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The future of fertility

Navigating technology, power and policy

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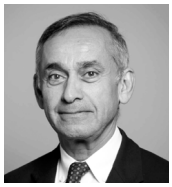
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FOREWORD

Infertility affects around one in six people worldwide at some point in their lives, and its effective evidence-based treatment progressed by leaps and bounds over the last 40 years. Complications, such as multiple pregnancies induced by the transfer of several embryos after in vitro fertilization, that threaten the wellbeing of the mother-to-be and her family, have decreased. This progress is sometimes led by the profession, but also by varied regulatory bodies. The necessity to take into account the welfare and health of the future child – the most vulnerable party in the care equation – is a specific feature of our specialty. There are few fields in medicine where one has to consider a professional responsibility to a future person, and this has been possible thanks to societal debate, codes of practice and laws that may differ within different regions, but which mostly recognize our joint responsibility to future generations.

Thus, societal debate, national policy and regulations are important in order to offer fair and equitable treatment, as well as prospective data registers and research to validate (or reject) the many innovative technologies claiming to improve our patients' care in a safe manner.

This report aims to inform care providers, regulators and funders about the current debates in the fertility field so they can decide at national level what constitutes fair and affordable care provision.*



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* See World Health Organization (WHO). 2023. Infertility Prevalence Estimates: 1990–2021. https://iris.who.int/items/65853145-d18f-4dce-97dc-e317ff2c76ee.

EXECUTIVE SUMMARY

Reproductive medicine is undergoing rapid technological, social and commercial transformation. Egg freezing, preimplantation genetic testing, gene editing and artificial intelligence (AI) are challenging traditional boundaries between prevention, treatment and reproductive choice. These developments offer important opportunities, but they also raise questions about evidence, equity, affordability, ethics, regulation and public trust.

The purpose of this report is to outline recent advances in assisted reproductive technologies, assess their effectiveness, and consider whether they should be incorporated into the routine care of subfertile couples as a matter of health policy. The report examines four technology and sector areas that require attention from health policymakers: egg freezing; preimplantation genetic testing and gene editing; AI in fertility care; and the increasing commercialization of reproductive medicine. It then considers developments in the context of Qatar as a national case study.

- Oocyte vitrification has made it possible for women to store eggs for possible future use. The procedure's established role in fertility preservation for medical indications is now accompanied by rapidly increasing use for non-medical or age-related fertility preservation. Although egg freezing may expand reproductive autonomy, access, counseling, financing and regulation require careful consideration.

- Other techniques have attracted considerable hype and require further evidence from appropriately designed research before they can be recommended for clinical use. These include stem-cell interventions intended to regenerate the endometrium or ovary, the creation of gametes from stem cells (in vitro gametogenesis), and stem-cell-based embryo models. Polygenic embryo scoring raises additional scientific, ethical and societal questions concerning predictive accuracy, applicability across populations, informed consent, equity and the potential shift from disease prevention to the selection of complex traits. Human germline gene editing raises still greater concerns because alterations could be transmitted to future generations.

- AI has the potential to influence many aspects of fertility care, including embryo assessment, laboratory workflow, and the prediction of treatment outcomes. Its most immediate contribution may lie in improving consistency, efficiency and data-informed decision-making. The use of AI to identify the embryo with the greatest chance of resulting in pregnancy and live birth remains unproven: the largest randomized trial to date did not demonstrate non-inferiority to embryologist assessment for clinical pregnancy, although gains in consistency and workflow may be real. However, use of AI should be guided by demonstrated clinical value rather than technological novelty. Therefore, health systems should require appropriate clinical validation, external evaluation, monitoring for bias, data-governance safeguards, cybersecurity protections and meaningful human oversight.

- Commercialization has accelerated innovation and expanded access to fertility services. However, reproductive medicine is particularly vulnerable to market practices that may conflict with public health interests. The growing

promotion of fertility 'add-ons' – supplementary interventions offered in addition to standard IVF treatment despite limited or inconsistent evidence of improving live birth rates – poorly validated technologies, outcome claims and direct-to-consumer marketing make independent regulation increasingly important. Fertility policy should seek to ensure that access to effective treatment is determined primarily by clinical need and transparent eligibility criteria rather than the ability to pay.

FROM PRINCIPLES TO IMPLEMENTATION

This report proposes a practical framework of recommendations that policymakers can use to translate these principles into national fertility policy:

1. **Develop a national fertility and assisted reproduction strategy** that establishes equitable access to assisted reproductive technology (ART) and defines eligibility, quality standards, reproductive rights, provider responsibilities and mechanisms for incorporating new technologies. The strategy should enable ethical governance that prioritizes evidence-based medicine, accountability and patient-centered care.
2. **Establish or designate an independent regulatory authority for assisted reproduction,** responsible for licensing centers, regularly inspecting laboratories, monitoring outcomes, regulating advertising, and enforcing clinical, ethical and best practice standards.
3. **Promote fertility awareness and education** to help individuals and families make informed reproductive decisions, and to reduce the stigma associated with treatments such as egg freezing.
4. **Clearly distinguish research from routine care.** Interventions offered within registered research protocols and subject to independent oversight must not be presented or priced as established treatments.
5. **Create an evidence-to-coverage pathway for fertility technologies.** This pathway should clearly differentiate established interventions, emerging technologies and experimental procedures.
6. **Embed equity and sustainable financing in fertility policy.** Governments should consider benefit design, financial protection, eligibility criteria and mechanisms to reduce out-of-pocket expenditure.
7. **Strengthen national fertility data systems and transparency.** National registries should monitor access, treatment use, outcomes, complications, demographic disparities and the adoption of emerging technologies.
8. **Protect informed reproductive decision-making.** Fertility education should begin before infertility develops and should address age-related fertility decline, realistic expectations of assisted reproduction, and options for fertility preservation.

The overarching message for policymakers is that innovation in fertility care should be enabled, but must not be allowed to outpace evidence, governance or equity. Governments should neither impede responsible innovation nor permit technological enthusiasm or commercial incentives to determine standards of care.

KEY POLICY MESSAGES

- Fertility innovation should be enabled where it demonstrates value, but should not outpace evidence, regulation or equity.
- National policy should distinguish between established care, emerging technologies and experimental interventions, with clear implications for access, financing and patient counseling.
- Patients should receive transparent information on effectiveness, uncertainty, cost, alternatives and conflicts of interest before adopting new fertility technologies.
- Independent regulation, outcome monitoring and public reporting are essential to protect trust in fertility services.
- Policy should account for cultural, ethical and religious context while preserving scientific integrity, patient autonomy and equitable access.

SECTION 1. INTRODUCTION

The report begins from a simple premise: technology expands the range of reproductive choices, but policy determines who can benefit, on what terms, and with what safeguards. The challenge is to support useful innovation without losing sight of evidence, ethics or equity.

THE SCOPE OF THIS REPORT

This policy report is focused on selected reproductive technologies, not a comprehensive clinical guideline on infertility. It includes three related but different policy objectives: treating infertility; preserving fertility for later use; and responding to the wider burden infertility imposes on individuals and families. A complete health system response extends beyond assisted reproductive technology (ART). It also requires prevention, timely diagnosis, basic fertility services, attention to male infertility, emotional and psychosocial support, affordable care, appropriate follow-up, and consideration of the welfare of children. Advanced technologies are only worth governing well if this foundation exists: a national strategy should fund diagnosis of both partners, including semen analysis and male-factor assessment, basic treatments such as ovulation induction and insemination, and psychosocial support, before it funds add-ons, and should follow the long-term health of children born after new techniques.

THE USE OF ART

Within the broader field of reproductive health, ART has developed from an experimental intervention into an established component of healthcare. Since the birth of the first child following in vitro fertilization (IVF) in 1978,[1] millions of children have been born through IVF worldwide, alongside many more pregnancies resulting from ovulation induction, intrauterine insemination and other fertility treatments. Clinical outcomes have improved and early complications have declined, particularly through the reduction of multiple pregnancies. ART now includes mature techniques and rapidly developing applications. The central questions for this report are: which innovations are supported by evidence; which should remain within research; and which are unlikely to offer meaningful benefit beyond their commercial appeal?

While sperm preservation is a long-established and successful practice, female fertility preservation raises a different set of questions: it may be offered before medical treatment that could impair reproductive function; or used electively to preserve the possibility of having children later. Even so, preservation does not guarantee a future birth. The value of the practice depends on factors such as age, indication (medical or planned), timing, access, cost and the quality of counseling offered to women who undergo the procedure.

