The unintended effects of the COVID-19 pandemic and stay-at-home orders on abortions

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Abstract

We study the effect of the COVID-19 pandemic and of government mandated mitigation policies on the number of abortions performed by Mexico City's public abortion program. We find that the COVID-19 pandemic and stay-at-home orders (SAHO) implemented in Mexico led to unintended consequences for women's sexual and reproductive health. Using difference-in-differences and event study analyses, we show that SAHO and the pandemic led to a fall in abortions of around 25% and find no evidence that unsafe abortions increased. We find a decrease in the share of single and teenage women getting abortions, arguably due to fewer unwanted pregnancies from decreased sexual activity, and estimate that at most 9.8% of the total fall in abortions can be attributed to this. We complement our analysis using call data from a government helpline and show that the SAHO time period led to fewer abortion- and contraception-related calls but to an increase in pregnancy-related calls.

Keywords Abortion · Reproductive health · COVID-19 · Fertility

JEL Classification I18 · I12 · J13

1 Introduction

As the COVID-19 pandemic continues to impose heavy costs on health, well-being, and economic performance around the globe, additional concerns over how the

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current context has affected women's access to essential sexual and reproductive health services have arisen. In particular, strained healthcare systems, stay-at-home orders (SAHO), and economic hardship and uncertainty are all likely to affect women's desire and ability to determine whether and when to have a child. Unwanted fertility is likely to negatively affect economic, social, and individual-level outcomes (Ananat et al. 2009; Lin and Pantano 2015; Sonfield et al. 2013), and it is strongly determined by two essential reproductive health services that allow women to achieve their reproductive desires: access to contraception to prevent unintended pregnancies and safe abortion care to avoid unwanted births (Bongaarts et al. 2012; Bailey 2012). Safe abortion care is a time-sensitive service for which a delay may increase health risks and decreases the possibility of receiving a legal procedure because of gestational age legal limits (Bayefsky et al. 2020). We analyze the full effect of the COVID-19 pandemic and SAHO on abortions in Mexico City (CDMX).

Many countries have implemented SAHO as key mitigation policies, and while they have been generally successful at containing the spread of the virus, they have had unintended consequences on general health (Pfefferbaum and North 2020; Wong et al. 2020) and women's sexual and reproductive health (Cousins 2020; Bullinger et al. 2020). In this paper, we analyze the effects of the SAHO time period in the Mexico City Metropolitan Area (MCMA) on the number of legal abortions performed at CDMX's public abortion program called *Interrupcion Legal del Embarazo* (ILE). The program has been found to be associated with improvements in maternal health and aggregate fertility rates (Clarke and Mühlrad 2020). We present evidence that the start of SAHO coincided with a sharp reduction in the number of abortions compared with week-to-week trends observed in previous years (2016–2019). We use detailed woman-level data on abortions performed by ILE merged with municipal measures for MCMA's 72 municipalities to explore heterogeneous effects by municipal poverty levels, rates of informality, and COVID-19 mortality rates.¹ Additionally, we explore how the composition of women getting abortions was affected by the pandemic and SAHO.

We use a difference-in-differences (DiD) strategy that compares the weekly municipal-level number of abortions provided by the ILE program during 2016–2019 (averaged) and 2020 before and after the SAHO. We further explore differential effects on abortions corresponding to conceptions occurring before and after the start of the SAHO. Additionally, we use an event study approach to analyze the dynamic effects of the beginning of SAHO on the decline in abortions. We complement our strategy by analyzing the effects of COVID-19 and SAHO on abortion-related morbidity (ARM) using hospital discharge data (as in Clarke and Mühlrad (2020)) in order to explore potential effects on maternal health and unsafe abortions. Furthermore, we use detailed call-level administrative data for reproductive health-related calls from a government “helpline” that assists women with legal, medical, and psychological issues in order to explore the mechanisms that may be driving the observed changes in abortions.

¹The MCMA is comprised of 76 municipalities but four of these are not represented in the data as there were no women from these municipalities getting abortions over our study period.

We find that the COVID-19 pandemic and the SAHO to contain it led to a large and significant decrease in the number of abortions performed by ILE of approximately 25%, and of around 20% once anticipatory effects are accounted for (i.e., women getting earlier abortions in anticipation of restricted access from SAHO). We find that this effect was more pronounced for women living in municipalities that were arguably more likely to comply with SAHO (Weill et al. 2020): those in CDMX where SAHO tended to be more strict, and those with lower poverty levels and a smaller informal economy. Effects were similarly stronger in municipalities with high COVID-19 mortality rates, where individuals may experience greater fear of visiting healthcare facilities.

While SAHO—as well as the pandemic in general—are likely to have affected the number of occurring pregnancies (and the composition of pregnant women), and thus indirectly affected abortion-seeking patterns, we exploit the fact that abortions performed during the first weeks of the policy correspond to conceptions happening *before* SAHO and thus unaffected by SAHO's indirect effects on abortions through its effects on pregnancies. We find a smaller decline in abortions (18%) in the weeks immediately following the start of policy, and that no compositional changes are observed. The effect as of seven weeks after the policy's start—when changes in pregnancies due to SAHO and the pandemic may affect abortion patterns—is significantly larger (a decline of 29%), and we observe relevant compositional changes in the women getting abortions: the shares of single and young women getting abortions fall significantly.² This evidence is consistent with a reduction in unwanted pregnancies among women not living with a partner, arguably from reduced sexual activity due to social distancing measures. Taking into account the dynamic effects of the SAHO time period on ILE abortions and the differential effects for single and non-single women, a conservative back-of-the-envelope calculation suggests that about 4.9% of the observed fall in abortions for single women can be attributed to a reduction in unwanted pregnancies.

A decline in safe, legal, and free abortions is likely to have a broad range of consequences for women's health, well-being, and overall fertility (Clarke and Mühlrad 2020). In particular, fewer ILE abortions may translate to either an increase in abortions performed in the private sector (although these tend to be more expensive and of lower quality, Becker and Diaz Olavarrieta (2013)), an increase in unsafe abortions, self-managed abortions or emergency contraception, or an increase in unwanted fertility—or it may reflect a change in preferences over terminating a pregnancy. We present evidence suggesting that unsafe abortions did not increase after SAHO, as ARM discharges typically associated with these procedures did not increase (we actually observe a decrease in these discharges, consistent with generalized trends regarding hospital utilization). Additionally, our analysis using call data shows that the COVID-19 pandemic and SAHO led to a decrease in the share of teenagers making abortion-related calls; an increase in pregnancy-related calls two weeks after the

²We find no effects on women's schooling conditional on their municipality of residence—which is consistent with the absence of differential effects over desired fertility by socio-economic status (SES).

start of the policy; a fall in contraception-related calls; and an important increase in domestic violence calls (driven by married and cohabiting women).

Taking together our evidence, our results suggest that the sharp fall in the volume of ILE abortions after SAHO were implemented is mostly explained by restricted access to healthcare, in addition to fewer abortions mostly from single women, arguably from fewer unwanted pregnancies due to reduced sexual activity from SAHO and the pandemic in general. Additionally, we find evidence of anticipatory effects of SAHO as abortions increased the week prior to the beginning of the policy, implying that the effect of SAHO and the COVID-19 pandemic on the *total* number of abortions is smaller (the estimated effect falls to approximately 20% when we account for anticipatory effects).

We find no evidence of an increase in unsafe abortions or of changes on desired fertility but cannot exclude the possibility that self-managed abortions/emergency contraception increased. Our results point to some increase in undesired fertility among married and cohabiting women—a topic where empirical evidence and data are currently scarce (Aassve et al. 2020) and that merits future research. To the best of our knowledge, our paper contributes some of the first empirical evidence of a potential increase in *unwanted* pregnancies that will arguably influence the effects of the COVID-19 pandemic on fertility.

Our analysis exploits the sudden start of SAHO in Mexico, but it is still hard to separate the total effect of the pandemic from the effects of the SAHO. While the sharp reduction in abortions immediately following SAHO provides some suggestive evidence that the effects we estimate are mainly driven by this policy, many things were changing in correlated ways during the first few weeks of the pandemic, so our estimates are likely to capture not only the effects of SAHO but the effects of the pandemic itself as well. We argue that in any case, identifying the total effect of the pandemic on abortions is highly relevant.

Our paper contributes to understanding the effects of lockdown policies on non-COVID-19 health-related outcomes—in particular, its effects on access to abortions. Our results are consistent with findings for the USA and other settings, where the pandemic has affected abortions and reproductive health services (Andersen et al. 2020; Adelekan et al. 2020). By using individual-level data, our study contributes to the literature by shedding light on the mechanisms driving the decline in abortions following SAHO and the pandemic. Additionally, while we exploit the specific context of the COVID-19 pandemic, we argue that the insights from our research transcend the specific context of the lockdown and offer valuable lessons for economic and health policies regarding the effects of limited access to abortions and reproductive health services more broadly.

