



Perspective

Reproductive Autonomy and the Limits of Embryo Selection Technologies

Aleksi Nowak^{1*}, Markus Janssens² and Petr Pedersen³

¹Department of Public Health Ethics, Aegean Institute of Philosophy and Health, Greece

²Institute for Health Policy and Ethics, Alpine Institute of Health Policy, Austria

³Institute for Health Policy and Ethics, Alpine Institute of Health Policy, Austria

ABSTRACT

Embryo selection has expanded from monogenic testing for single-gene disorders to polygenic risk scoring for complex, common conditions, and the ethical arguments built around reproductive autonomy have not kept pace.

This review examines what current selection technologies can and cannot reliably predict, and weighs that technical picture against two competing currents: the disability-rights critique, which holds that selecting against a condition can devalue people already living with it, and liberal arguments for procreative beneficence, which hold that parents have some obligation to select for a child's expected wellbeing.

It also examines the narrower policy question of non-medical sex selection, where professional societies have grown more permissive under specific conditions, and asks what that shift implies for broader regulation.

We argue that the evidentiary weakness of polygenic embryo scores, combined with commercial incentives to overstate their predictive power, means informed consent in this domain often fails procedurally before the deeper substantive disagreements are even reached.

We conclude that reproductive autonomy is necessary but insufficient justification for expanding embryo selection, and that defensible practice requires independent counseling, honest disclosure of absolute risk, and a clearer line between testing tied to a medical indication and testing sold as a stand-alone product.

Keywords: embryo selection; polygenic embryo screening; reproductive autonomy; disability rights; preimplantation genetic testing

Citation: Nowak A, Janssens M and Pedersen P (2024) Reproductive Autonomy and the Limits of Embryo Selection Technologies. *Bioethics*. 1(2):01-05.

Corresponding Author: Aleksi Nowak

E-mail Address: a.nowak@aiph.gr

Article History: Received 14 June 2024 | Accepted 21 September 2024 | Published 30 December 2024

Copyright: © 2024 Aleksi Nowak, et al. This is an open access article distributed under the Creative Commons Attribution License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited (<https://creativecommons.org/licenses/by/4.0/>).

INTRODUCTION

Preimplantation genetic testing has been part of clinical fertility practice for over three decades, but the

technology it was built on has changed faster than the ethical framework surrounding it. What began as a way to screen embryos for single-gene disorders and chromosomal abnormalities in couples at known genetic risk has expanded, first into testing for adult-onset and reduced-penetrance conditions, and more recently into polygenic embryo screening, which ranks embryos by a statistically estimated risk score for complex conditions such as diabetes, coronary disease, and even, in some commercial offerings, cognitive ability [1,2]. Each expansion has been justified, at least in part, by an appeal to reproductive autonomy: the idea that prospective parents have a right to information about, and some measure of control over, the genetic makeup of the children they bring into the world.

That appeal is not wrong so much as underspecified. Autonomy is not a single lever that, once pulled, settles every question about what parents may select for and what a clinic may offer. It has to be weighed against the interests of the future child, against the interests of people already living with the conditions being screened against, and against the fact that "choice" in this context is mediated by companies selling a product, not simply exercised in a vacuum [3]. This review examines where that weighing currently stands: what embryo selection technologies can and cannot actually do, what the disability-rights critique of selection has forced bioethicists to confront, how liberal eugenics arguments for parental choice hold up against those objections, and where regulators have and have not drawn lines around non-medical selection. Table 1 summarizes how the field's major frameworks differ on how much latitude they extend to parental choice, and Figure 1 places embryo selection technologies on a schematic spectrum from narrowly diagnostic to broadly enhancement-oriented, illustrating why the ethical stakes rise as the technology moves along that spectrum.

