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Impact of the COVID-19 Pandemic on Access to Fertility Care: A Retrospective Study at a University-Affiliated Fertility Practice



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ABSTRACT

Objective: To elucidate the impact of the COVID-19 pandemic on access to fertility services.

Methods: A retrospective quality improvement study was conducted at a university-affiliated fertility practice in southwestern Ontario. Annual procedural volumes for intrauterine and donor inseminations (IUI/DI), in vitro fertilization and intracytoplasmic sperm injections (IVF/ICSI), and frozen embryo transfers (FET) during the COVID-19-affected year were compared with mean annual volumes from the 2 preceding years. In addition, volumes for the same procedures were compared between the first quarter of 2021 and mean first quarter volumes from 2018 to 2019. Piecewise linear regressions were conducted to evaluate whether any changes in monthly procedural volume were attributable to the COVID-19 pandemic.

Results: In 2020, our fertility practice attained the mean annual volumes of 89.7% for IUI/DI, 69.0% for IVF/ICSI, and 60.6% for FET. In contrast, in 2021, we performed mean first quarter volumes of 130.1% for IUI/DI, 164.3% for IVF/ICSI, and 126.8% for FET. The slopes of the pre- and post-COVID-19 segments of the piecewise linear regressions were significantly different for IUI/DI ($P < 0.001$) and IVF/ICSI ($P = 0.001$), but not for FET ($P = 0.133$).

Keywords: COVID-19; coronavirus; pandemics; infertility; fertility clinics

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Conclusion: The COVID-19 pandemic resulted in decreased annual volumes of medically assisted reproductive procedures at a university-affiliated fertility practice in southwestern Ontario. Impact on monthly procedural volume was confirmed for IUI/DI and IVF/ICSI by linear regression. Local adaptations helped compensate and exceed expected volumes in 2021. As a result, the COVID-19 pandemic resulted in a short-lived limitation in access to fertility care.

RÉSUMÉ

Objectif : Examiner les répercussions de la pandémie de COVID-19 sur l'accès aux services de fertilité.

Méthodologie : Une étude rétrospective sur l'amélioration de la qualité a été menée dans une pratique de traitement de l'infertilité affiliée à une université dans le sud-ouest de l'Ontario. Les volumes annuels des techniques pour l'insémination intra-utérine et l'insémination avec sperme de donneur (IUI/IIUD), la fécondation in vitro et les injections intracytoplasmiques d'un spermatozoïde (FIV/IICS) et les transferts d'embryons congelés (TEC) au cours de l'année touchée par la pandémie de COVID-19 ont été comparés aux volumes annuels moyens des 2 années précédentes. De plus, les volumes pour les mêmes techniques ont été comparés entre le premier trimestre de 2021 et les volumes moyens du premier trimestre de 2018 et de 2019. Des régressions linéaires par segments ont été réalisées pour évaluer si des changements dans les volumes mensuels des techniques étaient attribuables à la pandémie de COVID-19.

Résultats : En 2020, notre pratique de traitement de l'infertilité a atteint des volumes annuels moyens de 89,7 % pour les IUI/IIUD, 69,0 % pour les FIV/IICS et 60,6 % pour les TEC. Par comparaison, en 2021, nous avons réalisé des volumes moyens au premier trimestre de 130,1 % pour les IUI/IIUD, 164,3 % pour les FIV/IICS et 126,8 % pour les TEC. Les courbes des segments pré- et post-COVID-19 des régressions linéaires par segments étaient significativement différentes pour les IUI/IIUD ($p < 0,001$) et les FIV/IICS ($p = 0,001$), mais pas pour les TEC ($p = 0,133$).

Conclusion : La pandémie de COVID-19 a entraîné une diminution des volumes annuels des techniques de reproduction

médicalement assistée dans une pratique universitaire de traitement de l'infertilité du sud-ouest de l'Ontario. Des régressions linéaires ont permis de confirmer un effet sur le volume mensuel des techniques d'IUI/IIUD et de FIV/IICS. Des adaptations locales ont aidé à compenser cet effet et à dépasser les volumes prévus en 2021. Par conséquent, la pandémie de COVID-19 a entraîné une limitation de courte durée de l'accès aux soins de l'infertilité.

