

Title page

Title:

Cross-border reproductive care in times of pandemic and ART legislation changes in European countries: a population based study

Authors:

Adéla Volejníková

Department of Demography and Geodemography, Faculty of Science, Charles University

Albertov 6, 128 00 Prague 2, Czech Republic

E mail address: [adela.volejnikova@natur.cuni.cz](mailto:adela.volejnikova@natur.cuni.cz)

ORCID ID: 0009-0001-1369-4246

Anna Šťastná

Department of Demography and Geodemography, Faculty of Science, Charles University

Albertov 6, 128 00 Prague 2, Czech Republic

E mail address: [anna.stastna@natur.cuni.cz](mailto:anna.stastna@natur.cuni.cz)

ORCID ID: 0000-0002-8315-0965

Corresponding author:

Jiřina Kocourková

Department of Demography and Geodemography, Faculty of Science, Charles University

Albertov 6, 128 00 Prague 2, Czech Republic

E mail address: [jirina.kocourkova@natur.cuni.cz](mailto:jirina.kocourkova@natur.cuni.cz)

ORCID ID: 0000-0003-1339-8508

## Abstract

**Background:** Cross border reproductive care (CBRC) is shaped by the legal framework, high costs, quality of care, access issues and socio-cultural preferences. The COVID-19 pandemic acted to disrupt access to MAR/ART services through lockdowns, travel bans and shifting regulations, thus rendering CBRC unstable and reducing access unevenly across countries. This study explores how did the COVID-19 pandemic and associated restrictions impact the dynamics of cross-border reproductive care in Czechia, the key target country in Europe, in 2020 and 2021. Focusing on assisted reproductive technology (ART), we analyse changes in the volume of care provided and changes in the types of ART cycles of foreign patients.

**Methods:** Population based quantitative study of all ART cycles initiated in Czechia between 2016 and 2021. Using anonymised individual data from the National Registry of Assisted Reproduction, 261,571 ART cycles entered the analysis – 167,641 (64%) were cycles initiated by natives and 93,930 (36%) cycles sought by women who visited Czechia for infertility treatment.

**Results:** Trends in the use of ART in Czechia were significantly influenced by CBRC, with its share increasing from 36% in 2016 to 38% in 2019. The measures associated with the COVID-19 pandemic exerted a significant impact, notably via a reduction in the volume of care provided by 14% overall and 27% for CBRC. However, the impact of the pandemic restrictions on the decrease in CBRC was observed only for patients from certain countries (Germany, Ireland, UK), whereas concerning those from other countries, the number of patients either increased significantly (Poland and Hungary) or continued to grow moderately (Austria, France).

Conclusions: The COVID-19 pandemic exerted a specific impact on the overall volume of CBRC provided in Czechia, but changes in reproductive legislation and access to ART services remained the primary drivers of the volume and nature of CBRC sought by foreign women in Czechia.

Key words

Assisted reproductive technology, cross border reproductive care, COVID-19, Czechia

## 1. Introduction

The volume of cross-border reproductive care is increasing steadily worldwide, yet we still know relatively little about its true scale (1). Cross-border reproductive care (CBRC) is defined by the European Society of Human Reproduction and Embryology (ESHRE) as the provision of fertility-related care services for patients travelling to other countries for treatment (2). Such services are subject to national legislation, one of the main factors in terms of the decision-making of those who opt for CBRC. Other deciding factors include the limited availability of assisted reproduction methods in the home country and the high level of interest in donated oocytes and semen, conception via which is considered third-party reproduction in many countries and is, therefore, banned for either religious or ethical reasons (1). Moreover, significant changes are being made to legislation concerning reproductive rights in various European countries, which are directly impacting the accessibility of assisted reproductive technology (ART). Overall, the trend is towards greater permissiveness in line with cultural changes that are acting to enhance the level of acceptance of assisted reproduction and diverse family forms (3). The number of countries that allow medically assisted reproduction access for single women and lesbian couples is gradually expanding (3,4). A major shift in the European context occurred in France with the introduction of the 2021 Bioethics Law, which expanded access to ART for lesbian couples and single women and legalised social egg freezing, which was previously

permitted only for medical reasons (5). Italy moved away from its traditionally restrictive approach in 2014 when the Constitutional Court lifted the ban on heterologous fertilisation, thus allowing the use of donated sperm and eggs (6). The United Kingdom abolished donor anonymity in 2005, thus introducing the right for children conceived through ART to access information on their biological origins (7). However, some countries have recently introduced stricter regulations regarding ART. Hungary tightened its ART regulations in 2021 by bringing private clinics under state control and banning ART advertising, thus significantly limiting access to such services. Ireland only recently introduced formal ART legislation with the 2022 Assisted Human Reproduction Bill, which established regulations on gamete and embryo donation and set out plans for state-funded IVF (3,8). Nevertheless, CBRC is driven not only by legal restrictions but also by its high costs in home countries, quality of care concerns, including waiting times and success rates, and socio-cultural factors such as privacy and cultural and linguistic familiarity (9–13). These developments render the study of trends concerning the use of CBRC of particular interest from the perspectives of healthcare policy, bioethical considerations and the evolving legal landscape concerning medical assisted reproduction (MAR), which is experiencing dynamic transformation across Europe.

Moreover, the COVID-19 pandemic profoundly affected and limited the uptake of MAR/ART (14). As demonstrated by Tierney and Lazzari (15), for the United States, the suspension of services during the COVID-19 pandemic likely led to a notable decline in MAR birth rates, although the rates soon returned to pre-pandemic levels. It is therefore highly probable that the COVID-19 pandemic also had a substantial impact on the use of CBRC. As national lockdowns, travel bans and rapidly changing regulations came into effect, the provision of CBRC became unstable and unpredictable. Thus, a detailed analysis of CBRC during the pandemic can help to understand the immediate impact of the crisis and can serve as a bases for more resilient, flexible frameworks for reproductive care that are able to withstand future public health emergencies.

However, the study of CBRC is often challenging due to the limited availability of data. For this reason, it is appropriate to analyse CBRC from the perspective of the target country, i.e., the country where patients travel for treatment. In Europe, Spain, Belgium and Czechia appear to be the most frequently visited countries for such treatments (16). However, only Czechia offers a unique opportunity for research in this area due to the mandatory reporting of all ART cycles to the National Register of Assisted Reproduction (17). Register data includes the citizenship and country of current residence of all women who undergo ART, thus allowing for the identification of foreign patients.

In Czechia nearly 4% of children were born via the use of ART in 2020 (18); moreover, in 2018, the country had one of the highest ART cycle rates in Europe, with 18.3 thousand cycles per million women in 2018 – second only to Denmark (19). Czechia is a major CBRC target country in central Europe due primarily to its liberal legislation, availability and anonymity of donors, high-quality care and relatively low costs (17,18,20). Moreover, Czechia has adopted relatively liberal ART legislation, which allows the use of the full range of techniques, and ART is publicly accepted and used widely in Czech society (18,21,22). These factors thus render Czechia an attractive destination for many foreign couples, particularly those seeking treatment with donor eggs (17,21).

So far, the only article that has analysed the volume of cross-border reproductive care in detail is Volejníková et al. (17), which, however, focused on the pre-COVID-19 period of 2016-2019. It showed that the structure of types of ART cycles undergone varies according to the origin of foreign patients and that this largely reflects differences in the legal regulation of access to ART methods in the countries concerned. However, knowledge about the development of CBRC in relation to the impact of COVID-19 is lacking. The contribution of this article is to provide a more detailed analysis of trends regarding the provision of CBRC in Czechia between 2016 and 2021 aimed at enhancing the understanding of this phenomenon in the European context. In particular, the key objective was to determine the impact of the COVID-19 pandemic and the associated restrictions on the movement of people and the provision of medical care (14), including:

- Identifying the source countries of CBRC in Czechia and the dynamics of the inflow from these countries in the period 2016-2021
- Identifying the impact of the COVID-19 pandemic on CBRC in 2020 and 2021
- Identifying differences and trends in terms of the types of ART cycles used by women from various countries
- Discussing the factors that have influenced recent trends concerning CBRC in Czechia.

