are driven by female respondents. Overall, the results have implications for the development of the fertility rate and population in post-pandemic Iran.

JEL codes:

C83, D91, D1, J12, J13, P46, Q54

Keywords:

COVID-19, pandemic, disaster, Iran, survey, logistic regression, marriage, fertility, family planning, inequality

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1. Introduction

After the outbreak of the coronavirus (COVID-19) in Wuhan, China, in December 2019, it took only two months until Iran reported its first case of infection, which was identified in the city of Qom (Yavarian et al. 2020). Like most parts of the world, Iran suffered from the direct and indirect consequences of the pandemic. It affected the physical and mental health of citizens, as well as social and economic life. Since the outbreak of the pandemic in Iran, more than 144,000 people have lost their lives and more than 7.5 million Iranians have been infected (WHO 2022). This makes it one of the largest disasters experienced by the country in modern times, which is exceeded in death count only by the Iran-Iraq War. Between February 2020 and November 2022, Iran experienced seven waves[1] of COVID-19 with several lockdowns. This led to people staying home with their families more hours per day than before the pandemic, impacting social and family dynamics.

In this study, we investigate the impact of the COVID-19 pandemic on the family planning behavior of Iranian citizens[2]. We commissioned a comprehensive survey in Iran through R-Research Limited (organization responsible for implementing Wave 7 of the World Values Survey in Iran), employing computer-assisted telephone interviews (CATI) technology. This initiative yielded an extensive cross-individual dataset comprising of 1,214 respondents. The interviews were conducted during the sixth wave of the pandemic, specifically in January and February 2022. We use logistic regression models to determine the association between the experience of the pandemic, measured by eight questions covering the direct and indirect effects of the pandemic, and family planning behavior, measured by two questions that refer to marriage and childbirth during the pandemic. Additionally, we investigated the heterogeneity of the responses across genders, locations, and social classes, which is used as a proxy for income level and social values. Thus, the research question is the following: *Did the COVID-19 pandemic affect marriage and childbirth in Iran?*, followed by: *Do responses vary depending on gender, location, and social class?*

The contribution of this study is to provide new empirical evidence on the social impact of the COVID-19 pandemic in Iran. The studied outcome variables also have implications for the fertility rate in Iran, affecting social and economic development. The highlight of our study is the impact of the COVID-19 pandemic and related changes on the marriage and fertility intentions of women and men in Iran, which to our knowledge, has not yet been studied. Many

[1] More information on the seven waves of COVID-19 in Iran are presented in Figure A1 in the Appendix.
[2] For macroeconomic drivers of family planning as well as related formal and informal institutional backgrounds in Iran see Farzanegan and Gholipour (2015; 2016; 2018) and Asna-ashary et al. (2020).

previous surveys only focus on women's intentions (Tan, Ryan, and Lim-Soh 2021; Afshari, Abedi, and Beheshtinasab 2022; Akinyemi et al. 2022; Chen et al. 2022; Zimmerman et al. 2022). Moreover, it is the first study that systematically investigates the heterogeneity across genders, locations (rural versus urban), and social classes, while other studies have only briefly touched this topic (Fostik and Galbraith 2021; Manning, Guzzo, and Kamp Dush 2021; Akinyemi et al. 2022; Zimmerman et al. 2022; Bailey, Currie, and Schwandt 2023). Finally, it is also the first comprehensive study on the case of Iran and the first on this scale from a lower-middle income country. The remaining paper is structured in the following way: Section 2 gives an overview of the relevant literature related to the topic and Section 3 presents the data and methodology. In Section 4, the results are presented and discussed, and Section 5 concludes the paper.

2. Literature Review

While there is recent growing interest in the consequences of pandemics on the marriage and fertility behavior of citizens, especially due to the COVID-19 pandemic, there is already a body of literature on behavior and decision-making under situations of uncertainty, such as war and conflict, manmade and natural disasters (including pandemics), and economic crises.

2.1 Theoretical Considerations

There are different theoretical approaches that discuss the connection between situations of uncertainty and marriage and fertility decisions. A starting point to understand fertility dynamics is the demographic transition theory which describes the transition from a high fertility and high mortality society to a low fertility and low mortality society. This happens due to several economic and social changes, for example, improvements in the provision of education and healthcare services, as well as changes in societal values, and is usually connected to modernization, industrialization, and urbanization. Abbasi-Shavazi et al. (2009) summarize several relevant theories in this context, such as the child survival theory, demand theory, status enhancement theory, gender equity theory, and with an institutional perspective. While previous theories have explained how societal changes affect fertility decisions, we are more interested in the role of periods of uncertainty such as in war and conflict, manmade and natural disasters, and economic crises. Rodgers et al. (2005) summarize three theoretical approaches that link political and sociocultural events as well as manmade and natural disasters with an increase of fertility rates, namely the community influence theory, replacement or insurance theory, and terror management theory. First, the community influence theory suggests that parents want to raise children in a positive and supportive community. In the case

of the COVID-19 pandemic, this would mean that a competent response to the crisis might increase the fertility desires of couples. A related concept is the 'narratives of the future' framework that sees the rise of social and economic uncertainties as an important driver of fertility decisions (Vignoli et al. 2020).

Second, the replacement or insurance theory, which builds on the child survival theory. It suggests that as couples observed the loss of life, especially of children, they might perceive life to be more fragile. This can motivate couples to have more children, which will replace lives lost or be an insurance for the potential loss of a child. Aassve et al. (2020) argues against the replacement theory in the context of COVID-19, because the virus is more lethal to older people. Third, the terror management theory suggests that in a situation where mortality becomes more visible, people will turn to traditional values and behaviors, such as having children and raising families. Nitsche and Lee (2022) discuss the terror management theory in the context of the COVID-19 pandemic and argue that negative emotions, such as anxiety, anger, and loneliness, and other concerns at the beginning of the pandemic should have a positive effect on fertility desires.

Chin and Wilson (2018) discusses an economic theory of household fertility decision-making, previously labelled demand theory, in the context of the human immunodeficiency viruses (HIV) and acquired immunodeficiency syndrome (AIDS). The authors argue that the risk of disease will affect the demand for children through mainly two channels, the adult health risk and the child health risk. First, the health risk for adults reduces the time horizon for decision-making, as the life expectancy becomes lower. This will also reduce labor productivity and increase the demand for care labor in the home and thus, reduce household income. Depending on the level of industrialization, this can mean an increase in childbearing, so that children can help with the housework or add to the household income through external work. However, it can also mean a decrease in the number of children in the household because a child becomes an economic burden. Second, the health risk for children increases the shadow price of child quantity and quality. This means that children become an economic liability through the risk of death and in combination with the cost of education, can decrease fertility desires.

Ahmed and Tan (2022) and Wilkins (2021) summarize several mechanisms through which disasters might affect fertility rates. First, supported by empirical evidence, they argue that crisis-induced psychological stress can lead to a decrease in fecundity, and thus, a reduction in fertility. This medical argument opposes the terror management and replacement theory. Second, contact between partners can be disrupted, for example, by geographical separation or death, which will reduce the number of children. This separation can happen because of

temporary labor migration due to conflict or an economic crisis. On the other hand, the type of disaster can also cause more bonding and time spent between couples; for example, the lockdowns during the COVID-19 pandemic can increase the number of children. However, a lockdown also means a reduced work-life balance and an increased burden on the parents, which can reduce the motivation for additional children.

