RESEARCH NOTE

The impact of the COVID-19 crisis on meeting needs for family planning: a global scenario by contraceptive methods used

[version 1; peer review: 3 approved with reservations]

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Abstract
The COVID-19 crisis could leave significant numbers of women and couples without access to essential sexual and reproductive health care. This research note analyses differences in contraceptive method mix across Sustainable Development Goal regions and applies assumed method-specific declines in use to produce an illustrative scenario of the potential impact of COVID-19 on contraceptive use and on the proportion of the need for family planning satisfied by modern methods. Globally, it had been estimated that 77 per cent of women of reproductive age (15-49 years) would have their need for family planning satisfied by modern contraceptive methods in 2020. However, taking into account the potential impact of COVID-19 on method-specific use, this could fall to 71 per cent, resulting in around 60 million fewer users of modern contraception worldwide in 2020. Overall declines in contraceptive use will depend on the methods used by women and their partners and on the types of disruptions experienced. The analysis concludes with the recommendation that countries should include family planning and reproductive health services in the package of essential services and develop strategies to ensure that women and couples are able to exercise their reproductive rights during the COVID-19 crisis.

Keywords
COVID-19, family planning, demand for family planning satisfied by modern methods, Sustainable Development Goals, contraceptive methods, scenario, global

Open Peer Review

Reviewer Status

Invited Reviewers

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version 1
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Any reports and responses or comments on the article can be found at the end of the article.

This article is included in the Coronavirus (COVID-19) collection.
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Introduction
Declared a global pandemic in March 2020, COVID-19 has come to affect the lives of billions of people around the world. It is the largest global public health emergency since the Spanish flu pandemic of 1918–1919 and has put many countries’ health-care systems under severe stress. Most governments have responded by introducing far-reaching policies, including behavioural changes aimed at limiting transmission and saving human lives. This has impacted a multitude of sectors, including sexual and reproductive health care, for which an essential component is the provision of safe, effective, affordable and acceptable methods of contraception. The COVID-19 crisis could leave significant numbers of women and couples without access to essential sexual and reproductive health care.

COVID-19 is impacting women’s ability to use contraception in a number of ways: disruptions to the supply chain are limiting the production, distribution and availability of contraceptive commodities, resulting in stock-outs (Purdy, 2020); some health-care facilities are reducing services (IPPF, 2020; MSI, 2020a); health-care providers are redirected from providing family planning services towards responding to COVID-19 (Santoshni, 2020); and many women are unable to visit health-care facilities due to lockdowns or fear of exposure to COVID-19 (UNFPA, 2020). When women’s and couple’s needs for family planning are not met, the number of unintended pregnancies is certain to rise, with life-long impacts on women and their families.

Riley et al. (2020) produced a scenario of 10 per cent decline in the use of short- and long-acting reversible contraception in low- and middle-income countries due to COVID-19, which resulted in an additional 49 million women with unmet need for modern contraception and an additional 15 million unintended pregnancies over the course of the year in low and middle-income countries. United Nations Population Fund (UNFPA, 2020) and Avenir Health modelled a range of scenarios of unmitigated impact in 114 countries covering 93 per cent of users in low- and middle-income countries and projected 47 million women to be unable to use modern contraceptives due to the COVID-19 disruptions continuing for six months. It is possible that these scenarios provide conservative estimates of the global impact, since service providers have suggested even larger disruptions to services in 2020 (MSI, 2020b). These scenarios were produced for a selection of countries and limited to estimates of contraceptive use changes and their impact on a range of outcomes, such as unintended pregnancies, unsafe abortions and maternal deaths.

This research note presents a scenario of the impact of COVID-19 on the Sustainable Development Goals (SDG) indicator 3.7.1., the proportion of women who have their need for family planning satisfied by modern methods. The indicator is monitored annually by the United Nations Population Division. Globally, it was estimated that the proportion of women of reproductive age (15–49 years) who had their need for family planning satisfied by modern methods increased slightly, from 74 per cent in 2000 to 77 per cent in 2020 (United Nations, 2020a) (Figure 1). It is projected to reach 78 per cent in 2030, with a 95 per cent uncertainty interval of 74 per cent to 81 per cent. Just half of the need is satisfied with modern methods in sub-Saharan Africa today.

