Early assessment of the relationship between the COVID-19 pandemic and births in high-income countries

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Drawing on past pandemics, scholars have suggested that the COVID-19 pandemic will bring about fertility decline. Evidence from actual birth data has so far been scarce. This brief report uses data on vital statistics from a selection of high-income countries, including the United States. The pandemic has been accompanied by a significant drop in crude birth rates beyond that predicted by past trends in 7 out of the 22 countries considered, with particularly strong declines in southern Europe: Italy (−9.1%), Spain (−8.4%), and Portugal (−6.6%). Substantial heterogeneities are, however, observed.

COVID-19 | fertility | pandemics | birth rates | baby bust

One year on, the COVID-19 pandemic has caused over 3 million deaths worldwide. Received demographic wisdom suggests that the population implications of pandemics extend beyond deaths to affect conceptions and births. Throughout history, in fact, pandemics have been a key driver of human population change: In the combined mortality and fertility crises that recurred in the Malthusian era, mortality peaks due to adverse external shocks led to birth troughs within 9 mo to 12 mo, usually followed by conception surpluses once mortality fell back either to or to below precrisis levels (1). The largest pandemic of the last century, the 1918–1919 H1N1 influenza A pandemic (Spanish flu), caused, in the United States, a decline in birth rates from 23 per 1,000 population in 1918 to 20 per 1,000 in 1919, a 13% drop (2). As Spanish flu swept the world, comparable effects were recorded in Britain (3), India (4), Indonesia (5), Japan (6), New Zealand (7), Norway (8), Sri Lanka (9), and Taiwan (10).

What can we expect from the COVID-19 pandemic? It has proved difficult to speculate, for two reasons. First, estimates from Spanish flu are of limited use, as socioeconomic development, and, with it, fertility levels and fertility control, are vastly different today in high-income countries (HICs). Second, while studies of modern economic crises show modest fertility declines in their immediate aftermath, catastrophic events that increase mortality may have independent effects above and beyond the economic disruption that they cause, such as lacking family support or the immediate return to childcare within the home (11). Preliminary assessments of the impact of COVID-19 from a subset of HICs point to adverse effects on births. Survey data on fertility intentions, collected during the early stage of the first wave of the COVID-19 outbreak in Germany, France, Spain, and the United Kingdom, indicate that 73% of those planning to have a child in 2020 decided to delay or abandoned their plans entirely (12). Wilde et al. (13) use data on Google searches during the COVID-19 pandemic to predict changes in aggregate fertility rates in the United States. They suggest that, between November 2020 and February 2021, monthly US births might have dropped by ∼15%—a decline much larger than that of the Great Recession of 2008–2009 and comparable to that of the Spanish flu (13).

Today, newly released vital registration statistics allow for early empirical assessments of these claims. In the United States, a 3.8% drop in births was computed for 2020 compared to 2019, with an accelerating rate of decline at the end of 2020 (14). Across a set of 17 countries, Sobotka et al. (15) find that the rate of decline in births increased, on average, from 5.1% in November 2020 to 8.9% in January 2021, when compared with the same month of the previous year. With the aim of offering a comprehensive early view on the relationship between COVID-19 and births, we compile, in this paper, the most recent available data for 22 HICs, accounting for about 37% (34%) of the total reported COVID-19 cases (deaths) worldwide.* Given COVID-19's different epidemiological profile compared to pandemics of the past, assessing its association with births is likely to shape our understanding of how pandemics change population dynamics. It will, likewise, have policy implications for childcare, housing, and the labor market.

Results

We define the pandemic as having started in February 2020, days after the World Health Organization (WHO) declared the coronavirus outbreak an international public health emergency.† We thus expect to observe effects 9 mo later, that is, starting in November 2020. A simple year-to-year comparison of the mean for monthly crude birth rates (CBRs) before and during the pandemic suggests a negative difference in CBRs for all countries except for Denmark, Finland, Germany, and The Netherlands (Table 1; see *Data* for details on sample selection). Statistically significant decreases range from 5.2% in Austria to 11.2% in Portugal and Spain. For the United States in November and December 2020 (conceptions of February and March), we find a 7.1% decline in CBRs relative to the same months of 2019. Comparing CBRs 1 y apart returns estimates robust to seasonality. Clearly, the measured decline in births might be due to secular trends of CBR decline, driven, in part, by modifications in age structure.