FROM DIAGNOSIS TO RISK ESTIMATION:
WHAT THE TECHNOLOGY ACTUALLY
DOES

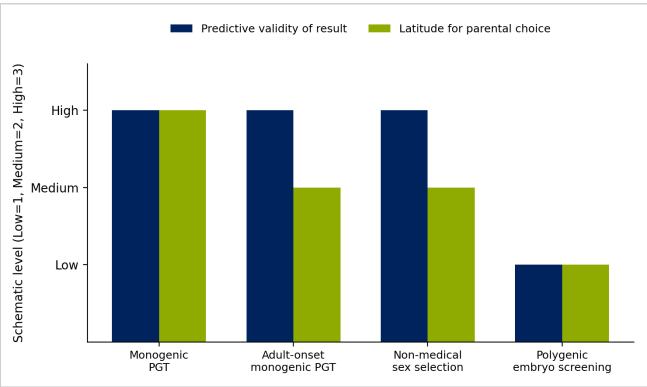
The ethical questions raised by embryo selection depend heavily on what, technically, is being selected for, and this is where a good deal of public discussion goes wrong. Monogenic preimplantation genetic testing looks for a specific, well-characterized variant known to cause or strongly predispose to a single condition, and its predictive power is high: an embryo carrying a pathogenic BRCA1 variant, for instance, either does or does not carry it [4]. Polygenic embryo screening is a different kind of test entirely. It aggregates the small, individually weak effects of thousands of common genetic variants into a single risk score, derived from genome-wide association studies conducted mostly in adult populations of European ancestry, and it reports differences in relative risk between embryos from the same IVF cycle

rather than an absolute diagnosis [2]. A 2024 review in Human Reproduction Update concluded that the epidemiological basis for these scores, when applied to embryos rather than to the adults on whom the underlying studies were conducted, remains considerably less robust than marketing materials tend to suggest, and that the absolute risk reduction achievable by selecting among a typical clutch of five to eight embryos is often modest [2].

Table 1. Major embryo selection technologies compared by what they test for, the type of result returned, and the ethical stance most commonly taken toward parental choice.

Technology	Target of testing	Type of result	Typical ethical stance
Monogenic PGT	Single known pathogenic variant	Binary: variant present or absent	Widely accepted for serious, well-characterized disease
PGT for adult-onset/reduced-penetrance conditions	Variant with delayed or incomplete penetrance	Binary variant status, probabilistic clinical outcome	Accepted but debated case-by-case by ethics committees
Non-medical sex selection	Chromosomal sex	Binary: XX or XY	Increasingly permitted when riding along with indicated testing
Polygenic embryo screening	Aggregated common-variant risk score	Relative risk ranking across embryos in a cycle	Considered not clinically ready; contested in principle

Figure 1. Schematic comparison of predictive validity and the latitude professional bodies currently extend to parental choice across four embryo selection technologies (illustrative synthesis of the positions discussed in this review, not a quantitative meta-analysis).



This distinction matters ethically because much of the reproductive-autonomy argument for embryo selection was built around monogenic testing, where the information is comparatively clear and the choice being offered is, in some sense, a choice about whether to have a child affected by a specific, well-understood condition. Polygenic screening instead offers parents a probabilistic nudge across many embryos on many traits simultaneously, several of which carry only weak biological plausibility as a

target for individual reproductive decision-making. The American Society for Reproductive Medicine's Ethics and Practice Committees concluded in 2024 that polygenic embryo screening is not ready for clinical use, citing exactly this evidentiary gap along with the risk that patients will over-interpret small relative differences as meaningful individual predictions [5]. A companion clinical review has argued that whatever the eventual evidentiary status of these scores, their premature commercial deployment already requires a level of pretest and posttest counseling that most fertility clinics are not currently staffed to provide [6].

THE DISABILITY-RIGHTS CRITIQUE

The strongest and most persistent objection to embryo selection does not come from concerns about the technology's accuracy but from disability advocates and scholars who argue that the entire enterprise of screening out embryos associated with a condition sends a message about the worth of people currently living with that condition. This "expressivist" critique holds that selecting against, say, embryos carrying a marker for a disability is not ethically neutral information-gathering; it is an act that implicitly communicates that lives with that condition are worth preventing, independent of what any individual disabled person's actual quality of life looks like [7]. Advocates have pointed out that this dynamic is not hypothetical: clinics routinely test for and disclose findings related to conditions ranging from severe, early-lethal disorders to conditions compatible with a full and flourishing life, and the same testing infrastructure and counseling script tends to be applied to both without much differentiation [8].