Figure 1. Trends in the proportion of women of reproductive age (15–49 years) who have their need for family planning satisfied with modern methods. Source: United Nations, Department of Economic and Social Affairs, Population Division (2020). Estimates and Projections of Family Planning Indicators 2020. This figure is reproduced here under a Creative Commons Attribution 3.0 IGO license.
The impact of the COVID-19 pandemic on meeting the demand for family planning will be influenced by many factors, one of them being the types of contraceptive methods used by women in each country. Individual contraceptive methods differ in terms of the need for contact with health-care providers, the periodicity of renewal, the susceptibility to stock-outs and global supply chains disruptions, and their effectiveness in preventing unintended pregnancies.

Estimates of contraceptive use by individual methods are available at the national, regional and global levels (United Nations, 2019). The prevalence of use of different contraceptive methods varies widely by region (Figure 2). For example, in Central and Southern Asia the most common method is female sterilisation (22 per cent of women of reproductive age rely on this method), while injectables are the dominant method in sub-Saharan Africa, with a prevalence of 9 per cent among women of reproductive age.

**Methods**

This research note analyses the differences in contraceptive method mix across regions and applies method-specific declines in use to produce an illustrative scenario of potential impact of COVID-19 on contraceptive use and the proportion of need for family planning satisfied by modern methods. The scenario is implemented in Microsoft Excel and is provided as Underlying data (Dasgupta et al., 2020).

Contraceptive prevalence is the percentage of women who report themselves or their partners as currently using at least one contraceptive method. Unmet need for family planning is the percentage of women who want to stop or delay childbearing for at least two years but are not using any contraceptive method. Demand for family planning satisfied by modern methods (SDG indicator 3.7.1.) is modern contraceptive prevalence divided by total demand, which is the sum of contraceptive prevalence and unmet need.

The methods for national, regional and global estimates and projections of family planning indicators among women of reproductive age (15–49 years) used in this research note are described in Kantorová et al., 2020. The estimates and projections are available from 1990 to 2030 for all women of reproductive age (15–49) for 186 countries or areas with a total population of 90,000 people or more and with at least one observation of contraceptive prevalence, as well as for aggregate geographic regions (United Nations, 2020a). They are weighted by population and take into account changes in marital status. The survey data underlying the model-based estimates and projections are publicly available as a comprehensive data set of 1,317 survey-based observations for 196 countries or areas for the period 1950 to 2019 (United Nations, 2020b).

The scenario assumes no change in sexual activity, fertility intentions, or total demand for family planning, as was also

![Figure 2. Contraceptive use by method among women of reproductive age (15–49 years), by region, in 2019. Source: United Nations, Department of Economic and Social Affairs, Population Division (2019). Contraceptive use by method 2019. Note: In this figure, Oceania includes Australia and New Zealand. Abbreviations: IUD, intrauterine device. This figure is reproduced here under a Creative Commons Attribution 3.0 IGO license.](image-url)
 assumed by Riley et al. (2020), and no difference in the impact of COVID-19 disruptions on married/in-union versus unmarried women.

The assumed percentage decline in use for each method is presented in Table 1. Where possible, we followed the UNFPA (2020) assumptions of service disruption according to their public sector medium scenario. Broadly, we assume a 10 per cent decline for commodities that can be sourced from a range of distribution channels (e.g. condoms and oral contraceptive pill), and a 20 per cent decline for methods that require a service provision from a health care provider (e.g. injectables). For long-acting and permanent methods, all of which require a service from a health care provider, we use the metric couple years of protection (CYP) (USAID, 2019) to estimate the number of users requiring a service over the course of the year to maintain the existing number of users, and apply the 20 per cent decline to that portion. No decline was assumed for methods that do not require any commodity or contact with a service provider. Because of the lack of country-specific data, we assume no differences in method-specific decline across countries and regions, despite the fact that some countries and regions may be better prepared to handle the crisis than others. We also make no assumptions about switches between modern methods of contraception (e.g. from injectables to oral contraceptive pills or condoms).

Regarding the time-frame of our analysis, we assume the disruptions take place over the year 2020 and calculate the estimates for this year. While the disruptions might not be equally spaced through 2020, we assume the impact is averaged over the year.

As a sensitivity test, we also prepared a separate scenario using an assumed 10 per cent decline in short-term and long-acting reversible contraception (the scenario is included in Underlying data) (Dasgupta et al., 2020). This replicates the Riley et al. (2020) approach, but extends their analysis to the global level.