Third, previous experience with or the perception of the probability of a disaster can increase voluntary birth control, as discussed in the community influence theory, or it can increase fertility desires, as discussed in the terror management and replacement theory. Fourth, a disaster can also postpone or prevent marriages due to separation or financial problems or it can facilitate marriages, which can reduce the financial burden on, usually, the bride's parents. Additionally, the disaster can also damage or disrupt the health system, which means worse reproductive healthcare at conception and worse access to family planning services, reproduction technology, and contraceptives. This can negatively affect the mother and baby's health and decrease fertility. Overall, we can see that the discussed theories and mechanisms address many aspects of marriage and fertility decisions during a disaster. The various explained effects might happen simultaneously, so that we cannot clearly state if a disaster such as the COVID-19 pandemic will have a positive or negative impact on marriage and childbirth.

2.2 Empirical Studies on COVID-19 and Other Large Catastrophes

Previous theoretical considerations about the effect of societal change and times of uncertainty on marriage and fertility decisions have also been empirically investigated. One part of the literature focuses on the impact of war and conflict on marriage, fertility, and life expectancy (Heuveline and Poch 2007; Cetorelli 2014; Ladier-Fouladi 2021; Farzanegan 2023). Large catastrophes can have direct effects on reproductive organs (Abu-Musa 2008; Bolouki and Zal 2020) and on life situations, both of which can have negative effects on fertility rates and intentions. War and conflict do not only mean that people die but can also cause the separation of couples and families, displacement and migration of people, and underreported births, all of which can reduce fertility rates in the short term. This was shown in several conflicts in Africa and Asia, where some authors found a drop in birth rates during the crises and a spike in birth rates afterwards (Agadjanian and Prata 2002; Blanc 2004; Heuveline and Poch 2007; Woldemicael 2008; Kraehnert et al. 2019; Thiede et al. 2020; Ahmed and Tan 2022).

Another part of the literature focuses on the impact of natural disasters on marriage and fertility decisions. Several authors have shown that natural disasters increase the number of marriages, especially child marriages, in South Asia (Dewi and Dartanto 2019; Asadullah, Islam, and Wahhaj 2021; Dietrich et al. 2022). Additionally, Das and Dasgupta (2022) show that a large-

scale earthquake in India reduced the marriage age and marriages into wealthier households in the affected areas. They argue that the negative economic shock due to the natural disaster pushed parents to arrange earlier marriages for their daughters to save on dowry expenditures. In addition, many studies from different parts of the world found an increase in birth rates after hurricanes, tsunamis, and earthquakes (Cohan and Cole 2002; Carta et al. 2012; Nobles, Frankenberg, and Thomas 2015; Behrman and Weitzman 2016; Davis 2017; Nandi, Mazumdar, and Behrman 2018). However, the impact of natural disasters is not always straightforward. Other studies show a decrease of birth rates after flood disasters and earthquakes in high-income countries (Tong, Zotti, and Hsia 2011; Hamamatsu et al. 2014) and several authors provide evidence for heterogenous effects depending on the disaster type and country characteristics, such as social attitudes, cultural values, network behavior, history, politics, and fertility preferences (Lin 2010; Sellers and Gray 2019; Norling 2022).

Another part of the literature discusses the impact of economic recessions on marriage and fertility decisions. Economic hardship during recessions will also have an impact on individual relationships, especially marriages, and can cause marital problems and divorces, and can affect husbands and wives differently (Aytac and Rankin 2009; Chowdhury 2013; Dong 2018). Hill (2015) shows that the Great Depression delayed marriages in the USA in the short term and presents evidence that while poor labor market conditions for men reduced marriages, poor labor market conditions for women increased marriages. Sobotka et al. (2011) argue that unemployment during an economic recession will lead to a delay in marriages and a decline in first-birth rates. This applies especially to countries where marriage is the traditional and legal precondition for having children. The role of unemployment was also highlighted by other studies (Schneider 2015; Alderotti et al. 2021; Matysiak, Sobotka, and Vignoli 2021; Gatta et al. 2022). Additionally, several authors show that high uncertainty about the future is associated with a decline in fertility (Aassve, Le Moglie, and Mencarini 2021; Comolli and Vignoli 2021), but that this effect might depend on other individual characteristics, such as income levels. Davalos and Morales (2017) show that in the case of Colombia, recessions are associated with fertility decline in poor areas and fertility growth in well-off areas.

Before COVID-19, previous studies on the effects of pandemics mainly focused on the impact of influenza and HIV/AIDS on marriage and fertility rates. Boberg-Fazlic et al. (2021) find evidence for a baby boom directly after the 1918-19 influenza pandemic in Sweden, followed by a decline in fertility in the long term. They also show an increase of births by married women, especially in families with higher income. There are mixed results on the impact of the HIV/AIDS pandemic on fertility and marriage decisions in Africa. On the one hand, Chin and

Wilson (2018) show a positive association between the HIV/AIDS pandemic and fertility rates for 14 Sub-Saharan African countries. Family composition and fertility decisions can also be impacted by foster children that come into new families (Deininger, Crommelynck, and Kempaka 2005). On the other hand, there are several studies that provide evidence that an HIV infection and the risk of infection can reduce both child quality, as reflected in children's schooling and health, and child quantity (Hunter et al. 2003; Terceira et al. 2003; Castro et al. 2015).

Finally, the most recent part of the literature focuses on the impact of the COVID-19 pandemic on marriage and fertility rates. The first observation at the beginning of the pandemic was a delay in marriages and divorces due to administrative challenges. Lockdowns, quarantines, limitations of public gatherings, and distancing regulations affected both the supply and demand side of marriage and divorce services (Ghaznavi et al. 2022; Komura and Ogawa 2022). However, practical barriers cannot always explain the decline in marriages. Hoehn-Velasco et al. (2023) show that in the case of Mexico, there was a drop in marriages and divorces during the first months of the pandemic, but that only divorces returned to pre-pandemic baseline levels. Several studies from the USA also argue that the decline in marriages cannot only be explained the closure of government agencies (Wagner, Choi, and Cohen 2020; Manning and Payne 2021; Westrick-Payne, Manning, and Carlson 2022). Guetto et al (2021) provide survey-based evidence from Italy and show that the prospect of the pandemic's persistence reduces marriage intentions.

Empirical evidence from several countries also shows a significant decrease in crude birth rates in the beginning of the pandemic and stabilized or slightly increased in subsequent months (Aassve, Le Moglie, and Mencarini 2021; Lima, Ferreira Soares, and Monteiro da Silva 2021; Pomar et al. 2022; Sobotka et al. 2022; Bailey, Currie, and Schwandt 2023; Kearney and Levine 2023). In contrast, Bujard and Andersson (2022) present results from Germany and Sweden, where the decline in fertility only started with the beginning of mass vaccination campaigns. This suggests that people adjusted their behavior to get vaccinated before becoming pregnant as societies were re-opening with post-pandemic life conditions. Nisen et al. (2022) show an increase in fertility in Finland during the pandemic.