The rest of the paper is organized as follows: Section 2 discusses some of the potential effects of the pandemic on desired abortions and fertility and describes the context in which we study the effects of SAHO on reproductive health, Section 3 presents our abortion, hospital discharge, and call data and shows some raw trends in our outcome variables. Section 4 discusses the empirical approach. We present results in Section 5. Section 6 concludes.

2 Context

2.1 COVID-19, SAHO, abortions, and fertility

While the COVID-19 pandemic along with the implementation of SAHO are likely to reduce access to reproductive health services, the social and economic dynamics created by the pandemic and these mitigation policies are also likely to affect women's entire fertility decision plan (as in Levine (2002)) by differentially affecting sexual activity, contraception, pregnancy, abortion, and birth. It is thus uncertain how they will affect women's demand for abortions (Aassve et al. 2020). Changes in sexual activity, contraception, and preferences over fertility are among the relevant determinants of demand for abortions that are likely to have been affected by SAHO. Similarly, it is ultimately ambiguous how the COVID-19 pandemic and SAHO will affect observed and desired fertility in the end, although the deep economic and social changes that have been triggered by the COVID-19 pandemic are likely to influence both desired and completed fertility.

Sexual activity among women not cohabiting with their partners may have decreased due to social distancing (Jacob et al. 2020) although it is also possible that increased time at home increased cohabiting couples' sexual activity (Bayefsky et al. 2020). Additionally, increases in domestic violence may have led to a higher number of sexual assaults inside the household (Bullinger et al. 2020; Leslie and Wilson 2020; Bayefsky et al. 2020).

Strained health systems have led to a reduction in access to contraception and to safe, legal abortions (Bayefsky et al. 2020; Cousins 2020; Adelekan et al. 2020). Additionally, women may have changed their abortion and/or contraception seeking behavior if SAHO lead to a loss of privacy and autonomy (Ashraf et al. 2014) or if their mobility became restricted. The evidence suggests that decisions to terminate a pregnancy can potentially react immediately to changing circumstances (Gonzalez et al. 2018). Finally, the COVID-19 pandemic is likely to have led to reduced willingness to attend healthcare facilities from fear of the virus (Wong et al. 2020), which in turn may have decreased the demand for abortions (and access to contraception) in these settings.

Women's preferences over having a child during a pandemic, as in times of economic hardship and uncertainty, are also likely to be affected. The empirical evidence of pandemics on fertility shows some evidence that the Ebola epidemic in 2013 led to a substantial decline in contraceptive use and family planning care (Riley et al. 2020; Bietsch et al. 2020), while Almond and Mazumder (2005) find no evidence of negative selection into fertility during the 1918 influenza pandemic. On the other hand, the literature on the effects of economic recessions on fertility would suggest that the negative economic prospects related to COVID-19 could negatively affect desired fertility (Currie and Schwandt 2014), although its effects may differ across women with different opportunity costs of time (Dehejia and Lleras-Muney 2004; Buckles et al. 2018; Arkes and Klerman 2009). Finally, the sheer fear of catching COVID-19 may have an impact on desired fertility as well (Chin and Wilson 2018).

2.2 Abortion in CDMX

CDMX decriminalized first-trimester elective abortion in 2007, and legally created the city's public abortion program called ILE which provides first-trimester abortions in public facilities free of charge for CDMX residents (at a fee for non-residents).³ Since ILE's beginning and until July 2020, a total of 227,686 first-trimester abortions have been performed at public clinics in CDMX. Approximately 70% of ILE users reside in CDMX and 25% in the State of Mexico (Mexico City's Ministry of Health 2020a). Previous research has found a relationship between abortion legislation and fertility results in CDMX: Clarke and Mühlrad (2020) show that public abortion services availability reduces births in CDMX by between 2.3 and 3.8%, with a more substantial impact on adolescent women (Clarke and Mühlrad 2020).

During the COVID-19 contingency CDMX's government recognized abortion care as an essential service and sought to continue providing safe and legal abortions as usual (Mexico City's Ministry of Health 2020b). However, there is some evidence that these procedures were disrupted and services were discontinued in clinics that traditionally performed abortions, as some facilities where ILE abortions were provided were temporarily reassigned as centers to face the COVID-19 pandemic, effectively limiting the supply of abortions.⁴

2.3 COVID-19 in Mexico

The first cases of COVID-19 in Mexico were reported in late February 2020. On March 16th, the Mexican government announced schools' closure beginning on March 23rd (Official Journal of the Federation. Mexican Ministry of Public Education 2020). On March 24th, the beginning of SAHO was announced (General Direction of Epidemiology 2020a). On March 30th, the government announced the suspension of non-essential activities (Official Journal of the Federation. Federal Ministry of Health 2020). These mitigation actions were not strictly mandatory and adherence to them varied across the country and the city itself, particularly in the informal sectors of the economy.

3 Data

3.1 ILE program data

We use detailed administrative data from ILE from January 2016 to June 2020 (Mexico City's Government 2020a). Data includes basic individual and procedure-related

³In Mexico, abortion law is determined at the state level (as opposed to the federal level). Legal abortion is highly restricted in 30 of Mexico's 32 states (CDMX and, as of 2019, Oaxaca).

⁴<https://www.milenio.com/politica/cuarentena-aumenta-asesoria-interrupcion-legal-embarazo>

information of women seeking abortion care such as age, schooling, cohabiting status, gestational age of the pregnancy, and individuals' municipality of residence. Additionally, ILE data includes the date when abortion care was provided. For our analysis, we create a "High Education" dummy for individuals reporting having at least high school education and indicators for cohabiting status (where we will refer to as "single" when a woman reports being single, separated, divorced, or widowed females—vs cohabiting and married women) and different age groups.

We merge these data to municipality-level indicators to analyze whether abortions are more affected by the SAHO in certain types of municipalities. We divide municipalities into equally sized high- vs low-poverty groups according to the share of population living in poverty to proxy for municipalities' SES and high- or low-informality according to the share of population deprived of access to social security to proxy of labor informality using data from CONEVAL, Mexico's National Council for the Evaluation of Social Development Policy. We create a high- vs low-COVID-19 indicator using COVID-19 mortality data at the municipality-level.⁵ Total municipal population comes from the 2010 census. Finally, we classify the 16 CDMX municipalities as high- vs low-mobility reduction during the lockdown, according to relative changes in vehicle transit using a public dataset from CDMX's government constructed using Waze data.

We focus our analysis on women living in the MCMA, representing 87.5% of ILE patients. The MCMA is formed by CDMX's 16 municipalities and an additional 59 from the neighboring State of Mexico.⁶ From our MCMA sample, approximately 70% of ILE users are CDMX residents while the rest live in the State of Mexico (Fig. 4 in the [Appendix](#) shows all MCMA municipalities by state and population, as well as the location of ILE centers). While voluntary pregnancy interruption is not legal in the State of Mexico, it is relatively easy to commute to CDMX in order to get an abortion for women living in State of Mexico municipalities within the MCMA.⁷

Figure 1 shows the raw trends in the weekly number of abortions performed at the ILE program for all women living in MCMA. The figure shows week-of-year (WOY) data for 2020 as well as the average WOY volume for the 2016–2019 period. Trends in abortions for the weeks prior to SAHO implementation (WOY13; March 23–29)

⁵COVID-19 deaths' data included observations until August 27, General Direction of Epidemiology (2020b))

⁶It also includes one municipality from the state of Hidalgo which we exclude from our analysis.

⁷The MCMA is a well integrated metropolitan area and commuting between CDMX and the State of Mexico is very common among those living in the MCMA. The most recent Mexican census (2020) shows that more than 21.6 million people live in the MCMA: 9.2 million in CDMX and 12.4 in the State of Mexico. According to the Origin-Destination Survey in Households of the Metropolitan Zone of the Valley of Mexico (National Institute of Geography and Statistics 2017), 2.2 million commutes from the urban areas of the State of Mexico to CDMX occur every day (and 2.1 million commutes from CDMX to the metropolitan area of the State of Mexico). The CDMX public transportation networks includes stations in the State of Mexico's urban areas. As can be seen in Fig. 4 in the [Appendix](#), many ILE centers are actually located very close to the border between CDMX and the State of Mexico.

Fig. 1 Weekly number of abortions performed at CDMX's public abortion program. Notes: The weekly average number of abortions performed at CDMX's public abortion program from the 2nd to the 26th week of each year during 2016–2019 (average) and 2020. The 1st week of each year is excluded from the analysis due to a systematic low level of abortions. The SAHO were implemented in week 13 of 2020 (dashed line)

are similar for both groups.⁸ However, after WOY13 we observe a significant drop in total abortions only for 2020.