### Table 1. Scenario assuming declines in use by method, with justification.

<table>
<thead>
<tr>
<th>Method</th>
<th>Assumed percentage decline in use</th>
<th>Justification</th>
</tr>
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<tbody>
<tr>
<td>Female sterilization</td>
<td>2%</td>
<td>Some existing female sterilization users age-out and are not replaced by adopters of sterilization. We applied the 20% decline to this fraction, estimated as 1/10, because the CYP for female sterilization is 10.</td>
</tr>
<tr>
<td>Male sterilization</td>
<td>2%</td>
<td>Some wives/partners of existing male sterilization users age-out and are not replaced by adopters of sterilization. We applied the 20% decline to this fraction, estimated as 1/10, because the CYP for male sterilization is 10.</td>
</tr>
<tr>
<td>IUD</td>
<td>4.3%</td>
<td>Some existing IUD users age-out or discontinue their use because the commodity expires. We applied the 20% decline to this fraction, estimated as 1/4.6, because the CYP for Copper T IUD is 4.6. The assumed decline is an overestimate, since existing users who require a resupply are likely to still be somewhat protected by their expired IUD.</td>
</tr>
<tr>
<td>Implant</td>
<td>5.3%</td>
<td>Some existing implant users age-out or discontinue their use because the commodity expires. We applied the 20% decline to this fraction, estimated as 1/4.6, because the CYP for Jadelle implant is 3.8. The assumed decline is an overestimate, since existing users who require a resupply are likely to still be somewhat protected by their expired implant.</td>
</tr>
<tr>
<td>Oral contraceptive pills</td>
<td>10%</td>
<td>Pills can be accessed from a variety of sources (e.g. pharmacies) with limited interaction with health care system. The 10% decline is consistent with UNFPA (2020) medium public sector scenario.</td>
</tr>
<tr>
<td>Condoms</td>
<td>10%</td>
<td>Condoms can be accessed from a variety of sources and distribution channels. Access does not require interaction with health care system. The 10% decline is consistent with UNFPA (2020) medium public sector scenario.</td>
</tr>
<tr>
<td>Injectables</td>
<td>20%</td>
<td>With the exception of self-injectables (e.g. Sayana press), the majority of injectable users require interaction with a service provider. This interaction is typically required every three months, so discontinuation is likely to be more heavily impacted by COVID-19. The 20% reduction is consistent with UNFPA (2020) medium public sector scenario.</td>
</tr>
<tr>
<td>Other modern methods (including vaginal barrier methods, emergency contraception)</td>
<td>10%</td>
<td>Consistent with UNFPA (2020) medium public sector scenario.</td>
</tr>
<tr>
<td>Lactational amenorrhea method</td>
<td>0%</td>
<td>No decline assumed since women can use this method without contraceptive commodity / service provision</td>
</tr>
<tr>
<td>Traditional methods including rhythm, withdrawal</td>
<td>0%</td>
<td>No decline assumed since women can use this method without contraceptive commodity / service provision. Any change in traditional use does not affect SDG 3.7.1. since the indicator is concerned with demand satisfied by modern methods.</td>
</tr>
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CYP, couple years of protection; IUD, intrauterine device; UNFPA, United Nations Population Fund; SDG, Sustainable Development Goal.
and to the indicator demand for family planning satisfied by modern methods.

**Results**

In the scenario of method-specific declines presented above, the proportion of women who have their need for family planning satisfied with modern methods could fall to 71 per cent in 2020 (Figure 3), which would be a regression to levels not seen at the global level since 1995. The largest declines would be in Latin America and the Caribbean (6.7 per cent) and sub-Saharan Africa (6.8 per cent), because these regions have a method-mix skewed towards short-term methods. Central and Southern Asia would experience a smaller average decline (3.7 per cent), because this region has a high proportion of women using female sterilization, which is least affected by short-term disruptions.

Under this scenario, the impact of the pandemic could be around 60 million fewer users of modern contraception worldwide in 2020. Overall declines in contraceptive use will depend on the methods used by women and their partners, and the types of disruptions experienced (availability of commodities, health care service provision). For example, countries with a high prevalence of long-acting and permanent methods (LAPM) would likely experience little change, as many LAPM users will continue to be protected. On the other hand, countries that rely more heavily on short-term methods such as injectables, requiring repeated contact with a service provider, would likely see a decline in use.