## 2. Legal context of ART in Czechia and CBRC in the context of pandemic-related restrictions

Assisted reproductive technology (ART) has been regulated by legislation in Czechia since 1997, when legislation enabled its partial reimbursement from the public health insurance system. In the period under study, 2016-2021, women who paid statutory health insurance contributions in the country were entitled to reimbursement for up to four ART cycles provided only one embryo is transferred during the first two cycles, and up to age 39 (in 2022, the age limit for covering ART costs from the statutory health insurance system was extended to the age of 40, i.e. 39 years and 364 days). Access to ART is limited by an age cap of 50; moreover, not all costs are covered – in reality, patients typically cover up to one-third of the related costs due to the non-reimbursement of the costs of certain drugs and treatment approaches, e.g. ICSI, AH (assisted hatching) and FER (18). The full range of ART methods, including IVF, ICSI and egg donation, are legally allowed in Czechia; however, single women and same-sex couples are excluded from direct access to the system since women who apply for ART treatment must provide the written consent of their male partner.

Along with the broader societal impacts of the COVID-19 pandemic, most European countries significantly reduced the provision of medical assisted reproduction (MAR) methods during the pandemic period, usually in line with regulations set by local authorities and/or national scientific societies. Internationally, following the outbreak of COVID-19 in Europe, ESHRE promptly took the lead in regulating assisted reproduction practices. On 27 February 2020, it issued its first statement, which

recommended a precautionary approach, advising against ART pregnancies for those who met COVID-19 diagnosis criteria (14). By mid-March, this advice had been extended to all patients, regardless of the diagnosis status - a detailed statement in April advised the suspension of the commencement of new ART cycles. The recommendations were aimed at avoiding ART-related complications, reducing potential pregnancy risks, supporting healthcare resource reallocation and upholding social distancing. Urgent fertility preservation methods were excluded so as to ensure continued access for patients at risk of sterility (14).

As a result, MAR/ART services were severely restricted in early 2020 across Europe. As of 1 March 2020, Italy suspended the provision of ART. In mid-March, other countries, including Czechia, followed with full or partial suspensions; shortly after, WHO declared COVID-19 a global pandemic and ESHRE and other international scientific societies recommended the postponement of the provision of ART (14). As of 1 April, almost all European countries had either fully or partially halted the provision of MAR/ART services, which reflected a unified response to the crisis that prioritised the reallocation of health resources and public safety. Czechia was among the first countries to recommence the provision of ART, along with Denmark, Germany, Luxembourg and Norway, in April 2020 (14).

In addition, CBRC was significantly disrupted by travel restrictions. Lockdowns and border closures in 2020 and 2021 led to the suspension of CBRC and substantial delays in terms of accessing fertility treatment abroad (23). These restrictions were part of broader global efforts to restrict the spread of the pandemic by limiting international mobility, which had far-reaching consequences for patients seeking CBRC (24). The rules often differed between countries and evolved based on the epidemiological situation. Czechia, for example, experienced fluctuating travel restrictions, including strict entry bans in the early phases of the pandemic and again in early 2021, when new COVID-19 variants emerged (25). This compounded the uncertainty for patients seeking CBRC and amplified the challenges associated with accessing ART during the crisis.

### 3. Data and methods

The analysis is based on anonymised individual-level data on all ART cycles performed in Czechia between 2016 and 2021. The data was sourced from the National Register of Assisted Reproduction, managed by the Institute of Health Information and Statistics of the Czech Republic (IHIS CR). This Register was established in 2007, but only since 2016 has it been possible to identify cross-border reproductive care cycles. The data encompasses the full range of ART procedures and employs the terminology applied in the Czech Registry of Assisted Reproduction in alignment with international recommendations on infertility treatment terminology (26,27). The analysis distinguished the following types of ART cycles: IVF/ICSI (in vitro fertilisation/intra cytoplasmic sperm injection) cycles with fresh embryo transfer, FET (frozen embryo transfer), ED (egg donation), OoR (oocyte receipt), EmR (embryo receipt) and FREEZ (freezing of oocytes and embryos).

Information on the women's citizenship, current residence and ART treatment health insurance coverage was used to identify cases of CBRC in the dataset. Women who sought CBRC were defined as individuals with non-Czech citizenship with residence outside Czechia, and whose ART treatment was not covered by Czech statutory health insurance. All the other ART recipients were classified as natives, i.e. women with Czech residence and/or citizenship and/or coverage of ART cycles by public health insurance.

In total, 261,571 ART cycles initiated in Czechia between 2016 and 2021 were included in the analysis. The legislative obligation to report all ART cycles initiated in healthcare facilities in Czechia to the national registry of assisted reproduction ensures the full coverage of the data employed and, thus, the population level analysis. Of the total number of cycles, 167,641 (64%) were performed for natives and 93,930 (36%) for women who travelled to Czechia for infertility treatment.

The CBRC analysis focused on the 10 primary CBRC source countries that recorded the highest number of initiated cycles during the observed period. Together, these countries accounted for 82% of the total volume of CBRC in Czechia (Table 1). This approach allowed us to capture the dynamic changes that

occurred in the number and proportion of ART cycles of patients from specific countries. Table 1 shows the number of cycles analysed per country and their share of the total volume of CBRC provided in Czechia in 2016-2021. The selected CBRC source countries, in order of ranking, were: Germany, Italy, Slovakia, France, the United Kingdom, Serbia, Hungary, Ireland, Poland and Austria.

Table 1: Source countries of CBRC performed in Czechia included in the analysis, number of ART cycles in the period 2016-2021, share of total CBRC volume

	Number of ART cycles	Share of CBRC
Total CBRC	93,930	100.00%
Germany	27,675	29.46%
Italy	8,855	9.43%
Slovakia	7,533	8.02%
France	6,788	7.23%
UK	6,077	6.47%
Serbia	5,206	5.54%
Hungary	4,165	4.43%
Ireland	3,979	4.24%
Poland	3,464	3.69%
Austria	3,217	3.42%
Total for the selected countries	76,959	81.93%

The quantitative analysis focused on the dynamics of the number and share of CBRC cycles and the development of CBRC in Czechia with respect to the selected countries. The structure of ART cycles was analysed by types of ART cycles and age of women using the median and mean age as indicators. Furthermore, we used the base index to show how much a quantum of ART cycles initiated in Czechia by women from the considered source countries has changed compared to a chosen starting point – the base period of 2016. The base period was set to 100, and other values are expressed as percentages of it. The content analysis was applied of documents on ART-related legislation and the regulations imposed in these countries. The data on ART regulation, legislation and funding was mostly taken from Calhaz-Jorge et al., FE and EPF and Compans (4,28,29), as supplemented by national legislation where necessary.

## 4. Results

### 4.1. Cross-border reproductive care in Czechia – trends in 2016-2021

Between 2016 and 2019, the total number of ART cycles increased steadily year-on-year (Fig. 1), continuing a long-standing trend in Czechia. Figure 1 clearly shows that the overall trends in ART use in Czechia are strongly influenced by CBRC, as the increase in ART cycles up to 2019 reflects the growing use of ART by both natives and those seeking CBRC. Moreover, the share of CBRC in the total number of ART cycles initiated in Czechia rose from 36% in 2016 to 38% in 2019, further highlighting the increasing significance of CBRC in the country.

In 2020 the use of ART in Czechia were influenced significantly by both the COVID-19 pandemic itself and its impact on CBRC (Fig. 1). The share of CBRC dropped to 33% in 2020 and 2021 due to the pandemic-related travel restrictions (Fig. 1). Thus, in the case of CBRC, the number of ART cycles decreased from 17.8 thousand in 2019 to 13.1 thousand in 2020, corresponding to a decline of 27%. Growth subsequently returned to an upward trajectory in 2021, when the number of ART cycles among natives exceeded pre-COVID-19 levels; however, while the volume of CBRC also increased, it remained below the 2016 baseline.

