

Infertility and fertility: demographic problems of assisted reproduction

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Received 30 June 2023 ♦ Accepted 24 October 2024 ♦ Published 2 May 2024

Citation: Rusanova NE (2024) Infertility and fertility: demographic problems of assisted reproduction. *Population and Economics* 8(1):156-167. <https://doi.org/10.3897/popecon.8.e108842>

Abstract

The article dwells upon topical demographic problems of infertility in the context of their national specifics and institutional features. The purpose of the study was to analyze the impact of infertility correction on the annual number of births in Russia through identifying reproductive disorders and expanding assisted reproduction programs as effective tools of the pronatal fertility policy. The material for the analysis is statistical data of the Russian Federal State Statistics Service, official information from the Russian Association of Human Reproduction published in the National Registers of Assisted Reproductive Technologies in 2000-2021, materials of the World Health Organization and international professional associations of reproductive health professionals, domestic and foreign themed publications. The paper casts light on the economic, psychological, medical, social, professional, financial and gender changes in society associated with the development of assisted reproduction as the most effective way to correct infertility. A currently prevailing global trend towards universal access to assisted reproduction programs as the realization of everyone's right to the highest level of health, regardless of income, marital status, gender identity, etc., is limited in some countries by cost-effectiveness and "threshold of utility" of in vitro fertilization in treating infertility. In Russia, the main concern is the programs involving "third parties" and reproductive donors, especially surrogacy, therefore, it is necessary to strengthen state regulation to make the assisted reproductive technologies most similar to the natural processes and traditional ethical standards.

Keywords

infertility, fertility, assisted reproductive technologies, in vitro fertilization, availability of treatment

JEL codes: J13, I19

Introduction

Until the end of the twentieth century, infertility was one of the reasons for decrease in the number of births, i.e. the inability of the population of reproductive age to reproduce. According to the World Health Organization (WHO), one in six married couples worldwide has an experience of some form of infertility at least once during their reproductive lives. It is estimated that the current global prevalence of infertility that lasts for at least 12 months equals to 8-12% among women aged 20-44. 20-30% of all infertility cases are explained by physiological causes in men, 20-35% - by physiological causes in women and 25-40% of cases are related to problems in both partners; and in 10-20% of cases, the cause is not detected (ESHRE 2023). Unlike other diseases, infertility prevents a person from achieving one of the most important life goals - to become a parent. A long uncertainty associated with involuntary childlessness can affect all aspects of a person's life, from self-identification to the relationship with family members and friends, even disrupting ability to work – female infertility ranked fifth in terms of severity of disability worldwide (ESHRE 2021).

Including assisted reproductive technologies (ART) based on in vitro fertilization (IVF) in the public health system gives any person a chance to become a parent, regardless of age, health status, having a partner, etc., therefore, a focus on infertility as a reproductive dysfunction has somewhat faded away. ART has entered the picture, also becoming a way of solving social and economic problems rather than the treatment method only, increasingly modifying the traditional structure and quality of fertility. However, studies conducted by WHO and international professional communities in the early 2020s show that infertility remains a current issue, many aspects of which are yet to be solved.

The purpose of the study is to analyze the effect of infertility treatment on the annual number of births in Russia. Identification of reproductive disorders and expansion of assisted reproduction programs are effective tools of the pronatal fertility policy. The material for the analysis is statistical data of the Russian Federal State Statistics Service, official information of the Russian Association of Human Reproduction (RAHR) published in the National ART Registers in 2000-2021, materials from WHO and international professional associations of reproductive health professionals, domestic and foreign themed publications.

Background and research problems

Infertility as a medical and social problem has already existed in ancient times, but its demographic and economic aspects became relevant only during a period of sustained fertility decline. ART has become a breakthrough in the treatment of infertility, although its demographic effect cannot be fully investigated, since the first children born as a result of IVF have not yet reached beyond the reproductive age. However, a range of problems not affected by ART has been identified with prevalence of infertility, its registration, and the very possibility of recovery, and so on, being almost the main ones (Fig. 1).

1. It has always been difficult to determine the actual prevalence of infertility, because even now not all those with reproductive health problems seek medical care, and before the advent of reproductive medicine there was nowhere to go. There are still no absolutely accurate data, because due to length of infertility period, an individual reproductive status, reproductive status of the couple or composition of the couple may change. A widespread “registration based on care seeking” overestimates the data, since it is possible for one pa-

tient to contact several doctors, while detection of individual reproductive disorders against the background of other more serious pathologies can reduce the actual level of infertility in society.