**Conclusions**

This scenario is intended to be illustrative of the potential impacts during 2020 of continued disruptions due to COVID-19. Although we applied simplified assumptions across all countries, not all countries will experience the same level of disruptions due to COVID-19. We have assumed that such disruptions could last for a full year, but a shorter disruption would obviously have less impact. For example, a six-month disruption would result in half the impact (the demand for family planning satisfied by modern methods in 2020 would be 74 per cent).

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1 Under the separate scenario where we assumed a 10 per cent decline in all short-term and long-acting reversible contraception in line with the approach taken by Riley et al., 2020, the estimate of the need for family planning satisfied with modern methods in 2020 is 72 per cent. There are not large differences between the two scenarios at the global level.

**Figure 3.** Proportion of women of reproductive age (15–49 years) who have their need for family planning satisfied with modern methods in 2020.
To understand the impacts of COVID-19 disruptions on contraceptive services and use, countries and family planning service providers need to continue data collection through health management information systems, focusing on data quality and completeness during the crisis. This is especially needed because major survey programmes paused the data collection field work. By the time surveys have resumed, some of the gaps in contraceptive use may have recovered, as shown by research on contraceptive use during and after the West African Ebola crisis (Bietsch et al., 2020), and so the decline in use during the crisis might not be observed in future surveys. The data from health management information systems and information about supply chains will also help to inform projections for year 2030.

While we do not yet know how fertility preferences will change in response to the COVID-19 crisis, it is likely that as a result of the economic downturn and increasing uncertainties, some women and couples who were planning a pregnancy may decide to postpone childbirth to a later period. These changes in childbirth preferences increase the need for family planning methods, and therefore our scenario could underestimate the potential impact of COVID-19.

Countries should include family planning and reproductive health services in the package of essential services and develop strategies to ensure that women and couples are able to exercise their reproductive rights during the COVID-19 crisis. Countries should plan for adequate stocks of commodities. Family planning programmes could also increase availability of some less common self-care methods such as diaphragm, female condom, emergency contraception, and provide information about fertility awareness-based methods, which do not require resupply or do not require commodity. The experience gained during the present pandemic should be used to develop preparedness and contingency plans for any future disruptions. For example, countries could improve access to long acting methods because existing users of these methods are less impacted when there are disruptions to services.

Data availability
Source data

Source data are available under the terms of the Creative Commons Attribution 3.0 IGO license (CC BY 3.0 IGO).

Underlying data
Harvard Dataverse: Supplementary material to “The impact of the COVID-19 crisis on meeting needs for family planning: A global scenario by contraceptive methods used”. https://doi.org/10.7910/DVN/C6V7PN (Dasgupta et al., 2020).

Data are available under the terms of the Creative Commons Zero “No rights reserved” data waiver (CC0 1.0 Public domain dedication).

Acknowledgements
The authors wish to thank Jorge Bravo, Joseph Molitoris, Karoline Schmid, and John Wilmoth for comments on an earlier version of this manuscript.

References


Purdy C: How will COVID-19 affect global access to contraceptives—and what can we do about it? Devex. 2020. Reference Source


Santoshini S: Family Planning Efforts Upended by the Coronavirus. Foreign Policy. 2020; Accessed 19 May 2020. Reference Source


This research note adds to the growing model-based evidence on the disastrous indirect impacts that COVID-19 may have on essential sexual and reproductive health services. The researchers extend on prior work by producing global estimates for all countries (as compared to only low- and middle-income countries), focus particularly on the impact on the Sustainable Development Goal 3.7.1 (demand for family planning satisfied with modern methods), and expand on earlier scenarios of method-specific service reductions to account for disruptions in new users and renewal of long-acting and permanent methods. These are important contributions in drawing attention to the impact of COVID-19 on SRHR-related development goals.

We had a few suggestions for how the authors could (1) further strengthen the underlying analysis, (2) frame the results to better center the impacts on individuals, and (3) make the underlying data available at the country-level.

(1) While the prior modeling work on the impacts of COVID-19 on family planning were done in the early stages of the pandemic, this paper is coming out at a time when we are starting to know more about how services are being impacted across countries, and also on how well some of the original assumptions made by Riley et al. (2020) and UNFPA/Avenir (2020) hold up. As such, it would be great to see this paper tackle some of those underlying assumptions, either in the analysis itself, or through incorporating relevant literature.