Figure 1: Trends in the number of ART cycles and the share of CBRC in Czechia, 2016-2021

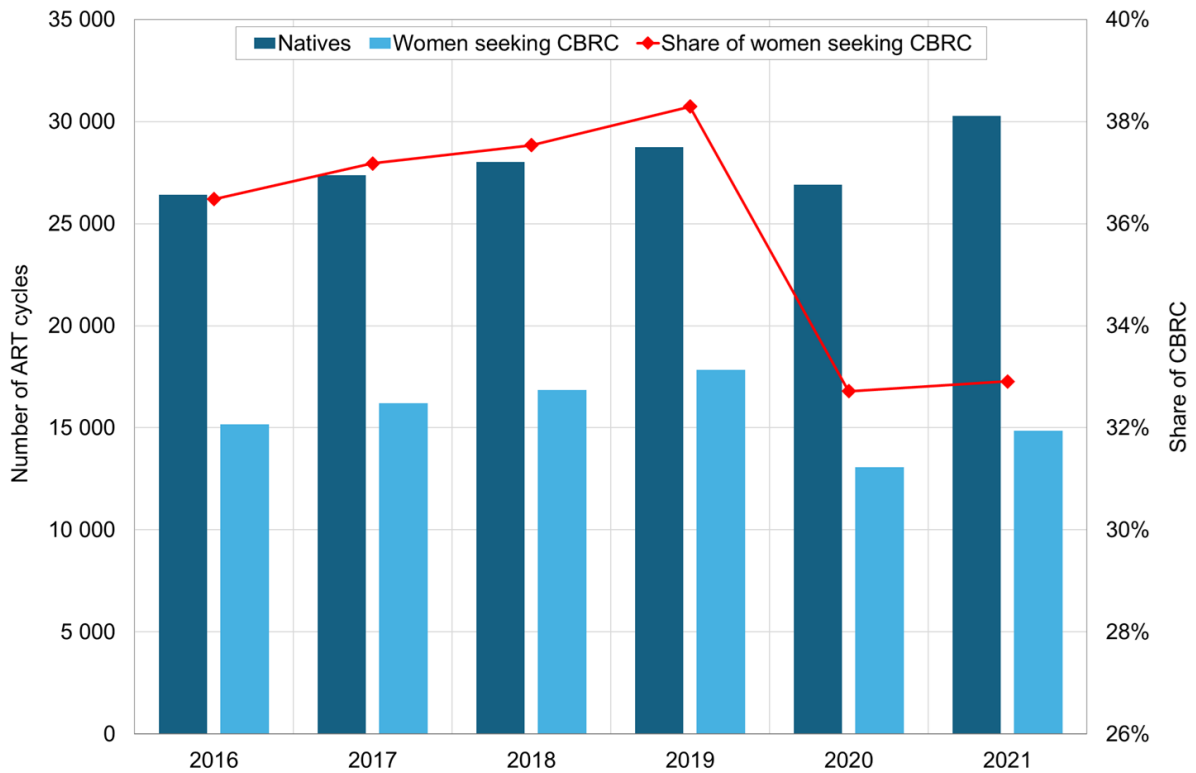
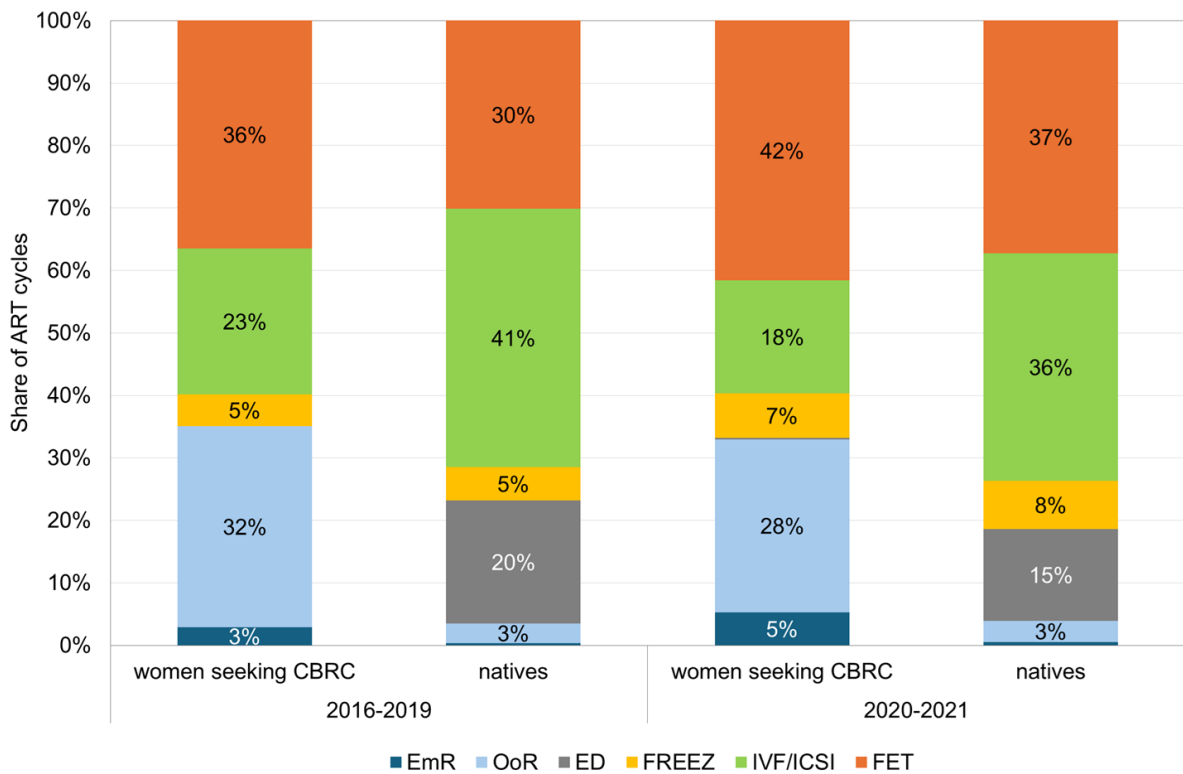
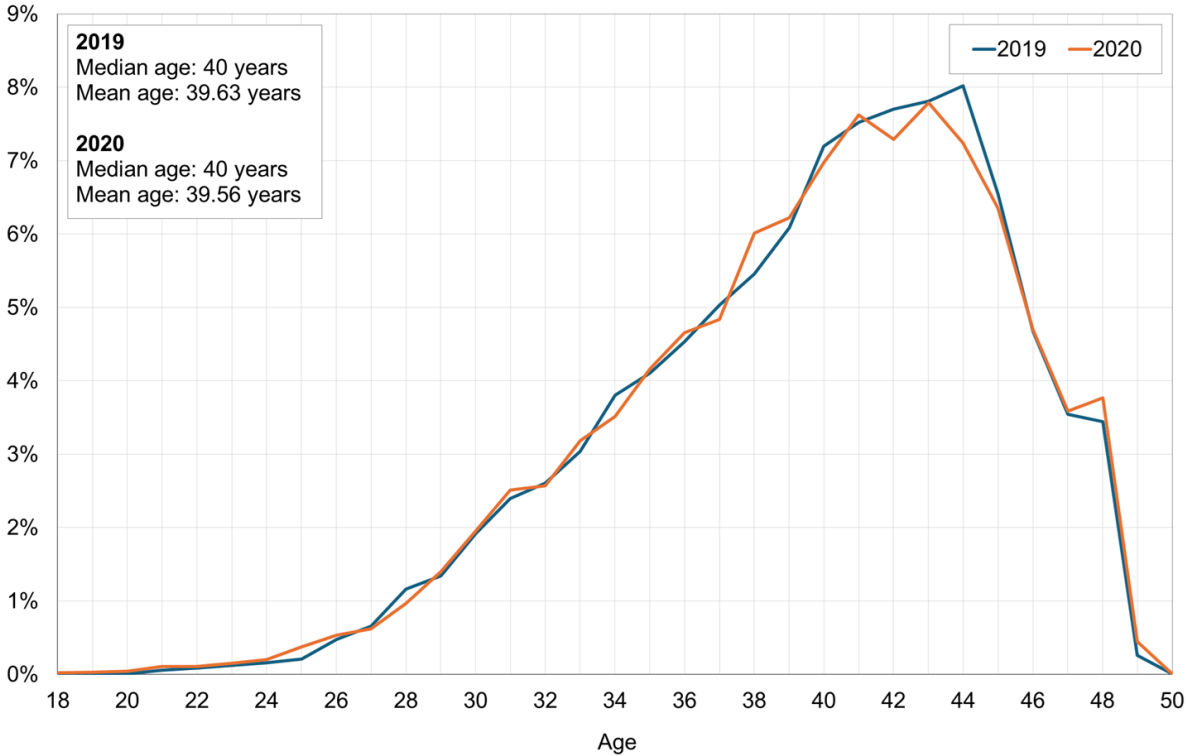


Figure 2: Structure of ART cycles by type of treatment in the pre-pandemic (2016-2019) and pandemic (2020-2021) periods, natives and women seeking CBRC, in %



Changes in the uptake of ART since 2020 encompassed not only the volume but also the type of care provided (Fig. 2). Between 2016 and 2019, women seeking CBRC in Czechia most frequently underwent FET cycles (36%), whereas natives most often used fresh IVF/ICSI cycles (41%). In 2020–2021, the share of FET cycles among women seeking CBRC in Czechia increased, but FET cycle uses also rose among natives, narrowing the differences between the two groups. The largest distinction remains that, despite a slight decline, the second most common method among women seeking CBRC is OoR cycles, whereas for natives ED cycles rank as the third most frequently used method. On the contrary, Fig. 3 demonstrates that despite the COVID-19 pandemic, the age profile of women that sought CBRC in Czechia remained practically unchanged between 2019 and 2020. Both the median and mean ages stabilised at 40 years.