Infertility		
Medicine	Demography	Society
<ul style="list-style-type: none"> • A disease? • Who's sick? • What's the cause? • How to treat? • Can be cured? 	<ul style="list-style-type: none"> • Population (number) • Vital statistics ("quality") 	<ul style="list-style-type: none"> • Individuum • Family • Public institutions (traditions, laws, etc.) • Treatment expenses

Figure 1. Infertility-related issues. *Source:* compiled by the author

Different countries have attempted to estimate prevalence of infertility at the turn of the XIX-XX centuries, mainly by extrapolating statistics on visits to specific gynecological clinics. A common focus was the age structure of patients - infertility was noted during the years of maximum biological ability to conceive (Shuster-Kadysh 1927: 238), as well as the role of abortions and postpartum complications as the dominant cause of secondary infertility with at least **one pregnancy**. Empirically, in the middle of the twentieth century a "striking infertility zone" has been identified - territories in Africa where 20-40% of women over 50 are childless (Pepperell et al. 1986: 308). But it was only in 1989, when the first child born as a result of IVF treatment turned 11 years, at the International Conference on the Tenth Revision of the International Classification of Diseases, WHO defined male and female infertility as a disease with the right of everyone to treatment (WHO Scientific... 1992: 820). It turned out that in Europe, the U.S., Australia and Canada there are 10 to 17% of infertile people (Templeton et al. 1990).

From this point of view, the attempt undertaken by WHO in 2022 to estimate global prevalence of infertility through the data generalization on the number and quality of local studies is of interest (Infertility 2023). Data from five WHO regions, comprising 3/4 of the population and 95% of the world's countries, showed a relative independence of infertility prevalence from the main demographic and economic characteristics, yet revealing the importance of state regulation of the availability of treatment for reproductive disorders.

2. Social consequences of infertility remain a problem, since having children is still not an issue of exclusive private personal decisions, through constant social control, the reproduction of a morally approved norm is carried out.

Infertility affects not only patients, but also close relatives and friends who may feel a sense of emptiness in their families and feel deprived of the opportunity to play important and positive family roles (grandparents, etc.). The additional emotional burden puts family and friendly relations at risk, since a healthy spouse/partner does not always agree to undergo treatment, which is often long and uncomfortable.

3. Medical and psychological consequences are associated with the fact that involuntary infertility can become a source of stress and emotional disorders with negative effects on mental health and general well-being.

Local European surveys show that more than 80% of the respondents have experienced shock, sadness, anger and disappointment, loss of self-esteem, self-control and self-confidence when diagnosed with infertility, while 40% reported suicidal thoughts, 59% noted the

detrimental effect of fertility problems and/or treatment on the relationship with the partner, and for 2% infertility was the reason for breaking up the relationship (The far-reaching trauma...). The very need for infertility treatment, from the moment of diagnosis to child-birth, has affected mental health of more than 60% of the respondents (Boivin et al. 2022).

4. Professional consequences are manifested in the fact that infertility often negatively affects a person's career, reducing his or her qualifications and performance.

The specifics of infertility treatment require free time during periods that cannot be foreseen in advance, therefore, employees have to disclose their personal medical information or give false reasons for absence. In such conditions, about 15% of specialists are ready to stop their careers, reduce working hours or give up vacancies in order to fully engage in infertility treatment, and about 58% of women are concerned that infertility treatment will affect their career prospects (The Imperative... 2023: 11).

5. Financial implications at the micro level are associated with the fact that infertility treatment using effective modern methods is expensive and often inaccessible to those who cannot benefit from state funding.

At the macro level, this requires taking into account the corresponding costs, which should not exceed the expected economic effect of the birth. Ensuring equal access to safe and effective methods of infertility treatment is possible only if it is interpreted as a long-term profitable investment, therefore, the question of profitability arises.

6. Gender consequences are associated with the increased inequality as a result of the ongoing stigmatization of infertility as a predominantly “female problem”, although 30 million men are infertile in the world (Martinez et al. 2012).

Infertility today: where, how much, how to treat

WHO currently defines infertility as a disease of the male or female reproductive system caused by the failure to achieve a pregnancy after 12 months of regular unprotected sexual intercourse. In the world, due to specifics of registration, from 48 million couples to 186 million people are registered with primary infertility if pregnancy never occurred, and secondary infertility if there was at least one pregnancy (regardless of the outcome) (Infertility 2023). According to the 2010 calculations, half of all infertile couples live in South Asia (14.4 million) and Africa (10 million), 29.3 million couples cannot give birth to another child in addition to the existing ones. In the world, about 2% of women aged 20-44 years have experienced primary infertility, about 11% - secondary infertility (Mascarenhas et al. 2012).