In addition to country-level studies that focus on fertility and birth rates, there are also several studies that use surveys to determine individual characteristics that are responsible for the change in fertility behavior. The majority of studies come from Europe and North America and highlight the role of economic uncertainties, such as employment and household finances, or individual characteristics such as age, education, and mental well-being, or regional differences,

such as the severity of COVID-19 infections and access to healthcare facilities (Luppi, Arpino, and Rosina 2020; 2022; Tavares, Botelho Azevedo, and Arpino 2022; Kurowska, Matysiak, and Osiewalska 2022; Malicka, Mynarska, and Swiderska 2021; Emery and Koops 2022). Existing studies also reveal that there are differences among population subgroups, for example, the location (urban versus rural), household income level, or ethnicity (Fostik and Galbraith 2021; Manning, Guzzo, and Kamp Dush 2021; Akinyemi et al. 2022; Zimmerman et al. 2022; Bailey, Currie, and Schwandt 2023).

A study from China revealed that the COVID-19 pandemic lowers the fertility intentions of women of childbearing age and economic pressure, such as a decline in income, emerged as the biggest factor (Chen et al. 2022). Another study from China shows that the access to health facilities is the biggest concern for a couple's childbearing decisions (Chu et al. 2022). Tan et al. (2021) compare the impact of the Zika virus (ZIKV) outbreak in 2016-17 and the COVID-19 pandemic on women's fertility desires in Singapore and found some differences. In both cases, women delayed pregnancy, but in the case of COVID-19, they also reduced childbearing. The authors argue that this was due to the fear of infection, changes in subjective well-being, and income loss, all of which were associated with the pandemic.

While the previously discussed studies come from high- and upper-middle income countries, there are also a few studies that include countries from low- and lower-middle income countries. Wang et al. (2022) use a global sample and panel data to study the impact of pandemic-related uncertainty on fertility rates. They found that pandemic-related uncertainty decreases fertility rates, especially in non-OECD countries. Ameyaw et al. (2021) argue that the COVID-19 pandemic has put additional strain on healthcare systems in Africa and thus, also disrupted birth-related services, which creates higher risks for mothers and newborns. This situation, in addition to travel restrictions, had an impact on fertility decisions. Akinyemi et al. (2022) show that in the case of Nigeria, women changed their fertility intentions due to the COVID-19 pandemic, mainly driven by economic concerns. In another study from Kenya, Zimmerman et al. (2022) did not find a change in fertility desires due to COVID-19-related factors such as income loss, food insecurity, and social distancing. The only exception was in the most vulnerable women, who reported chronic food insecurity. They had higher fertility desires.

In addition to the studies from other countries, there are also some studies on the case of Iran in the context of fertility and marriage. Wilkins (2021) discusses a drop in marriages and thus, potential children, in Iran at the beginning of the pandemic. There are several studies that focus on marital problems during the pandemic and quarantine, such as parental-burnout, depression, sexual dissatisfaction, internet addiction, and domestic violence, which can lead to divorces or

changes in the desire for children (Mousavi 2020; Aghamohseni et al. 2021; Banaei et al. 2021; Neyestani et al. 2022; Yari et al. 2021). Most studies focus on the topic of mental health, which can impact the fertility intentions of couples (Ahmadi and Ramezani 2020; Daneshfar et al. 2021; Mirzaei et al. 2021; Hasannezhad Reskati et al. 2023). The fertility desires of Iranian women was studied by Afshari et al. (2022), who surveyed pregnant and non-pregnant women about their attitudes towards fertility and childbearing. They showed that half of the women deferred pregnancy until after the pandemic and women who were employed, not pregnant, and not hospitalized due to COVID-19 had positive attitudes towards fertility. Several other empirical studies reveal some characteristics for the individual fertility and household decisions in Iran (Kiani 2011; Moeeni et al. 2014; Sabermahani, Goudarzi, and Nasiri 2017; Azmoude et al. 2019; Basu and Maitra 2020; Hosseini, Saikia, and Dasvama 2021), including duration of marriage, woman's age, husband's age, age at marriage, level of religiosity, employment status, educational level, and household income level.

This is where our study provides new empirical evidence to the literature. We are interested in the impact of the COVID-19 pandemic and the related changes to the social lives of women and men in Iran in the context of marriage and fertility, which has not yet been studied. Moreover, it is the first study that systematically investigates the heterogeneity across gender, location (rural versus urban), and social class. It is also the first comprehensive study on Iran and the first study on this scale from a lower-middle income country.

3. Data, Hypotheses, and Methodology

3.1 Data

In this study, we evaluate the impact of the COVID-19 pandemic on marriage and childbirth in Iran using cross-sectional data from a self-developed survey, collected by computer-assisted telephone interviews (CATI)[3]. We used previous theoretical considerations and empirical studies as the basis for the development of the questionnaire. There are a total of 58 questions, including 21 questions capturing aspects related to the experience of the COVID-19 pandemic, as well as 37 questions related to socio-economic characteristics and personal attitudes. The questionnaire was tested for reliability using Cronbach's alpha which resulted in a value of 0.99, indicating an excellent internal consistency (Tavakol and Dennick 2011). The interviews were conducted between 17 January 2022 and 4 February 2022 among a representative sample of 1,306 Iranians, with 1,214 completed interviews. The margin of error of the sample is

[3] The survey was conducted by R-Research Limited and financially supported by the German Academic Exchange Service (DAAD) and German Federal Foreign Office (DAAD Project ID: 57571405).

approximately +/- 2.7%. To achieve a sample that represents the Iranian population, we used multi-stage cluster sampling with six stages, as presented in Figure A2 in the Appendix.

The sampling procedure includes two strata, namely, region and type of locality, which are the first two stages. For this reason, Iran is divided into nine regions and these regions are further divided into rural and urban locations. The next two stages are the primary sampling units (PSU), which are cities, towns, and rural districts, and the secondary sampling units (SSU), which are the selection of municipal districts in tier I and tier II settlements. These types of settlements are cities with at least a population of 500,000. Within each defined sampling unit, the random digit dialing (RRD) method with landline telephone was used to randomly select households, which is the fifth stage. Finally, in the sixth stage, the respondents were selected by the next birthday method, where only people 18 years or older were considered. With this approach all Iranian provinces were covered, but not every province was selected, as the sample was not stratified by province. On the basis of the standard definitions of the American Association for Public Opinion Research (AAPOR 2016), the contact rate of the survey was 89%, the cooperation rate 75%, and the overall response rate 67%. The interviews lasted 15-51 minutes, with an average of 24 minutes.

An overview of the sampling distribution of completed interviews in each region compared to the share of the region's population is presented in Table A1 in the Appendix. The population in each of the nine regions was calculated based on the official Iranian 2016 Census (SCI 2018). We can see that the completed interviews in each region have a similar share to the population living in these regions. The split between the urban and rural population of 74% and 26%, respectively, was achieved among the completed interviews, with a split of 75% and 25%. Due to the random sampling procedure to determine the survey participants, we also have a representative distribution of other characteristics such as age, gender, and education, as presented in Table A2 in the Appendix. The goal of the sampling procedure was to achieve a sample that represents the general population of Iran, and the achieved shares of characteristics are comparable. Descriptions of the variables used are presented in Table 1.