FALLING BIRTH RATES AND FERTILITY PRESERVATION

Demographic trends have placed fertility increasingly on national policy agendas. In many affluent countries, including Qatar, women are having their first child later in life.[2] Governments are concerned about falling birth rates, population aging, and changing expectations regarding education, employment and family formation. ART

and fertility preservation may have a limited place in this discussion, but national birth rates are shaped more broadly by housing, employment, childcare, parental leave, gender equality and support for family formation.

Qatar and many other countries are experiencing elements of these demographic transitions. Fertility policy intersects with healthcare, but also with women's participation in education and the workforce, family policy, economic development and population strategy.



Fertility policy intersects with healthcare, but also with women's participation in education and the workforce, family policy, economic development and population strategy.

Fertility services may support people who want children, but they are not a substitute for the wider social and economic policies that shape families. This distinction helps clarify the role of government. Policymakers must increasingly determine: which services should be considered essential healthcare; who should have access to these services; how they should be financed; which emerging technologies should enter routine practice; how evidence should be evaluated; and what regulatory safeguards are necessary to protect patients, future children and society.

USING INNOVATION TO CREATE EQUITABLE ACCESS

The distinction between established treatment, promising innovation and experimental intervention is fundamental to responsible fertility policy. Therefore, the challenge for policymakers is not to choose between innovation and regulation, but to create systems where innovation can progress while evidence, patient protection, equity and public value determine how it enters clinical practice.

DEVELOPMENTS IN REPRODUCTIVE MEDICINE

This report looks at a small number of selected developments in reproductive medicine to determine what the policy questions are, and what they mean for patients, families and policymakers. It does not attempt to cover every new technology. Instead, it concentrates on four areas of technology and market practice (Sections 2 to 5) where the tension between innovation and evidence is still developing, and the choices for policymakers are especially difficult. Section 6 then places these choices in their cultural context and in the specific setting of Qatar.

Section 2 examines oocyte vitrification and the changing role of fertility preservation. Initially developed to preserve a patient's fertility before undergoing medical treatments that could damage ovarian function, the procedure is increasingly used by women who wish to keep open the possibility of having children later in life. Freezing oocytes at a younger age may reduce some of the effects of reproductive aging, but it cannot guarantee a future pregnancy. The section considers the clinical evidence and the wider questions of counseling, expectations, access and reproductive choice in non-medical freezing.

Section 3 examines stem cells, genetic testing and interventions involving embryos and germ cells. Preimplantation genetic testing (PGT) can help couples avoid passing on serious inherited conditions, including thalassemia, which is prevalent in the Middle East, and which can now be treated in affected individuals with somatic gene therapy, a distinct matter from heritable editing of embryos.[3] The evidence is less clear for routine screening for aneuploidy (PGT-A) in the general IVF population, despite more than three decades of use. Newer applications raise still more difficult questions. Polygenic embryo scoring has limited predictive value and blurs the boundary between preventing disease and selecting preferred traits, while heritable genome editing could affect future generations. These uses require a much higher level of scientific, ethical and public scrutiny.

Section 4 looks at the use of AI in fertility care, including embryo assessment, sperm analysis, treatment planning, outcome prediction, laboratory workflow and patient communication. AI may improve consistency and efficiency, but attention and commercial availability are not evidence of better patient outcomes. The section asks what level of clinical validation, transparency, human oversight and accountability should be required when these systems influence decisions for patients and their families.

Section 5 considers the ethics of the commercialization of reproductive medicine. Private investment can expand services and support innovation, but it can also encourage inflated claims and the sale of poorly validated interventions. Patients seeking fertility treatment may be under intense emotional and time pressure, making it difficult to judge uncertain benefits or resist the promise of even a small chance of success. The section examines how regulation can address this imbalance, protect informed choice and prevent higher costs from widening inequalities without improving outcomes.

Section 6 considers Qatar's evolving fertility care landscape in the context of national demographic priorities, public and private provision, existing legal and financing arrangements, and the importance of culturally responsive access. It highlights opportunities to build on current strengths through greater statutory clarity, enhanced outcome reporting, strengthened national data systems, and proportionate oversight that supports responsible innovation.

The technologies covered in this report are very different, but they raise many of the same questions. Where a treatment clearly helps patients, it should be supported. Where the evidence is uncertain, it should be tested properly. Where too little is known, it should remain within research. At every stage, patients need honest information, fair access and effective protection.

The report that follows moves from technological capability to the distribution of power between patients, providers and the fertility sectors, and finally to the policy choices needed to govern fertility care responsibly.

SECTION 2. ELECTIVE EGG FREEZING

Elective egg freezing illustrates the report's central policy challenge: a technically established procedure may still have uncertain value for an individual patient. Policy must therefore connect evidence on outcomes with realistic counseling, equitable financing, culturally responsive care and regulatory oversight.

WHY ELECTIVE EGG FREEZING IS IMPORTANT

Elective egg freezing (also known as planned or social egg freezing) allows women – for non-medical reasons – to store eggs for possible use later in life, often because they are not yet ready for pregnancy. This differs from medical fertility preservation which is used when an illness or treatment may reduce a woman's future fertility. For example, eggs may be frozen before chemotherapy or radiotherapy because these treatments can damage the ovaries. Professional societies removed the 'experimental' label from mature-oocyte cryopreservation in 2013.[4] According to the latest Human Fertilisation and Embryology Authority data, 5,580 of 64,000 UK fertility patients in 2024 froze eggs, although these data do not clearly distinguish between indications.[5]



In many countries there has been a steady rise in the age at which women have children; the number of women wishing to have children at an age where their fertility may be low, in their later 30s and 40s, is increasing.

The key background fact is the decline in female fertility that occurs with age. In many countries there has been a steady rise in the age at which women have children; the number of women wishing to have children at an age where their fertility may be low, in their later 30s and 40s, is increasing. For natural conception, it is the fall in the developmental potential (or quality) of the oocytes remaining within the ovary that is most important. This quality is reflected by changes in the chromosomal cohesion, which deteriorates over the time since meiosis is initiated during fetal life, and results in rising rates of oocyte and embryo aneuploidy (the presence of an abnormal number of chromosomes). Attempts to overcome this with assisted reproduction are compromised by the concurrent decline with age in the number of follicles in the ovary, resulting in fewer and poorer-quality oocytes being obtained in older women. Elective egg freezing seeks to overcome this with cryopreservation of eggs at a younger age when pregnancy is not wanted, for the possibility of using them later when the woman wishes to conceive.

The policy question is not whether elective egg freezing should be available, but how its benefits and limitations should be communicated and governed.

Currently, many women are storing their eggs when they are already in their later reproductive years, and the proportion returning to use them is low, around 10 percent in pooled analyses, although this partly reflects short follow-up: a cohort followed for up to 10 years reports return rates of 27.4 percent.[6]

As age is such an important determinant of success, live birth rates are substantially higher in women under the age of 35 at the time of cryostorage than in older women. In a meta-analysis,[7] the live birth rate per woman who returned to use her eggs was 28 percent overall: 52 percent in women aged under 35 at freezing, 34 percent at age 36 to 39, and 19 percent at age 40 and over. Modeled estimates[8] suggest that women aged under 35 typically need around 10 to 15 mature oocytes for a 50 to 70 percent chance of at least one live birth, and that older women need considerably more. This highlights that many women, even under the age of 35, may need to undergo more than one cycle of ovarian stimulation and egg recovery to achieve the likelihood of later success that they wish, and that this may not be possible for older women, even with multiple cycles of treatment. It is unclear how many women do not return to use cryopreserved oocytes because they have conceived naturally.

OUTCOMES, RISKS AND COSTS

Counseling and public reporting should present outcomes by age at freezing and by the number of mature oocytes stored. Data should record live birth rates per woman who starts treatment as the preferred patient-centered measure and show cumulative outcomes where appropriate. Reports should separately state the proportion who return to use stored oocytes, because continued storage does not mean that there will not be a future treatment attempt. Patients should also receive clear information on the risks and burdens of ovarian stimulation and retrieval; the possibility that more than one cycle may be needed; storage and later treatment costs; and the uncertainty that remains when follow-up is incomplete.

Evidence from mixed cohorts, including studies combining medical and elective fertility preservation, should not be applied to elective users without explicit qualification. Laboratory measures such as oocyte survival after warming or fertilization rate should never be presented as the chance of taking home a baby; the figure that matters to a woman deciding whether to freeze is the cumulative live birth rate per woman who stores eggs, which also reflects the majority who never return.

GOVERNANCE AND REGULATORY IMPLICATIONS

Regulators should answer a consistent set of questions on eligibility; provider oversight; consent; counseling; storage and disposition; advertising; pricing; and culturally legitimate care. Please see the Appendix for a suggested regulator checklist.