In the context of modern fertility problems, clarifying the prevalence and identifying the qualitative features of infertility is crucial to mitigate its negative consequences. To this end, various estimates of infertility registration are proposed, including those not directly related to the biological nature of fertility disorders. Thus, the analysis conducted within the framework of the WHO study is based on the identification of the “lifetime” and “period” prevalence of infertility according to generalized data from several dozen large-scale regional studies in 1990-2021: lifetime is defined as a share of population who has at least once experienced infertility in their lives, and period is defined as a share of population with current infertility or infertility registered during a certain period. The total number of respondents in different studies varied: most of them included the reproductive age population, yet with different limits: 15-49 years, 20-44 years, in some cases the lower limit was lower, and the upper one was not set at all or exceeded the generally accepted one. Also, some of the studies

were limited only to the respondents of a specific age, for example, women aged 20-34 or 30-49; sometimes the age range was not specified at all, or estimates were presented for two different age groups, resulting in double counting.

Thus, in countries comprising three quarters of the world's population (except for the WHO South- East Asian Region, for which estimates are not available), the lifetime prevalence of infertility is 17.5%, and period prevalence of infertility equals to 12.6% (WHO 2023). The highest lifetime prevalence of infertility is registered in the WHO Western Pacific Region (23.2%), the lowest one in the Eastern Mediterranean Region (10.7%). The maximum period prevalence of infertility is observed in the African region (16.4%), the minimum one - in the Eastern Mediterranean Region (10.0%) (Table 1).

Table 1. Lifetime and period prevalence of infertility (%)

WHO Regions	Lifetime prevalence of infertility	Period prevalence of infertility
1. Eastern Mediterranean Region (21 states, 766542 people - 10%)	10.7	10.0
2. European Region (53 states, 930809 people - 12%)	16.5	12.4
3. Region of the Americas (35 states, 1029510 people - 13%)	20.0	10.4
4. African Region (47 states, 1162658 people - 15%)	13.1	16.4
5. Western Pacific Region (27 states, 1932809 people - 24%)	23.2	13.0

Sources: (Infertility 2023; World Health Statistics 2023)

In the European Union, 25 million people suffer from infertility (ESHRE 2021). The prevalence of infertility is almost independent of the income level: lifetime prevalence of infertility reaches 17.8% in high-income countries and 16.5% in low- and middle-income countries, while period prevalence of infertility equals to 12.6% in all countries. Lifetime prevalence of primary infertility equals to 9.6% and period prevalence of primary infertility is 9.0%, lifetime and period prevalence of secondary, infertility which is usually due to postpartum infections, unsafe abortions, sexually transmitted infections (STIs) adds up to 6.5% and 4.9%, respectively (Infertility 2023). Infertility treatment methods vary in complexity from a simple intrauterine insemination (IUI) to high-tech ART, some of which cause an ambiguous attitude in society due to interference in traditional physiological processes and child-parent relations (preimplantation genetic testing (PGT), surrogacy, gamete and embryo donation). ART has been in existence for more than four decades, and about 10 million children were born in the world with its help, in Europe one child in every primary class is born as a result of ART, and in the Nordic countries 2-7% of births are due to ART (ESHRE 2021).

But these methods are yet to become universally available because of the high cost, which is especially relevant to low- and middle-income countries. To determine the most effective measures to ensure equal access to infertility treatment in 2021, a European Atlas of Infertility Treatment Policies has been developed by experts from ESHRE and the European Parliamentary Forum for Sexual and Reproductive Rights. The equal access policy is based on three basic criteria, including 22 profile parameters: legal norms, financing/reimbursement of expenses and patient prospects; a maximum compliance with these criteria creates ideal conditions for infertility treatment. At the time of the creation of the Atlas none of

the 43 countries considered managed to reach the maximum – the most favorable situation was observed in Belgium and the Netherlands (86%, as in Israel), the least favorable one in Albania (13%); in Russia, the accessibility level is 59% (The imperative... 2023: 20).

Here the question arises about the balance between treatment length, its medical effectiveness and its economic costs. Despite a close relationship between the number of children an individual has and the birth rate in the country, the patient interests and the society interests do not always coincide. In many cases, at least for one of the infertile parents, the unborn child becomes an absolute emotional and biological value, not limited by any material costs and independent of the probability of a favorable outcome of the treatment. If the state pays for such treatment, then it is interested, at least, in the birth of a healthy child, which, in turn, is related to the age and health of the woman during pregnancy.