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The authors declare no competing interest.

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†WHO, Statement on the second meeting of the International Health Regulations. Emergency Committee regarding the outbreak of novel coronavirus (2019-nCoV). Available at https://www.who.int/news/item/23-01-2020-statement-on-the-meeting-of-the-international-health-regulations-(2005)-emergency-committee-regarding-the-outbreak-of-novel-coronavirus-(2019-ncov).

Table 1. Year-to-year *t* test comparison for CBRs by country

	Prepandemic		During pandemic		
	Mean	SD	Mean	SD	Difference
Austria	9.05	0.20	8.58	0.78	−0.47*
Belgium	9.79	0.18	9.01	0.78	−0.78***
Czechia	9.56	0.25	9.34	0.07	−0.22
Denmark	10.02	0.27	10.15	0.58	0.13
Finland	8.09	0.34	8.41	0.60	0.32
France	10.63	0.45	9.91	0.66	−0.72*
Germany	8.56	0.16	8.87	0.49	0.30
Hungary	9.27	0.56	9.15	0.30	−0.11
Iceland	11.98	0.23	11.67	0.99	−0.31
Israel	21.50	0.45	20.15	0.34	−1.35**
Italy	6.92	0.19	6.17	0.15	−0.75***
Japan	6.60	.	6.33	.	(−0.27)
Netherlands	9.41	0.33	9.66	0.45	0.25
Norway	8.52	0.59	8.26	0.26	−0.26
Portugal	8.18	0.51	7.26	0.61	−0.92*
South Korea	5.53	0.54	5.04	0.57	−0.49
Singapore	6.67	0.46	6.24	0.68	−0.43
Slovenia	8.52	0.53	8.27	0.54	−0.24
Spain	7.40	0.34	6.57	0.62	−0.83**
Sweden	10.67	0.82	10.53	0.96	−0.13
Switzerland	9.28	0.37	8.84	0.56	−0.44
United States	11.07	0.28	10.27	0.09	−0.79*
Total	9.27	2.86	8.93	2.77	−0.35

Pandemic data include CBRs from November 2020 to March 2021 for Denmark, Finland, France, Hungary, The Netherlands, Singapore, Slovenia, Spain, and Sweden; to February 2021 for Germany, Portugal, South Korea, and Switzerland; to January 2021 for Belgium, Israel, and Italy; to December 2020 for Austria, the Czech Republic, Iceland, Norway, and the United States; and to November 2020 for Japan. Prepandemic data include CBRs for corresponding months 1 y before the pandemic.

$*P < 0.10$; $**P < 0.05$; $***P < 0.01$.

To address these potential confounders, in Fig. 1, we report coefficient from a set of within-country ordinary least squares (OLS) models, where we regress CBRs from 2016 to 2021 on a dummy which takes a value of one starting November 2020. These models include month fixed effects and account for existing trends in CBRs, therefore partly controlling for the evolution of age structure as well (see *Model* for further details). Once these factors are taken into account, we find negative coefficients for 13 out of 22 countries, significant at the 5% level in seven cases: Hungary, Italy, Spain, Portugal, Belgium, Austria, and Singapore. The coefficient for the United States hints at a decline there as well, with a point estimate only just insignificant at the 5% level ($\beta = -0.240$; 95% CI: −0.483 to 0.002). The largest declines were recorded in Hungary, with a 0.79-point reduction in CBRs (−8.5% compared to the same period 1 y before); in Italy (−0.63 points or −9.1%); in Spain (−0.62 points or −8.4%); and in Portugal (−0.54 points or 6.6%). The remaining nine countries present positive coefficients, but their CIs overlap the zero line.