RISKS, ETHICS AND PATIENT CHOICE

- **Informed consent:** It is crucial that women are provided with comprehensive and clear information that enables them to make an informed decision about egg freezing. Necessary elements of this information include: discussion of potential risks and side effects; clear communication about potential success rates; transparent information regarding the costs of the procedure; the likelihood that stored eggs will never be used; the absence of any guarantee of a birth; the obstetric risks of pregnancy at older ages; ongoing storage charges and consent renewal; and what happens to stored eggs on death, separation, relocation

or non-payment. Some may also argue that the availability of counseling or a similar space to think through the potential implications and consequences of egg freezing is also an essential component to facilitate informed consent.

- **Safety and efficacy of treatment:** It is an important ethical, as well as practical, requirement that any fertility treatment that is provided for patients is safe and efficacious.
- **Aftercare and follow-up:** What kind of aftercare are women receiving following egg collection and is there appropriate follow-up regarding their short-, medium- and long-term health outcomes?
- **Reasonable expectations:** Are women clear about their potential chances of having a baby using their frozen eggs? Or are they under misapprehensions about the level of 'insurance' the technology can provide?
- **Women's experiences and feelings:** Is there research available about how women themselves are experiencing egg freezing and what their feelings and reflections are afterwards?
- **Religious and cultural sensitivity:** Some patients may have religious, cultural or personal concerns about transvaginal scanning or oocyte retrieval. Services should explain clinically appropriate alternatives where available, avoid assumptions based on marital status or culture, and support informed choice through respectful, confidential counseling.

EQUITY, FINANCING AND COMMERCIAL PRESSURE

- **Access and equality:** Who can afford or access this technology? How are the costs for egg freezing set and by whom? (For example, by individual clinics or by state? Is there professional body guidance?) Is the pricing of egg freezing creating further and problematic inequalities within society? If so, can those inequalities be addressed, minimized or mitigated?
- **Funding:** Is there any form of funding provision for egg freezing? If so, who is providing this (employers, insurance, state health service), and who are they providing it for? (That is, is it just for women who are freezing for 'medical' reasons or for everyone? How are these decisions made and justified?)
- **Commercialization and advertising:** Is there widespread advertising of egg freezing? Where does such advertising appear and who does it target? Is it considered appropriate?

RELIGIOUS, CULTURAL AND SOCIAL CONSIDERATIONS

- **Demographics:** How does egg freezing in a given social context or jurisdiction interact with general attitudes to fertility and family planning? For example, we know that there is a global trend for delaying motherhood and this has an impact on why egg freezing is seen by some as an attractive technology. What are the specific local contexts?
- **Relationships:** What is the local context regarding gender relationships and relationship stability? Empirical research has shown that relationship reasons (including the lack of a partner or the lack of a suitable partner) are

the primary drivers for women who are freezing their eggs,[9] so it is important to understand the demographic realities and considerations shaping women's decision-making.

- **Work life:** What is the local context of maternity provisions, particularly in employment? What is women's participation in the labor market and the associated motherhood penalty? Are women able to access good maternity leave, job security and flexible working arrangements? These considerations have a direct impact on women's decision-making regarding whether and when to start a family.
- **Stigma:** What are local attitudes to both motherhood and childlessness? Is there an inherent pressure on women to use fertility technologies?
- **Fertility awareness:** In some settings, family expectations, consent practices and stigma may make it difficult for unmarried women to discuss or access fertility preservation. Broader, accurate fertility information for women and men can help reduce stigma, support family conversations and improve understanding of age-related fertility decline.
- **Social discourse:** Who is leading or contributing to the creation of social attitudes and discourses around egg freezing? Is this topic covered accurately in the media and across social media, or are certain ideological positions or types of misinformation rampant? If so, do these need to be addressed, and how?
- **Non-maleficence and proportionality:** When considering who is being targeted to freeze their eggs (particularly by commercial interests), it is important to ask what kind of balance there is between the potential risks and discomforts of ovarian stimulation and egg retrieval versus the uncertain prospects of future benefit. This balance will be different for different women, depending on their age, life plans, reproductive health, and so on.
- **Reproductive empowerment or pressure:** Is egg freezing, as practiced in a particular social context or jurisdiction, giving more women genuinely more reproductive options and thereby enhancing their reproductive empowerment and autonomy? Or is it creating further pressures for women, who are struggling to give themselves reproductive choices within a context that is inhospitable to motherhood or reproductive autonomy?
- **Medicalization of social problems:** Society must consider whether egg freezing is becoming a temporary solution for the problem of delayed reproduction and falling fertility rates, and whether better, more equitable and more just solutions to such problems must be considered.

IMPLICATIONS FOR GOVERNMENTS AND REGULATORS

1. **Standardize counseling and outcome reporting.** Regulators should require providers to report age at freezing, number of mature oocytes stored, utilization, complications, total costs and live birth outcomes using transparent patient-centered denominators. Marketing should not present egg freezing as insurance or imply a guaranteed future birth.

2. **Define equitable and culturally responsive access.** Governments and payers should distinguish medical from elective fertility preservation, publish eligibility and coverage criteria, protect informed choice, and ensure that service design responds respectfully to religious, cultural and personal concerns without relying on unsupported assumptions.

Implementation considerations: Policy design should also address employer- or insurance-sponsored freezing (which can support autonomy but may also signal that parenthood should be deferred for work), cross-border transfer of stored oocytes, and the clinical factors that shape individual prognosis.

Key conclusion: Elective egg freezing is a technically established procedure whose value for an individual woman depends on her age at freezing, the number of mature oocytes stored and whether she ever returns to use them. Most women who freeze do not return; among those who do, roughly one in three to one in two will have a child, with much lower chances when eggs are frozen after the age of 35. Policy should therefore secure honest, age-specific counseling using per-woman denominators, transparent total costs, clear rules on storage and disposition, and protection from marketing that presents freezing as insurance, while respecting each woman's right to make an informed choice.

The next section turns from preserving reproductive potential to selecting and modifying reproductive material, where questions of evidence, consent and future generations become even more acute.

SECTION 3. STEM CELLS, GENETIC TESTING AND GERMLINE INTERVENTION

Stem-cell science, preimplantation genetic testing (PGT) and germline intervention span very different stages of clinical maturity. Some uses of PGT are established for defined genetic risks; other applications remain uncertain, research-only or speculative. This section applies the report's common test to ascertain: what patient benefit is demonstrated; what remains uncertain; do commercial claims exceed evidence; and what should governments and regulators permit, monitor or restrict?

Across these technologies, proof of concept does not establish clinical benefit. Adoption of technology should follow independent evidence, transparent counseling and a clear separation between registered research and routine care.

CURRENT USE AND EVIDENCE: STEM-CELL APPLICATIONS

Stem-cell applications relevant to fertility span a spectrum – from tissue regeneration (already tested in patients) to gamete generation (still confined to animal models), to structures whose ontological status (embryo or embryo-like model) remains contested. Policy must track this spectrum precisely rather than treat stem cells as a single, undifferentiated technology.

ENDOMETRIAL AND ADULT STEM CELLS: RESEARCH ONLY

The endometrium includes adult stem/progenitor cell populations and bone-marrow material that adds to its remarkable monthly regeneration. This biology has motivated clinical attempts to use autologous (from an individual's body) or allogeneic (from a donor) mesenchymal stem cells to treat thin, scarred or otherwise dysfunctional endometrium and recurrent implantation failure. Early trials report improved endometrial thickness, vascularity and, in some series, implantation outcomes. However, as with other ART add-ons (supplementary interventions), the certainty of this evidence remains low: studies are small, heterogeneous in cell source, dose and delivery route, and rarely randomized. No adequately powered randomized trial has shown an improvement in live birth, and long-term safety data are absent. Best practice recommendations by the European Society of Human Reproduction and Embryology (ESHRE) for add-ons in reproductive medicine classify regenerative interventions such as platelet-rich plasma (PRP) infusion as lacking sufficient evidence for routine use, and recommend that they remain confined to registered research protocols with transparent patient counseling.[10]

IN VITRO GAMETOGENESIS (IVG): SPECULATIVE CLINICAL POTENTIAL

The prospect of generating human oocytes and spermatozoa from pluripotent stem cells – IVG – has advanced considerably in animal models, with live, fertile offspring obtained from stem-cell-derived gametes in mice. In humans, differentiation has so far been achieved only to early meiotic or primordial germ cell-like stages, well short of functional gametes. Even if functional gametes are eventually produced, genomic and epigenetic fidelity and the long-term health of offspring would need to be established across generations before any clinical use. IVG could, in principle, offer genetically related children to people who currently have no gametes of their own – for example, after chemotherapy, in premature ovarian insufficiency, or in absolute azoospermia. However, no clinical application currently exists, nor is one imminent.[11] International scientific and bioethics bodies agree that clinical translation would currently be premature and unsafe. They recommend that research remains strictly laboratory-based, overseen by institutional review, until safety and efficacy can be demonstrated.[12]



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STEM-CELL-BASED EMBRYO MODELS: SCIENTIFIC VALUE AND GOVERNANCE UNCERTAINTY

A related but distinct development is the generation of stem-cell-based embryo models – structures that self-organize and can repeat aspects of early post-implantation development in culture, which in non-human models have been cultured to developmental stages beyond those permitted for human embryo research. These models are scientifically valuable for studying early human development without requiring donated embryos, but their resemblance to embryos raises questions analogous to the 14-day limit on human embryo research: because these models are not embryos and are not created by fertilization, most existing statutes do not cover them. The 2021 revised International Society for Stem Cell Research guidelines call for dedicated oversight of such models – distinct from, but informed by, existing embryo research frameworks.[12] Commentators have stressed that ethical debate must run in parallel with, not behind, the science.[13] In the European context, most jurisdictions have no explicit legal framework for such models.