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INTRODUCTION

Inability to access health care has been a described effect of the coronavirus disease 2019 (COVID-19) pandemic.^{1,2} The population of patients seeking fertility care are under particular biological duress because they require health care services to conceive, unlike their fertile counterparts. In addition, time is often a crucial factor underlying many infertility diagnoses. As such, delays in care could affect a patient's ability to access government funding programs and have an impact on the success of treatments.

On March 18, 2020, following public health recommendations to cancel all non-essential procedures,³ the Canadian Fertility & Andrology Society (CFAS) advised Canadian fertility centres to halt reproductive services.⁴ As a result of the CFAS guidelines, centres for reproductive care were shuttered across the country. The effect of centre closures on the patient experience has been well documented.⁵⁻⁷ However, the impact of these closures and of adapted re-openings on procedural volume and efficiency has yet to be examined.

The aim of our study was to elucidate the impact of the COVID-19 pandemic on access to and availability of fertility services, first by quantifying the changes in procedural volumes during the pandemic at a university-affiliated fertility practice in Southwestern Ontario and second by comparing the trends in procedural volumes before and after the onset of the pandemic.

METHODS

Study Design

We conducted a retrospective quality improvement study using data from a university-affiliated fertility practice comprising 2 sites in London, Ontario. Monthly procedural volumes were tabulated for insemination

(intrauterine insemination [IUI]/donor insemination [DI]), in vitro fertilization (IVF) and intracytoplasmic sperm injection (ICSI), and frozen embryo transfer (FET) between January 1, 2018, and May 31, 2021. All procedures were captured in local databases at the hospital and office-based sites and included in the study.

Analysis

For the descriptive analysis, we quantified the change in procedural volumes during the pandemic by comparing the annual volumes achieved for IUI/DI, IVF/ICSI, and FET in 2020 with the mean annual procedural volumes from 2018 and 2019. To compare the most recent procedural volumes with pre-pandemic values, we compared the first-quarter volumes from 2021 to the mean first-quarter volumes from 2018 and 2019. Because the first quarter of 2020 coincided with the onset of the pandemic, we did not include this period in the pre-pandemic analysis.

To compare the trends in procedural volumes before and after the onset of the pandemic, we performed piecewise linear regression models for IUI/DI, IVF/ICSI, and FET separately. We used monthly procedural volumes during pre- and post-COVID-19-affected periods. A comparison of the 2 segments of the regression model was tested against the null hypothesis that they could be defined by a single regression line.

We defined the pre-COVID-19-affected period as January 1, 2018, to February 29, 2020, and the COVID-19-affected period as March 1, 2020, to May 31, 2021, the end of our collection period. March 2020 was selected as the start date for the COVID-19-affected period because it was the first month affected by COVID-19 adaptations. Owing to CFAS and Ontario Ministry of Health directives,^{3,4} fertility services were halted at our centres from March 15, 2020, to June 7, 2020.

A third-party statistician used The R Project for Statistical Computing, Version 4.0.2, to conduct statistical analyses.⁸

RESULTS

Analysis of medically assisted reproduction volumes for 2020 revealed that our clinics did not meet the mean annual rates from the 2 preceding years. Our centres were able to attain 89.7% of the mean annual IUI/DI volume from 2018 to 2019, 69.0% of mean annual IVF/ICSI volume, and 60.6% of mean annual FET volume.

Medically assisted reproduction volumes for the first quarter of 2021 (January to March) exceeded mean first-quarter

volumes from 2018 to 2019: 130.1% of mean first-quarter IUI/DI volume, 164.3% of mean first-quarter IVF/ICSI volume, and 126.8% of mean first-quarter FET volume.

Piecewise linear regressions were used to compare the trend in monthly procedural volumes between pre- and post-COVID-19-affected periods (Figure 1). Assumptions of the piecewise linear regression were tested against the Gauss–Markov theorem and were noted to satisfy the following conditions: homoscedasticity and strict exogeneity. The residuals were not normally distributed, and as a result they were modeled using ordinary least squares.