Table 1: Responses to survey questions (shares in percent)

No.	Variable	Question	n	[0]	[1]	[2]	[3]	[4]
Q1	Marriage	Did you marry during the pandemic in the years 2020 and 2021 (1399 and 1400)? Do you have plans to get married within the next 6 months? (Binary variable with [0] "No" and [1] "Yes")	1214	94.65	5.35			
Q2	Childbirth	Do you have a child that was born in 2020 or 2021 (1399 or 1400)? Are you expecting that your child will be born in the next 6 months? (Binary variable with [0] "No" and [1] "Yes")	1214	95.63	4.37			
Q3	Concern	In general, to what extent are you concerned that the coronavirus will continue to spread and infect many people in your country over the next 6 months? (4-point Likert scale from [0] "Not at all concerned" to [3] "Very concerned")	1211	13.54	18.74	28.41	39.31	
Q4	Infection	Did you personally experience a COVID-19 infection? (Binary variable with [0] "No" and [1] "Yes")	1198	65.28	34.72			
Q5	Vaccination	Are you vaccinated against the COVID-19 virus? (Binary variable with [0] "No" and [1] "Yes")	1125	7.33	92.67			
Q6	Life loss	Did you experience the loss of a close relative or a family member due to COVID-19? (Binary variable with [0] "No" and [1] "Yes")	1214	59.97	40.03			
Q7	Job loss	How does your current job situation compare with what it was before the COVID-19 pandemic started in March 2020? (Binary variable with [0] "Other" and [1] "I lost my previous job because of the pandemic")	1205	90.62	9.38			
Q8	Family time	How did the time spend with your family change since the beginning of the pandemic? (Binary variable with [0] "Other" and [1] "The time spent with family has increased")	1214	60.13	39.87			
Q9	Home office	On average, how many days per week did you work from home before the pandemic started in March 2020? And how many days per week, on average, did you work from home during the pandemic, especially between March 2020 and September 2021? (Dummy variable which is [1] if the first difference is positive and [0] otherwise)	1214	92.17	7.83			
Q10	Income loss	Have you experienced a fall in household income as a consequence of the COVID-19 pandemic? (Binary variable with [0] "No" and [1] "Yes")	1214	82.7	17.3			
Q11	Age	What is your year of birth? (In this table rescaled to the shares of five age groups [0] ages 18-24, [1] ages 25-34, [2] ages 35-44, [3] ages 45-54, and [4] ages55-65)	1211	12.8	14.78	25.85	19.98	26.59
Q12	Gender	What is your gender? (Binary variable with [0] "Male" and [1] "Female")	1214	50.58	49.42			
Q13	Education	What is your level of education? (Rescaled to categorical variable with [0] "Illiterate", [1] "Primary education", [2] "Secondary education", and [3] "Tertiary education")	1214	8.4	12.03	43.57	36	
Q14	Social class	People sometimes describe themselves as belonging to the working class, the middle class, or the upper or lower class. Would you describe yourself as belonging to one of them? (Categorical variable with [0] "Lower class", [1] "Working class", [2] "Lower-middle class", [3] "Upper-middle class", and [4] "Upper class")	1211	10.49	26.26	46.16	16.85	0.25
Q15	Job type	Where are you currently working? If you do not work currently, characterize your major work in the past! Do you or did you work for? (Categorical variable with [0] "Never employed", [1] "Private sector", and [2] "Public sector")	1171	32.37	45.69	21.95		
Q16	Life satisfaction	All things considered, how satisfied are you with your life as a whole these days? (4-point Likert scale from [0] "Completely dissatisfied" to [3] "Completely satisfied")	1212	15.35	20.79	46.62	17.24	
Q17	Security	Could you tell me how secure do you feel these days in your neighborhood? (4-point Likert scale from [0] "Not at all secure" to [3] "Very secure")	1212	4.54	10.07	39.85	45.54	
Q18	Trust	Generally speaking, would you say that most people can be trusted or that you need to be very careful in dealing with people? (Binary variable with [0] "Need to be careful" and [1] "Can be trusted")	1211	84.39	15.61			
Q19	Religiosity	Indicate how important religion is in your life? (4-point Likert scale from [0] "Not at all important" to [3] "Very important")	1211	3.39	6.03	20.4	70.19	
Q20	Location	Determined by phone number. (Binary variable with [0] "Rural" and [1] "Urban")	1214	25.12	74.88			

Notes: The questions were originally asked in Persian language and not in the here presented order.

For practical reasons, several of the variables which are used in the analysis are rescaled from a four-point Likert scale to binary variables, namely Q3, Q16, Q17, and Q19. In the first three questions, answers [3] and [4] are rescaled to one and zero otherwise and in question Q19, the answer [4] is rescaled to one and zero otherwise. Q11 is used as a continuous variable which measures the age of respondents in years. As there were only three respondents from the upper class in Q14, we combine the upper and upper-middle classes into one category, leaving us with four categories. The descriptive statistics presented in Table 1 already provide a first glimpse of the impact of the COVID-19 pandemic in Iran. After six waves of COVID-19, the direct health consequences of the pandemic are that 34.7% of the respondents have personally experienced a COVID-19 infection and 40% reported that they have lost a close relative or family member due to the virus. Related to economic consequences, 17.3% of respondents answered that they have experienced a decrease in household income and 9.4% have lost their jobs because of the pandemic. Moreover, 39.9% of respondents reported increased time spent with family and 7.8% of respondents answered that the time spent working from home increased compared to before the pandemic.

3.2 Hypotheses

Based on the theory and previous empirical results, we have developed several hypotheses that help to answer our research questions. We are interested to learn if marriage and childbirth in Iran were affected by the COVID-19 pandemic and if there is heterogeneity among the population subgroups. We measure the impact of the pandemic with several survey questions, and which are used to test following eight hypotheses:

Hypothesis 1: Having the concern that the COVID-19 pandemic will persist is associated with lower probabilities of marriage and childbirth.

The hypothesis was formulated under the assumption that the uncertainty concerning the development of the COVID-19 pandemic and its consequences will motivate respondents to postpone or cancel plans for marriage and childbirth. This argument was used by several authors to explain the drop in marriages (Wagner, Choi, and Cohen 2020; Guetto, Vignoli, and Bazzani 2021; Manning and Payne 2021; Westrick-Payne, Manning, and Carlson 2022; Hoehn-Velasco et al. 2023) and birth rates (Luppi, Arpino, and Rosina 2020; Aassve et al. 2021; Lima, Ferreira Soares, and Monteiro da Silva 2021; Afshari, Abedi, and Beheshtinasab 2022; Pomar et al. 2022; Sobotka et al. 2022; Wang, Gozgor, and Lau 2022; Bailey, Currie, and Schwandt 2023).

Hypothesis 2: Having experienced a COVID-19 infection is associated with lower probabilities of marriage and childbirth.

The underlying assumption of this hypothesis is that the experience of a COVID-19 infection changes the respondent's attitudes towards marriage and childbirth. On the one hand, marriages at least need to be postponed due to an infection, and on the other hand, a life-threatening experience, especially when being hospitalized, can create fear for a newborn's health. The health risk for the child is also discussed in the community influence theory (Rodgers, St John, and Colemann 2005) and economic theory (Chin and Wilson 2018). This fear or risk can be stronger if the healthcare system was not able to cope with the burden of the pandemic, as seen in several countries (Ameyaw et al. 2021; Chu et al. 2022). Afshari et al. (2022) show that in the case of Iran, women who were not hospitalized due to COVID-19 had positive attitudes towards fertility.

Hypothesis 3: Being vaccinated against COVID-19 is associated with higher probabilities of marriage and childbirth.