Defenders of selection have offered two main responses, neither of which fully dissolves the objection. The first distinguishes between a general social statement (which the disability-rights critique targets) and a particular reproductive decision (which is what the parent is actually making), arguing that a parent's choice not to have a child with a specific condition need not imply any judgment about the worth of people who already have it, any more than choosing to marry one person over another implies the second person's marriage-worthiness is defective. The second response, more pragmatic, notes that most existing testing targets conditions associated with substantial and unavoidable suffering rather than the broad range of human variation that "disability" as a category actually covers, and argues the critique proves too much if extended to all cases. Neither response has fully persuaded disability scholars, and a recent scoping review of the ethical and social literature on polygenic embryo screening specifically found that this tension — between respecting reproductive choice and avoiding an expressivist harm to people currently living with a screened-for trait — remains the single most cited unresolved issue in the field, now compounded by polygenic screening's move toward complex traits with no clean line between "disorder" and "variation"

[9].

LIBERAL EUGENICS AND THE LIMITS OF PROCREATIVE BENEFICENCE

A parallel line of argument, associated most closely with Julian Savulescu's principle of procreative beneficence, takes the opposite tack: rather than worrying that selection stigmatizes disability, it argues that prospective parents who can select among embryos have something close to a moral obligation to select the embryo expected to have the best life, all things considered, among the available options [10]. Savulescu's original formulation was explicitly agnostic about which traits counted toward a "better life," which is precisely what has made it controversial: if a trait correlates with better life prospects in a given society, the principle in its strong form does not obviously distinguish between selecting against a serious disease and selecting for traits like sex, height, or, in a society structured to reward it, IQ [11].

Critics have pushed on this ambiguity from several directions. Some have argued that the principle collapses into a form of liberal eugenics that merely relocates historical eugenic aims from the state to the individual consumer, without addressing the structural harms — homogenization of the population, pressure on parents who decline testing, reinforcement of existing social hierarchies about which traits are advantageous — that made twentieth-century eugenics objectionable in the first place [12]. Others have offered a narrower critique, granting that something like procreative beneficence has intuitive pull for clearly disease-linked traits, while arguing that Savulescu and Kahane's own attempts to specify which traits qualify as legitimately "beneficial" import contestable value judgments the principle claims to avoid [13]. A more sympathetic reading, developed in later work responding to these objections, treats procreative beneficence not as a strict obligation but as a weak reason among several that parents may permissibly weigh, which blunts the force of the eugenics comparison but also reduces the principle's usefulness as a guide to what clinics should actually be permitted to offer [14].

SEX SELECTION AND THE BOUNDARY OF "MEDICAL" PURPOSE

Nowhere is the tension between reproductive autonomy and professional gatekeeping more concrete than in the debate over selecting embryos by sex for non-medical reasons, sometimes called "family balancing." The American Society for Reproductive Medicine's 2022 Ethics Committee opinion revisited this question and concluded, notably, that non-medical sex selection is ethically permissible in the context of preimplantation genetic testing already being performed for another indication, a shift from the organization's more cautious historical stance, though it continues to discourage sex selection as the sole

reason for undergoing IVF given the costs and risks the procedure carries independent of any selection goal [15]. This position illustrates a recurring pattern in the field: professional bodies have generally been more willing to extend autonomy-based permission to selection choices that ride along with clinically indicated testing than to selection sought for its own sake, a distinction that has more to do with managing the appearance of frivolous use of a medical procedure than with any clean ethical line between the two cases.

Internationally, the range of policy responses is wide. Several countries prohibit non-medical sex selection outright, others permit it without restriction, and a growing number occupy an ambiguous middle ground in which the practice is neither clearly authorized nor clearly banned by statute, leaving individual clinics and professional societies to set de facto policy [16]. A recent policy analysis argued that the United States in particular has allowed embryo selection technology, including polygenic screening for non-disease traits, to outpace any coordinated regulatory response, leaving oversight almost entirely to professional self-regulation of the kind reflected in ASRM's ethics opinions rather than to binding law [16].