3.2 Linea mujeres

Linea Mujeres is a CDMX 24/7 government helpline that provides counseling, emotional support, and legal advice on gender violence, discrimination, and family issues. Additionally, *Linea Mujeres* offers medical guidance, especially for advice on gynecology and trauma. On average, *Linea Mujeres* receives 334 calls every day.

We analyze individual-level phone calls of the *Linea Mujeres* helpline from January 2017 to July 2020, corresponding to WOY 1 to 26 (Mexico City's Government 2020b). We again focus on calls from women residing in the MCMA (95.9% of total

⁸Table 3 in the [Appendix](#) shows summary statistics of ILE users, using as analytical unit the 72 municipalities of MCMA for the period before SAHO (or its equivalent of WOY1–12) between the 2016–2019 period and 2020 (except for Panel C which presents statistics at the individual level). Panel A shows small differences in the mean of total weekly abortions overall. Panel B shows no significant differences in the composition of women getting abortions according to individual characteristics. Panel C shows some small differences in the share of women living in different types of municipalities.

calls). Data includes women's demographic characteristics (age, educational level, cohabiting status, and municipality of residence).

We classify calls as abortion-related if any of the following descriptors was captured for the call: "abortion", "termination of pregnancy", or "ILE services". Pregnancy-related calls are classified as such whenever "pregnancy" or "maternity" descriptors are used. If the woman asks for information about contraception, we classify it as a contraception-related call. Finally, descriptors such as "domestic violence", "intimate partner violence", or "abuse in the domestic context" are classified as domestic violence-related calls.⁹

Due to the smaller average volume of weekly calls volume, we further aggregate call data and use fortnight-of-year (FOY) averages instead and analyze the biweekly evolution of calls before and after SAHO. We use 2017–2019 biweekly averages as our counterfactual. We exclude from the analysis the three weeks following the SAHO announcement (WOY12, 13, and 14) due to a systematic health-related call forwarding to a specific COVID-19 helpline.

3.3 Abortion-related morbidity and births

We use Ministry of Health (MoH) hospital discharge and births' data for 2019 and 2020. Data are currently publicly available only at aggregate levels so we use monthly, municipal-level data for all municipalities in the MCMA from January to June. Hospital discharge data (Federal Ministry of Health. General Directorate of Health Information (2020)) is available for all MoH health facilities,¹⁰ and allows us to observe all morbidity events resulting in a hospital inpatient visit. Following Clarke and Mühlrad (2020), we identify abortive-related morbidity (ARM) using the International Classification of Diseases (ICD-10) codes O02–O08, and define as abortion-related discharges (ARD) by also including the O20 code, haemorrhage in early pregnancy (O02 to O08 + O20). Individual-level controls are not available. We also consider any discharge classified as abortion-related in the "type of attention" variable included in the data.

Using births' data from birth registries collected by the MoH we analyze the municipal monthly number of births (total and by type of healthcare institution) for MCMA residents. These data are collected at the time of birth and have been found to be a good and timely source for estimating total fertility, especially in urban areas (Hernandez et al. 2015). We also use births' data from the hospital discharge system, which includes facilities operated by national and state MoH.

⁹Abortion, pregnancy, and contraception are considered "medical" issues while domestic violence calls are considered under "legal" assistance.

¹⁰These facilities primarily serve individuals without insurance or covered by Seguro Popular/INSABI, the public insurance for the unemployed, self-employed, or those without access to employment-based social security.

4 Empirical approach

4.1 Differences-in-differences

We use a DiD approach using 2020 and 2016–2019 (average) WOY municipal-level abortions as treatment and control groups, comparing the WOYs before and after the SAHO that started in WOY13. Our empirical approach most closely resembles Leslie and Wilson (2020) and Bullinger et al. (2020) who estimate the effects of COVID-19 on domestic violence. For our model to be correctly specified, we need the trends in abortions for the weeks prior to WOY13 to be parallel for 2020 and the 2016–2019 average.¹¹

$$y_{mt} = \beta_0 + \beta_1 SAHO_t + \pi_w + \phi D_t^{2020} + \alpha_m + \lambda CDMX_m \cdot t + \varepsilon_{mt} \quad (1)$$

where y_{mt} is the number of abortions in municipality m in WOY t (for the years before 2020, it is the average number of abortions in municipality m in WOY t over the 2016–2019 period), π_w are WOY fixed effects to account for seasonality, α_m are municipality fixed effects that control for time unvarying municipal characteristics, D_t^{2020} is a 2020 dummy, and $CDMX \cdot t$ is a state time trend (as only two states are included in our sample). $SAHO_t$ is a dummy equal to one if $t \geq$ week of 23.Mar.2020, the time when SAHO were implemented.¹² Thus, our $SAHO_t$ variable captures the beginning of the social distancing policy and is also a proxy for the start of pandemic behavior. Note that $SAHO_t$ is equivalent to $D_t^{2020} \times \mathbb{1}[WOY \geq 13]$. The coefficient of interest is β_1 . We cluster standard errors at the municipality-level. We present baseline OLS estimates and also show analogous WLS models, weighing by the 2010 municipal population.

In our main specifications, we define y_{mt} as the logarithm of the total number of abortions obtained by women living in municipality m on WOY t to interpret our results in percentage terms. In practice, we use $\log(1 + \text{no. abortions})$ in order to avoid dropping municipality-WOY when no abortions were performed. We also estimate models using the quartic root and the inverse hyperbolic sine of the weekly number of abortions to proxy for the log transformation.¹³ We additionally estimate our model using the municipal-WOY number of abortions per 1,000 women aged 12 to 49 years old as the dependent variable.¹⁴ In alternative specifications we use the municipal call volume when using the helpline data as our dependent variable.¹⁵

¹¹Our results are robust to using only 2019 as the control group or to including every year between 2016 and 2019 separately and including year fixed effects as the control group. These results are available upon request.

¹²Figure 5 in the Appendix shows that the largest decline in vehicular traffic in CDMX happened between WOY12 and WOY13 (with relatively stable levels thereafter) yielding additional support to treating the start of SAHO as $t \geq 13$.

¹³Inverse hyperbolic sine transformation takes the form $\sinh_x^{-1} = \ln(x + \sqrt{1 + x^2})$.

¹⁴We used the number of women of reproductive age (12 to 49 years old) at municipal level from (National Institute of Geography and Statistics 2021).

¹⁵We analyzed and found no effects of SAHO on the average gestational age recorded in the ILE data.

We present our DiD results defining alternative time frames for our overall “post-SAHO” ($WOY \geq 13$) period in order to differentially estimate effects for abortions corresponding to pre-SAHO vs post-SAHO pregnancies. In particular, as the mean and median gestational age is 7 weeks, we estimate our models restricting $13 \leq WOY < 20$ as the post period (pre-SAHO conceptions) and $WOY \geq 20$ (post-SAHO conceptions) differentially. We interpret the estimations for the “pre-SAHO conception”-period to reflect the direct effects of SAHO on abortions only while the “post-SAHO conception”-period estimations also reflect the indirect effects driven by SAHO’s effects on pregnancies (as well as those driven by time trends). Additionally, as a sensitivity check and in order to incorporate potential anticipatory effects of the policy, we consider an alternative specification where we modify the WOY that we consider as the beginning of SAHO, from WOY13 to WOY12, and also test whether results change when excluding the week prior the SAHO implementation (WOY12) in our preferred specification.

We would expect that the women more affected by SAHO—according to their place of residence—to have a greater decrease in abortions; in the case of the MCMA, this is likely to be in municipalities in CDMX and municipalities with higher SES and lower of informality (Weill et al. 2020). It is also likely that individuals in municipalities with higher COVID-19 mortality reduce their mobility more (as in Bailey et al. (2020)) or are more skeptical of visiting healthcare facilities due to fear of the virus.