As the vaccination against COVID-19 increases the protection against the virus, we assume that vaccinated respondents will return to pre-pandemic behavior and thus, have a higher likelihood in marrying and bearing children than their unvaccinated counterparts. A marriage will be safer if the participants are vaccinated and might fulfill existing legal requirements for social gatherings during the pandemic. For that reason, we assume that vaccination will increase the probability of marriage. Women might also feel safer if they are vaccinated before deciding to get pregnant. This was also shown by Bujard and Andersson (2022) in the cases of Germany and Sweden, where women postponed their pregnancies until after vaccination. However, there is also skepticism about the side effects of the COVID-19 vaccination and misinformation about the danger for the unborn child (Sparks et al. 2022), which can convince women to postpone pregnancy. Additionally, trust in the healthcare system might also influence the decision of childbirth. Overall, the expected effect of vaccination of childbirth is not clear because we do not know when the respondents were vaccinated and if skepticism about the vaccination will affect the respondent's childbearing behavior.

Hypothesis 4: Having experienced the loss of a close relative or family member due to COVID-19 is associated with higher probabilities of marriage and childbirth.

The hypothesis was formulated under the assumption of the terror management and replacement theories (Rodgers, St John, and Colemann 2005; Nitsche and Lee 2022). First, we assume that in a situation where mortality becomes more visible, people will turn to traditional values and behaviors, such as marrying and having children. Second, we assume that the loss of life will motivate people to have more children, which will replace lost lives. This was already discussed by Abbasi-Shavazi et al. (2009) in the context of the Iran-Iraq War. However, there are also

theoretical frameworks that argue for the opposite effect; for example, the community influence and economic theories discussed under Hypothesis 2 would argue for a decrease in childbirth. Additionally, the grief related to the loss of a loved one can also negatively affect relationships (Ungureanu and Hall 2020), which might cause separations or postponement of marriages and thus, a lower probability of marriage. Therefore, the direction of the impact of a loss of a loved one on marriage and childbirth is not clear.

Hypothesis 5: Having experienced a job loss due to the COVID-19 pandemic is associated with lower probabilities of marriage and childbirth.

The underlying assumption of this hypothesis is that the income lost due to the newly gained unemployment will motivate respondents to postpone or cancel plans for marriage and childbirth. This argument was used by several authors to explain the drop in marriages (Sobotka, Skirbekk, and Philipov 2011; Hill 2015) and birth rates (Schneider 2015; Alderotti et al. 2021; Matysiak, Sobotka, and Vignoli 2021; Kearney and Levine 2023) in the context of economic uncertainties and the COVID-19 pandemic. There might also be a different effect on marriage behavior depending on the respondent's gender (Hill 2015), because women might marry for economic reasons on the one hand to reduce the burden on her parents during a crisis (Cetorelli 2014; Das and Dasgupta 2022) and on the other hand, to have her own financial security in the future. The loss of employment does not only reflect the loss of income, but has wider psychological implications because employment has manifest and latent functions (Jahoda 1981). The manifest benefit is the financial reward that enables people to earn a living and there are five latent byproducts of employment, for example, the structuring of the working day, provision of social contacts, participation in a collective purpose, development of personal identity and status, and imposition of regular activity.

Hypothesis 6: Spending more time with family due to the COVID-19 pandemic is associated with higher probabilities of marriage and childbirth.

As spending more time with family brings married couples physically closer together, we assume that it increases fertility desires. Experiences from natural disasters have shown an increase in birth rates after hurricanes, tsunamis, and earthquakes (Cohan and Cole 2002; Carta et al. 2012; Nobles, Frankenberg, and Thomas 2015; Behrman and Weitzman 2016; Davis 2017; Nandi, Mazumdar, and Behrman 2018). This is especially the case if there is an increase of sexual activity and problems with accessing family planning services and contraceptives as a consequence of the disaster event. The previous explanation applies only to married individuals, but there are also non-married individuals who will spend more time with their parents because of lockdowns and quarantines. We assume that this will motivate young adults

to marry and leave the parental household so that they can avoid parent-child conflicts which can be a consequence of prolonged closed quarters.

Hypothesis 7: Spending more time working from home due to the COVID-19 pandemic is associated with higher probabilities of marriage and childbirth.

The hypothesis was formulated under the assumption that more time spent working from home will allow parents to combine paid work, career opportunities, and childcare and thus, might facilitate childbirth. Several authors have discussed that home-based work can make it easier to combine family and work life (Powell and Craig 2015; Chung and Van der Horst 2018; Chung and Van der Lippe 2020). In addition, more time spent at home will bring married couples physically closer together, as discussed in Hypothesis 6, which can facilitate childbirth. However, spending more time in working from home can also blur the boundaries between paid work and family life and exacerbate the work-family conflict (Glavin and Schieman 2012; Kurowska 2020; Kurowska, Matysiak, and Osiewalska 2022), which can result in the opposite effect. Overall, the final effect of working from home on marriage and childbirth might depend on other factors, such as gender, employment type, or working hours. Therefore, the direction of the effect is not clear.

Hypothesis 8: Having experienced a decline in household income due to the COVID-19 pandemic is associated with lower probabilities of marriage and childbirth.

The underlying assumption of this hypothesis is that the decline in household income will motivate respondents to postpone or cancel plans for marriage and childbirth. This hypothesis is similar to Hypothesis 5 but has different implications. First, asking about the decline in household income does not only account for the individual loss of income due to unemployment but takes into account the decline in household income by other members of the household, such as parents or marital partners, and it also considers a reduction in working hours or disturbances in self-employed business activities due to the pandemic. Previous studies have found evidence for the negative impact of the loss of household income on marriage and fertility decisions (Tan, Ryan, and Lim-Soh 2021; Akinyemi et al. 2022; Chen et al. 2022). Second, Hypothesis 5 also accounts for the individual psychological effects that are associated with unemployment.

3.3 Methodology

For the empirical investigation, we use logit regressions where the dependent variable is the measurement of family development (*FD*), as presented in the following specification (1). The variable *FD* is measured with two questions that asked if the respondent married during the COVID-19 pandemic or plans to marry within the next six months (*Marriage*) and if the

respondent bore a child during the pandemic or plans to have a child within the next six months (*Childbirth*).

$$FD_i = \alpha + \beta_1 \cdot Concern_i + \beta_2 \cdot Infection_i + \beta_3 \cdot Vaccination_i + \beta_4 \cdot Life\ loss_i + \beta_5 \cdot Job\ loss_i + \beta_6 \cdot Family\ time_i + \beta_7 \cdot Home\ office_i + \beta_8 \cdot Income\ loss_i + \beta_9 \cdot Controls_i + \varepsilon_i \quad (1)$$

We aim to explain the family development (*FD*) by the respondent's concern about the persistence of the COVID-19 pandemic (*Concern*), experience with a COVID-19 infection (*Infection*), vaccination status (*Vaccination*), experience with a loss of a close relative or family member due to COVID-19 (*Life loss*), experience of a job loss due to the pandemic (*Job loss*), increase in the time spent with family since the start of the pandemic (*Family time*), increase in time spent working from home since the start of the pandemic (*Home office*), and decrease in household income due to the pandemic (*Income loss*). The constant (α) and error term (ε) are also included. In addition, we control for several other socio-economic characteristics (*Controls*) that are relevant in the context of marriage and childbirth, such as age, gender, education, social class, employment type, life satisfaction, security perception, trust, religiosity, and location (urban versus rural). Except for age, all independent variables are binary.

4. Results and Discussion

Table 2 reports the average marginal effects of the empirical investigation using the logit regressions where we study the determinants of marriage and childbirth during the pandemic.