Changes in demand: While prior work assumed no changes in fertility preferences, the authors hypothesize in the conclusions that couples may postpone childbearing. Since the SDG indicator of primary interest in this analysis is demand satisfied, it seems worth exploring how shifts in the denominator might also impact SDG 3.7.1. Could you build another scenario looking at how demand will likely shift? To do this you could draw from recent publications on an increased desire to delay or postpone childbearing in the US (https://www.guttmacher.org/report/early-impacts-
Method switching: If the disruptions in services are assumed to be greater for certain methods such as injectables, is it reasonable to assume that the full 20% of users would stop using any modern method entirely? It would be interesting to account for some degree of method switching, or show how sensitive the overall reductions in indicator 3.7.1. are to whether or not method-switching occurs. It would also be worth noting in the conclusions that in the face of disruptions to supply-based methods, women may at least be adopting other non-supply methods that afford them some protection from unintended pregnancy over non-use.

(2) The authors note in the conclusions that prior research from the Ebola outbreak in West Africa showed a recovery back to prior levels of contraceptive use. This is an important point that we think is worth elaborating on more, and using in the framing of how the results are interpreted. The goal of this paper is to show the potential impact on the SDG indicator 3.7.1, and the effect of COVID-19 on our development goals. However, if we observe a similar trend to that of West Africa post-Ebola, it’s possible that we could see a complete reversal on these declines in demand satisfied, putting us back on target with our development goals. The potential for a short, but not a long term impact on this goal is important to discuss further. It also highlights the need to frame the results more on the impact on women and couples, as opposed to just the indicator. While we could see a recovery in the indicator, the millions of women unable to access contraceptive methods in the intervening time will experience very real consequences of this disruption. It would be great to see the authors stress this point more, and the importance of looking not only at the SDG indicator, but also considering the impact of even short-term disruptions in coverage on individual outcomes.

(3) If it is possible, we urge the authors to consider releasing not just the underlying regional data for the analysis, but also the country-level data and underlying excel workbook. This would be a really valuable tool for use by stakeholders in countries who are monitoring their progress on the SDGs during this pandemic.

Other minor recommendations to consider:

Abstract: It would help to provide detail in the abstract about the scenario itself, and the range of declines assumed across methods. This is important information with which to contextualize the decline in SDG indicator 3.7.1.

Conclusions: The last point in the conclusion suggests improving access to LARCs because these methods are less impacted. This recommendation takes away from the importance of method choice and what people want to use. While LARCs are less impacted from disruptions, we don’t want the unintended consequence of programs/countries just focusing on LARC access at the detriment to other methods to ensure choice.

References
Is the work clearly and accurately presented and does it cite the current literature? Yes

Is the study design appropriate and is the work technically sound? Yes

Are sufficient details of methods and analysis provided to allow replication by others? Yes

If applicable, is the statistical analysis and its interpretation appropriate? Not applicable

Are all the source data underlying the results available to ensure full reproducibility? Yes

Are the conclusions drawn adequately supported by the results? Yes

**Competing Interests:** We are both currently working on an unrelated paper with the second author. We can both confirm that our collaboration on this upcoming paper has not affected our ability to provide an unbiased review.

**Reviewer Expertise:** Sexual and reproductive health, modeling impacts and costs of family planning services, abortion measurement

We confirm that we have read this submission and believe that we have an appropriate level of expertise to confirm that it is of an acceptable scientific standard, however we have significant reservations, as outlined above.
I find the research note generally convincing and welcome, especially considering the pandemic is still rapidly evolving in many parts of the world. The paper is a considerable first step for more specific country analysis when country-specific service data become available, and has important policy implications.

The scenario presented in the note assumes no change in sexual activity and total demand for contraceptives. This assumption may lead to an overestimate of the demand given previously sexually active women who are not married or living with a partner may experience a decrease in sexual activity, leading to lower or no demand for contraceptives during a lockdown. The research team may consider limiting the research scope to married or in-union women only, suggesting further assumptions for un-married/in union sexually active women, or providing a brief discussion of the implication.

The research team also makes no assumptions about the method switch, but no further details are provided. A brief discussion of the implication of this assumption would be desired.

The authors indicate that a separate scenario using an assumed 10 percent decline in both short-term and long-acting reversible contraception is prepared as a sensitivity test. However, the results of this different scenario are not presented in the paper, nor are any comparisons and discussions provided.