We focus our analysis on women residing in the MCMA. We exclude non-MCMA residents as the pandemic and SAHO may have had an even larger impact on the possibility of these women to travel to CDMX.¹⁶

We explore the heterogeneous effects of the COVID-19 pandemic and SAHO on abortions for different types of municipalities using analogous models that include interaction terms between SAHO and an identifier for different subgroups in terms of women’s municipality of residence. Namely, we use dummies to indicate whether a municipality is in CDMX, high-poverty, high-informality, has a high COVID-19 morality, or had high mobility reduction according to vehicular traffic (only available for CDMX).¹⁷ We estimate models of the form:

$$y_{mts} = \delta_0 + \delta_1 SAHO_t + \delta_2 [SAHO_t \times D_{ms}] + \lambda_{ws} + \psi D_{ts}^{2020} + \gamma_m + \psi CDMX_m \cdot t + \varepsilon_{mst} \quad (2)$$

where y_{mts} is the logarithm of the total number of abortions by women living in municipality m with characteristic s on week t , and D_{ms} indicates that municipality m is of type s (i.e., is in CDMX, is high-informality, high-poverty, or high-COVID-19). λ_{ws} are WOY/type fixed effects and D_{ts}^{2020} is a 2020/type dummy. γ_m are municipality fixed effects and $CDMX_m \cdot t$ is a state-specific time trend. All other variables remain the same. The coefficients of interest are δ_1 and δ_2 : δ_1 shows the effect of SAHO on the number of abortions when $s = 0$ and $\delta_1 + \delta_2$ shows the effect when $s = 1$. δ_2 shows the differential effect between groups. For exploring differential effects across different subgroups of women (i.e., cohabiting, teenagers,

¹⁶As an additional robustness check, we estimate our models including all municipalities by creating a “residual municipality”—including all non-MCMA residents—for estimation purposes.

¹⁷See Fig. 5 in the [Appendix](#).

high schooling), we use similar specifications where y_{mts} is the logarithm of the total number of abortions for women of subgroup s living in municipality m .

Finally, to explore whether the start of SAHO had an effect on the composition of women getting abortions we analyze whether it affected the average characteristics of women getting abortions (as in Dehejia and Lleras-Muney (2004)). We use as dependent variables a woman's age group, whether she is single, and a dummy indicating she graduated from high school. Formally, we estimate:

$$y_{imt} = \beta_0 + \beta_1 SAHO_t + \pi_w + \psi D_t^{year} + \alpha_m + \varepsilon_{imt} \quad (3)$$

where y_{imt} is woman i 's individual characteristic and D_t^{year} are year dummies. We control for municipality fixed-effects. As multiple hypotheses are tested, we implement Romano and Wolf's multiple hypothesis correction method following Clarke et al. (2020) and report adjusted p -values.

4.2 Event study

To provide evidence of the parallel trends assumption needed for our DiD model to be correctly specified and in order to analyze the dynamic effects of the beginning of SAHO and the pandemic on abortions we present week-by-week event study figures. The equations we estimate are of the form:

$$y_{mt} = \sum_{\tilde{w} = -12}^{13} \theta_w D^{2020} \times \mathbb{1}(WOY = \tilde{w}) + \pi_w + \phi D^{2020} + \alpha_m + \lambda CDMX_m \cdot t + \varepsilon_{mt} \quad (4)$$

where θ_w are the coefficients of interest, as they show the differential effect between the comparison years (2016–2019) and 2020 of being w -weeks away from the beginning of SAHO for abortion performed at ILE program. Event studies are also shown for different types of municipalities where Eq. 4 is estimated separately using y_{mts} , the log of weekly total abortions in ILE program for women living in a municipality with characteristic s for $s \in \{0, 1\}$. Additionally, we perform event study analyses using different measures of abortion-related hospital discharges as the dependent variable.¹⁸

We use data from the government's helpline to explore the dynamic effects of SAHO and the pandemic on other variables that could affect (or be affected) by abortion availability. We use biweekly averages on specific topics as the dependent variable, y_{mt} . We analyze effects of SAHO on the number of calls related to abortions, pregnancy, contraception, and domestic violence. As fortnights including the three weeks immediately following the SAHO announcement (WOY12, 13, and 14) are excluded due to measurement issues, we interpret the θ_w coefficients as the effect of the w^{th} fortnight before WOY12 for $w < 0$ or w^{th} fortnight after WOY14 for $w > 0$.

¹⁸For our hospital discharge analysis we use months as opposed to weeks and do not include individual-level controls due to data availability. Additionally we use 2019 as opposed to average 2016–2019 values as our control group.

Table 1 Average effects of SAHO and the COVID-19 pandemic on abortions

Panel A.

OLS

	$\log(1+x)$	$\sqrt[4]{x}$	$\sinh_x^{-1}$	$\frac{x}{pop}(1000)$	$\log(1+x)$
SAHO	-0.25*** (0.03)	-0.19*** (0.02)	-0.31*** (0.04)	-0.01*** (0.00)	-0.46*** (0.07)
Observations	3,744	3,744	3,744	3,744	832
Mean log(y) Pre-SAHO	1.02	1.02	1.02	1.02	2.29
Mean y Pre-SAHO	4.17	4.17	4.17	4.17	12.39
Only Mexico City	No	No	No	No	Yes

Panel B.

WLS

	$\log(1+x)$	$\sqrt[4]{x}$	$\sinh_x^{-1}$	$\frac{x}{pop}(1000)$	$\log(1+x)$
SAHO	-0.45*** (0.04)	-0.27*** (0.02)	-0.53*** (0.05)	-0.02*** (0.00)	-0.45*** (0.07)
Observations	3,744	3,744	3,744	3,744	832
Mean log(y) Pre-SAHO	2.14	2.14	2.14	2.14	2.74
Mean y Pre-SAHO	12.47	12.47	12.47	12.47	19.81
Only Mexico City	No	No	No	No	Yes

Panel C.

Heterogeneous Effects

	(1)	(2)	(3)	(4)	(5)
SAHO	-0.19*** (0.03)	-0.45*** (0.06)	-0.37*** (0.06)	-0.20*** (0.03)	-0.50*** (0.11)
× Mexico City	-0.26*** (0.07)				
× High poverty		0.25*** (0.07)			
× High inform.			0.17** (0.07)		
× High Covid-19				-0.22*** (0.07)	
× High mobility reduction					0.07 (0.13)
Observations	3,744	3,744	3,744	3,744	832
Mean log(y) Pre-SAHO	1.02	1.02	1.02	1.02	2.29
Only Mexico City	No	No	No	No	Yes

Notes: Estimates are based on Eq. 1. Columns 1 and 5 (Panels A and B) and Panel C present $\log(1 + \text{no. abortions})$ at the municipal-WOY level as the dependent variable. Columns 2 and 3 (in Panels A and B) present the quartic root and the inverse hyperbolic sine of the weekly number of abortions at municipal-level, respectively, as the dependent variable. Column 4 (Panels A and B) presents the weekly number of abortions at municipal-level per 1,000 women aged 12 to 49 years old as the dependent variable. Estimates in column 5 only include CDMX's 16 municipalities. Models are estimated using the baseline specification, which includes state-specific time trends for CDMX and the State of Mexico; state trends are excluded from regressions restricted to CDMX. Standard errors clustered at the municipal level in parentheses; 72 and 16 clusters for the full sample and sample restricted to CDMX, respectively. Weights constructed using total municipal population in 2010. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

5 Results

5.1 Effects on ILE abortions

Our DiD estimations show that the beginning of SAHO led to a strong and significant decline in the volume of ILE abortions. Panel A of Table 1 shows OLS estimates and Panel B presents WLS estimates, where we weight observations by municipal population. Different columns use different transformations of the number of abortions as the dependent variable. Column 1 uses $\log(1 + \text{no. abortions})$ at the municipal-WOY level as the dependent variable. Columns 2 and 3 present as the dependent variable the quartic root and the inverse hyperbolic sine of the weekly number of abortions at municipal-level, respectively. Column 4 presents the municipal-WOY number of abortions per 1,000 women aged 12 to 49 years old as the dependent variable; and column 5 limits the estimation (as in column 1) for the 16 municipalities in CDMX. Regressions are estimated using our baseline specification that includes a SAHO dummy, WOY and municipal fixed effects, as well as state-specific time trends for CDMX and the State of Mexico. Our preferred specification corresponds to column 1 in Panel A.

Table 1 shows that SAHO and the pandemic led to a decrease in the number of abortions performed of approximately 25% (if we weight by population the estimated effect of SAHO on abortions is of 45%). Our results are robust to using alternative transformations of the dependent variable, and the coefficients' magnitudes do not vary significantly (with the most conservative effect of 19% corresponding to using the quartic root). Using the abortion rate suggests that SAHO and the pandemic decreased this rate by about 0.01 per 1,000 women of reproductive age, which corresponds to a decrease of about 24%—an effect consistent with our preferred specification. Column 5 shows that the decline in abortions is even larger when we focus on women residing in CDMX municipalities: SAHO and the pandemic led to a fall of at least 46% (unweighted regressions).