CURRENT USE AND EVIDENCE: PREIMPLANTATION GENETIC TESTING

Established indications: PGT-M and PGT-SR

Preimplantation genetic testing (PGT) for monogenic or single-gene disorders (PGT-M) and PGT for structural chromosomal rearrangements (PGT-SR) are established, medically indicated technologies for couples at defined genetic risk, governed by well-described technical and good-practice standards.[14]

The use of PGT for aneuploidy (PGT-A) was initially based on the hypothesis that aneuploidy indicates a non-viable embryo, and the knowledge that aneuploidy increases sharply in women after 35, with decreased live birth rates and increased miscarriage rates. Chromosomal mosaicism (two or more genetic cell lines) levels are high and, for many years, such mosaic embryos were discarded, until it was demonstrated that mosaic embryos could be viable and that low-grade mosaics behave much like euploid embryos (with the correct number of chromosomes). This led to a policy of transferring mosaic embryos if no euploid embryos were available.

PGT-A is now more widely used as a screening test intended to shorten time-to-pregnancy and reduce miscarriage. However, after three decades of iteration, the evidence for a net benefit in live birth rate for the general IVF population remains contested, with a Cochrane medical research review concluding that current data are insufficient to support routine use of the PGT-A screening test.[15] Furthermore, a recent observational study based on the Human Fertilisation and Embryology Authority data from the UK found that PGT-A as used in routine care was associated with lower live birth rates at first transfer and cumulatively, alongside fewer pregnancy losses; in almost half of PGT-A cycles, no embryo was transferred in the first cycle.[16] In randomized trials, PGT-A has not improved cumulative live birth per woman or per cycle started (intention to treat);[17] an apparent benefit per transfer in women aged over 35 reflects the exclusion of embryos before transfer rather than more babies born. The case against routine use[18] rests on the viability of mosaic embryos, false-positive results that lead to transferable embryos being discarded, the safety of trophectoderm biopsy, and cost. Any value is likely to be confined to selected older women with several blastocysts, for whom a shorter time to pregnancy may matter more than cumulative live birth; this should be explained in counseling rather than offered routinely.

Polygenic embryo screening: research only

Building on the falling cost of genome-wide genotyping, some commercial laboratories now offer polygenic embryo screening (PES, or PGT-P), ranking embryos by a modeled genetic liability for common, multifactorial conditions or, more controversially, for non-medical traits. The predictive value of polygenic scores at the level of a single embryo is inherently limited: full siblings differ little in polygenic risk (so the absolute difference in risk between embryos from the same couple is small, and smaller still when only a handful of embryos is available), ancestry-based miscalibration of scores is well documented, and pleiotropic effects (where a single gene influences multiple traits) mean that selecting against one trait may inadvertently select for another. Both the European Society of Human Genetics – a position formally

supported by ESHRE – and, more recently, a joint report by the American Society for Reproductive Medicine (ASRM) Ethics Committee and Practice Committee concluded that PES is unproven and should not be offered clinically at present, and that any use should be confined to research under ethics-committee oversight;[19] the European Society of Human Genetics went further, describing its clinical use as unethical.[20] The American College of Medical Genetics and Genomics has reached a similar conclusion regarding the clinical utility of PES/PGT-P.[21]

Heritable human genome editing: not ready for clinical use

In November 2018, Chinese biophysicist He Jiankui announced the birth of twin girls whose embryos had been edited with clustered regularly interspaced short palindromic repeats and CRISPR-associated protein 9 (CRISPR-Cas9) genome editing technology at the C-C chemokine receptor type 5 (CCR5) locus, intending to confer HIV resistance. The intervention proceeded without adequate preclinical evidence, transparent ethical review or valid informed consent. The procedure produced unintended and incompletely characterized edits, and led to the researcher's imprisonment. The episode remains the defining case for keeping heritable human genome editing outside clinical application: mosaicism, off-target and on-target risks, the inability of future generations to consent and the absence of societal agreement all support continued restraint and robust international governance.[12] Laboratory research into safety and precision may continue under appropriate oversight, but there is no present scientific or ethical basis for clinical use.

RISKS, ETHICS, EQUITY AND COMMERCIAL PRESSURE

- **The hope–reality gap:** Across every technology reviewed here, patient and public expectations regularly exceed demonstrated benefit – a gap between hope and reality that commercial providers, and occasionally predatory or low-quality journals, can exploit to market unproven interventions at a cost to vulnerable patients.
- **Research versus routine care:** Regulators, professional bodies and clinicians share responsibility for keeping the boundary between 'research' and 'routine care' visible to patients. What is offered inside a registered research protocol, with independent oversight, must not be presented or priced as established treatment.
- **Generalization across fields:** Evidence and governance developed for one stem-cell application (for example, oncology) cannot simply be extrapolated to reproductive applications; each requires its own evidence base and regulatory pathway.
- **Patient counseling:** Both stem-cell interventions and advanced genetic testing require counseling that is explicit about uncertainty, other options, and the difference between statistical risk reduction and guaranteed outcome.

IMPLICATIONS FOR GOVERNMENTS AND REGULATORS

1. **Protect the research–care boundary.** Regulators should limit endometrial stem-cell interventions, in vitro gametogenesis, polygenic embryo screening and research on embryo models to registered, ethically approved research until robust evidence establishes safety, effectiveness, equity and patient benefit. These interventions should not be marketed, reimbursed or priced as established care.

2. **Use indication-specific evidence and international governance.** Public funders should support independent multicenter studies of promising interventions, while regulators and international bodies should maintain explicit governance for embryo models and heritable genome editing. PGT should be assessed by indication and by patient-centered outcomes, not treated as a single category.

Key conclusion: Stem-cell science and genetic testing show why technology status must be explicit: established indications should be supported, uncertain uses evaluated, research interventions kept within research, and speculative applications excluded from clinical care. The same discipline is required when algorithmic tools enter embryo assessment.

Having considered technologies that act on embryos and gametes, the report next examines how AI's algorithmic tools are entering the laboratory and reshaping responsibility for clinical decisions.

SECTION 4. AI-DRIVEN EMBRYO SELECTION

Artificial intelligence (AI) is already being marketed and used for embryo grading and selection, but availability of the technology does not guarantee patient benefit. This section assesses current evidence, uncertainty, risks, commercial incentives and the governance required when AI influences clinical decisions. It applies the same standard used elsewhere in the report: adoption should depend on demonstrated value, transparent disclosure, patient choice, data safeguards and accountability by a named human.

CURRENT USE AND EVIDENCE

Conventional embryo grading is subjective and shows substantial interobserver variability. AI-assisted grading may offer a more reproducible, standardized scoring process that is less affected by operator fatigue or experience.[22] In the largest published randomized controlled trial (RCT), the algorithm was roughly 10 times faster than an embryologist at selecting an embryo. However, the study did not demonstrate non-inferiority (that the algorithmic method was not unacceptably worse than the embryologist) for its primary outcome of clinical pregnancy, and the study did not assess live birth as the primary endpoint; live birth, a secondary outcome, was 39.8 percent with the algorithm and 43.5 percent with morphology – a difference that was not statistically significant.[23] The time saving therefore indicates potential workflow efficiency, not improved patient outcomes. Claims that AI will lower the cost of ART or narrow access gaps remain hypotheses that require real-world economic and equity evaluation.[24]

WHAT REMAINS UNCERTAIN

The strongest evidence gap relates to patient outcomes. The largest available RCT[24] did not demonstrate non-inferiority for clinical pregnancy, and no adequately powered RCT has yet shown that AI-based embryo selection improves live birth rates over expert morphological assessment. Any evidence from the American Society for Reproductive Medicine 2025 conference abstract[25] should be treated as preliminary until a complete peer-reviewed publication is available.