Table 2: Determinants of marriage and childbirth during the pandemic, marginal effects

Dependent variables: Marriage and childbirth during pandemic	(2.1) Marriage	(2.2) Childbirth
Concern	-0.021	**-0.032****
	(-1.534)	**(-2.339)**
Infection	-0.019	-0.021
	(-1.211)	(-1.447)
Vaccination	0.018	**-0.046*****
	(0.663)	**(-2.857)**
Life loss	**-0.025***	0.006
	(-1.696)	(0.511)
Job loss	**0.044****	-0.041
	(2.308)	(-1.213)
Family time	0.003	0.010
	(0.195)	(0.775)
Home office	0.012	0.026
	(0.447)	(1.065)
Income loss	0.024	-0.011
	(1.338)	(-0.584)

Female	0.007	**0.030****
	(0.477)	**(2.230)**
Age	**-0.004*****	**-0.003*****
	(-5.612)	**(-4.172)**
Secondary education	0.011	-0.012
	(0.499)	(-0.486)
Tertiary education	**0.048***	0.003
	(1.882)	(0.094)
Working class	-0.022	0.015
	(-0.719)	(0.513)
Lower-middle class	-0.023	-0.005
	(-0.771)	(-0.195)
Upper and upper-middle class	-0.013	-0.005
	(-0.400)	(-0.170)
Private sector job	0.005	0.006
	(0.281)	(0.471)
Public sector job	-0.017	-0.028
	(-0.711)	(-1.176)
Life satisfaction	**0.029***	**0.041****
	(1.950)	**(2.530)**
Security	**-0.038****	-0.018
	(-2.380)	(-1.013)
Trust	0.014	-0.021
	(0.917)	(-1.100)
Religion	0.012	0.010
	(0.835)	(0.723)
Urban	**-0.033****	-0.022
	(-2.137)	(-1.611)
Childbirth	0.009	
	(0.416)	
Marriage		-0.001
		(-0.032)
Observations	1130	1130

*Notes: z-statistics based on robust standard errors are reported in parentheses. Significance levels: *** p<0.01, ** p<0.05, * p<0.1.*

While most of the eight measures of the impact of the COVID-19 pandemic show the expected direction, only half of the variables related to marriage or childbirth are statistically significant on conventional levels.

4.1 Marriage

When using marriage as the dependent variable, we can see a statistically significant and negative relationship with *Life loss* and a statistically significant and positive relationship with *Job loss*. More precisely, respondents who have experienced the loss of a close relative or family member due to the pandemic have a 2.5 pp lower probability of marriage during the pandemic. This refers to Hypothesis 4 and supports the literature that discusses the negative impact of the experience of life loss on relationships (Ungureanu and Hall 2020). When taking into account the gender and social class of the respondents, as presented in the interaction terms in Table 3, we can see that the effect is driven by the female respondents and the respondents who consider themselves upper and upper-middle class.

Related to job loss, we can say that respondents who became unemployed due to the pandemic have a 4.4 pp higher probability of marriage during the pandemic. This refers to Hypothesis 5 and supports the discussed literature from other catastrophes which show that times of economic uncertainties facilitate marriages of women (Cetorelli 2014; Hill 2015; Das and Dasgupta 2022). This means that women who lost their job due to the pandemic compensated the income loss with marriage, bringing financial security for the bride and reducing the burden on her parents' household. Table 3 provides additional evidence for this explanation, because it shows that the effect is especially driven by the female and working-class respondents. The other interactions in Table 3 show that infection with COVID-19, which refers to Hypothesis 3, is statistically significant for female respondents, and that income loss, which refers to Hypothesis 8, is statistically significant for respondents from the upper and upper-middle classes. The results suggest that female respondents who were infected with COVID-19 have a 3.5 pp lower probability of marriage during the pandemic and upper and upper-middle class respondents who have experienced a loss of household income have a 12.2 pp higher probability of marriage during the pandemic.

Table 3: Determinants of marriage including interaction terms, marginal effects

Dependent variable: Marriage during pandemic	(3.1)	(3.2)	(3.3)	(3.4)	(3.5)	(3.6)	(3.7)	(3.8)
Concern × Female	-0.028							
Concern × Urban	-0.015							
Concern × Working class	0.021							
Concern × Lower-middle class	-0.029							
Concern × Upper and upper-middle class	-0.039							
Infection × Female		**-0.035****						
Infection × Urban		0.005						
Infection × Working class		-0.040						
Infection × Lower-middle class		-0.026						
Infection × Upper and upper-middle class		0.010						
Vaccination × Female			0.004					
Vaccination × Urban			omitted					
Vaccination × Working class			omitted					
Vaccination × Lower-middle class			omitted					
Vaccination × Upper and upper-middle class			omitted					
Life loss × Female				**-0.033***				
Life loss × Urban				-0.019				
Life loss × Working class				-0.021				
Life loss × Lower-middle class				-0.011				
Life loss × Upper and upper-middle class				**-0.044***				

Job loss × Female				**0.115****				
Job loss × Urban				**0.063***				
Job loss × Working class				**0.249*****				
Job loss × Lower-middle class				0.009				
Job loss × Upper and upper-middle class				0.016				
Family time × Female					0.016			
Family time × Urban					0.001			
Family time × Working class					0.021			
Family time × Lower-middle class					-0.014			
Family time × Upper and upper-middle class					0.021			
Home office × Female						omitted		
Home office × Urban						omitted		
Home office × Working class						omitted		
Home office × Lower-middle class						omitted		
Home office × Upper and upper-middle class						omitted		
Income loss × Female								0.006
Income loss × Urban								0.036
Income loss × Working class								0.009
Income loss × Lower-middle class								-0.019
Income loss × Upper and upper-middle class								**0.122****
Observations	1130	1130	1130	1130	1130	1130	1130	1130

Notes: All other variables from Table 2 are also included in the estimations, but not reported. Significance levels: *** p<0.01, ** p<0.05, * p<0.1.

4.2 Childbirth

When using childbirth as the dependent variable, as presented in Table 2, we can see a statistically significant and negative relationship with *Concern* and *Vaccination*. More precisely, respondents who are concerned about the continuation of the pandemic have a 3.2 pp lower probability of childbirth during the pandemic. This refers to Hypothesis 1 and supports the community influence theory and empirical studies from other countries (Luppi, Arpino, and Rosina 2020; Aassve et al. 2021; Lima, Ferreira Soares, and Monteiro da Silva 2021; Afshari, Abedi, and Beheshtinasab 2022; Pomar et al. 2022; Sobotka et al. 2022; Wang, Gozgor, and Lau 2022; Bailey, Currie, and Schwandt 2023). As presented in the interaction terms in Table 4, when taking into account the gender, location, and social class of the respondents, we can see that the effect is driven by female respondents, urban respondents, and respondents who consider themselves lower-middle class. The stronger effect for female respondents is plausible as the woman will carry the baby and therefore have higher health risks in an uncertain environment during the pandemic.