Regression models for each procedure had the following measures of fit: IUI/DI ($F = 6.1$, $R^2 = 0.34$), IVF/ICSI ($F = 4.1$, $R^2 = 0.25$), and FET ($F = 1.0$, $R^2 = 0.08$). The pre- and post-COVID-19 procedural volume trends were significantly different for IUI/DI ($P < 0.001$) and IVF/ICSI ($P = 0.001$) but not for FET ($P = 0.133$).

DISCUSSION

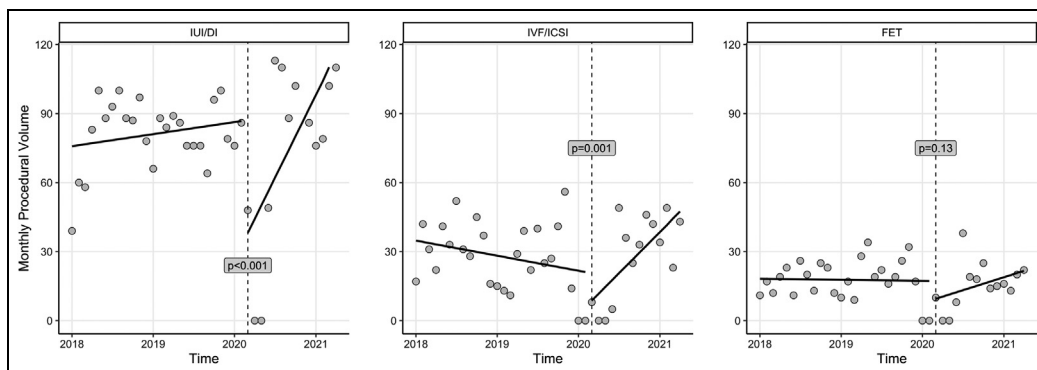
Whereas most studies on reproductive care during the COVID-19 pandemic have focused on patient wellbeing,^{5–7} our study is the first to quantify the effect of the pandemic on availability of fertility services. The key findings of our study demonstrate that there was a modest reduction in delivered fertility services and procedures (IUI/DI –10.3%; IVF/ICSI –31.0%; FET –39.4%) attributable to the COVID-19 pandemic. Although this was an anticipated finding with known centre closures, the magnitude of the impact was not previously described.

In contrast to mean first-quarter figures before the pandemic, the centre performed 30.1% more inseminations (IUI/DI), 64.3% more IVF/ICSI, and 26.8% more FET in the first quarter of 2021. The rise above pre-pandemic volumes may be attributable to a resolution of patient backlog or more efficient procedure delivery after COVID-19 adaptations. In the clinical context, our hospital site saw a trend towards an increased live birth rate, from a pre-COVID-19 rate (January 2018 to November 2020, accounting for 9 months gestation) of 476.7 births per month to 488.4 births per month rate during the COVID-19 period (December 2020 to September 2021), although this was not statistically significant ($P = 0.38$).

We illustrated a significant alteration in procedural volume trends after the onset of the pandemic for IUI/DI (pre-pandemic $m = 0.4$, post-pandemic $m = 6.0$; $P < 0.001$) and IVF/ICSI (pre-pandemic $m = -0.5$, post-pandemic $m = 3.0$; $P = 0.001$), although the same trend was not seen with FET (pre-pandemic $m = -0.04$, post-pandemic $m = 0.9$; $P = 0.133$). The more modest difference in FET procedural volumes would explain why the comparison did not meet statistical significance, but the same global trend was seen as with IUI/DI and IVF/ICSI (Figure 1). A possible reason for this smaller increase in FET volume may be related to patients being more willing to delay transfer of a frozen embryo than to delay the more age- and time-sensitive IVF/ICSI cycles. Alternatively, COVID-19-related delays in fresh IVF/ICSI cycles may have resulted in a secondary paucity of frozen embryos to transfer.

Our findings should be considered in the context of the closures and setbacks experienced by our fertility practice.

