



Since January 2020 Elsevier has created a COVID-19 resource centre with free information in English and Mandarin on the novel coronavirus COVID-19. The COVID-19 resource centre is hosted on Elsevier Connect, the company's public news and information website.

Elsevier hereby grants permission to make all its COVID-19-related research that is available on the COVID-19 resource centre - including this research content - immediately available in PubMed Central and other publicly funded repositories, such as the WHO COVID database with rights for unrestricted research re-use and analyses in any form or by any means with acknowledgement of the original source. These permissions are granted for free by Elsevier for as long as the COVID-19 resource centre remains active.

**FEMALE GAMETE AND HUMAN EMBRYO SUSCEPTIBILITY TO SARS-COV-2.** Frida Entezami, MD,<sup>1</sup> Delphine Haouzi, PhD,<sup>1</sup> Sophie Brouillet, PharmD, PhD,<sup>1</sup> Fatima Barry, PhD,<sup>1</sup> Anna Gala, MD,<sup>1</sup> Samir Hamamah, MD, PhD<sup>2</sup> <sup>1</sup>Inserm U1203, CHU Montpellier, St-Elloi Hospital, Montpellier, France; <sup>2</sup>Arnaud de Villeneuve Hospital, CHU Montpellier, Montpellier, France.



**OBJECTIVE:** To determine the susceptibility of the oocytes, embryos, granulosa and cumulus cells to SARS-CoV-2 infection.

**MATERIALS AND METHODS:** To address this question, we retrospectively examined the gene expression profiles of SARS-CoV-2-associated receptors and proteases in human granulosa cells (GCs), cumulus cells (CCs), mature oocytes, day 3 embryos, blastocysts and trophectoderm cells obtained from our previously described Affymetrix microarray data from assisted reproduction patients. Human GCs and CCs (n=17), mature oocytes (n=6), and preimplantation embryos (n=20) were analyzed and gene expression levels of receptors and proteases closely related to SARS-CoV-2 infection was reported. For each gene, the number of samples with the probe set 'present', based on the detection call was studied. Each probe set was classified according to the signal intensity value median, as low (<100), medium (100-200) or high expression level (>200).

**RESULTS:** *ACE2*, *BSG*, *CTSL*, *CTSA* were detectable at high expression level in all mature oocyte samples, while only *CTSL* was strongly expressed in all day 3 embryos. The most representative dual co-expression of SARS-CoV-2-associated receptor and protease (60% of samples) during the embryonic genome activation stage (EGA) was *ACE2-CTSL* and *BSG-CTSL*. In blastocysts, *ACE2*, *BSG*, *CTSL*, *CTSA* and *FURIN* were detectable in the entire cohort at high expression level, and the prevalence of the different dual co-expression of SARS-CoV-2-associated proteases and receptors was optimal (100% of samples). Interestingly, only *CTSL* was detectable in all trophectoderm samples and a prevalence of 60% was found for the *BSG-CTSL* co-expression. *ACE2*, *BSG*, *CTSL* and *CTSA* were present at high expression level in CCs samples. In contrast, *ACE2* and *BSG* expression was very low while *CTSL* and *CTSA* showed a high expression level in GCs. A prevalence of 100% was reported for *ACE2-CTSL*, *ACE2-CTSA* co-expression for both cell types. In addition, *BSG-CTSL* and *BSG-CTSA* co-expression were also present in all CCs against ~70% in GCs samples. This data suggests a potential risk of SARS-CoV-2 infection either GC or early embryo development.

**CONCLUSIONS:** Transcriptomic analyses of SARS-CoV-2-associated receptors and proteases strongly suggest that blastocysts are most permissive to SARS-CoV-2 compared with mature oocytes and day 3 embryos.

**IMPACT STATEMENT:** Specimens from female genital tract may be considered as potential targets for SARS-CoV-2.

**SUPPORT:** None

**PATIENT SATISFACTION OF IMPLEMENTED COVID-19 PROTOCOLS IN A PRIVATE FERTILITY PRACTICE.** Lisa P. Rosenthal, M.A., Alexandra S. E. Fontaine, M.S., Robin Mangieri, M.A., Spencer S. Richlin, M.D. Reproductive Medicine Associates of Connecticut, Norwalk, CT.



**OBJECTIVE:** In following national and state guidelines, most fertility practices in Connecticut closed for varying periods of time due to COVID-19. To patients, the reopening guidelines may have been seen as barriers to care such as delaying treatment, mandatory quarantine, and required COVID-19 testing. These changes in care were the motivating factors to uncover insight on patient perspectives towards guidelines, telehealth, and emotional obstacles during this time. The goal was to learn if Reproductive Medicine Associates (RMA) of CT, a private fertility practice in CT, met the needs of patients throughout COVID-19, such as effectively communicating information. We hypothesized that RMA of CT effectively conveyed relevant information and offered appropriate support to their patients in a satisfactory way during COVID-19.