Figure 3: Age structure of women who sought CBRC in the pre-pandemic (2016-2019) and pandemic (2020-2021) periods, mean and median ages and relative proportion in %



#### 4.2. CBRC source countries and the dynamics of the demand for care under pandemic constraints

Germany has consistently accounted for the largest share of CBRC in Czechia (28% of all CBRC cycles in 2016-2021), followed by Italy (9%), Slovakia (8%), and France (both 7%) (Tab. 1). While the ranking of individual countries by their share of CBRC remained relatively unchanged, a detailed year-by-year analysis indicates that, from 2019 onward, significant shifts in CBRC volumes have taken place in several countries. Based on the trends concerning the ART cycles initiated by women from the 10 monitored countries, four distinct developmental patterns were identified over the study period. Changes in the number of initiated ART cycles were illustrated applying a base index, with 100% representing the number of ART cycles in 2016 for each country (Fig. 4).

Group 1 comprises three CBRC source countries – Germany, the UK and Ireland – that evinced a predominantly increasing trend or stagnation (Ireland) in the number of ART cycles initiated in Czechia in the pre-COVID-19 period (Fig. 4). However, this was followed by a sharp decline from 2019 to 2020. Although 2021 exhibited a slight recovery, the volume of reproductive care provided for women from these countries had not returned to the 2016 baseline volume by the end of the studied period.

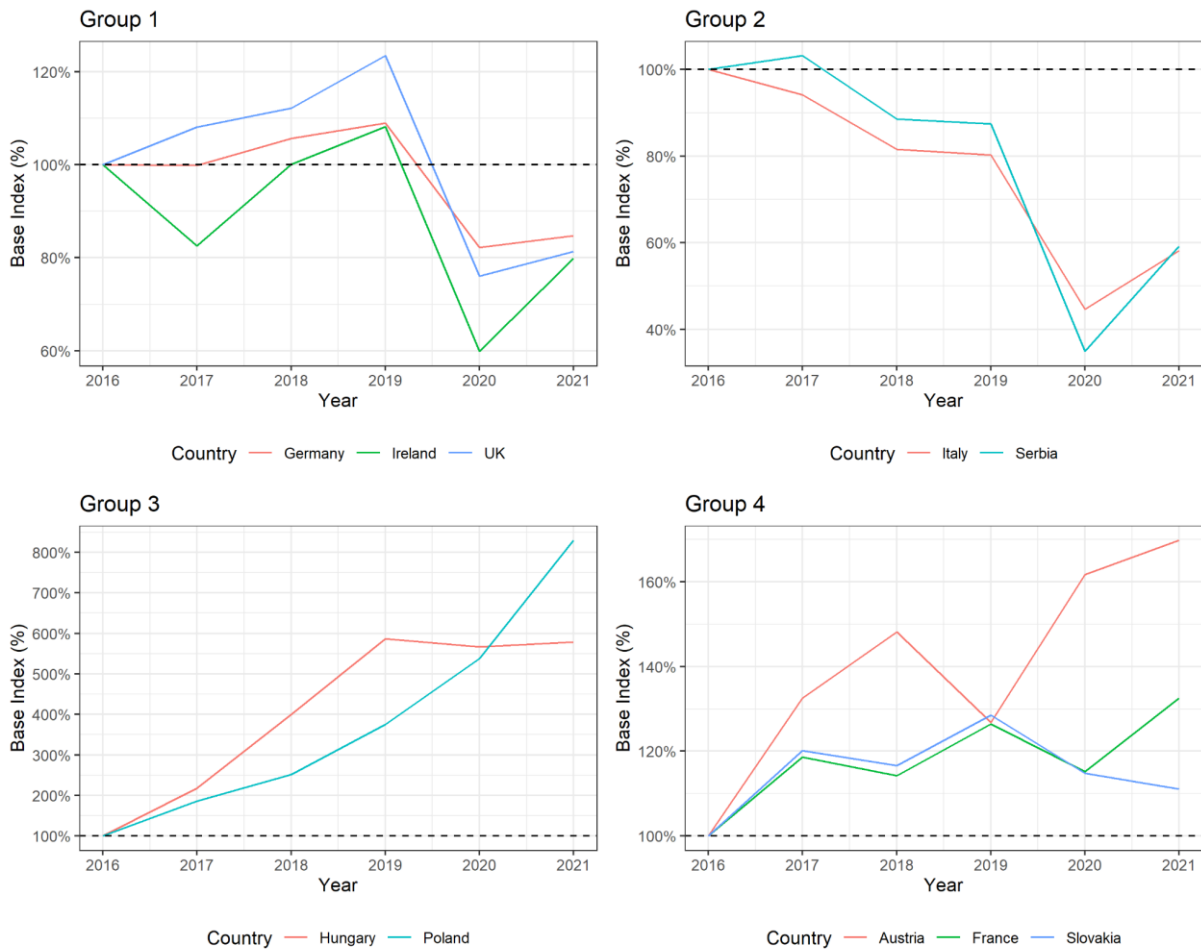
Group 2 consists of Italy and Serbia, both of which evinced a steady decline in ART cycles initiated in Czechia throughout the observed period (Fig. 4). The numbers of ART cycles initiated exhibited signs of decline even in the pre-COVID-19 period. The pandemic accelerated this downward trend, with both countries experiencing a significant drop in the number of initiated cycles in 2020, reaching less than half the number recorded in 2016. A modest rebound occurred in 2021, though only future developments will reveal whether this upturn indicates a sustained increase or merely temporary compensation for the sharp decline observed in 2020 due to the COVID-19 restrictions.

A predominantly increasing trend was observed for the remaining countries over the studied period (Groups 3 and 4). Although the COVID-19-related restrictions limited access to care for women from several of the monitored countries, the impact is not clearly visible; at most, it suggests a slight decline or stabilisation in the volume of care provided.

The number of ART cycles for women from Poland and Hungary (Group 3, Fig. 4) increased dynamically during the studied period. The number of ART cycles provided for women from Hungary increased six-fold from 2016 to 2019, then stabilised in 2020 and 2021. The number ART cycles provided for women from Poland exhibited continuous growth, with the most rapid increase occurring in the last two years of the studied period. While in 2019 the number of ART cycles reached nearly four times the 2016 level, by 2021, it had exceeded an eight-fold increase on 2016.

The Group 4 (Fig. 4) also exhibited a growth trend over the studied period, though not necessarily every year. One of the common characteristics for these countries concerned the fact that the number of ART cycles remained above the 2016 level throughout the period; however, the increases differed. Concerning Austria, the number of ART cycles reached 1.7 times the baseline in 2021, primarily due to a substantial increase between 2019 and 2020. In comparison, France had reached 1.3 times the baseline and Slovakia 1.1 times by 2021.