Lastly, in the conclusion section, the authors suggest that “countries could improve access to long-acting methods because existing uses of these methods are less impacted where are disruptions to services.” This statement may be premature as we don't fully understand how the pandemic evolves in different parts of the world and how countries and local governments mitigate the risks. The suggestion may lead to unintended consequences, such as promoting long-acting methods even after the pandemic. Methods should be about women’s choices not to be limited by method availability.

Despite the limitation, the paper provides timely insights and reflects the global interest in women’s access to contraceptives in the pandemic. I would recommend the article for indexing with minor revisions.

**Is the work clearly and accurately presented and does it cite the current literature?**
Yes

**Is the study design appropriate and is the work technically sound?**
Yes

**Are sufficient details of methods and analysis provided to allow replication by others?**
Yes

**If applicable, is the statistical analysis and its interpretation appropriate?**
Not applicable

**Are all the source data underlying the results available to ensure full reproducibility?**
Yes

**Are the conclusions drawn adequately supported by the results?**
Yes

**Competing Interests:** No competing interests were disclosed.

**Reviewer Expertise:** Sexual and reproductive health and rights

I confirm that I have read this submission and believe that I have an appropriate level of expertise to confirm that it is of an acceptable scientific standard, however I have significant reservations, as outlined above.

Reviewer Report 28 July 2020

https://doi.org/10.21956/gatesopenres.14340.r29087

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Michelle Weinberger
Avenir Health, Washington, DC, USA

This research note presents estimates of the potential impact of COVID-19 on global contraceptive use. It builds on estimates already published by others by (1) taking a global scope to include all countries of the world, and (2) quantifying the impact on SDG indicator 3.7.1 the proportion of women who have their need for family planning satisfied by modern methods.

As acknowledged by the authors, they present results based on a simplified set of assumptions to provide illustrative results of the potential impact of COVID-19 on the achievement of SDG 3.7.1. These results provide useful evidence to support advocacy efforts for the importance of sustaining access to contraception during COVID-19. While there is value in such a simple set of assumptions/scenarios, there could also be benefit in the authors exploring some additional considerations, for example:

- Including a starker scenario in their sensitivity testing to explore a full range of possibilities given the large uncertainty about the potential impacts of COVID-19 (so that the detailed scenario presented in the paper is a middle ground between the 10% declines and some higher level of decline). This would be useful, especially as in the introduction the authors note that existing scenarios may provide “conservative estimates” of impact.

- Quantifying the impact of potential increases in demand as a result of COVID-19. The authors acknowledge fertility preferences may change in response to COVID-19. While there is not yet data to understand these changes, such changes would lead to changes in the denominator of the demand satisfied indicator. The paper already explores changes to the numerator (mCP). Adding a simple set of assumptions to quantify potential denominator changes would provide useful context, especially as a focus on demand satisfied is a unique...
aspect of this research note.

Finally, a few more specific notes regarding the research note:

- It may help to add some detail to the methods section to more closely follow the calculations shown in the Excel file. For example, that method mix is applied to the projected CP in 2020 to estimate method prevalence, then prevalence by method is reduced based on the %s in Table 1, then a new mCP is constructed and divided by the 2020 total demand projection to estimate a new demand satisfied measure.

- In discussing the declines in demand satisfied in the results the numbers presented are percentage point declines, not percent changes. The language should be edited to clarify this.

- The authors may wish to cite existing guidance (from groups such as WHO, FIGO and FSRH CEU) in the final paragraph of their conclusion on the use of self-care methods and other strategies to minimize the impact of COVID-19.

- Given the focus on an SDG indicator, the authors may wish to add some text to the conclusion about how COVID-19 may impact on 2030 SDG achievement; do they hypothesize these changes to be short term, or, potentially have lasting impacts on trajectories towards 2030?

Is the work clearly and accurately presented and does it cite the current literature?  
Yes

Is the study design appropriate and is the work technically sound?  
Yes

Are sufficient details of methods and analysis provided to allow replication by others?  
Partly

If applicable, is the statistical analysis and its interpretation appropriate?  
Yes

Are all the source data underlying the results available to ensure full reproducibility?  
Yes

Are the conclusions drawn adequately supported by the results?  
Partly

**Competing Interests:** The reviewer and the first author are currently drafting a commentary piece together on an unrelated topic. I confirm that this hasn't affected my ability to write an objective and unbiased review of the article.

**Reviewer Expertise:** family planning, modeling health impact

I confirm that I have read this submission and believe that I have an appropriate level of
expertise to confirm that it is of an acceptable scientific standard, however I have significant reservations, as outlined above.