Institute for Statistical Studies and Economics of Knowledge

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priority2030^ leaders are made, not born

Human Capital Multidisciplinary Research Center

Institute for Statistical Studies and Economics of Knowledge (ISSEK) HSE presents the results of a study of human potential trends. The research methodology includes methods of big data mining based on the iFORA system created at HSE ISSEK, as well as expert sessions and the Delphi survey with the participation of more than 400 leading foreign and Russian scientists in the field of human potential.

The project is implemented within the framework of the activities of the World-Class Human Capital Multidisciplinary Research Centre and the UNESCO Chair on Future Studies (UNESCO Futures Literature Chairs network). The full list of trends is available in a unique open-access database https://ncmu.hse.ru/chelpoten_trends.

Trendletter was prepared using the following resources: Issek.hse.ru, Who.Int, Nti2035.ru, Ncbi.nlm.nih.gov, Bioedonline.org, Statista.com.

Key subtrends

- **Growing number of infertile couples**
- **Increasing average age of having first child**
- **Development of assisted reproductive technologies, and their relatively low effectiveness**

Birth rate is falling the world over. If in the 1950s the overall global fertility rate was 4.7 births per woman, in 2019 it has dropped to just 2.4. Scientists predict that by 2100 it will decrease to 1.66, which is significantly less than required for natural reproduction (2.1). This is primarily due to the emergence of industrial and post-industrial society, when children are no longer seen as additional labour for the economy, while their upbringing becomes increasingly costly for the family. Women now have more opportunities to study, and realise their professional ambitions, so they more often opt for career limiting themselves to having one or two children, or abandoning the role of a mother completely. The average age of parents at child's birth also increases. E.g. in Russia it grew from 24.8 years in 1995 to 28.8 in 2020.

While delaying pregnancy and first childbirth has its benefits (e.g. more conscientious attitude of parents to their responsibilities), it leads to increased infertility. Also, with parents' age increase the risks of intrauterine death and complications during pregnancy, and for women over 30 also of spontaneous abortion, ectopic pregnancy, and foetal development with trisomy on the 21st chromosome which causes Down's syndrome. After 35, women are more likely to have preterm births and stillbirths.

The number of people suffering from infertility is also on the rise. At least 15% of the world's couples of reproductive age are facing this problem. Assisted reproductive technologies (ART) are increasingly being applied to solve it, but their effectiveness still remains low. Only one in three in vitro fertilisation (IVF) cycles ends in pregnancy. Nevertheless, this technology remains the most popular one: its share of the ART market exceeds 50%. The annual demand for IVF is 1,500 cycles per 1 million people.

New advances in medicine and biology, including in the field of genomic and cellular technologies, can significantly increase the chances of pregnancy, and the birth of a healthy child. E.g. pre-implantation genetic diagnostics almost double the IVF effectiveness, allowing to identify embryos with genetic abnormalities which hinder the development of the foetus at an early stage. Delayed pregnancy becomes possible due to the use of cryotechnologies for freezing eggs and sperm. Couples can carry out this procedure at the most favourable for conception age (at 20–30 years). This is particularly relevant for people at high risk of reduced reproductive function, first of all cancer patients. In 2015 a child was for the first time conceived with the help of IVF procedure by three parents: the mother's faulty mitochondria was replaced with a healthy one provided by a donor, which allowed to prevent the development of a genetic disease in the infant.

Key estimates

35.5 billion USD

could reach the global assisted reproductive technologies market by 2030 (13.6 billion USD in 2019)

10 million

children were born with the help of IVF technology since 1978

Trend's characteristics

Impact on human potential[1]

1 2 **3**

Weak signal[2]

Editing the human genome

Strongest manifestation period

2026–2030

Wild card[3]

Genetic design of children

Effect of COVID-19 pandemic

Strengthened the trend

Consequences of wild card

Social stratification by genetic

Level of occurrence in Russia

Comparable with the global level

[1] 1 – weak influence, 2 – medium, 3 – strong.

[2] Weak signal is an event that has a low degree of significance (mention, popularity), but indicates a radical trend transformation in the future.

[3] WIld card is an unpredictable event, which, if realized, can have a significant impact on the trend development.

Drivers and barriers

Drivers

- Development of reproduction, genomic, and cellular technologies
- Prevention, and timely treatment of diseases leading to reduced reproductive potential, primarily STDs
- Increased public awareness of ways to improve and protect reproductive health
- Increased availability of family planning services
- More active application of unwanted pregnancy prevention techniques
- Inclusion of ART and egg and sperm storage services in public health insurance programmes

Barriers

- Ethical issues associated with the use of ART
- Reduced physical activity, proliferation of obesity and bad habits negatively affecting reproductive health
- Postponing the birth of a child to a later age
- Proliferation of infectious and chronic diseases negatively affecting fertility
- High costs, and low effectiveness of ART

Effects

Opportunities[4]

- Reduced mortality and morbidity rates
- Scientific substantiation of the relationship between individual biomarkers and the development of diseases, and creating effective diagnostics and treatment techniques on this basis
- Reduced overall treatment costs due to choosing more effective therapy strategies

Threats

- Unpredictable consequences of changing the genetic profile of living organisms due to the use of genomic technologies
- The risk of overdiagnosis which can cause more harm than good, among other things due to increased time and costs, and a negative impact on the patient's psyche
- Possible discrimination of certain groups of people based on genomic analysis results

[4] Opportunities that will emerge if efforts to combat the decline in fertility, and the increased occurrence of reproductive dysfunction are stepped up.