Figure 4: Increase/decline in the number of ART cycles initiated in Czechia by women from the considered source countries, 2016–2021, Base index (2016=100%)



### 4.3. Type of reproductive care sought in Czechia

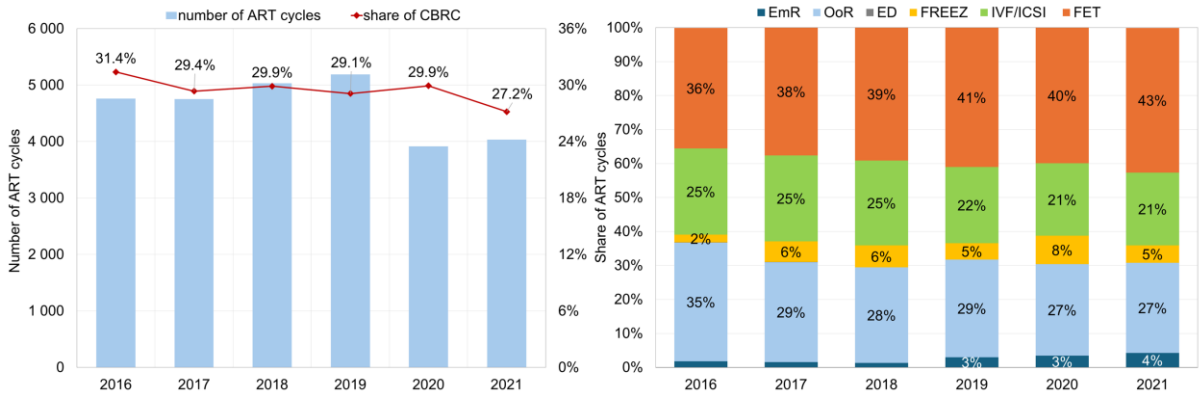
Aimed at forming a more detailed understanding of the identified trends, we focused on changes in the type of reproductive care sought by foreign women in Czechia. The typology of countries suggests that, in addition to the Covid-19 pandemic and its associated restrictions, other factors likely reinforced or altered certain trends. In particular, changes in reproductive rights and ART legislation in source countries may have influenced the types of cross border reproductive care demanded by patients.

Although CBRC in Czechia involves patients from a wide range of source countries, the analysis concentrated on those that displayed distinct dynamics during the COVID-19 period (see Fig. 4). Germany, Italy, Hungary and Poland were selected based on their share of the total CBRC volume and their representation in the Groups 1-3. Group 4 was not examined in detail, as the growth patterns of

these countries largely mirrored those of Group 3, albeit with greater volatility in the second half of the study period.

The analysis of ART cycles for women from Germany, who accounted for the largest share of CBRC cycles confirms that the structure of ART cycles reflects the overall trend of increasing share of FET cycles and a declining share of OoR cycles. The main change associated with COVID-19 concerned the volume of care provided (Fig. 5).

Figure 5: Trends in the share of CBRC cycles for women from Germany of all CBRC in Czechia and the structure of the ART cycles by type of treatment for women from Germany, 2016-2021



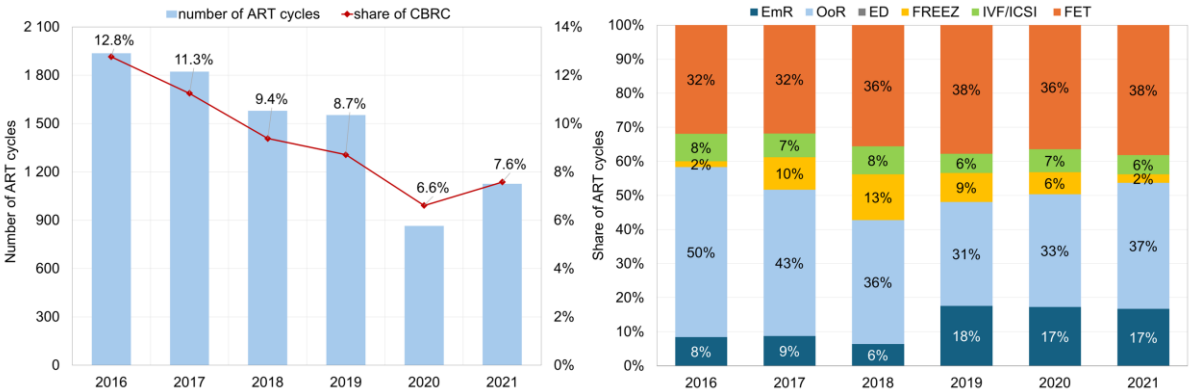
Note: IVF/ICSI - in vitro fertilisation/intra cytoplasmatic sperm injection, FET - frozen embryo transfer, ED - egg donation, OoR - Oocyte receipt, EmR - Embryo receipt, FREEZ - freezing of oocytes and embryos.

The proportion of ART cycles undertaken by women from Germany within total CBRC remained stable at around 30% between 2016 and 2020 (Fig. 5), before declining slightly in 2021. The impact of COVID-19 was evident in a 25% reduction in initiated ART cycles, from 5.2 thousand in 2019 to 3.9 thousand in 2020 (Fig. 5). The structure of the ART cycles by type of treatment remained largely stable, with frozen embryo transfer (FET) cycles strengthening their dominance to 43% in 2021, accompanied by a modest decline in IVF/ICSI cycles. This development reflects the broader trends in the uptake of ART

in both Czechia and internationally. In addition, German patients consistently relied on third-party ART; cycles involving donated oocytes or embryos accounted for roughly one-third of all ART cycles, reflecting the prohibition of oocyte donation under German legislation (30,31).

The number and proportion of Italian patients seeking CBRC in Czechia steadily declined during the observed period, and the restrictive measures due to the pandemic accelerated this decline, though a slight recovery was observed in 2021 (Fig. 6). Italian patients differed from German patients in that they more frequently opted for third-party reproductive treatment, as oocyte donation was banned in Italy until 2014 and embryo donation is still not allowed (32). In 2016, OoR cycles accounted for 50% of all ART cycles initiated by Italian patients in Czechia. The pandemic exerted a clear impact on the number of ART cycles initiated, with a noticeable drop in 2020 compared to 2019. Despite the treatment structure remained largely stable, the balance between OoR and EmR within third-party reproduction shifted, as the use of donated embryos increased: EmR cycles accounted for 17% of all cycles performed in 2021.

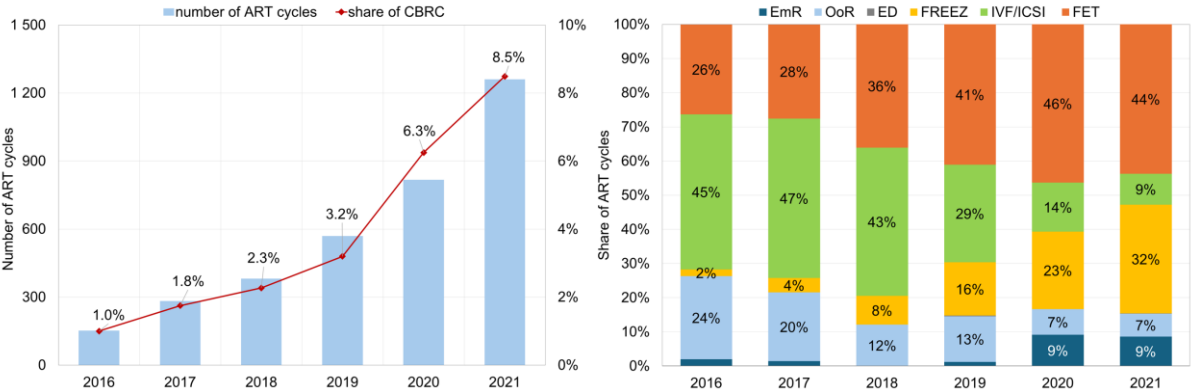
Figure 6: Trends in the share of CBRC cycles for women from Italy of all CBRC in Czechia and the structure of the ART cycles by type of treatment for women from Italy, 2016-2021



Note: IVF/ICSI - in vitro fertilisation/intra cytoplasmic sperm injection, FET - frozen embryo transfer, ED - egg donation, OoR - Oocyte receipt, EmR - Embryo receipt, FREEZ - freezing of oocytes and embryos.

The most significant increases in the initiation of ART cycles concerned women from Poland and Hungary regardless of the restrictions imposed during the COVID-19 pandemic. Poland differed from Italy and Germany in that IVF/ICSI cycles were the most common among Polish women in Czechia until 2018, when their share was still 43% (Fig. 7). Since 2019, the use of FET cycles has begun to dominate among Polish women, similar to German women, and the proportion of IVF/ICSI cycles with fresh embryo transfer has fallen in 2021 to just 9% of all cycles of Polish women in the Czechia, compared to 45% in 2016.