Panel C of Table 1 (that uses the $\log(1 + \text{no. abortions})$ transformation) shows that effects are significantly stronger for women living in CDMX municipalities within the MCMA and that the effect of the SAHO period on abortions is weaker for women living in municipalities that are arguably less likely to comply with SAHO: those with higher poverty rates and more informality. We also see a stronger effect on municipalities with high COVID-19 mortality consistent with women in these municipalities being less likely to visit healthcare facilities due to fear of the virus. Surprisingly, we find no differential effect across high- vs low-mobility reduction (from vehicular data) for CDMX municipalities, although given that only 16 municipalities are included in this specification confidence intervals are large.¹⁹

Panel A of Fig. 2 shows how abortions declined in time after SAHO began, according to our baseline specification corresponding to column 1 in Panel A (OLS)

¹⁹We estimate our model including non-MCMA residents creating a “residual municipality” for estimation purposes and our results are robust to this specification. We find that the effect of SAHO on non-MCMA residents is significantly larger (of approximately 85 percentage points (p.p.); results available upon request), as restricted mobility from SAHO and the COVID-19 pandemic are likely to have had an additional negative effect for visiting MCMA clinics for women living further from the city.

Fig. 2 Event-study: the effect of SAHO and the COVID-19 pandemic on abortions and abortion-related morbidity. Notes: The figure plots week-level (Panel A.1 & A.2) and month-level (Panel B) coefficients of interest and their 95% confidence intervals (standard errors clustered at the municipality-level; 72 clusters for Panel A.1 & A.2 and 75 for Panel B) from estimating Eq. 4 using $\log(1 + \text{no. abortions})$ at the municipal-WOY level in Panels A.1 & A.2 and $\log(1 + \text{no. abortion-related conditions})$ at the municipal-MOY level in Panel B as the dependent variable. Weights constructed using total municipal population in 2010. Abortion-related morbidity (ARM) includes O02 to O08 International Classification of Diseases (ICD-10) codes as the main health condition for hospitalization. Abortion-related discharges (ARD) includes O02 to O08 + O20 (Haemorrhage in early pregnancy) ICD-10 codes. Abortion-related services were identified using a “type of attention” variable that indicates whether the service was abortion/miscarriage-related. In Panel A we use as comparison years 2016–2019 (averaged), and in Panel B the comparison group is 2019. Models are estimated using the baseline specification, which includes state-specific time trends for CDMX and the State of Mexico. The vertical long-dashed line represents SAHO implementation (WOY13/MOY 3). The red short-dashed line divides the post-SAHO period into pre-SAHO conceptions and post-SAHO conceptions (WOY20)

and B (WLS) of Table 1 using an event study framework. It shows that the parallel trends assumption in the period before WOY13 is satisfied as coefficients consistently oscillate around zero and are statistically not significant, with the exception of the week immediately before the beginning of the SAHO (while this likely reflects an increase in abortion seeking once SAHO were announced but before they took effect, we present a more detailed discussion below). The figure shows a clear drop in the estimated coefficients for the weeks following SAHO compared to the 2016–2019 period. The fall's magnitude is consistent with the coefficients from Table 1, column 1. We observe a small decrease in abortion volume in the weeks immediately following SAHO (mostly corresponding to pre-SAHO conceptions) and a relatively larger fall thereafter (abortions corresponding mostly to post-SAHO conceptions).²⁰ These trends are consistent with an additional effect of SAHO on abortions by its effects on the number of (arguably) undesired pregnancies, driven mostly by women not cohabiting with their partners. Figure 7 in the Appendix show equivalent event study analyses for different types of municipalities separately and shows consistent evidence for all subgroups.

Table 4 in the Appendix shows DiD estimates for different subgroups of the population according to women's characteristics when we divide the post-SAHO period in two: (1) a pre-SAHO conception period ($WOY < 20$) where abortions correspond mainly to pregnancies initiating before SAHO (and are therefore unaffected by the policy) and (2) a post-SAHO conception period ($WOY \geq 20$) where abortions are by and large performed on pregnancies starting while SAHO are in place. In particular, we calculate the total WOY-municipality volume of abortions for different subgroups (i.e., single vs married/cohabiting, teenagers vs rest, high vs low schooling) and include an interaction term in order to estimate differential effects between subgroups.²¹ Our estimations show that for every subgroup, the magnitude of the effect of SAHO is smaller in the weeks immediately following the policy (when abortions correspond only to pre-SAHO conceptions) in column 2 and becomes stronger later as the number of abortions reflects both the direct effects of the policy in addition to indirect effects on pregnancies during the post-SAHO conceptions period in column 3.²²

Our estimates show that in the weeks immediately following SAHO there was no differential effect of the policy between single women and those that cohabit with their partner. However, the difference between these groups of women becomes significant (and the pointwise estimate larger) once we analyze the weeks for which abortions mostly correspond to post-SAHO pregnancies (column 3)—a pattern that is consistent with less abortion-seeking if women not cohabiting with their partners

²⁰Figure 6 in the Appendix shows an event study analysis where we identify individual abortions as corresponding to a pre-SAHO or post-SAHO conception according to gestational age. Consistent with our analysis, point-estimates of week-to-week coefficients are consistently larger for pre-SAHO conceptions (except for weeks late in the year when too few pre-SAHO conceptions are observed and confidence intervals grow substantially).

²¹Note that as we aggregate data in a different way that in our main specification, our baseline estimates for the universe of abortions is not a (weighted) average of our subgroup estimates.

²²For Table 4 in the Appendix: this is, $|\beta^{SAHO}|_{col.2} < |\beta^{SAHO}|_{col.3}$ if $D_w = 0$ or $|\beta^{SAHO} + \beta^{SAHO \times D_w}|_{col.2} < |\beta^{SAHO} + \beta^{SAHO \times D_w}|_{col.3}$ if $D_w = 1$, where D_w is a dummy for different woman-level characteristics.

were less likely to have become pregnant after SAHO began. Similar patterns are not observed when we classify women according to age or schooling.

We use these results to estimate what share of the fall in ILE abortions from SAHO is a result of changes in sexual behavior as opposed to restricted access (either from reduced mobility or restrictions on supply). For single women, if we take the trend observed for married women between WOYs 13–19 and WOYs 20–26 as a (conservative) counterfactual for the reduction in abortions, we would expect an effect of SAHO of 24.7% during the post-SAHO conceptions period.²³ In fact, we see a 26.0% fall, suggesting that approximately 4.9% of the observed fall in abortions for single women can be attributed to a reduction in unwanted pregnancies arguably from reduced sexual activity.

The large increase in abortions we observe during the week immediately before the beginning of the SAHO (i.e., WOY12) is likely to affect our estimates and presents some interesting evidence of the effects of SAHO in and of itself. In particular, the patterns we observe appear to be consistent with a decline in abortions when people are uncertain about the risks of COVID-19 followed by a rush to perform abortions before SAHO come into effect if anticipatory effects exist (i.e., women anticipate that access to abortions may be restricted once SAHO are implemented).

In order to verify that our results are not driven by the unusually high number of abortions in WOY12 in 2020 relative to 2016–2019, we show in Table 5 in the [Appendix](#) our DiD specification but either exclude WOY12 or change the WOY indicating the beginning of SAHO in order to account for anticipatory effects that may affect women's decisions. Column 1 presents our baseline specification as reference. In column 2 we exclude the week prior to SAHO implementation (WOY12) so that this unusual week does not affect the control group and artificially inflate our estimates. The estimated negative effect of SAHO and the pandemic falls to 23%. Column 3 shows the effect of the SAHO period on abortions when we consider the policy to have started a week earlier, on WOY12 as opposed to WOY13, in order to fully incorporate anticipatory effects. The estimated coefficient suggests a decline of 20% which may be interpreted as the (total) effect of SAHO on abortions taking into account anticipatory effects.

Furthermore, Fig. 7 in the [Appendix](#) shows that the unusually high number of abortions in WOY12 was largest precisely in the municipalities where SAHO were arguably more enforced (i.e., low-poverty, low-informality, high COVID19 mortality), providing further evidence of anticipatory effects, as we would expect precisely these municipalities to respond more to the expectation that abortion access will be restricted.²⁴

²³We argue that using the trends observed by married/cohabiting women are a conservative counterfactual as by using the same logic suggesting that pregnancies to single women fell after SAHO due to decreased sexual activity from living away from their partners (Jacob et al. 2020), pregnancies to married/cohabiting women are likely to have increased if sexual activity became more frequent after SAHO for women living with their partners (Bayefsky et al. 2020).

²⁴An analysis showing event studies for different types of women (according to age, marital status, and education) shows that the effects were stronger for singles, non-teenagers, and more educated women, plausibly precisely the groups that we would expect to show stronger anticipatory effects. These results are available upon request.