Related to the vaccination status, which refers to Hypothesis 3, we can say that respondents who are vaccinated have a 4.6 pp lower probability to have a child born in 2020 and 2021. A possible explanation for the negative relationship is the skepticism about the side effects of the vaccination, especially the misinformation about the danger for the unborn child (Sparks et al. 2022), convincing some women to postpone pregnancy or not get vaccinated. Table 4 provides additional evidence for this explanation because it shows that the effect is especially driven by female respondents. More precisely, female respondents who are vaccinated have a 13.2 pp lower probability of childbirth during the pandemic. Other notable interactions in Table 4 show that more time spent with family, which refers to Hypothesis 6, has increased childbirth in the case of working-class respondents. The results suggest that working-class respondents who have spent more time with family have a 7.2 pp higher probability of childbirth. This supports the argument that spending more time with family brings married couples physically closer together and therefore increased the fertility intentions, which has also been discussed by other authors in the context of natural disasters (Ahmed and Tan 2022). Moreover, the relationship between income loss and childbirth is statistically significant and negative, as discussed in Hypothesis 8, for the interactions with the working class and urban areas variables. This means that working-class respondents who have experienced a loss of household income during the pandemic have a 6.2 pp lower probability of childbirth and urban respondents have a 3.5 pp lower probability.

Table 4: Determinants of childbirth including interaction terms, marginal effects

Dependent variable: Childbirth during pandemic	(4.1)	(4.2)	(4.3)	(4.4)	(4.5)	(4.6)	(4.7)	(4.8)
Concern × Female	**-0.078*** **							
Concern × Urban	**-0.032** **							
Concern × Working class	-0.003							
Concern × Lower-middle class	**-0.054** **							
Concern × Upper and upper-middle class	-0.044							
Infection × Female		-0.028						
Infection × Urban		**-0.023***						
Infection × Working class		-0.033						
Infection × Lower-middle class		-0.008						
Infection × Upper and upper-middle class		-0.035						
Vaccination × Female			**-0.132** **					
Vaccination × Urban			omitted					
Vaccination × Working class			omitted					
Vaccination × Lower-middle class			omitted					
Vaccination × Upper and			omitted					

upper-middle class								
Life loss × Female				0.001				
Life loss × Urban				-0.001				
Life loss × Working class				omitted				
Life loss × Lower-middle class				omitted				
Life loss × Upper and upper-middle class				omitted				
Job loss × Female					omitted			
Job loss × Urban					**-0.028***			
Job loss × Working class					omitted			
Job loss × Lower-middle class					omitted			
Job loss × Upper and upper-middle class					omitted			
Family time × Female						0.027		
Family time × Urban						0.015		
Family time × Working class						**0.072****		
Family time × Lower-middle class						-0.010		
Family time × Upper and upper-middle class						-0.008		
Home office × Female							omitted	
Home office × Urban							omitted	
Home office × Working class							omitted	
Home office × Lower-middle class							omitted	
Home office × Upper and upper-middle class							omitted	
Income loss × Female								-0.001
Income loss × Urban								**-0.035*****
Income loss × Working class								**-0.062*****
Income loss × Lower-middle class								0.001
Income loss × Upper and upper-middle class								-0.008
Observations	1130	1130	1130	1130	1130	1130	1130	1130

Notes: All other variables from Table 2 are also included in the estimations, but not reported. Significance levels: *** p<0.01, ** p<0.05, * p<0.1.

In addition to our main variables of interest, we have also included other control variables, of which *Female*, *Age*, *Tertiary education*, *Life satisfaction*, *Security*, and *Urban* show statistically significant results. First, gender shows a positive and statistically significant association with childbirth, which means that respondents who are female have a 3 pp higher probability to have a child born in 2020 and 2021. Second, age shows a negative and statistically significant association with both dependent variables. Third, respondents with tertiary education have a 4.8 pp higher probability of marriage during the pandemic. Fourth, life satisfaction shows a positive and statistically significant association with marriage and childbirth, which supports the community influence theory. Fifth, respondents who feel secure have a 3.8 pp lower

probability of marriage during the pandemic and respondents located in urban areas have a 3.3 pp lower probability of marriage.

5. Conclusion

This study provides new empirical evidence on the impact of the COVID-19 pandemic on marriage and childbirth in Iran. We used logistic regressions and the responses from our representative survey to investigate the channels through which the pandemic affected the two dependent variables. The main findings are that the concern about the pandemic persisting (*Concern*) and vaccination status (*Vaccination*) show negative associations with childbirth during the pandemic and the experience of unemployment due to the pandemic (*Job*) is positively associated with marriage during the pandemic. Moreover, further analysis revealed heterogenous effects depending on gender, location, and social class. The results suggest that the effects of COVID-19 infection, loss of a close relative or family member, and job loss on marriage are driven by the female respondents. The effects of the concern and vaccination on childbirth are also driven by the female respondents. We can also see that the direct and indirect effects of the pandemic did not show statistically significant associations with marriage and childbirth in all social classes and locations.

Based on these findings, we have learned that the impact of the COVID-19 pandemic on marriage and childbirth in Iran is complex and that the pandemic affects population subgroups differently. Therefore, policies that are aimed at changing the behavior of the population need to be carefully designed and should consider gender, location, and social class. We are assuming in this context that the government wants to increase marriage and fertility rates, which have been on its agenda in recent years (Ladier-Fouladi 2021). As marriage is a pre-condition for legal childbirth in Iran, policy should target the pandemic-related factors that reduce marriage intentions, which are according to our results, include COVID infections (among females) and the experience of life loss due to the pandemic. As both factors are associated with trust in the health system, a strategy can be to improve the healthcare infrastructure. This strategy might also help to increase childbirth during the pandemic since we found that concerns about COVID and the vaccination, which are also related to confidence in the health system, especially negatively impacted childbirth. Another strategy in this context would be the use of campaigns to inform the public about COVID, pregnancy, and the role of the vaccination as it relates to pregnancy.

In this case, information campaigns and healthcare services targeted at women can be helpful. Another factor that is associated with a reduction in childbirth is the loss of employment due to

the pandemic, which is statistically significant among urban respondents. This situation can be improved if the government designs policies that help respondents to regain employment and create incentives for childbirth, such as transfer payments for couples who are willing to have children, compensating for the loss in income due to the disaster. On the positive role of government economic support on consumer confidence in the economic and political systems during the COVID-19 crisis, refer to the works of Farzanegan and Gholipour (2023) and Gholipour et al. (2023).

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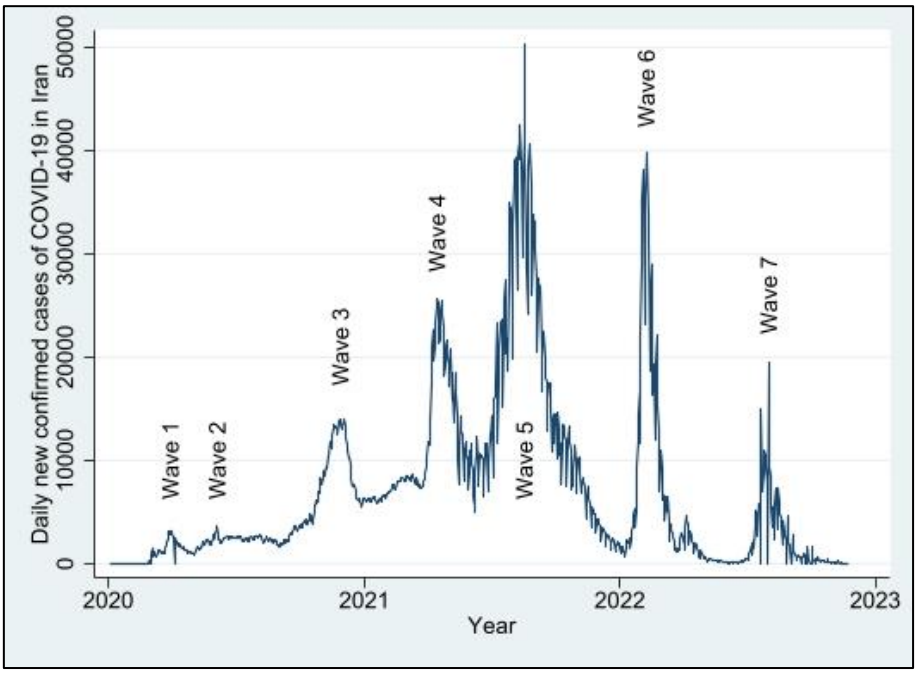
Appendix