Discussion

In this brief report, we present an early assessment of the relationship between the COVID-19 pandemic and births for a set of 22 HICs. Descriptive evidence points to a negative effect of the pandemic on CBRs, which are found to fall, in absolute terms, in 18 out of 22 countries in our sample. When modeling confounding factors, including seasonality and longer-term trends, substantial heterogeneities arose, with only seven countries showing a significant decline in CBRs beyond that predicted by past trends. This might suggest that declines appear in a limited number of countries. It should be noted, however, that currently available data offer information on the first wave of COVID-19 and thus only a glimpse into the overall decline during the pandemic. Our data coverage also provides insights into various stages of the first wave. For some countries, for example, we observe a recovery in CBRs in March 2021, referring to conceptions in June 2020 (e.g., France and Spain; Fig. 2). For these countries, June 2020 marked the point when the first wave of the pandemic subsided, and might consequently reflect a rebound following postponement during the very first months of the outbreak. Such an upswing is not observed for the United States, where, however, the most recent available data point is December 2020 (conceptions of March). One piece of evidence suggesting the beginning of a fertility decline comes from Wilde et al. (13). They estimate fertility in the United States falling by 15% between November 2020 and February 2021, with an acceleration in fertility decline over this period. Thus, given currently available data, we cannot be certain about the continued path of CBR trends, although, with two additional pandemic waves in the fall of 2020 and winter 2021, it is likely that our current estimates represent lower bounds for the overall declines during the pandemic.

When assessing changes over the pandemic, we also find positive, albeit not significant, coefficients for 9 out of the 22 sample countries. These are Slovenia, South Korea, the Nordic European countries (Norway, Denmark, Finland, and Sweden), Germany, The Netherlands, and Switzerland. Several factors might explain the resilience of these countries' CBRs, including country-specific trends. This appears to be the case, for instance, for Finland, whose CBRs had been recuperating since 2019, after a multiyear decline; increases in 2020–2021 came in the context of limited pandemic impact (Fig. 2). For some countries, such as Switzerland and The Netherlands, we observe rebounds in CBRs even in the absence of pandemic-induced declines. When compared to the large fall in southern Europe, the relative stability of CBRs in northern Europe points to the role of policies in support of families and employment in reducing any impact on births. These factors are likely to affect CBRs in the subsequent pandemic waves. Future studies should be undertaken as additional data become available, in order to assess the full population implications of the pandemic, the potentially

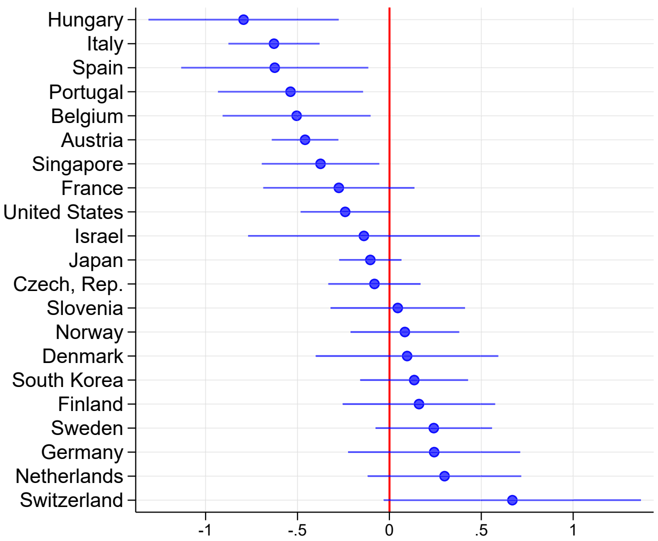

Fig. 1. Changes in CBRs by country. Shown are point estimates and 95% CIs for within-country models. For illustrative purposes, Iceland ($\beta = -0.61$) was excluded due to large CIs (−2.23, 1.01).