5.2 ILE-user composition

Table 2, Panel A, shows the effects of SAHO and the pandemic on the composition of the women getting ILE-abortions, estimated at the individual-level, over the entire period. Our results show a decrease in the share of teenagers of 2 p.p., or about 13.3%. Additionally, they show a significant decrease in the probability of being single (vs married or cohabiting) of 4 p.p. or about 6.6%. We find no compositional effects in terms of women's education. Our results are significant at the 5% level,

Table 2 Effect of SAHO and the COVID-19 pandemic on ILE-user composition

	Age < 20	Single	High Edu.
Panel A.			
Full period			
SAHO	-0.02** (0.01)	-0.04** (0.02)	-0.03 (0.02)
Observations	35,691	35,691	35,691
MDV (pre-SAHO)	0.15	0.60	0.63
<i>p</i> -value	0.03	0.02	0.12
Romano-Wolf <i>p</i> -value	0.03	0.03	0.09
Panel B. Pre-SAHO conceptions			
WOY < 20			
SAHO	-0.02* (0.01)	-0.03 (0.02)	-0.04** (0.02)
Observations	26,218	26,218	26,218
MDV (pre-SAHO)	0.15	0.60	0.63
<i>p</i> -value	0.09	0.10	0.02
Romano-Wolf <i>p</i> -value	0.06	0.06	0.01
Panel C. Post-SAHO conceptions			
WOY ≤ 13 & WOY ≥ 20			
SAHO	-0.02 (0.01)	-0.06** (0.02)	-0.01 (0.02)
Observations	28,120	28,120	28,120
MDV (pre-SAHO)	0.15	0.60	0.63
<i>p</i> -value	0.17	0.01	0.60
Romano-Wolf <i>p</i> -value	0.18	0.03	0.56

Notes: Estimates are based on Eq. 3, where the dependent variable is a given characteristic of women getting abortions. Standard errors clustered at the municipal level in parentheses; 72 clusters. Estimates do not include state trends. MDV (pre-SAHO) is the mean dependent variable from the period before SAHO implementation. Romano-Wolf *p*-value accounts for multiple hypotheses test using resampling methods (Clarke et al. 2020); Romano-Wolf procedure are implemented based on 500 replications. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

even after adjusting for multiple hypotheses testing, as can be seen in the reported Romano-Wolf p -values.

Panels B and C present equivalent estimates for the pre-SAHO and post-SAHO conception periods separately. Consistent with the evidence from the ILE abortion volume analysis, we see that the compositional changes happen during the post-SAHO conception period (Panel C) and that these are for the most part not significant during the weeks immediately following the start of SAHO (Panel B), further strengthening the evidence that there are indirect effects from fewer pregnancies to single and relatively young women after SAHO began.²⁵ In particular, the probability of a ILE user being single falls by 6 p.p. in the post-SAHO conception period (9.8%). This result is robust to multiple hypotheses adjustments and remains statistically significant, as can be seen in the Romano-Wolf adjusted p -value.

These results are consistent with a reduction in the demand for abortions from a decline in unwanted pregnancies, mainly driven by women not living with a partner and younger women, arguably due to reduced sexual activity from restricted mobility. If we assume that the entire 6 p.p. decrease in the probability of being single reflects fewer unwanted pregnancies from this subgroup, given that approximately 61% of ILE users are single a simple back-of-the-envelope calculation suggests that abortions should have fallen by 3.7 p.p. due to fewer unwanted pregnancies—explaining at most 12.6% of the total observed fall of 29% in the post-SAHO-conceptions period (and at most 9.8% of the total fall of 25% considering the entire period after the start of SAHO).

5.3 Abortion-related morbidity

Our event study analysis shows an important *negative* shift in inpatient ARM visits following SAHO. As documented with other non-COVID-19 health services (Santoli 2020; Wong et al. 2020), we observe an important decline on different measures of abortion-related discharges in Panel B of Fig. 2 following the lockdown, suggesting that SAHO and the subsequent fall in ILE-provided abortions did not lead to an increase in abortion-related morbidity typically associated with unsafe abortions. In fact, we observe a fall in ARM of more than 50% at its lowest point. While part of this is likely to be driven by women being less likely to go to healthcare institutions for a given severity of a condition due to SAHO and/or the fear of the epidemic (Wong et al. 2020), given the magnitude of the fall it is unlikely that there was an actual *increase* of ARM following SAHO (total hospital discharges excluding COVID-19 in CDMX also fell by approximately 50% after SAHO were implemented). Figure 8 in the [Appendix](#) show there was no decline for “essential” and non-postponable healthcare services by showing an event study analysis for total births as our outcome variable. This figure also shows that there does not appear to have been an apparent

²⁵We find a significant effect for women with higher education in the pre-SAHO conceptions period, which is consistent with the effect being stronger in low-poverty, low-informality municipalities.

crowd-out from medical services provided at the MoH to private healthcare providers (Panel E), which can give some suggestive evidence that publicly provided abortions and medical care for ARM were probably not completely substituted by privately provided ones after the lockdown.

Our analysis suggests that safe ILE abortions were not generally substituted with unsafe abortions as we find no evidence of increases in ARM. However, we have no evidence about the potential of an increase of “safe” abortions performed outside of formal healthcare settings, such as those using *misoprostol*.

5.4 Reproductive health calls

The COVID-19 pandemic and SAHO may have affected the number and nature of calls to the CDMX government’s women’s helpline through different channels, so the interpretation of estimates that use call data must be taken with caution. SAHO may have affected the probability that a woman actually calls to the helpline: calls may have increased (e.g., new reproductive health concerns related to COVID-19 or more time for making calls) or decreased (e.g., a loss of privacy or less time for making calls given increases in domestic demands associated with SAHO). Additionally, SAHO may have affected the issues that women face, thus changing the number of calls related to different issues. A decrease in the number of calls related to abortions does not necessarily imply fewer women needed information on abortions—it may also reflect that it is more difficult for women to make calls about sensitive topics.

Figure 3 shows our results for the effects of SAHO and the pandemic on reproductive health-related calls using our event study approach. We present estimates for our baseline model which includes state-specific time trends for CDMX and the State of Mexico, and municipal fixed-effects (results from equivalent estimations but using a DiD approach are presented in Table 6 column 1 in the [Appendix](#)).²⁶

Panel A in Fig. 3 shows the evolution of abortion-related calls following SAHO. The figure shows a sharp fall after the beginning of SAHO, followed by important increases in abortion-related calls and another subsequent decrease after that. This pattern is consistent with an initial drawback in seeking abortion services after SAHO were announced, most likely due to a loss of privacy and/or fear of going to a healthcare facility mid-pandemic, followed by an increase in abortion-related calls if SAHO also affected unwanted pregnancies. The fall observed after FOY10 (i.e., or WOY20 when abortions begin to correspond to conceptions happening during the post-SAHO-period) is consistent with our results from ILE estimations: a decrease in unwanted pregnancies for certain subgroups following SAHO.

Panel B shows an increase in pregnancy-related calls two weeks after SAHO began. Given the timing of this increase this pattern is likely to reflect an increase in pregnancy-related calls due to potential effects from COVID-19 and newfound health concerns. It could also be consistent with an increase in the number of pregnancies from increased sexual activity from cohabiting women (Bayefsky et al. 2020).

²⁶Our results are robust to using the share of total calls regarding a specific topic (as opposed to the volume). This is consistent with the fact that the total volume of calls received by *Línea Mujeres* remained mostly unchanged after SAHO.

Fig. 3 Event-study: the effect of SAHO and the COVID-19 pandemic on reproductive health-related call volume. Notes: The figure plots biweekly-level coefficients of interest and their 95% confidence intervals (standard errors clustered at the municipality-level; 75 clusters) from estimating Eq. 4 using $\log(1 + \text{no. topic-}x \text{ calls})$ at the municipal-FOY level as the dependent variable. Models are estimated using the baseline specification, which includes state-specific time trends for CDMX and the State of Mexico. We use the average volume of biweekly calls for the period 2017–2019. We removed from our analysis weeks 12, 13, and 14 (thus excluding fortnights 6 and 7) due to a systematic health-related call forwarding to a specific COVID-19 helpline. θ_w coefficients should be interpreted as the w^{th} fortnight before WOYs 11–12 for $w < 0$ and as the w^{th} fortnight after WOYs 13–14 for $w > 0$. The vertical dashed line represents the SAHO announcement (WOYs 11–12) and the base category corresponds to WOYs 9–10 (FOY 5). The red short-dashed line divides the post-SAHO period into pre-SAHO conceptions and post-SAHO conceptions (WOY20/FOY10)

After FOY10, we observe a decrease with respect to the previous weeks which again appears to be consistent with fewer pregnancies after SAHO began from single women.

Panel C shows a decrease in contraception-related calls after SAHO started, although confidence intervals are large given the low call volume for contraception calls (DiD estimates do show a statistically significant effect of SAHO of around 6 p.p. as can be seen in Table 6 column 1 in the [Appendix](#)). The decrease in the volume of calls might be explained by loss of privacy from staying at home in addition to higher domestic demands by cohabiting women and by a decrease in the actual need of contraception for single women whose sexual activity was negatively affected by SAHO.