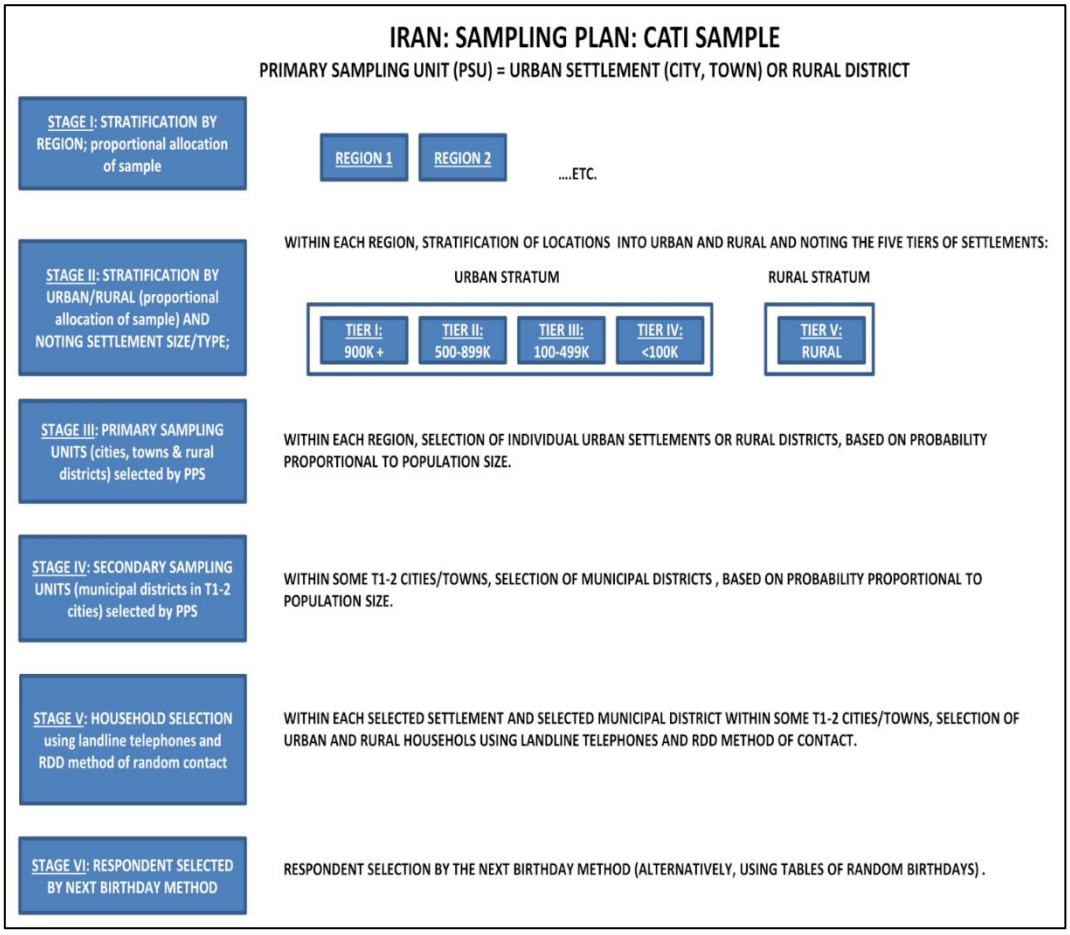
Figure A1: COVID-19 waves in Iran



Notes: The figure shows the seven waves of COVID-19 infections in Iran from February 2020 to November 2022. The peak of the first wave was on 30 March 2020 (with 3,186 new cases), followed by a second wave peaking on 5 June 2020 (with 3,574 new cases). The third wave peaked on 28 November 2020 (with 14,051 new cases). The peak of the fourth wave was on 15 April 2021 (with 25,582 cases), followed by a fifth wave peaking on 18 August 2021 (with 50,228 new cases). The latter also represents the day with the highest number of newly confirmed cases during the entire pandemic. The sixth wave peaked on 8 February 2022 (with 39,819 new cases, and the latest (seventh) wave peaked on 2 August 2022 (with 19,426 new cases).

(Source: authors' illustration using data from WHO (2022))

Figure A2: Overview of the survey's multi-stage cluster sampling



(Source: technical report of R-Research)

Table A1: Sample distribution of completed interviews

Region	Provinces	Share of population			Completed interviews		
		Region	Urban	Rural	Region	Urban	Rural
1. North	Gilan, Golestan, Mazandaran	10%	59%	41%	119 (9.8%)	71 (59.7%)	48 (40.3%)
2. Tehran	Tehran, Alborz, Semnan, Qazvin, Qom, Markazi, Hamadan	28%	89%	11%	335 (27.6%)	305 (91%)	30 (9%)
3. Centre	Isfahan, Chaharmahal and Bakhtiari, Yazd	9%	84%	16%	104 (8.6%)	89 (85.6%)	15 (14.4%)
4. North-West	West Azerbaijan, East Azerbaijan, Ardabil, Zanjan	12%	69%	31%	149 (12.3%)	104 (69.8%)	45 (30.2%)
5. North-East	Razavi Khorasan, North Khorasan, South Khorasan	10%	70%	30%	120 (9.9%)	90 (75%)	30 (25%)
6. South-West	Khuzestan, Lorestan	8%	73%	27%	94 (7.7%)	63 (67%)	31 (33%)
7. South	Fars, Kohgiluyeh and Boyerahmad, Bushehr, Hormozgan	11%	66%	34%	125 (10.3%)	80 (64%)	45 (36%)
8. West	Ilam, Kurdistan, Kermanshah	5%	73%	27%	75 (6.2%)	59 (78.7%)	16 (21.3%)
9. South-East	Sistan and Baluchestan, Kerman	7%	54%	46%	93 (7.7%)	48 (51.6%)	45 (48.4%)
Total		**100%**	**74%**	**26%**	**1214 (100%)**	**909 (74.9%)**	**305 (25.1%)**

Notes: The share of population in the nine regions and the share of urban and rural population within each region are based on the official Iranian 2016 Census (SCI 2018) *as presented in the technical report of R-Research.*

Table A2: Characteristics of respondents in the survey sample compared to the general population

		Target (in %)	**Achieved (in %)**
Age	18–24	15	12.8
	25–49	59	50.4
	50–59	13	23.7
	60–65	4	12.9
Gender	Female	49.6	50.6
	Male	50.4	49.4
Education	Illiterate	15	8.4
	Primary school	18	12
	(Partial) middle school	14	10.2
	Partial high school	7	2.4
	High school diploma	22	31
	Tertiary education	24	36

Notes: The target is based on the official Iranian 2016 Census (SCI 2018) *as presented in the technical report of R-Research.*