Beyond efficacy, two further problems are reported. First, generalizability is poor. Models trained on one platform's imaging system, incubation protocol and patient population often perform worse when externally validated on another's, and only a minority of published models have been rigorously externally validated across sites.[22] Second, most deployed models remain uninterpretable black boxes where only patients' data, variables and prediction are visible, but not why the AI made that particular decision. This creates a genuine epistemic and ethical problem, since neither embryologists nor patients can verify why a given embryo was ranked highest, and there is emerging evidence that black-box models can underperform compared to simpler, interpretable models.[26,27] Some commentators argue that only interpretable glass-box models should be used clinically, where the AI reasoning is visible and traceable.[26]

POTENTIAL FUTURE USE

Future systems are likely to combine multimodal AI models that integrate imaging with clinical history, genetic and morphokinetic (timing) data. This would result in individualized prognosis rather than scoring embryos in isolation. Early prototypes of such whole-cycle systems already exist.[28] AI could also provide expert-level decision support in clinics that lack a senior embryologist, which is particularly relevant to expanding access in low-resource settings.[24]

EVIDENCE AND IMPLEMENTATION GAPS

Poor external validity remains the most important limit of the actual tools available on the market. Isolated data sources and jurisdictional privacy limits restrict the pooled, diverse datasets needed to fix this problem. Federated learning (training models across institutions without centralizing raw patient data) has been proposed as a technical workaround but is not yet standard practice. Adoption of the CONSORT-AI international reporting guideline[29] and the corresponding prediction-model standard is recommended.[30]

RISKS, ETHICS AND EQUITY

Disclosure, consent and the right to decline

Patients should be told before treatment whenever AI will contribute to embryo grading, ranking or selection, because this will influence which embryo is transferred. Disclosure should be in plain language, explaining the tool's role, supporting evidence and limitations. Patients should also have an unambiguous right to decline AI involvement and receive embryologist-only assessment as a standard care alternative without financial or clinical penalty.



Patients should be told before treatment whenever AI will contribute to embryo grading, ranking or selection, because this will influence which embryo is transferred.

Benefits, harms and accountability

Potential harms include misranking embryos because of software failure, model drift, dataset shift or reliance on features unrelated to the intended clinical outcome. Reported accuracy is also inflated when training and test data overlap, when performance is measured only on embryos that were transferred (embryos never transferred have no outcome label), and when models are updated after validation without re-evaluation.

Models may also reproduce unwanted correlations, including ancestry-associated patterns, if training data and performance are not adequately assessed across populations. Additional harms include automation bias, loss of clinical skills and unclear accountability, particularly for junior or early-career embryologists.[31]

Equity and commercial pressure

Sole reliance on AI for embryo selection without meaningful human oversight creates responsibility gaps.[31] Embryo ranking is a consequential clinical decision for patients and potential future children, and it should be made in a transparent fashion to the providers of the gametes. The Principles for the Ethical Use of Artificial Intelligence in the United Nations System govern United Nations system entities and are not, by themselves, rules that clinics can breach. The stronger basis for clinical recommendations is the broader United Nations Educational, Scientific and Cultural Organization (UNESCO) framework and relevant health-sector guidance (neither of which is binding law, so their force comes through national regulation), which emphasize human oversight, transparency, safety, privacy and accountability.[32] Commercial pressure may encourage clinics to market unproven AI add-ons at a premium, and claims that AI will reduce IVF costs should also be tested empirically.

Data governance and privacy

The right to privacy of personal and identifying information pertains to all medical treatments and research, but may be more at risk when generated for AI models. This right to privacy is also upheld by the United Nations principles.[32] Data generated should not be sold without the consent of the patient. For patient protection there should be regular upgrades in data protection such as de-identification, system audits and penetration testing to prevent unauthorized access or use of the data.

IMPLICATIONS FOR GOVERNMENTS AND REGULATORS

1. **Require evidence and external validation.** Regulators should require clinically relevant evaluation, including live birth where feasible, and stable performance across sites, imaging systems and patient populations before AI is used beyond supervised decision support.
2. **Protect disclosure and patient choice.** Providers should disclose AI use in writing, explain its role and limitations, and preserve the patient's right to decline without penalty.
3. **Maintain named human accountability.** A supervising embryologist should remain responsible for the final decision and document any reliance on, or departure from, the AI output.
4. **Govern data and commercial claims.** Authorities should require privacy, cybersecurity, audit, model-change monitoring, clarity on who owns patient images and data and what vendors may do with them, post-deployment monitoring of outcomes, and truthful advertising, and should assess cost and equity claims rather than assume them.

Key conclusion: AI may improve consistency and workflow, but current evidence does not show improved live birth outcomes over expert assessment. It should therefore remain a supervised decision-support tool subject to independent validation, disclosure, patient choice, data governance and named human accountability. Where clinics charge for AI without demonstrated patient benefit, the issue becomes one of commercial governance as well as clinical evidence.

Several technological advances described above have commercial implications that may benefit patients but could also distort appropriate care. The ethical implications of commercialization in ART are discussed in the next section of this report.

SECTION 5. THE ETHICS OF COMMERCIALIZATION IN ASSISTED REPRODUCTIVE TECHNOLOGY

Commercial investment can expand capacity and support innovation in ART, but it also shapes which services are promoted, how outcome uncertainty is described, and who can afford care. This section examines conflicts of interest, provider–industry relationships, third-party reproduction and cross-border care, egg-freezing and commercial marketing, IVF add-ons and direct-to-consumer marketing, and the governance and regulatory safeguards needed to maintain patient welfare, evidence and public value as a priority ahead of commercial incentives.[33]

WHY COMMERCIALIZATION IS AN ISSUE

Commercialization is not inherently unethical. Concern arises when financial incentives distort clinical judgment, exaggerate likely benefit, weaken consent, or shift effective care to only those able to pay. The policy task is to permit responsible investment while requiring transparency, independent evidence, fair access and effective accountability.

CONFLICTS OF INTEREST AND PROFESSIONAL RESPONSIBILITY

Professionalism represents a moral contract between the medical profession and society, requiring physicians to place the interests of patients above personal gain. Pellegrino argued that medicine differs fundamentally from commercial enterprises because its primary objective is healing rather than profit generation. Accordingly, professional success should be measured by ethical conduct, quality of care, and service to society rather than financial performance.[34]



Professional success should be measured by ethical conduct, quality of care, and service to society rather than financial performance.

These principles are particularly relevant in ART, where patients often seek treatment during periods of emotional distress and may therefore be especially vulnerable to persuasive marketing or unrealistic expectations regarding treatment success. Although commercial investment has contributed significantly to innovation and improved access to fertility care, financial incentives may unintentionally shift the focus from patient-centered care to consumer-driven healthcare.

Conflicts of interest are among the most significant ethical challenges associated with the commercialization of ART. A conflict of interest exists when secondary interests, such as financial gain, academic advancement, institutional incentives, or professional recognition, have the potential to influence professional judgment concerning patient welfare or scientific integrity. Importantly, the existence of a conflict of interest does not imply misconduct, but highlights circumstances requiring transparency and

appropriate management. Fauser and Macklon observed that nearly every clinician or researcher has some form of competing interest, whether financial or non-financial. The ethical objective is therefore not to eliminate all conflicts but to recognize, disclose and manage them responsibly.[35]

Financial conflicts often receive the greatest scrutiny, but non-financial interests, including academic prestige, career advancement, institutional affiliations and personal beliefs, may also influence professional judgment. Conflicts may arise throughout research and clinical practice, including study design, industry-funded research, publication, guideline development, and clinical decision-making. While industry collaboration has been instrumental in advancing reproductive medicine, it must remain transparent and should never compromise scientific independence or evidence-based patient care. Supporting this concern, Nejstgaard et al. demonstrated an association between declared conflicts of interest and favorable recommendations in clinical guidelines, advisory committee reports, opinion pieces and narrative reviews. Although conflicts do not invalidate scientific evidence, they reinforce the importance of independent guideline development, rigorous peer review, and balanced interpretation of research findings.[33]

PROVIDER–INDUSTRY RELATIONSHIPS

Collaboration between clinicians and industry has contributed substantially to advances in reproductive medicine through research, innovation, pharmaceuticals and medical technologies. Such partnerships are valuable and often necessary, but they also require careful management to preserve professional independence and public trust. Financial relationships, including consultancy fees, sponsored education, research funding, and corporate ownership of fertility services, may unintentionally influence clinical decision-making. Furthermore, Farquhar et al. emphasized that clinicians must openly acknowledge competing interests and ensure that patient welfare remains paramount.[36]

THIRD-PARTY REPRODUCTION AND CROSS-BORDER CARE

Third-party reproduction, including oocyte donation and surrogacy, is one of the most ethically sensitive areas of ART because it involves individuals who assume medical and psychological risks without becoming the intended parents of the child. Ethical considerations therefore extend beyond the intended parents to include the rights, welfare and autonomy of donors, gestational carriers and the future child.