Therefore, many countries limit the age of women in state-funded ART programs to 40-42-45 years, based on clinical experience, chances for success and the belief that the risks of treating patients over 45 years do not meet their best interests outweighing the possible benefits. Even if patients are willing to pay for treatment, it is not always offered, based on the generally accepted opinion that the chances for success are so low that treatment is considered futile given the need to use donor germ cells, high risk of miscarriage, increased frequency of certain health disorders in children, etc. (Savulescu & Tremellen 2016; Chambers et al. 2013). In most European countries, the “age of futility” is regulated by clinical practice and recommendations of the industry associations, but the general trend is such an “ageing” demand for IVF that reproductive health professionals consider it unethical to offer deliberately ineffective programs. In the United States, the American Society for Reproductive Medicine (ASRM) in 2019 issued guidance on excluding what it considers to be a “futile treatment” that can reasonably be refused. In particular, it was proposed to define futility as a situation where IVF treatment has hardly any chance for achieving a successful pregnancy as a desired medical goal, and the probability of having a healthy child does not exceed 1% (ASRM 2019). There is a problem of matching the diagnosis of “infertility from a medical point of view” and “medically necessary” treatment, to solve this problem an analysis of cost-effectiveness (“utility”) of live birth can be used, for example, with due regard to changes in the life quality after the birth of a child (according to QALYs - quality-adjusted life years (years of life adjusted for quality) (Polyakov et al. 2022).

Calculations show that in the context of the modern healthcare systems and prospects for participation in national production of those born as a result of IVF, the use of ART can remain effective up to the upper limit of reproductive age, bringing it closer to the natural physiology.

IVF: there will be children, but whose?

Marriage has initially had an indirect effect on the reproductive component, since it regulated the realization of reproductive function. At different times, society allowed different forms of de-facto marital status, which made it possible to maintain the population at an optimal level at that time, and supplemented them with various ways of regulating reproductive potential aimed at preserving the qualitative characteristics of the population. Back in the early twentieth century, the absence of children referred to “personal difficulties” that were identified only after the wedding and almost did not threaten families. Although the church allowed the dissolution of infertile marriages, divorce was unpopular, because it was

expensive and time-consuming, many former spouses entered the secondary marriage market with low chances for success, so the inability of a couple to have their own children was usually compensated by the appearance of bastard children, adopted children, foster children from large families, etc.

In the 1980s, ART became available in many countries as a method of infertility treatment without additional restrictions unrelated to health conditions – ART was allowed to be used by officially registered married couples who had not been able to conceive a child for several years. Even the Catholic Church in Italy agreed with this approach, although not immediately. Today, WHO, in its recommendations on infertility treatment, proceeds from the fact that everyone has the right to enjoy the highest attainable level of physical and mental health, independently determining how many children to have, when and with what intergenetic intervals. Infertility can negate the exercise of these basic human rights, and therefore solving the problem of infertility acquires an important humanistic meaning (Zegers-Hochschild et al. 2013).

As ART programs improved, not only patients with reproductive disorders began to demand them, but also “clients” who needed IVF for social reasons: same-sex couples, single women, and in recent years, single men. The availability of ART for each of these groups varies by country and depends on national family legislation, but the general trend is to expand accessibility at the expense of all new groups. For example, some child-frees say that they do not like children and do not want to raise them themselves, but are ready to fulfill their “biological role” and leave offspring, becoming egg or sperm donors “delegating parenthood” to others. Of all the forms of marriage and family relations that exist today, the state and society are the most positive about ART for traditional heterosexual unions, regardless of their official registration, as well as for single women (in this case, infertility is defined as “social”).

In the context of marriage as a fertility factor, this means an increase in the impact of stable families on the individual number of births after IVF: in 2019, 38% of the countries allowed IVF to couples in confirmed stable family relationships, in 2022 – already 54%. The increase in such requirements is influenced by the spread of ART in states with conservative forms of heterosexual unions, documented by laws, charters, professional associations or authorized government agencies – in most European countries such evidence is not needed. More than 70% of the countries do not recognize same-sex partners as legal parents, but in Australia, Austria, Argentina, Bolivia, Brazil, Great Britain, Denmark, Iceland, Canada, Kenya, Colombia, the Netherlands, New Zealand, Paraguay, the U.S., Sweden and South Africa, ART is available to transgender and intersex people (IFFS 2022, Chapter 5). The trend may be associated with the ambiguous attitude towards same-sex couples, which have been legitimized in many countries in recent years, while in Bangladesh, Japan, Jordan, Malaysia, Mali, the Philippines, Trinidad and Tobago, decisions of professional associations, religious organizations, sometimes even household customs and cultural traditions are enough to confirm the stability of the relationship between the potential parents.