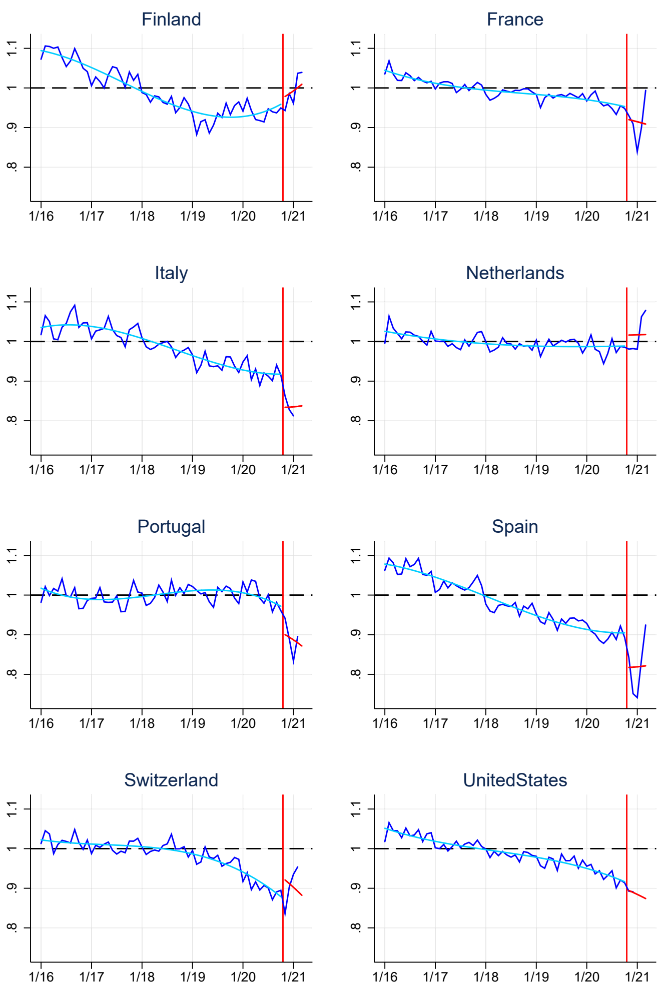

Fig. 2. CBRs relative to the 2016–2019 average for selected countries. Shown are CBRs as a ratio to the mean for the respective month in 2016–2019. The red vertical line is the pandemic cutoff for births (November 2020). The dashed black line refers to the CBR in the respective month being equal to the mean for the respective month in 2016–2019. Time trends (fitted light blue and red lines) are estimated based on the OLS model: $CBRRatio_t = \beta Pandemic_t + \gamma_1 Time_t + \gamma_2 Time_t^2 + \gamma_3 Time_t^3 + \epsilon_t$.

moderating impact of policy interventions, and the nexus between short- and long-run effects in relation to the various waves of the COVID-19 pandemic.

Materials and Methods

Data. We use monthly live birth data from January 2016 to March 2021, which corresponds to conceptions (carried to term) from April 2015 to June 2020. These were retrieved from the Human Fertility Database, which compiles high-quality statistics on live births from national sources for a select number of countries. These were retrieved on May 17, 2021 and are publicly available at https://www.humanfertility.org/cgi-bin/stff.php. Having implemented a similar data collection in parallel, our dataset now differs only slightly from theirs, with data revisions for Singapore (January 2020 to December 2020) and Finland (January 2021 and February 2021) not being taken into account there. For data quality issues, we excluded the Baltic countries (Estonia, Latvia, and Lithuania), Croatia, and Romania from our sample (15). For most countries, live birth counts for 2020 and 2021 are provisional and are likely to be marginally updated. In the last 2 mo of our data collection period, we observed updates for 5 of 12 countries for the data we compiled until mid-March (Finland, France, Italy, Spain, and Sweden), for an average update of 0.37% (min: −0.36%; max: +1.1%). We matched information on monthly live births with midyear population estimates from the United Nations (UN) Population Division's World Population Prospects (2019 Revision), available at http://data.un.org/Data.aspx?q=population&d=PopDiv&f=variableID%3a12. Monthly CBRs per 1,000 population per year were computed as follows: (Monthly Live Births/MidYear Population)* 1,000* 12. We only included in our sample countries that belong to the high-income group, according to the World Bank, and that had both population and birth data available up to at least November 2020.

Model. To assess the relationship between the pandemic and births in each country, we estimate the following model: $CBR_t = \beta Pandemic_t + \sum_{i=1}^{3} \gamma_i Time_t^i + \alpha_m + \epsilon_t$, where the dependent variable, CBR_t, is the country-specific CBR in month−year t, and *Pandemic* is a dummy equal to one from November 2020. Fig. 1 plots β coefficients, that is, the average change in CBRs from prepandemic to during the pandemic. We also include month fixed effects (α_m), while $Time_t$ represents the month and year. Coefficients γ_i thus estimate the linear, quadratic, and cubic time trend. Heteroscedasticity-robust SEs are estimated with the Huber−White estimator. Estimation of the model using the general fertility rate, that is, the ratio of the number of births over the number of women of reproductive age, yields, qualitatively, the same results as when using the CBR.

Data Availability. Previously published data were used for this work (https://www.humanfertility.org/cgi-bin/stff.php).

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