Commercialization has intensified concerns regarding the balance between fair compensation and the commodification of human reproduction. While reimbursement for medical expenses, time, inconvenience, and loss of income is ethically acceptable, excessive financial incentives may undermine voluntary decision-making and exploit economically vulnerable individuals.

Pennings et al. found that oocyte donors are motivated by a combination of altruism and financial reimbursement, with higher compensation increasing the importance of financial motivation. These findings support the need for compensation to remain proportionate rather than becoming an inducement to undergo invasive procedures.[37]

Surrogacy raises additional ethical concerns because it involves the interests of the intended parents, the gestational carrier and the future child. The 2025 ESHRE Ethics Committee considers non-commercial surrogacy ethically acceptable when supported by careful medical and psychological assessment, informed consent, independent counseling and appropriate legal safeguards. The committee emphasizes four ethical principles: respect for autonomy; proportionality; justice; and protection from exploitation. Gestational carriers should make decisions free from coercion, receive fair reimbursement for genuine expenses, and retain autonomy over medical decisions throughout pregnancy. Commercial surrogacy, particularly where financial vulnerability influences participation, carries a greater risk of exploitation and commodification, and should therefore be subject to strict regulation.[38]



Clinicians must openly acknowledge competing interests and ensure that patient welfare remains paramount.

Cross-border reproductive care further complicates third-party reproduction because differences in national legislation may encourage patients to seek treatment abroad. Fertility centers have an ethical responsibility to provide transparent information, ensure continuity of care, and protect the welfare of donors, gestational carriers, intended parents, and children born through these arrangements.[39]

Ultimately, the ethical acceptability of third-party reproduction depends on safeguarding informed consent, professional integrity, and the welfare of all parties rather than commercial interests.

EGG-FREEZING AND COMMERCIAL MARKETING

With the advances in vitrification technology and changing social trends, elective egg freezing has become increasingly popular. While this offers women greater reproductive autonomy by preserving fertility potential, its commercial expansion has raised concerns regarding direct-to-consumer marketing and unrealistic expectations of future reproductive success.

Marketing often portrays egg freezing as a form of 'fertility insurance', despite the fact that success depends on several factors, particularly the woman's age at oocyte retrieval and the number of oocytes stored. Patients should therefore receive balanced information regarding expected success rates, procedural risks, treatment costs, storage fees, and the limitations of fertility preservation to ensure truly informed decision-making.[40]

IVF ADD-ONS AND DIRECT-TO-CONSUMER MARKETING

Commercialization has also contributed to the widespread use of IVF add-ons – supplementary investigations or interventions offered in addition to standard IVF treatment, despite limited or inconsistent evidence that such add-ons improve live birth rates.[41]

Patients undergoing fertility treatment are often emotionally vulnerable and may therefore be more susceptible to interventions that promise even modest improvements in treatment success. Commercial pressures may encourage the routine use of adjunctive treatments before adequate evidence of effectiveness has been established, potentially challenging the principles of evidence-based medicine and informed consent.[10]

GOVERNANCE AND REGULATORY SAFEGUARDS

Transparency is fundamental to maintaining ethical standards in ART. Disclosure of financial relationships, research funding, consultancy roles and other competing interests enables patients, colleagues and policymakers to evaluate clinical recommendations in an informed and objective manner. However, disclosure alone is insufficient to eliminate bias. Ethical practice also requires robust institutional governance, independent guideline development, peer review and regulatory oversight to ensure that commercial interests do not compromise patient welfare or scientific integrity.

Professional societies play an important role in establishing ethical standards, promoting evidence-based practice, and supporting accountability among fertility specialists and ART centers. Similarly, governments and regulatory authorities should ensure equitable access to fertility services, as inadequate public funding may inadvertently encourage excessive commercialization by shifting the financial burden onto patients.

IMPLICATIONS FOR GOVERNMENTS AND REGULATORS

1. **Regulate claims, conflicts and ownership.** Authorities should require disclosure of financial and non-financial interests, transparent ownership of fertility services, truthful advertising, independent guideline development and proportionate enforcement.

2. **Link payment to evidence and patient value.** Governments and payers should use an evidence-to-coverage pathway for add-ons and emerging technologies. They should require transparent full-cycle pricing (including drugs, monitoring, storage and any add-ons), success rates reported with explicit denominators and risk adjustment, rules on patient selection and on refund or financing schemes. They should also prevent research interventions from being presented or priced as established care.

3. **Protect all parties and improve affordability.** Regulation should safeguard patients, donors, gestational carriers and future children; ensure independent counseling and continuity of care; and reduce reliance on out-of-pocket payment for effective treatment.

Key conclusion: Commercial practice becomes ethically problematic when payment, promotion or ownership weakens evidence-based counseling, informed choice or fair access. The regulatory response should address systems and incentives, not rely only on individual professional virtue.

The next section looks at priorities for the specific context in Qatar.

SECTION 6. PRIORITIES FOR VALIDATION AND POLICY DEVELOPMENT IN QATAR

STRATEGIC CONTEXT: FERTILITY DECLINE AND NATIONAL FAMILY POLICY

Fertility has become an increasingly important strategic policy issue for Qatar. Official statistics indicate a sustained decline in the total fertility rate among Qatari women, from 2.9 births per woman in 2017 to 2.6 births per woman in 2019.[42] Qatar's Third National Development Strategy (NDS3) 2024–2030 explicitly recognizes this trend, setting a national target of 3.0 births per woman by 2030.[43] Because Qatari citizens constitute a minority of the resident population, sustaining the national population and enabling citizens who wish to grow their families are legitimate strategic priorities.

THE IVF SECTOR: PUBLIC PROVISION, STATE-SUPPORTED SERVICES AND A GROWING PRIVATE SECTOR

Qatar's evolution in assisted reproduction illustrates the maturation of its health system. Before domestic capacity matured, Qatari couples requiring in vitro fertilization (IVF) were routinely referred overseas. The WISH 2020 report on Islamic ethics and infertility treatment notes that this placed a substantial economic burden on the government while creating emotional and logistical strain for patients and their families.[44] Under the national treatment-abroad framework, the state would cover the full cost of approved treatment, travel arrangements and airfares, as well as daily allowances for accommodation, food and local transportation for the patient and authorized companions. This model was particularly resource-intensive for fertility care, with historical IVF journeys sometimes extending into early pregnancy and, on occasion, until delivery.

Over the past three decades, Qatar has invested heavily in developing local reproductive medicine capacity. As a result, most conventional and many complex infertility conditions can now be evaluated and treated within the country, reducing the clinical need to refer patients abroad. This trend is reflected in unpublished governmental referral data from the International Medical Affairs Office, which documented a decline in approved referrals for IVF treatment abroad from 92 cases in 2014 to 21 cases in 2025.[45] Therefore, seeking IVF treatment overseas has become a relatively small and selective residual pathway compared with the scale of seeking care locally in Qatar.

Qatar's fertility care sector now comprises public, state-supported and private providers. Hamad Medical Corporation's Women's Wellness and Research Center (WWRC) delivers the principal public sector reproductive medicine pathway. Historically, public provision has dominated the sector. WWRC has provided IVF to Qatari nationals without point-of-care charges, and has offered subsidized care to eligible non-Qatari residents. In this model, private centers often served as an 'overflow' market for patients facing lengthy public sector waits or capacity constraints. According to Hamad Medical Corporation, IVF

access for non-Qatari residents is reported to have been restricted during 2026,[45] directing more self-paying patients to private providers. Given the limited private insurance coverage for IVF, most private ART expenses for these patients are now paid out of pocket.

In recent years, Qatar's Ministry of Public Health (MoPH) has promoted a transition from a highly centralized and fragmented public healthcare system toward an integrated public–private partnership model. As part of efforts to optimize national healthcare capacity, greater private-sector participation may help accommodate excess demand, shorten waiting times for specialized services such as IVF, expand the range of healthcare options available to citizens and residents, and accelerate the adoption of advanced and innovative technologies.