Figure 7: Trends in the share of CBRC cycles for women from Poland of all CBRC in Czechia and the structure of the ART cycles by type of treatment for women from Poland, 2016-2021

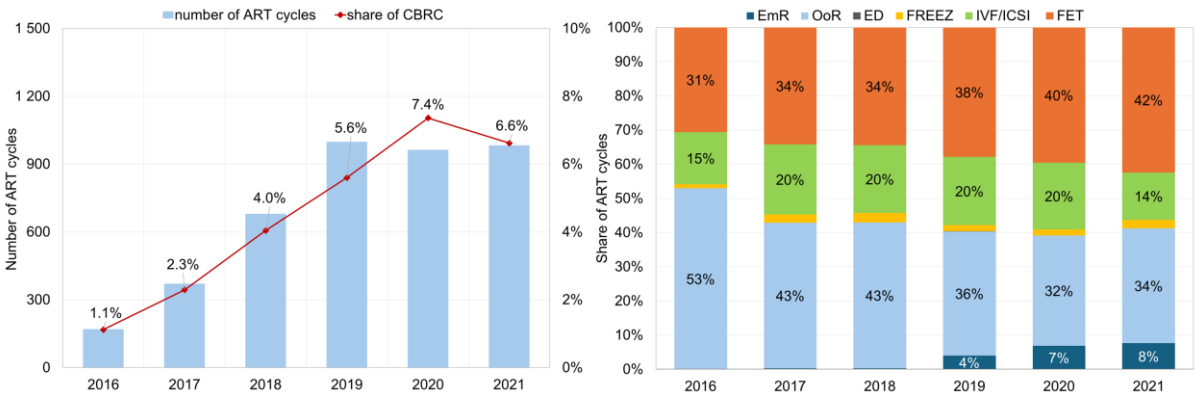


Note: IVF/ICSI - in vitro fertilisation/intra cytoplasmatic sperm injection, FET - frozen embryo transfer, ED - egg donation, OoR - Oocyte receipt, EmR - Embryo receipt, FREEZ - freezing of oocytes and embryos.

CBRC for women from Poland exhibited a significant upward trend (Fig. 7), which strengthened further from 2020, in contrast to the restrictive effects of the COVID-19 pandemic. This marked shift likely coincided with the tightening of reproductive rights in Poland following the introduction of the abortion law in 2020. Alongside a sharp increase in the volume of CBRC, a significant increase was observed in the proportion of FREEZ-all cycles initiated, which in 2021 accounted for one-third of the

total infertility treatment provided to Polish women in Czechia. The proportion of embryo receipt cycles also increased in 2020 and 2021 and, together with oocyte receipt cycles, reproduction via a third party comprised 16% of the ART cycles initiated. This is lower in percentage terms than in 2016 (25%) but higher in terms of absolute numbers due to the overall growth in the number of cycles initiated (329 cycles in 2020–2021 vs. 230 in 2016–2019).

Figure 8: Trends in the share of CBRC cycles of women from Hungary of all CBRC in Czechia and the structure of the ART cycles by type of treatment for women from Hungary, 2016-2021



Note: IVF/ICSI - in vitro fertilisation/intra cytoplasmic sperm injection, FET - frozen embryo transfer, ED - egg donation, OoR - Oocyte receipt, EmR - Embryo receipt, FREEZ - freezing of oocytes and embryos.

For women from Hungary, third-party treatment also accounted for a significant proportion of the ART cycles initiated in 2016, exceeding 50%, similar to the situation in Italy (Fig. 8). While in the early years, this involved exclusively cycles with a donated oocyte (OoR), from 2019 onward, the proportion of cycles with donated embryos (EmR) began to rise, while the share of OoR declined, mirroring the trend observed in Italy. At the same time, the proportion of FET cycles increased, in line with developments in the other three countries.

## 5. Discussion

Czechia's liberal legislation allows the application of the full range of ART methods, thus making it an attractive destination for foreign patients. Prior to the pandemic, CBRC accounted for nearly 40% of all ART treatment in the country and is likely to continue to rise going forward. In 2020, the COVID-19 pandemic exerted a significant impact on the volume of CBRC in Czechia due to restrictions including travel bans and the reduction in the number of clinical operations (27). The number of ART cycles in Czechia decreased by 27% between 2019 and 2020. This was in line with broader European trends, including a 34.1% decline in Italy and declines of up to 40% in northern Italy (14,33).

Despite the decline in the overall volume of CBRC in Czechia, the ranking of source countries remained essentially unchanged, with Germany continuing to account for by far the largest shares compared to other countries. The structure of CBRC cycles initiated in Czechia shifted slightly, as the share of FET cycles increased at the expense of fresh IVF/ICSI cycles. A more detailed analysis, however, indicated that the pandemic primarily affected the volume of CBRC through restricted access to care, while changes in reproductive preferences were only partly attributable to the COVID-19 crisis. As in other European countries, Czech ART clinics introduced safety protocols during the pandemic. Recommendations issued by ESHRE (the European Society of Human Reproduction and Embryology) and ASRM (the American Society for Reproductive Medicine) included freezing oocytes and embryos from COVID-19-positive patients and implementing measures to reduce infection risk (33,34). These practices may have indirectly contributed to the rise in FET cycles. At the same time, the increase in the share of FET cycles among both natives and CBRC patients in Czechia also reflected the global shift towards cryopreservation and the promotion of single embryo transfer to reduce multiple pregnancies (35). Thus, the growth in FET cycles at the expense of fresh IVF/ICSI cycles is better understood as part of the long-term development of ART methods rather than as a direct consequence of pandemic-related restrictions (36,37).

The age profile of women who opted for CBRC in Czechia remained stable during the pandemic, with both median and average ages of around 40 years. This suggests that the pandemic-related restrictions did not significantly affect the age composition of patients, and nor did they lead to a surge in older women seeking treatment due to reproductive timing concerns. The interruption of ART services thus appears to have exerted a short-term impact on access to treatment rather than on the reproductive decision-making of patients. This finding supports the argument that access to ART should be considered part of the fundamental right to health, as emphasised by Rallo et al. (33), who highlight the negative impacts of the pandemic on the mental health of infertile couples, particularly older women.

A reduction in the provision of CBRC due to pandemic-related restrictions was observed only for patients from certain countries – Germany, Ireland, and United Kingdom (Group1), Italy and Serbia (Group 2), while the numbers from other countries either increased significantly – Hungary and Poland (Group 3) or continued to grow – Austria, France, and Slovakia (Group 4).

Germany remained the primary CBRC source country for Czechia, consistently accounting for 30% of all CBRC cycles. The high demand for donated oocytes is a direct consequence of the long-term prohibition of egg donation by German legislation (16,38,39). This trend persisted even during the COVID-19 pandemic, thus highlighting that legislative factors exert a more stable influence on CBRC than temporary barriers such as the COVID-19 restrictive measures. A structural shift in the care provided was observed; while the total number of ART cycles declined in 2020 due to the pandemic restrictions, the proportion of frozen embryo transfers (FET) for German patients showed an increase. This reflects broader ART trends as driven by advances in cryopreservation and a preference for single embryo transfer aimed at reducing the risk of multiple pregnancies (see above). The increase in FET is probably also linked to the frequent use of previously cryopreserved embryos from donor oocytes. These cycles are recorded as FET in the ART register, as the share of OoR cycles declined and no new

donation occurred (27). This suggests that in addition to legislative drivers, provider practices and alignment with global ART standards significantly shape the structure of CBRC services.

The trend concerning the uptake of CBRC in Czechia by women from Italy differed substantially from that of Germany. Unlike Germany, where legislative restrictions have remained stable over the long term, the Italian legal framework has changed significantly over the past two decades. Act No. 40/2004 prohibited the use of donor gametes, which drove many patients abroad for treatment, including in Czechia. A 2005 referendum concerning changing this legislation failed to pass due to the low turnout (32). Only in 2014 did the Italian Constitutional Court legalise heterologous fertilisation via lifting the ban on oocyte and sperm donation (6,40). Since legal constraints were the predominant reason for patients travelling from Italy (16), this legal shift was most probably a key factor in terms of the gradual, long-term decline in the number of Italian patients seeking CBRC in Czechia – domestic access to donor gametes reduced the need for CBRC. However, Italy continues to prohibit embryo donation and faces pronounced regional disparities in terms of access to ART. Variations in the number of public centres, waiting times, costs and age limits for access to funded treatment render domestic access to care uncertain, particularly in the less developed regions of the country (41). These differences contributed to the continued interest in CBRC in Czechia in the post-pandemic period, although the volume of care was significantly lower than previously.