These results still reflect significant differences in countries’ attitudes towards the availability of ART for “non-traditional” couples and single women/men. The reason is differences in cultural and religious preferences. The demand for ART is growing in many countries where indefinite postponement of births has become the norm, and extramarital and non-heterosexual births are commonplace; these countries are becoming “hosts” of cross-border reproductive tourism. The expansion of the market for reproductive medicine services implies the availability of not only “classic” IVF, but also “open” reproductive donation and “full” surrogacy, when the surrogate mother is simultaneously the biological mother. This approach

to ART is explained by the fact that the opportunity to have and raise children is a universal value and an integral component of someone's identity. Individuals and couples, regardless of marital status, sexual orientation or gender identity, may be interested in raising children. Some studies support the view that marital status, sexual orientation, and gender identity don't have any negative effect on the child well-being (Ethics Committee... 2021]. In some jurisdictions, the anti-discrimination legislation prohibits the denial of infertility treatment services to LGBT people, and ART programs should be equally available to everyone, regardless of marital status, sexual orientation or gender identity (De Wert et al. 2014).

Infertility in Russia

In Russia, according to current expert estimates, about 15% of the couples (4-6 million people) are infertile, and the dynamics in the absolute and relative number of women diagnosed with infertility is on the rise (Fig. 2). However, a steady trend towards a rising “male factor” in couples applying to reproductive clinics for conception failures indicates the problem actualization, especially in the context of the fact that today infertility correction is considered both as an integral part of the realization of basic human rights and as a factor of fertility.

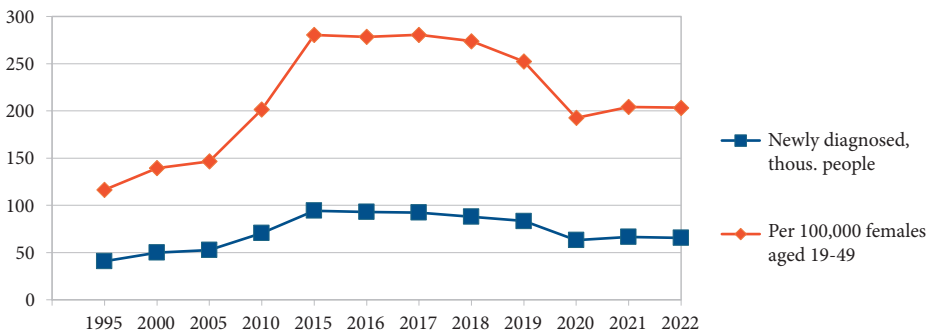


Figure 2. Incidence of female infertility in Russia. Sources: (Healthcare in Russia 2009, 2011, 2019, 2023)

Since IVF is the basis of ART, and was originally used in cases of female infertility, following the introduction of the ICSI (intracytoplasmic sperm injection) method into clinical practice, which can complement IVF, in the early 1990s, it started to be used in cases of male infertility (Fig. 3 and 4). However, in Russia, men are often reluctant to turn to health services with reproductive health problems. Even in conditions where young people have the opportunity to receive reproductive health services, young women most often seek such services, while men are often reluctant due to gender stereotypes: males seek care for infertility five times less often compared to females (Karelskaya 2016).

In Russia, since 2016, infertility has been the basis for IVF at the expense of public funds covering the main costs of most ART programs, with the exception of reproductive donation, surrogacy and PGT. There are no age restrictions, yet compliance with certain medical parameters is required, many of which somehow deteriorate with years. Such “natural” limits automatically eliminate the need to define the limits of the treatment “futility”, but increase the need for the above-mentioned programs with the participation of third parties, which are impossible without active legal regulation.