LEGAL ARCHITECTURE

At the time of this report, Qatar had no dedicated ART statute comparable to the specific assisted-reproduction laws enacted in Saudi Arabia, Bahrain and the United Arab Emirates. This does not mean that ART is unregulated. In Qatar, ART is governed within a broader framework comprising health facility licensing, professional licensing and clinical privileging, patient consent law, research governance, institutional policy and MoPH inspection.[46,47] Across the Gulf Cooperation Council, assisted reproduction regulation varies considerably. Saudi Arabia,[48] Bahrain[49] and the United Arab Emirates[50,51] have dedicated ART legislation. Oman combines general medical law with detailed MoPH standards.[52]

While Qatari general law can regulate medical practice, it does not adequately address the distinct issues arising from ART. These issues include sensitive matters such as non-medical oocyte cryopreservation, sex selection, the duration of storage and disposition of gametes/embryos, the cross-border movement of reproductive material, and the governance of emerging technologies such as polygenic embryo scoring and AI-assisted embryo selection.

Qatar established its first national clinical framework for infertility through the MoPH National Clinical Guideline: The Management of Infertility (2020).[53] Although this was an important step, clinical guidance could not substitute for legislation on matters involving rights, permissions, prohibitions, consent, family status, or the ownership and disposition of reproductive material. The guideline was substantially revised and approved in 2026, but remains unpublished at the time of this report. The revised version intentionally did not address several practices of significant social and religious sensitivity, notably planned non-medical egg freezing and non-medical gender selection. The rationale for this was to avoid embedding prohibitions or contested permissions in clinical policy guidance when such issues are more appropriately addressed through legislation and formal societal governance.

The absence of a dedicated statute is therefore best understood as a policy development opportunity. Drawing on the experience of neighboring Gulf Cooperation Council states, Qatar could develop an improved, principles-based ART law that provides statutory certainty where required, while allowing rapidly evolving technical standards to be addressed through regulations and professional guidance.

CULTURAL SENSITIVITY AND PATIENT AUTONOMY

Planned non-medical oocyte cryopreservation clearly illustrates the need for statutory clarity. Reportedly, WWRC does not currently offer planned age-related egg freezing, limiting oocyte cryopreservation to defined medical indications, particularly for patients facing gonadotoxic cancer treatment. Nevertheless, planned egg freezing is reported to occur on a limited and relatively low-profile basis in private practice, creating an uneven environment where clinical availability may precede clear national policy.

For some women who have never married, the issue can become more complex because transvaginal ultrasound and oocyte retrieval may raise concerns about hymenal integrity and the social meaning attached to it. These concerns are about social meaning and patient preference; the condition of the hymen is not a reliable indicator of sexual history, and clinicians should neither assume nor record it as such. When transvaginal access is unacceptable to the patient or technically unsuitable, other retrieval routes may offer a culturally responsive option. Qatar's current Department of Healthcare Professions advanced privilege framework explicitly recognizes both transvaginal and transabdominal oocyte retrieval.[54] A single-center retrospective series from the United Arab Emirates reported the feasibility of transrectal retrieval in selected patients: 105 nulliparous women underwent 152 cycles with no intraoperative or postoperative complications.[55] These other options should be regarded as specialist techniques requiring appropriate expertise, informed consent and governance, rather than promoted as universally equivalent approaches.



It is important to note that legal capacity, religious interpretation, family custom and institutional risk management should not be conflated.

Consent requirements need particular clarification. Article number 3 of Qatar's Law No. 22 of 2021 provides that consent must be obtained from the patient, while the consent of a guardian or custodian is required only when the patient is under 18 or lacks legal capacity.[46] On the face of this general provision, nothing in the statute requires a competent adult woman to obtain the consent of a father or brother for her own medical treatment solely because she is unmarried. Nevertheless, given the sensitivity of the issue and the absence of specific legislation governing non-medical egg freezing, some fertility facilities request a guardian letter before providing planned egg freezing. The MoPH may therefore need to clarify whether this represents a statutory requirement, an institutional policy, or customary practice. It is important to note that legal capacity, religious interpretation, family custom and institutional risk management should not be conflated. Where a practice has important religious implications, national guidance should draw on recognized Islamic jurisprudential expertise rather than rely on variable local custom.

THE POTENTIAL IMPACT OF INSURANCE REFORM

Financing is probably the most important determinant of how Qatar's IVF sector will evolve. Under the current statutory framework, Article number 6 of Law No. 22 of 2021 provides healthcare without charge to citizens in government facilities, while compulsory health insurance under Article 8 applies to expatriates and visitors.[46]

Discussions are underway to establish a national insurance entitlement that would allow Qatari citizens to seek medical care from any accredited public or private provider. A future insurance or strategic purchasing model could include infertility treatment and offer Qatari nationals greater provider choice. If adopted, such a model could materially reshape the sector by shifting from a predominantly public pathway toward patient choice among accredited centers, thereby stimulating capacity, service quality, convenience and investment in new technologies. It could also reduce the historical reliance on private centers, primarily to absorb demand exceeding public sector capacity.

It should be noted, however, that competition does not always deliver value. Fertility care is particularly susceptible to supplier-induced demand, premium-priced add-ons and the adoption of technologies before their clinical benefits are established. Without linking coverage to evidence and transparent outcomes, a new payer could inadvertently accelerate cost growth. Greater provider choice should therefore be accompanied by stronger oversight.

At the time of this report, no publicly available national IVF benefits schedule had been identified for such a future insurance model. Age-related egg freezing presents a different financing question from medically indicated fertility preservation. In the design of this new insurance model, a value-based purchasing model would be preferable to a simple expansion of fee-for-service reimbursement. The adoption of measures such as bundled IVF payments, evidence-based indications, exclusion of unproven add-ons, and risk-adjusted outcome reporting could protect patients while safeguarding public funds.

THE IMPORTANCE OF A NATIONAL ART REGISTRY

Qatar does not currently have a publicly accessible national ART registry that provides standardized cycle-level data or national reporting on IVF activities. Consequently, the size of the national sector, utilization patterns, age-specific outcomes and center-level performance cannot be reliably determined from publicly available information. Although institutional reports and occasional medical publications offer useful insights, they cannot substitute for a comprehensive national data system.

The MoPH has recently requested that ART centers submit official activity and success rate data from all IVF centers. This represents an important step toward data validation and center-level audit. Although earlier government discussions about establishing a national IVF registry have not yet resulted in a publicly accessible system, the current request could serve as the foundation for a phased national surveillance framework rather than remain a one-time data collection exercise.

The potential value of a national registry is substantial. It could: quantify access and unmet need; monitor treatment indications, complications and outcomes; compare performance and identify outliers; support workforce and capacity planning; and provide a platform for research and international benchmarking. Mature systems, including the US National ART Surveillance System and European registry initiatives, best demonstrate the benefits of standardized definitions, clinic reporting and data validation.[56,57]

Although registries can deliver substantial benefits, they may become restrictive if designed primarily as punitive regulatory tools. Over-regulation is a genuine risk in a small, rapidly developing sector. Oversight should therefore be proportionate: sufficiently robust to prevent unsafe practice, misleading claims and laboratory errors, but not so prescriptive that it constrains innovation or delays the adoption of technologies with demonstrated value.

IMPLICATIONS FOR GOVERNMENTS AND REGULATORS

1. **Establish a clear legal framework for planned oocyte cryopreservation.** The MoPH, led by its Legal Affairs Department, should develop a ministerial decision that defines eligibility criteria, consent requirements, storage and disposal provisions, and the circumstances in which guardian consent is required. Implementation will depend on completion of the appropriate legislative and regulatory pathway.

2. **Introduce standardized national ART reporting.** The MoPH, in collaboration with all fertility centers, should publish an annual national ART report. A standardized data set and agreed definitions should be used across centers, with per-woman cumulative live birth as the principal outcome measure, and appropriate reporting of treatment volume, patient characteristics, safety indicators and follow-up.

3. **Strengthen licensing and privileging standards.** The Department of Healthcare Professions should publish explicit licensing and clinical-privileging requirements for the introduction and use of fertility-treatment add-ons and AI-assisted embryo or gamete selection. These standards should address practitioner competence, evidence thresholds, validation, informed consent, auditability, data governance, bias, cybersecurity, and ongoing safety monitoring.

4. **Develop a transparent, evidence-based IVF benefit schedule.** The insurance design team should publish a benefit schedule specifying covered indications, eligibility criteria, cycle limits, cost-sharing arrangements, prior-authorization requirements, and rules governing fertility preservation and treatment add-ons. Coverage decisions should be linked to a formal evidence-to-coverage pathway that considers clinical effectiveness, safety, cost-effectiveness, equity, and periodic reassessment as new evidence emerges.

Key conclusion: Qatar is well positioned to progress from a mature clinical service environment to a comprehensive fertility governance system. The objective should not be maximal regulation, but a proportionate framework that provides legal clarity where rights and social values are at stake, robust safety oversight where errors could have serious consequences, evidence-based purchasing where public funds are involved, and sufficient regulatory flexibility to support responsible innovation.