**MATERIALS AND METHODS:** An anonymous 33-question survey was created on SurveyMonkey. Demandforce was used to send surveys to 1,250 email addresses of patients who were active at RMA of CT from March 2020-October 2020. Chi square tests for statistical significance were used to evaluate the data.

**RESULTS:** 369 respondents completed the survey. 56% of respondents were 35-44 and 88% chose female as their gender identity. 92% agreed or strongly

agreed (A/SA) they felt safe from COVID-19 at RMA of CT. 56% of respondents A/SA felt more stressed about fertility treatment/testing during the pandemic than pre-pandemic. 90% A/SA that team members were helpful in handling patient frustrations related to COVID-19. 77% of respondents A/SA email was the most helpful form of communication to relay COVID-19 information. 73% of respondents stated they did not utilize support services from RMA of CT after changes were made due to COVID-19. 18% said they were unaware of these services. 90% of respondents A/SA telehealth met their needs. 95% A/SA that their physician was focused during these appointments.

**CONCLUSIONS:** Evidence suggests that personalized emails were most effective in relaying time sensitive information. It was surprising that patients were unaware of support services offered, especially during an international crisis, as these services may have supported them in these times. It was encouraging that patients reported that RMA of CT team members were helpful, despite having to adjust to changes in protocols. Interestingly, only a little over half of patients reported feeling more stressed about fertility treatment/testing during COVID-19 than pre-pandemic. Patients felt safe despite the generalized feeling of unsafety due to COVID-19. Patients reported that the shift to telehealth appointments was successful. This opens possibilities of continuing telehealth appointments to make care more accessible.

**IMPACT STATEMENT:** During this complicated time, it was possible for a private fertility practice to adapt program protocols (such as successful telehealth appointments and effective communication dissemination) allowing patients to start or continue their family building, and for fertility team members to be sympathetic, accessible, and professional while following COVID-19 guidelines.

**ASSISTED REPRODUCTIVE TECHNOLOGY PROCEDURES IN THE US PRIOR TO AND DURING THE COVID-19 PANDEMIC.** Jennifer Chae-Kim, MD,<sup>1</sup>

Tongil T.I. Kim, PhD,<sup>2</sup> Larisa Gavrilova-Jordan, MD,<sup>3</sup> Gordon Wright Bates, MD<sup>1</sup> <sup>1</sup>Texas A&M College of Medicine, Baylor Scott & White Health, Temple, TX; <sup>2</sup>University of Texas at Dallas, Naveen Jindal School of Management, Richardson, TX; <sup>3</sup>Medical College of Georgia at Augusta University, Augusta, GA.



**OBJECTIVE:** The COVID-19 pandemic has created many uncertainties for those pursuing fertility care and assisted reproductive technology (ART) procedures, due to ever-changing healthcare restrictions. There is a lack of research on large-scale data for ART procedures during the pandemic. The objective of our study is to evaluate ART procedures, specifically oocyte retrieval and in vitro fertilization (IVF) cycles, prior to and during the pandemic.

**MATERIALS AND METHODS:** Claims data from Symphony Health, one of the largest databases of patient-level data on more than 280 million patients in the US, was examined from May 1, 2019 to February 28, 2021. Reproductive-aged women were included in the analysis. March - April 2020 was used as a threshold for when healthcare restrictions became widespread. We compared 10 months prior to the pandemic (May 2019 - Feb 2020) and the same time period after the start of the pandemic (May 2020 - Feb 2021). ART procedures were identified using CPT codes (58970 for oocyte retrieval, and S4011, S4015, and S4016 for IVF) under ICD-10. Data analysis was conducted in Stata, version 16.1, using 2-sided t-tests with significance set at P < 0.05.

**RESULTS:** Our search yielded 39,087 oocyte retrievals and 14,365 IVF cycles. The average age of patients who started an IVF cycle (36±4.2 vs 35±4.4 years) as well as the age of those who had an oocyte retrieval (36.2±4.6 vs 35.3±4.7 years) prior to and during the pandemic was statistically different. Time series plots show that, after a substantial drop in focal variables in March - April 2020, ART procedures quickly recovered to pre-pandemic baseline by June 2020. Afterwards, oocyte retrievals increased from 1,703 per month pre-pandemic to 2,010 per month during the pandemic, and this difference approached significance (P=0.06). There was not a significant difference in IVF cycles (677 per month pre-pandemic vs 686 per month during the pandemic, P=0.88).

**CONCLUSIONS:** Despite concerns regarding suspension of ART and delivery of infertility care during the pandemic, our study shows no significant difference in oocyte retrievals and IVF cycles prior to and during the COVID-19 pandemic.

**IMPACT STATEMENT:** These results suggest reassuring outcomes despite a health crisis in the US. There was no significant delay or interruption of fertility care and ART procedures in the US. Further research should examine how other social determinants such as ethnicity, income and geographic location affected access to and utilization of infertility care.

**SUPPORT:** None.