A further decline in the demand for CBRC from Italian patients is likely in the future due to the inclusion of fertility treatment in Essential Assistance Levels (LEA) from January 2025 (42). This development guarantees access to state-funded homologous treatment and partially-funded heterologous treatment at the national level. If effectively implemented, it could significantly reduce the need for CBRC. However, the extent to which regional disparities can be eliminated and equal access ensured across Italy remains an open question. Thus, beyond the legal changes, the actual degree of accessibility and quality of care in Italy will continue to be crucial in terms of shaping the decision to seek treatment abroad.

Legislative changes in the home countries of patients, particularly Poland and Hungary, most likely influenced the dynamics of CBRC during the COVID-19 pandemic. Notably, the number of CBRC cycles for Polish women increased more than eightfold during the study period, despite the pandemic restrictions. This surge coincided with the tightening of Polish abortion legislation in 2020 (43), which most probably drove the rapid increase in the demand for CBRC. Korolczuk (44) points out that discussions on assisted reproduction in Poland often take place within the same political framework as debates on abortion. The two issues are interconnected and are frequently framed in the context of broader bioethical questions surrounding the reproductive autonomy of women. The tightening of abortion legislation from 2020 further restricted reproductive rights in the country. Moreover, the Polish debate on IVF is often extremely heated and highly politicised, and IVF is vehemently opposed by the Catholic church (45). If the situation in Poland does not change, the country can be expected to remain a growing source of CBRC in Czechia, particularly in the context of fertility postponement.

The increased share of FET cycles, and particularly FREEZ cycles aimed at oocyte cryopreservation, undergone by Polish patients may well reflect growing concerns about future pregnancies under restrictive legislative conditions and a desire to preserve their genetic material for later use or for testing purposes. Recent findings suggest that reproductive rights, especially legislation related to abortion, are one of the most influential factors that shape the reproductive plans of (particularly childless) Polish women (46).

State control over private ART clinics and the tightening of reproductive legislation in Hungary led to a shift in the types of care sought in Czechia. The proportion of cycles involving third-party methods (e.g. embryo reception – EmR) initiated by Hungarian patients increased in the studied period accompanied by a decrease in fresh embryo transfers. This may have been related to both technological changes (e.g. the higher success rates of FET) and practical reasons – the storage of donated embryos provides patients with the option to undergo subsequent cycles, in a situation where donation of embryos to other couples is extremely rarely available in Hungary (47).

Using Czechia as one of the major target countries for CBRC in Europe, this study indicates that changes in reproductive legislation and access to ART services exert decisive impacts on the volume and nature of CBRC in Czechia, factors that influenced the volume of care provided even during the COVID-19 pandemic. While the liberalisation of reproductive rights in some European countries (e.g. Italy) may lead to reduced demand for CBRC in Czechia, the further tightening of reproductive legislation in countries such as Poland and Hungary may, in contrast, intensify the demand for treatment abroad. To sum up, CBRC trends were influenced by the COVID-19 pandemic only to a limited extent, as the national legislative context of source countries also played an important role.

The study has some limits. One limit concerns to the Czech dataset which reports data on the ART cycle rather than on individuals undergoing the treatment. Without having a unique identifier, it is not possible to track women who undergo reproductive care employing multiple treatment cycles, particularly non-Czech women, thus rendering it impossible to take into account repeated CBRC visits. Nevertheless, the aim was to analyse the total volume of care, where taking into account the ART cycles as a unit of analysis was more appropriate than analysing women who underwent ART cycles. Second, the study did not examine the trends in ART use within source countries in relation to possible changes in accessibility. Instead, the analysis focused solely on the potential impact of legislative changes on the demand for CBRC.

## Declarations

Ethics approval and consent to participate:

The study is based on anonymized data from the National Register of Reproductive Health, collected for statistical and monitoring purposes under national legislation. As the analyses used secondary registry data without the possibility of identifying individual persons, no informed consent was required. The use of data is in compliance with Czech legislation — Act No. 372/2011 Coll., on Health

Services and Conditions of Their Provision; Decree No. 373/2016 Coll., on the Provision of Data to the National Health Information System; and Act No. 110/2019 Coll., on Personal Data Processing — as well as the General Data Protection Regulation (EU 2016/679), and corresponds to the principles of the Declaration of Helsinki.

Consent for publication:

All authors have read and approved the final version of the manuscript and consent to its publication.

Availability of data and materials:

The data that support the findings of this study are available from the Institute of Health Information and Statistics of the Czech Republic (IHIS CR), but restrictions apply to the availability of these data, which were used under license for the current study and so are not publicly available. The data are, however, available upon reasonable request and with the permission of the Institute of Health Information and Statistics of the Czech Republic (IHIS CR).

Competing interests:

The authors declare no competing or conflicting interests.

Funding:

This paper was supported by the NPO “Systemic Risk Institute”, ref. number LX22NPO5101, funded by the European Union—Next Generation EU (Ministry of Education, Youth and Sports, NPO: EXCELES).

Authors' contributions:

AV: data management and analysis, interpretation, writing and editing

AŠ: conception, literature review, methodology, interpretation, writing of the original draft, revision

JK: data acquisition, interpretation, supervision

All authors approved the final version.

#### Acknowledgement:

This paper was supported by the NPO “Systemic Risk Institute”, ref. number LX22NPO5101, funded by the European Union—Next Generation EU (Ministry of Education, Youth and Sports, NPO: EXCELES).

#### References

1. Salama M, Isachenko V, Isachenko E, Rahimi G, Mallmann P, Westphal LM, et al. Cross border reproductive care (CBRC): a growing global phenomenon with multidimensional implications (a systematic and critical review). *Journal of Assisted Reproduction and Genetics*. 2018;35(7):1277–88.
2. ESHRE. Cross border reproductive care. Vol. 1. 2017.
3. Compans M, Zagel H. Medically assisted reproduction and non-normative family forms: legislation and public opinion in Europe. *European Societies*. 2025;27(1):171–203.
4. Compans M. Assisted Reproduction Law Database: Access & Age in High-Income Countries. 2024.
5. Library of Congress. France: President Macron Signs New Law on Bioethics [Internet]. 2021. Available from: <https://www.loc.gov/item/global-legal-monitor/2021-11-16/france-president-macron-signs-new-law-on-bioethics/>
6. Benagiano G, Filippi V, Sgargi S, Gianaroli L. Italian Constitutional Court removes the prohibition on gamete donation in Italy. *Reproductive BioMedicine Online* [Internet]. 2014;29(6):662–4. Available from: <http://dx.doi.org/10.1016/j.rbmo.2014.08.013>
7. HFEA. Rules around releasing donor information [Internet]. 2025. Available from: <https://www.hfea.gov.uk/donation/donors/rules-around-releasing-donor-information/>

8. Busardò FP, Gulino M, Napoletano S, Zaami S, Frati P. The Evolution of Legislation in the Field of Medically Assisted Reproduction and Embryo Stem Cell Research in European Union Members. *BioMed Research International*. 2014;2014.
9. Präg P, Mills MC. Cultural determinants influence assisted reproduction usage in Europe more than economic and demographic factors. *Human Reproduction*. 2017;32(11):2305–14.
10. Couture V, Drouin R, Tan SL, Moutquin JM, Bouffard C. Cross-border reprogenetic services. *Clinical Genetics*. 2015;87(1):1–10.
11. Shenfield F, Pennings G, De Mouzon J, Ferraretti AP, Goossens V. ESHREs good practice guide for cross-border reproductive care for centers and practitioners. *Human Reproduction*. 2011;26(7):1625–7.
12. Gürtin ZB, Inhorn MC. Introduction: Travelling for conception and the global assisted reproduction market. *Reproductive BioMedicine Online*. 2011;23(5):535–7.
13. Daar J, Benward J, Collins LR, Davis J, Franics L, Gates E, et al. Cross-border reproductive care: an Ethics Committee opinion. *Fertility and Sterility*. 2016;106(7):1627–33.
14. The ESHRE COVID-19 Working Group, Vermeulen N, Ata B, Gianaroli L, Lundin K, Mocanu E, et al. A picture of medically assisted reproduction activities during the COVID-19 pandemic in Europe. *Human Reproduction Open*. 2020;2020(3):1–8.
15. Tierney K, Lazzari E. Impacts of COVID-19 on Medically Assisted Live Birth Rates in the United States in 2020 and 2021. *Population Research and Policy Review* [Internet]. 2024;43(1). Available from: <https://doi.org/10.1007/s11113-023-09849-0>
16. Shenfield F, De Mouzon J, Pennings G, Ferraretti AP, Nyboe Andersen A, De Wert G, et al. Cross border reproductive care in six European countries. *Human Reproduction*. 2010;25(6):1361–8.