Domestic violence calls appear to increase significantly around week 8 of 2020 compared to the 2016–2020 period, as can be seen in Panel D. While we do not attempt to explain why the increase in domestic violence anteceded the implementation of SAHO, the evidence does show a significant increase in these calls during the SAHO, consistent with what has been found in the USA (Leslie and Wilson [2020](#); Bullinger et al. [2020](#)).

Table 6 in the [Appendix](#) shows the DiD estimations of the effects of SAHO on call volume in column 1. Our results imply that SAHO were associated with a significant decrease in the volume of abortion- and contraception-related calls of around 36% and 6% respectively, and an increase after SAHO of at least 7% and 15% for pregnancy- and domestic violence-related calls. As with our ILE-abortion analysis, we see that effects are consistently stronger for CDMX, higher-income or lower-informality municipalities, and for municipalities with higher COVID-19 mortality, as is shown in columns 2 to 5.

The effects of SAHO and the COVID-19 pandemic on caller composition can be seen in Table 7 in the [Appendix](#). Consistent with our findings regarding ILE-user composition, we find a significant decrease in the share of teenagers making abortion-related topics (5 p.p., or 55%). We also find an increase in the share of women making pregnancy-related calls with higher educational level, suggesting important compositional effects (23 p.p., or about 39%). We find a significant decrease in the probability that a single woman makes a domestic violence related call (7 p.p., or 13.5%)—consistent with aggressions increasing within households. The results for teenagers making abortion-related calls and for single women making domestic violence-related calls are significant at the 1% level, even after adjusting for multiple hypotheses testing, as can be seen in the reported Romano-Wolf *p*-values (the result for higher-education women making pregnancy-related calls remains significant only at the 10% level after making this correction).

6 Discussion and conclusions

We find that the COVID-19 pandemic and SAHO implemented to mitigate the spread of the virus led to a significant decline in the number of abortions performed by CDMX's public abortion program. We show that the effects were driven by municipalities more likely to comply with SAHO and present evidence of anticipatory effects to the policy. We find that the composition of women getting abortions

changed after the lockdown, where single and adolescent women were less likely to get an abortion. We interpret this compositional change as reflecting a decline in unwanted pregnancies for these groups of women (in addition to stronger mobility restrictions). Conditional on municipality of residence, SAHO and the pandemic did not affect women's average SES as measured by their schooling, suggesting that the reduction in abortions is not explained by changes in women's preferences over continuing with a pregnancy.

While most of our analysis focuses on the sudden start of SAHO in Mexico, it is hard to separate the total effect of the pandemic from the effects of the SAHO, which are likely to have affected abortion simultaneously and likely in correlated ways—as the fact that effects were stronger for municipalities with high COVID-19 mortality would suggest. We believe that in any case, identifying the total effect of the pandemic on abortions is both relevant and important.

We find no evidence that the reduction in ILE abortions led to an increase in unsafe abortions as hospital discharge data for ARM shows no increases following SAHO, but rather falls following the general hospital usage trends. While abortions not obtained through the public ILE program may have been obtained in the private sector, we show that at least for the case of births we do not observe a shift from public to private healthcare services, mitigating concerns that our results merely suggest a shift from public to private abortions. Our data does not rule out the possibility that self-managed abortions may have compensated for ILE's reduction in the supply of abortions.

We present additional evidence from helpline calls consistent with SAHO affecting women's ability to access safe and legal abortions. This is likely to be due to limited access (a fall in the supply of abortions by public health facilities and mobility restrictions), fear of visiting healthcare facilities, and to a loss of women's autonomy and privacy.

Taken the evidence together, our results present some of the first empirical evidence anticipating the potential effects of COVID-19 and SAHO on fertility, suggesting evidence consistent with an increase in unwanted pregnancies after SAHO started. Its potential relation with increased domestic violence and sexual abuse within the home highlights the importance of focusing policy efforts on providing more and better reproductive health services to women.

Some possible policy recommendations may include a “hotline” and/or telemedicine alternatives for safe misoprostol use in order to make home abortions safe (Drovetta 2015; Donovan 2019) and moving sexual and reproductive health services and care out of hospitals or into the community, in addition to improving the distribution of contraception (Cousins 2020).

Appendix

Fig. 4 Mexico City Metropolitan Area (MCMA). Source: Own elaboration based on 2020 Mexican Census data. MCMA shown in blue shades. MCMA includes CDMX's 16 municipalities and 59 municipalities from the State of Mexico

Fig. 5 Average vehicular traffic decline in CDMX (%). Notes: Average (%) change in vehicular traffic for the 16 municipalities in CDMX with respect to WOY-10, grouped into equally sized groups according to the magnitude of traffic decline. Dataset from CDMX Government, constructed using WAZE data

Fig. 6 Event-study: the effect of SAHO and the COVID-19 pandemic on abortions by pre-SAHO or post-SAHO conception. Notes: The figure plots week-level coefficients of interest and their 95% confidence intervals (standard errors clustered at the municipality-level; 72 clusters), from estimating Eq. 4 using $\log(1 + \text{no. abortions})$ at the municipal-WOY level as the dependent variable. The SAHO were implemented in week 13 of 2020 (dashed line). We classify abortions as corresponding to pre-SAHO conceptions using gestational age to calculate the week of conception. The red short-dashed line gives the post-SAHO period into pre-SAHO conceptions and post-SAHO conceptions (WOY20)

Fig. 7 Event-study: the effect of SAHO and the COVID-19 pandemic on abortions by municipality-level characteristics. Notes: The figure plots week-level coefficients of interest and their 95% confidence interval (standard errors clustered at the municipality-level; 72 clusters), from Eq. 4 of baseline models (which include state-specific time trends for CDMX and the State of Mexico) by municipality-level characteristics. The SAHO were implemented in week 13 of 2020 (dashed line). The red short-dashed line divides the post-SAHO period into pre-SAHO conceptions and post-SAHO conceptions (WOY20)

Fig. 8 Event-study: the effect of SAHO and the COVID-19 pandemic on registered births. Notes: The figure plots month-level coefficients of interest and their 95% confidence interval (standard errors clustered at the municipality-level; 75 clusters), from Eq. 4 of baseline models (which include state-specific time trends for CDMX and the State of Mexico) using $\log(1 + \text{no. births})$ at the municipal-MOY level as the dependent variable. In Panels A, B, D and E we use vital statistics data, Panel C depicts births using hospital discharge data. We use as comparison years 2019 and 2020. MoH (Ministry of Health) facilities. The SAHO were implemented in week 13 of 2020 close to the third month of the year (dashed line)

Table 3 Summary statistics abortion program

	Week 1–12 (2016–2019)		Pre-SAHO (2020)			
	Mean	Std. Dev.	Mean	Std. Dev.	Diff	t-test
Panel A.						
No. Abortions						
Abortions by week (total)	301.62	55.97	268.75	69.28	−32.88	(−1.28)
Abortions by week (municipal)	4.44	7.83	3.73	7.09	−0.71**	(−1.97)
Panel B.						
Individual characteristics						
Age	25.64	3.62	25.83	3.83	0.19	(0.83)
Single	0.62	0.27	0.65	0.29	0.03*	(1.82)
High education	0.64	0.27	0.67	0.29	0.03*	(1.92)
Gestational age in days	51.51	12.33	52.57	8.81	1.06	(1.55)
Panel C.						
Individuals living in:						
Mexico City	0.70	0.46	0.66	0.47	−0.04***	(−4.31)
High poverty	0.49	0.50	0.53	0.50	0.04***	(3.64)
High informality	0.47	0.50	0.48	0.50	0.01	(0.71)
High COVID-19	0.46	0.50	0.43	0.50	−0.04***	(−3.63)
High mobility reduction	0.32	0.46	0.31	0.46	−0.01	(−0.47)

Notes: Observations represent the total number of municipalities-by-WOY from week 1 to week 12, for 2016–2019 (average) and 2020. We classify as *High poverty* those individuals living in municipalities with the share of people living in poverty above that of the median municipality, as *High informality* those individuals living in municipalities below the median municipality in terms of the share of the population with access to social security, and as *High COVID-19* individuals in municipalities with a COVID-19 death rate above that of the median municipality (as of August 27, 2020). We classify the 16 CDMX municipalities as *High vs low mobility reduction* during the lockdown, according to relative changes in vehicle transit. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table 4 Effects of SAHO and the COVID-19 pandemic on abortions: pre- versus post-SAHO conceptions (OLS)