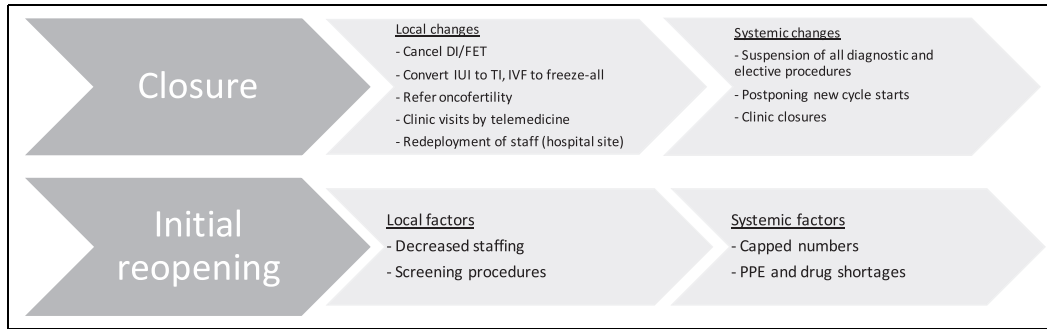
Figure 1. Piecewise linear regression models for IUI/DI, IVF/ICSI, and FET to compare the trends in monthly procedural volume before and after the onset of the COVID-19 pandemic.



Pre-COVID-19 was defined as January 1, 2018, to February 29, 2020. Post-COVID-19 was defined as March 1, 2020, to May 31, 2021, to incorporate the first month affected by the pandemic. The breakpoint is delineated by a dotted line. P values refer to the comparison of pre- and post-COVID-19 slopes.

COVID-19: coronavirus disease 2019; DI: donor insemination; FET: frozen embryo transfer; ICSI: intracytoplasmic sperm injection; IUI: intrauterine insemination; IVF: in vitro fertilization.

Figure 2. Local and systemic factors that contributed to decreased procedural volumes with COVID-19.



COVID-19: coronavirus disease 2019; DI: donor insemination; FET: frozen embryo transfer; ICSI: intracytoplasmic sperm injection; IUI: intrauterine insemination; IVF: in vitro fertilization; PPE: personal protective equipment; TI: timed intercourse.

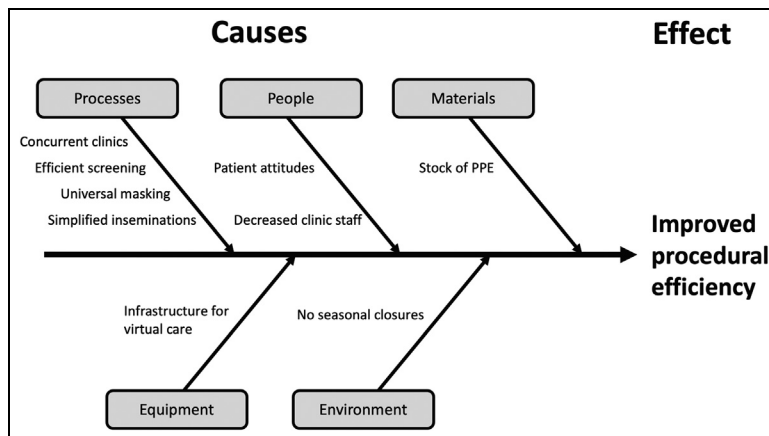
Our practice cancelled FET and donor insemination cycles and converted IUI to timed intercourse. Following CFAS guidance, this also meant conversion of ongoing IVF/ICSI cycles to a freeze-all approach and adoption of virtual care.⁴ Initially, reopening of our clinics was hampered by capped numbers from Ontario Health regulations⁹ and shortages of personal protective equipment and medications for conscious sedation. Locally, we experienced decreased staffing owing to hospital redeployment strategies and inefficient screening procedures (Figure 2).

Our practice underwent numerous adaptations throughout the pandemic, which may contextualize the increase in quarterly procedural volume seen in 2021. These adaptations are summarized in Figure 3 and may have led to an increase in the efficiency of procedure delivery. Simplified insemination procedures using urinary luteinizing hormone kits for ovulation prediction decreased patient visits for ultrasound and bloodwork. Virtual care also decreased requirements for

clinic space and staffing, allowing multiple physicians to run clinics concurrently. Universal patient masking, efficient screening, and updated computers and software for virtual encounters helped to process patients faster. Omission of holiday closures to compensate for expected losses started the new year at an advantage. From a patient perspective, the literature suggests there was a high degree of patient anxiety regarding cycle cancellation,⁵⁻⁷ and this may explain increased volumes on reopening.