17. Volejníková A, Šťastná A, Kocourková J. Cross-border reproductive care in Czechia: Insights from National Registry Data. *Comparative Population Studies*. 2025; in print
18. Kocourková J, Šťastná A, Burcin B. The influence of the increasing use of assisted reproduction technologies on the recent growth in fertility in Czechia. *Scientific Reports* [Internet]. 2023;13(1):1–11. Available from: <https://doi.org/10.1038/s41598-023-37071-7>
19. Wyns C, De Geyter C, Calhaz-Jorge C, Kupka MS, Motrenko T, Smeenk J, et al. ART in Europe, 2018: results generated from European registries by ESHRE. *Human Reproduction Open* [Internet]. 2022;2022(3). Available from: <https://academic.oup.com/hropen/article/2022/3/hoac022/6628623>
20. Volejníková A, Kocourková J. Asistovaná reprodukce v Česku z pohledu přeshraniční reprodukční péče. *Demografie* [Internet]. 2022;64(2):159–74. Available from: <https://www.czso.cz/csu/czso/asistovana-reprodukce-v-cesku-z-pohledu-preshranicni-reprodukcn-pece>
21. Slepíčková L. Assisted reproduction in the Czech Republic. In: Griessler E, Slepíčková L, Weyers H, Winkler F, Zeegers N, editors. *The Regulation of Assisted Reproductive Technologies in Europe: Variation, Convergence and Trends*. London: Routledge; 2022. p. 272.
22. Kocourková J, Burcin B, Kučera T. Demographic relevancy of increased use of assisted reproduction in European countries. *Reproductive Health*. 2014;11(1):1–10.
23. Tsakos E, Tsagias N, Stergioula A, Asimakopoulos B. The COVID-19 Pandemic Triggers Changes on the. 2020;3(2):6–8.
24. Li Z, Yang B, Wang J, Wen Y, Xu J, Ling L, et al. Global border restrictions in 2020–2021: Adherence and the effectiveness in long-term COVID-19 epidemic control. *Travel Medicine and Infectious Disease* [Internet]. 2023;52(September 2022):102556. Available from: <https://doi.org/10.1016/j.tmaid.2023.102556>

25. Slabá J. the Government'S Response To the Pandemic: an Overview of Measures Related To the Covid-19 Pandemic in the Czech Republic in 2020 and 2021. *Demografie*. 2022;64(2):175–96.
26. Zegers-Hochschild F, Adamson GD, Dyer S, Racowsky C, De Mouzon J, Sokol R, et al. The International Glossary on Infertility and Fertility Care, 2017. *Human Reproduction* [Internet]. 2017;32(9):1786–801. Available from:  
<https://academic.oup.com/humrep/article/32/9/1786/4049537>
27. IHIS CR. Asistovaná reprodukce v ČR 2020 [Internet]. Praha; 2022. Available from:  
<https://www.uzis.cz/res/f/008420/asistreprodukce2020.pdf>
28. Calhaz-Jorge C, De Geyter C, Kupka MS, Wyns C, Mocanu E, Motrenko T, et al. Survey on ART and IUI: legislation, regulation, funding and registries in European countries. *Human Reproduction Open*. 2020;2020(1):1–15.
29. FE, EPF. European Atlas of Fertility Treatment Policies [Internet]. 2021. Available from:  
<https://fertilityeurope.eu/atlas/>
30. Trappe H. Assisted Reproductive Technologies in Germany: A Review of the Current Situation. In: *Childlessness in Europe: Contexts, Causes, and Consequences*. Rostock: SpringerOpen; 2017.
31. Köppen K, Trappe H, Schmitt C. Who can take advantage of medically assisted reproduction in Germany? *Reproductive Biomedicine and Society Online*. 2021;13:51–61.
32. Vergallo GM, Marinelli S, Napoletano G, De Paola L, Treglia M, Zaami S, et al. 20 Years Since the Enactment of Italian Law No. 40/2004 on Medically Assisted Procreation: How It Has Changed and How It Could Change. *International Journal of Environmental Research and Public Health*. 2025;22(2):1–16.
33. Rallo G, Negro F, Piersanti V, Consalvo F, Marinelli S. Medically assisted procreation in times of

- COVID-19: What impact on health care system organization and the reproductive rights of couples? *Acta Biomedica*. 2021;92(5).
34. The ESHRE COVID-19 Working Group, Gianaroli L, Ata B, Lundin K, Rautakallio-Hokkanen S, Tapanainen JS, et al. The calm after the storm: Re-starting ART treatments safely in the wake of the COVID-19 pandemic. *Human Reproduction*. 2021;36(2):275–82.
  35. ESHRE Guideline Group on the Number of Embryos to Transfer, Alteri A, Arroyo G, Baccino G, Mertes H, Baldani DP, et al. ESHRE guideline: number of embryos to transfer during IVF/ICSI. *Human Reproduction*. 2024;39(4):647–57.
  36. Lawrenz B, Coughlan C, Melado L, Fatemi HM. The ART of frozen embryo transfer: back to nature! *Gynecological Endocrinology* [Internet]. 2020;36(6):479–83. Available from: <https://doi.org/10.1080/09513590.2020.1740918>
  37. Venetis CA. Pro: Fresh versus frozen embryo transfer. Is frozen embryo transfer the future? *Human Reproduction*. 2022;37(7):1379–87.
  38. Calhaz-Jorge C, De Geyter C h, Kupka MS, Wyns C, Mocanu E, Motrenko T, et al. Survey on ART and IUI: legislation, regulation, funding and registries in European countries. *Human Reproduction Open*. 2020;2020(1):1–15.
  39. Gunning J, Englert Y, Jouannet P, Critser JK, Baldock. Oocyte donation: The legislative framework in Western Europe. *Human Reproduction*. 1998;13(SUPPL. 2):98–104.
  40. Riezzo I, Neri M, Bello S, Pomara C, Turillazzi E. Italian law on medically assisted reproduction: Do women’s autonomy and health matter? *BMC Women’s Health* [Internet]. 2016;16(1):1–7. Available from: <http://dx.doi.org/10.1186/s12905-016-0324-4>
  41. Scaravelli G, De Luca R, Spoletini R, Speziale L, Fedele F, Bolli S, et al. Medically assisted reproduction in Italy, 2020 data from the Italian MAR Register. *Minerva Obstetrics and Gynecology*. 2024;76(2):118–26.

42. IBSA. Assisted Reproductive Technology joins the new Essential Levels of Assistance: a step forward for Italian couples [Internet]. 2025 [cited 2025 Jun 8]. Available from: <https://www.ibsaitaly.it/en/media/news/2025/la-procreazione-medicalmente-assistita-entra-nei-nuovi-lea.html>
43. Kehmová S. Towards a total ban on abortion? The factors shaping Polish perception of the right to abortion and reproductive injustice in Poland [Internet]. Vol. 3, SN Social Sciences. Springer International Publishing; 2023. 1–35 p. Available from: <https://doi.org/10.1007/s43545-023-00742-3>
44. Korolczuk E. Assisted Reproduction: Poland in a comparative perspective. In: The Routledge Handbook of Gender in Central-Eastern Europe and Eurasia. 1st Editio. Routledge; 2021.
45. Radkowska-Walkowicz M. How the Political Becomes Private: In Vitro Fertilization and the Catholic Church in Poland. *Journal of Religion and Health*. 2018;57(3):979–93.
46. Kurowska A, Matysiak A, Grabowska M. Unlocking Fertility: What Prevents Young Adults in Poland From Having (More) Children? Evidence From a Factorial Survey Experiment. In PAA Annual Meeting; Washington, DC; April 10-13; poster presentation.; 2025.
47. Vicsek L, Sándor J, Bauer Z. The human embryo: Mapping patients' ethical decisions in Hungary. *Intersections East European Journal of Society and Politics*. 2021;7(2):149–69.