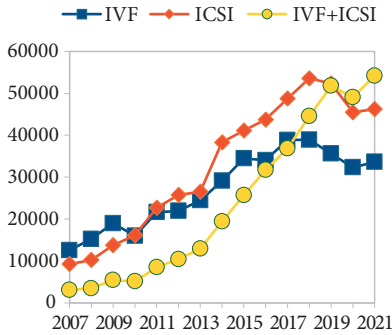


Figure 3. Number of IVF and ICSI cycles. *Source:* Calculated by the author according to (RAHR. ART registers for 2007-2021)

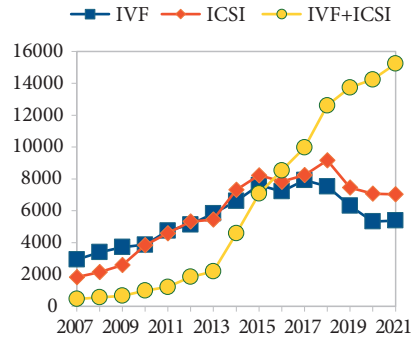


Figure 4. Number of births following IVF and ICSI. *Source:* Calculated by the author according to (RAHR. ART registers for 2007-2021)

Surrogacy is the focus of highest attention; its popularity is on the rise thanks to the mass media. In reality, the share of surrogacy in the Russian ART cycles in 2005-2021 is 1.2-1.7%, although the number of cycles involving surrogate mothers increased 7.2 times (from 289 to 2089, Fig. 5) (RAHR 2023). This is noticeably less than in the U.S. with the share adding up to 5.4% (Shamardina 2023).

Surrogacy is very sensitive to institutional changes, therefore, events related to the restriction of cross-country logistics and mobility have significantly complicated the program implementation considerably reducing their number. It took an increase in the number and specification of regulatory positions; one of the results was the adoption by the Government of the Russian Federation of the Decree No. 882 dated 31.05.2023 “On establishing potential parents as a genetic mother and genetic father, as well as a single woman as a genetic mother” (Decree... 2023]. The rules determine who can be the genetic parents of a child born to a surrogate mother. These are spouses in officially registered marriage, for whom carrying and giving birth to a child is impossible for medical causes, or a single woman who, for health reasons, cannot bear and give birth to a child herself, but gives her genetic material to a surrogate mother.

Thus, it is prohibited to replace one’s own germ cells with the donor ones, which guarantees the child’s genetic relation with at least one of the parents and a priori defines the

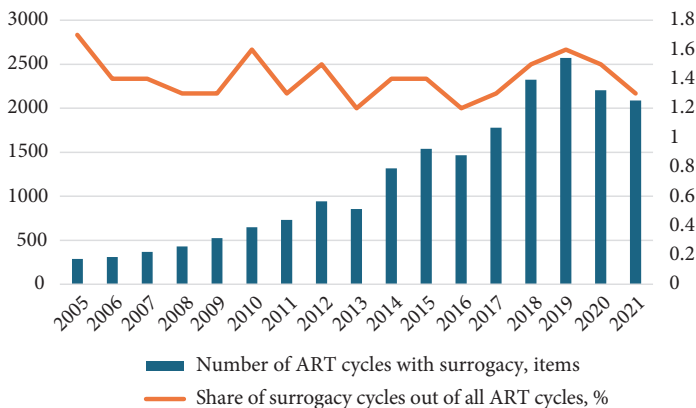


Figure 5. Surrogacy in ART programs. *Source:* Calculated by the author according to (RAHR 2023)

“genetic mother” as the only one to whom the child can be officially given. Partial donation assumes that the embryo is not created of the couple’s own eggs and sperm cells, but uses donor eggs (oocytes) with the germ cells of the genetic father or own oocytes with the donor germ cells. Full donation, when donor material from both parents is used to create an embryo, was initially prohibited in surrogacy programs by the Article 55 of the Law No. 323-FZ “On the Basics of Public Health Protection”.

Conclusion

Modern methods of treating fertility with ART have allowed almost all men and women diagnosed with infertility to have genetically related children. Thus, the “external” causes reducing reproductive potential have been eliminated, but there is no increase in the birth rate. One of the reasons is the side effects of the infertility treatment process itself, affecting the psychological, medical, social, professional, financial, gender, demographic and economic components of the development of an individual and society. International, regional and local studies show that the exact prevalence, causes and distribution areas of infertility are yet to be identified, making it impossible to cure infertility in many cases.

In this regard, procreation as the realization of one of the basic human rights, even if reproductive disorders remain, becomes an urgent task. WHO interprets infertility treatment via realization of the right to have the highest attainable level of physical and mental health, therefore, offering it to gender-diverse categories of the population with due regard to the age “threshold of utility”. The solution to these problems takes into account the institutional specifics, the public health system and the population quality of each country, but the main thing is equal access to infertility treatment. In Russia, the main problems of infertility are associated with programs that use donor material, and their state regulation is aimed at attaining maximum similarity with the natural processes.

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