As a single-practice study, our results may not be generalizable to the Canadian or global fertility populations. There were also site-specific confounders to our data and its analysis. Our hospital-based site was affected by a centre closure for building maintenance between December 20, 2019, and February 24, 2020. This affected all of the medically assisted reproduction procedures, but primarily IVF/ICSI and FET because they are only conducted at this site. As a result, the drop in annual volume

Figure 3. Ishikawa diagram enumerating factors that contributed to improved procedural efficiencies in the first quarter of 2021.



for IVF/ICSI and FET may be slightly overestimated, and the true decrease attributable to the pandemic is likely closer to the value for IUI/DI.

Although our study was limited to our single university-affiliated fertility practice, in a future study we hope to explore the experiences of other Canadian reproductive centres during the COVID-19 pandemic to characterize how medically assisted reproduction was affected across the nation.

CONCLUSION

The COVID-19 pandemic has had a significant effect on access to health care, including reproductive services. Our study is the first to provide a quantification of this impact, demonstrating an approximately 10% to 40% reduction in medically assisted reproduction in 2020, depending on the procedure. Month-to-month data showed a rapid recovery in procedures performed after the clinic reopened, particularly for IUI/DI and IVF/ICSI, with a nonsignificant trend for FET. All medically assisted reproductive procedures saw a recovery and exceeded projected volumes for the first quarter of 2021. As a result, the impact of COVID-19 on fertility services was a defined decrease in availability of procedures, but one that was limited. Future research should evaluate how fertility practices were affected on a national scale to illustrate a more generalized picture.

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REFERENCES

1. Núñez A, Sreeranga SD, Ramaprasad A. Access to healthcare during COVID-19. *Int J Environ Res Public Health* 2021;18:2980.
2. Centers for Disease Control and Prevention - National Center for Health Statistics. Reduced access to care: The Research and Development Survey (RANDS) during COVID-19. Available at: <https://www.cdc.gov/nchs/covid19/rands/reduced-access-to-care.htm>. Accessed July 29, 2021.
3. Ontario - Ministry of Health. Memorandum to Ontario health and hospitals. Ramping down elective surgeries and other non-emergent activities. Available at: https://www.health.gov.on.ca/en/pro/programs/publichealth/coronavirus/docs/memos/DM_OH_CMOH_memo_COVID19_elective_surgery_March_15_2020.pdf. Accessed July 29, 2021.
4. Canadian Fertility and Andrology Society. CFAS communication on COVID-19 – update #2: March 18th, 2020. Available at: https://cfas.ca/CFAS_Communication_on_COVID-19.html#february25. Accessed May 17, 2021.
5. Haham LM, Youngster M, Kuperman A, et al. Suspension of fertility treatment during the COVID-19 pandemic: views, emotional reactions and psychological distress among women undergoing fertility treatment. *Reprod Biomed Online* 2021;42:849–58.
6. Boivin J, Harrison C, Mathur R, et al. Patient experiences of fertility clinic closure during the COVID-19 pandemic: appraisals, coping, and emotions. *Hum Reprod* 2020;35:2556–66.
7. Gordon JL, Balsom AA. The psychological impact of fertility treatment suspensions during the COVID-19 pandemic. *PLoS One* 2020;15:e0239253.
8. R Core Team. The R project for statistical computing. Available at: <https://www.r-project.org>. Accessed July 29, 2021.
9. Ontario Health. Memorandum to hospital CEOs. Updated – A measured approach to planning for surgeries and procedures during the COVID-19 pandemic. Available at: <https://www.ontariohealth.ca/sites/ontariohealth/files/2020-05/A%20Measured%20Approach%20to%20Planning%20for%20Surgeries%20and%20Procedures%20During%20the%20COVID-19%20Pandemic.pdf>. Accessed July 29, 2021.