	Full period	WOY < 20 (pre-SAHO conceptions)	WOY ≤ 13 & WOY ≥ 20 (post-SAHO conceptions)
Panel A. Full sample			
SAHO	−0.25*** (0.03)	−0.18*** (0.03)	−0.29*** (0.04)
Observations	3,744	2,736	2,880
Mean log(y) Pre-SAHO	1.02	1.02	1.02
Mean y Pre-SAHO	4.17	4.17	4.17
Panel B. Cohabiting status			
SAHO	−0.15*** (0.03)	−0.11*** (0.03)	−0.17*** (0.03)
× Single	−0.07** (0.03)	−0.05 (0.04)	−0.09*** (0.03)
Observations	7,280	5,320	5,600
Mean log(y) Pre-SAHO	0.75	0.75	0.75
Mean y Pre-SAHO	2.19	2.19	2.19
Panel C. Age			
SAHO	−0.23*** (0.03)	−0.16*** (0.03)	−0.26*** (0.04)
× Teenager	0.10*** (0.03)	0.06** (0.03)	0.12*** (0.04)
Observations	7,176	5,244	5,520
Mean log(y) Pre-SAHO	0.70	0.70	0.70
Mean y Pre-SAHO	2.27	2.27	2.27
Panel D. Schooling			
SAHO	−0.15*** (0.03)	−0.09*** (0.03)	−0.19*** (0.03)
× High Edu.	−0.07** (0.03)	−0.08** (0.04)	−0.04 (0.03)
Observations	7,384	5,396	5,680
Mean log(y) Pre-SAHO	0.73	0.73	0.73
Mean y Pre-SAHO	2.16	2.16	2.16

Notes: Estimates are based on Eq. 1, where the dependent variable is $\log(1 + \text{no. abortions})$, at the municipal-WOY level. Standard errors clustered at the municipal level in parentheses; 72 clusters. Models are estimated using the baseline specification which includes state-specific time trends for CDMX and the State of Mexico. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table 5 Average effects of SAHO and the COVID-19 pandemic on abortions: anticipatory effects

Panel A.			
OLS			
	(1)	(2)	(3)
SAHO	−0.25***	−0.23***	−0.20***
	(0.03)	(0.03)	(0.03)
Observations	3,744	3,600	3,744
Mean log(y) Pre-SAHO	1.02	1.03	1.03
Mean y Pre-SAHO	4.17	4.18	4.16
Panel B.			
WLS			
SAHO	−0.45***	−0.42***	−0.37***
	(0.04)	(0.04)	(0.04)
Observations	3,744	3,600	3,744
Mean log(y) Pre-SAHO	2.14	2.14	2.14
Mean y Pre-SAHO	12.47	12.50	12.50
Weeks considered	All	≠ WOY12	All
Beginning of SAHO	WOY13	WOY13	WOY12

Notes: Estimates are based on Eq. 1 where the dependent variable is $\log(1 + \text{no. abortions})$ at the municipal-WOY level. Standard errors clustered at the municipal level in parentheses; 72 clusters. Column (1) presents our DiD main specification, we exclude WOY12 from models in column (2). Column (3) shows the effect of SAHO when the start date is considered to be WOY12 (as opposed to WOY13). Weights constructed using total municipal population in 2010. Models are estimated using the base-line specification which includes state-specific time trends for CDMX and the State of Mexico. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table 6 Average effects of SAHO and the COVID-19 pandemic on calls (heterogeneous effects)

	(1)	(2)	(3)	(4)	(5)	(6)
Dep. Variable: Abortion						
SAHO	-0.36*** (0.06)	-0.19*** (0.04)	-0.87*** (0.14)	-0.78*** (0.15)	-0.27*** (0.06)	-0.97*** (0.17)
× Mexico City		-0.80*** (0.13)				
× High poverty			0.63*** (0.15)			
× High inform.				0.54*** (0.16)		
× High COVID-19					-0.53*** (0.15)	
× High mobility reduction						-0.03 (0.25)
Mean log(y) Pre-SAHO	0.53	0.53	0.53	0.53	0.53	1.47
Dep. Variable: Pregnancy						
SAHO	0.07*** (0.02)	0.03 (0.02)	0.20** (0.08)	0.13 (0.08)	0.04** (0.02)	0.20* (0.12)
× Mexico City		0.18** (0.08)				
× High poverty			-0.17** (0.08)			
× High inform.				-0.09 (0.08)		
× High COVID-19					0.15* (0.09)	
× High mobility reduction						0.01 (0.16)
Mean log(y) Pre-SAHO	0.14	0.14	0.14	0.14	0.14	0.48

Table 6 (continued)

	(1)	(2)	(3)	(4)	(5)	(6)
Dep. Variable: Contraception						
SAHO	-0.06*** (0.02)	-0.01* (0.01)	-0.17** (0.06)	-0.18*** (0.05)	-0.04** (0.02)	-0.29** (0.13)
× Mexico City		-0.22*** (0.07)				
× High poverty			0.13** (0.07)			
× High inform.				0.16*** (0.06)		
× High COVID-19					-0.09 (0.07)	
× High mobility reduction						0.12 (0.15)
Mean log(y) Pre-SAHO	0.07	0.07	0.07	0.07	0.07	0.23
Dep. Variable: Domestic violence						
SAHO	0.15*** (0.03)	0.13*** (0.03)	0.28*** (0.05)	0.13** (0.06)	0.14*** (0.03)	0.14*** (0.05)
× Mexico City		0.06 (0.05)				
× High poverty			-0.16** (0.06)			
× High inform.				0.02 (0.07)		
× High COVID-19					0.03 (0.07)	
× High mobility reduction						0.12 (0.08)
Mean log(y) Pre-SAHO	1.00	1.00	1.00	1.00	1.00	2.81
Observations	2,100	2,100	2,100	2,100	2,100	448
Only Mexico City	No	No	No	No	No	Yes

Notes: Estimates are based on Eq. 1, where the dependent variable is $\log(1 + \text{no. topic calls})$, at the municipal-FOY level. We removed from our analysis weeks 12, 13, and 14 (thus excluding fortnights 6 and 7) due to a systematic health-related call forwarding to a specific COVID-19 helpline. Standard errors clustered at the municipal level in parentheses; 75 clusters. Models are estimated using the baseline specification which includes state-specific time trends for CDMX and the State of Mexico; state trends are excluded from regressions restricted to CDMX (column 6). * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table 7 Effect of SAHO and the COVID-19 pandemic on LM caller composition

	Age < 20	Single	High Edu.
Call topic: Abortion			
SAHO	−0.05*** (0.02)	−0.02 (0.04)	0.02 (0.03)
Observations	6,531	6,531	6,531
MDV (pre-SAHO)	0.09	0.62	0.68
<i>p</i> -value	0.01	0.59	0.42
Romano–Wolf <i>p</i> -value	0.01	0.51	0.50
Call topic: Pregnancy			
SAHO	−0.06 (0.05)	−0.03 (0.12)	0.23** (0.10)
Observations	1,219	1,219	1,219
MDV (pre-SAHO)	0.08	0.35	0.59
<i>p</i> -value	0.18	0.79	0.03
Romano–Wolf <i>p</i> -value	0.27	0.76	0.06
Call topic: Contraception			
SAHO	−0.08 (0.08)	−0.18 (0.14)	−0.01 (0.16)
Observations	435	435	435
MDV (pre-SAHO)	0.09	0.61	0.70
<i>p</i> -value	0.36	0.19	0.96
Romano–Wolf <i>p</i> -value	0.43	0.24	0.94
Call topic: Domestic Violence			
SAHO	−0.01 (0.01)	−0.07*** (0.01)	0.02 (0.02)
Observations	29,318	29,318	29,318
MDV (pre-SAHO)	0.02	0.52	0.58
<i>p</i> -value	0.19	0.00	0.15
Romano–Wolf <i>p</i> -value	0.13	0.00	0.13

Notes: Estimates are based on Eq. 3, where the dependent variable is a given characteristic of Linea Mujeres callers. Standard errors clustered at the municipal level in parentheses; 75 clusters. We removed from our analysis weeks 12, 13, and 14 (thus excluding fortnights 6 and 7) due to a systematic health-related call forwarding to a specific COVID-19 helpline. Estimates do not include state trends. MDV (pre-SAHO) is the mean dependent variable from the period before SAHO implementation. Romano–Wolf *p*-value accounts for multiple hypotheses test using resampling methods (Clarke et al. 2020); Romano–Wolf procedure are implemented based on 500 replications. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

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Data availability Data that support the findings of this study are publicly available.

Declarations

Ethics approval This study is a secondary analysis of de-identified publicly available data, therefore our analysis did not involve human subjects directly. The authors have not obtained Institutional Review Board (IRB) approval for this project.

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