SECTION 7. RECOMMENDATIONS AND CONCLUSIONS

This final section translates the report's findings into practical recommendations for governments, regulators, funders and providers. It then draws together central conclusions on evidence, governance, equity and public trust.

Reproductive medicine now combines established ARTs with fertility preservation, increasingly sophisticated genetic testing, artificial intelligence (AI), regenerative approaches and speculative interventions that may one day affect the human germline. These developments are unfolding within an increasingly global and commercial market. The policy task is not simply to permit or prohibit individual technologies, but to build a system that supports effective care, tests uncertainty rigorously and keeps experimental interventions within properly governed research.

RECOMMENDATIONS

The report recommends a policy implementation approach built around eight linked priorities:

1. A national strategy
2. Independent regulation
3. Fertility awareness
4. A clear boundary between research and care
5. An evidence-to-coverage pathway
6. Equitable financing
7. National data systems
8. Protection of informed reproductive decision-making

Table 1 converts these priorities into accountable actions. Table 2 provides an indicative classification of selected technologies to guide regulation, reimbursement, counseling and research oversight. These classifications should be adapted to national law and context, and reviewed as evidence develops.

Table 1. Priority actions for policy implementation, mapped to the eight priorities

Priority	Action	Proposed lead	Indicative timescale	Resources needed	Measure of progress
1. National strategy	Validate the national baseline: services, eligibility, financing, regulation and reporting	Ministry of Public Health, with providers and insurers	0–6 months	Legal, clinical, financing and data review	Published baseline and gap assessment
2. Independent regulation	Establish or designate an independent regulatory authority for assisted reproduction to license centers, inspect laboratories, monitor outcomes and regulate advertising	Ministry of Public Health (or designated authority)	6–18 months	Legal mandate, regulatory drafting, inspection and enforcement capacity	Authority in place with a published mandate, licensing standards and inspection schedule
3. Fertility awareness	Develop a national fertility awareness and education program covering age-related fertility decline in women and men, realistic expectations of assisted reproduction and fertility preservation options, and ways to reduce stigma	Ministry of Public Health, with education authorities, primary care and professional bodies	6–18 months	Culturally appropriate materials in Arabic and English, delivery through schools, universities and primary care, and public engagement	Program launched; population fertility knowledge measured at baseline and follow-up
4. Boundary between research and care	Set rules for advertising, add-ons, research pricing and conflicts of interest	Regulator with professional bodies and consumer protection authorities	6–12 months	Regulatory drafting, inspection and enforcement capacity	Compliance rates and corrective actions
5. Evidence-to-coverage pathway	Define a national evidence-to-coverage pathway for fertility technologies	Ministry of Public Health and designated regulatory authority	6–12 months	Health technology assessment, ethics and patient expertise	Published criteria and review schedule

Priority	Action	Proposed lead	Indicative timescale	Resources needed	Measure of progress
6. Equitable financing	Develop equitable benefit design and financial protection	Health-financing authority and payers	12–24 months	Budget-impact analysis and public consultation	Coverage, waiting times and out-of-pocket expenditure
7. National data systems	Standardize outcome reporting using patient-centered denominators	Regulator or national registry	6–18 months	Registry infrastructure, data standards and audit capacity	Provider completeness, audit results and public reporting
8. Protection of informed reproductive decision-making	Require standardized, independent counseling and written information on age-specific success rates, risks, total costs, alternatives and conflicts of interest before treatment or fertility preservation	Regulator with professional bodies and patient representatives	6–12 months	Patient decision aids, consent templates and counselor training	Audited consent compliance and patient-reported understanding

Table 2. Indicative status of selected technologies

Category	Technology or use	Policy implication
Established for defined indications	IVF and intracytoplasmic sperm injection (ICSI); medical fertility preservation; PGT-M and PGT-SR for defined serious genetic risks	Within licensed services, provide evidence-based eligibility criteria and routine outcome monitoring
Context-dependent	Elective egg freezing	Use age-specific counseling, transparent per-woman outcome measures, clear total costs and coverage review
Uncertain benefit – not for routine use	PGT-A; AI-assisted embryo assessment	PGT-A: no routine use; consider only in defined groups (for example, women aged 35–40 with several blastocysts), with counseling on cumulative live birth AI-assisted embryo assessment: supervised decision support only, subject to independent validation, disclosure and patient choice
Research only	Endometrial stem-cell interventions; polygenic embryo screening; stem-cell-based embryo models (research use under dedicated oversight)	Restrict to registered, ethically approved research; do not market or price as established care
Speculative or not ready for clinical use	In vitro gametogenesis (IVG); heritable human germline genome editing	Maintain laboratory research and international governance; no routine clinical use

CONCLUSIONS

This report shows why a common governance framework is needed for reproductive health. Egg freezing links technological capability with reproductive autonomy, realistic expectations and social conditions. Preimplantation genetic testing must be assessed by indication and by patient-centered outcomes rather than treated as a single category. Human germline genome editing demands exceptional restraint because consequences could extend to future generations. AI should remain subject to independent validation, disclosure, patient choice, data safeguards, meaningful human oversight and named professional accountability.

Commercialization cuts across every theme considered in this report. The concern arises when commercial incentives begin to determine clinical practice, particularly when patients are asked to purchase interventions whose meaningful benefit remains uncertain. Commercial interests are substantial and raise fundamental ethical concerns about providing patients with appropriate information, distinguishing research from evidence-based treatment, balancing beneficence and non-maleficence proportionately, and ensuring equitable treatment for all. These questions continue to arise, as illustrated by the excitement generated by claims about oocyte regeneration, despite insufficient evidence.[58] These questions will continue to arise as AI and advances in genomics accelerate technological development.



Progress should not be measured by the number of technologies available, but by whether they improve people's reproductive health and choices safely, fairly and over the long term.

Fertility policy cannot be based around a fixed list of technologies. New treatments will continue to appear, sometimes before their benefits and risks are fully understood. A regulatory authority can assess new evidence and revise governance decisions. This requires regular review of the evidence, the ability to change course when new information emerges, and the ability to decide whether a treatment or intervention should be funded, restricted to research, or kept out of clinical practice. This also requires fair access, reliable data and regular review of procedures that are excluded from practice.

Access, innovation and regulation must be considered together. Sound fertility policy has to address evidence, cost, fairness, ethics and accountability as part of the same problem. Progress should not be measured by the number of technologies available, but by whether they improve people's reproductive health and choices safely, fairly and over the long term.

APPENDIX. REGULATOR CHECKLIST FOR ELECTIVE EGG FREEZING

The following questions are a suggested checklist for regulators:

- Who is allowed to freeze their eggs? Is this technology available to all women? Are there any regulatory parameters for access (age, relationship status, reason for freezing)? If so, what are these and how are they justified?
- What is the framework for regulatory oversight for clinics offering this procedure? What aspects of their practice are covered by regulation and legislation and how is this enforced?
- Are there any aspects of clinical practice that are made mandatory by regulation? For example, practices of information provision and obtaining consent, or the availability of counseling?
- What is the regulatory framework for the storage and disposal of eggs? How long can eggs be stored for? Are women required to re-consent? Is it possible to discard unused (and unwanted) eggs? What are the regulatory parameters concerning the storage and disposal of unused eggs in circumstances of death or incapacity, and who has decision-making authority over such eggs?
- Are there any regulations that are relevant to the advertising and pricing of egg freezing? If so, what bodies are responsible for the oversight of these?
- Are there religious or cultural attitudes that must be considered or reflected in regulation?

ABBREVIATIONS

AI	artificial intelligence
ASRM	American Society for Reproductive Medicine
ART	assisted reproductive technology
CCR5	C-C chemokine receptor type 5
CRISPR	clustered regularly interspaced short palindromic repeats
CRISPR-Cas9	clustered regularly interspaced short palindromic repeats and CRISPR-associated protein 9
ESHRE	European Society of Human Reproduction and Embryology
ICSI	intracytoplasmic sperm injection
IVF	in vitro fertilization
IVG	in vitro gametogenesis
MoPH	Ministry of Public Health (Qatar)
PES	polygenic embryo screening
PGT	preimplantation genetic testing
PGT-A	preimplantation genetic testing for aneuploidy
PGT-M	preimplantation genetic testing for monogenic or single-gene disorders
PGT-P	preimplantation polygenic embryo screening
PGT-SR	preimplantation genetic testing for structural chromosomal rearrangements
PRP	platelet-rich plasma
RCT	randomized controlled trial
UNESCO	United Nations Educational, Scientific and Cultural Organization
WISH	World Innovation Summit for Health
WWRC	Women's Wellness and Research Center (Hamad Medical Corporation)

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