COUNSELING, COMMERCIAL INCENTIVES, AND THE LIMITS OF INFORMED CHOICE

A separate strand of the recent literature focuses less on which traits should be selectable in principle and more on whether patients undergoing embryo selection today are actually in a position to make an informed, autonomous choice. Polygenic embryo screening in particular is sold directly to fertility patients by companies with a commercial interest in patients perceiving the test as more predictive than the underlying science supports, and a qualitative study of healthcare professionals delivering these tests found many reported discomfort with what they characterized as risk information being presented to patients with more confidence than the professionals themselves felt was warranted [17]. A comprehensive mapping of the ethical, legal, and social implications literature on preimplantation genetic testing broadly found that informed consent processes across the field routinely underexplain the statistical and probabilistic nature of the results being returned, a problem that predates polygenic screening but that polygenic screening's genuinely more complex statistics make considerably worse [18].

This raises a version of the disability-rights and eugenics critiques that is procedural rather than substantive: even setting aside whether selecting for or against a given trait is ethically permissible in principle, autonomy requires that the choice be adequately informed, and the current evidence suggests that commercial and time pressures within fertility clinics make that difficult to guarantee in practice [19]. A 2026 analysis proposed that rather than an outright prohibition on polygenic embryo screening, a more

defensible interim position is "cautious use" bounded by mandatory independent counseling, explicit disclosure of the absolute (not merely relative) risk reduction achieved by selection, and a moratorium on marketing the technology for non-disease traits until better validation exists [20].

CONCLUSION

The reproductive-autonomy argument for embryo selection is strongest where the technology is most accurate and the condition being screened for is least ambiguous, and weakest where polygenic scoring extends selection into traits with contested boundaries between disorder and ordinary variation. Between those poles sits most of the field's actual practice, which is why no single principle in this literature — not procreative beneficence, not the expressivist objection to disability selection, not a simple appeal to parental choice — settles the matter on its own. What the recent literature converges on instead is a set of narrower, more procedural commitments: that predictive claims made to patients should track the actual epidemiological evidence rather than commercial incentive, that counseling needs to be resourced adequately enough to convey genuine uncertainty, that professional societies and regulators need to distinguish more carefully between testing that rides along with an existing medical indication and testing offered as a stand-alone consumer product, and that the disability-rights critique deserves a substantive answer in specific cases rather than a general dismissal. Reproductive autonomy remains a legitimate and important value in this domain, but it is not, on the current evidence, a value capable of doing all the justificatory work that has sometimes been asked of it.

DECLARATIONS

Acknowledgements

The authors are grateful to colleagues at their respective institutes for helpful conversations that sharpened the arguments developed in this review.

Funding

This review received no external funding.

Conflict of Interest

The authors declare no conflicts of interest relevant to this work.

Author Contributions

Aleksi Nowak conceived the review, drafted the introduction and conclusion, and coordinated the overall manuscript. Markus Janssens performed the literature synthesis on polygenic screening technology and the disability-rights critique and critically revised the manuscript. Petr Pedersen contributed the sections on procreative beneficence, sex selection policy, and informed consent, and provided final

approval of the submitted version. All authors read and approved the final manuscript.

Ethics Statement

As a literature review synthesizing previously published, publicly available research and policy analysis, this article did not involve new data collection from human participants and did not require institutional ethics committee approval.

Data Availability

No new data were generated or analyzed for this review. All sources discussed are cited in the reference list and are publicly available through their respective publishers.

REFERENCES

1. ESHRE Task Force on Ethics and Law 22: preimplantation genetic diagnosis. Human Reproduction.
2. Screening embryos for polygenic disease risk: a review of epidemiological, clinical, and ethical considerations (2024) Human Reproduction Update.
3. Designer babies: the ethical and regulatory implications of polygenic embryo screening (2024) Petrie-Flom Center, Harvard Law School.
4. Use of preimplantation genetic testing for monogenic adult-onset conditions: an Ethics Committee opinion (2024) American Society for Reproductive Medicine.
5. ASRM Ethics and Practice Committees release new report concluding polygenic embryo screening is not ready for clinical use (2024) American Society for Reproductive Medicine.
6. Beyond the score: the imperative of comprehensive counseling in polygenic embryo screening (2025) PMC.
7. A baby with a disease gene or no baby at all: genetic testing of embryos creates an ethical morass (2017) STAT News.
8. Journal of Health Ethics, Volume 21, Issue 1.
9. Ethical and social implications of implementing polygenic embryo screening into clinical care: a scoping review (2025) PMC.
10. Savulescu J (2001) Procreative beneficence: why we should select the best children. Bioethics.
11. Embryo selection debate: Savulescu's procreative beneficence imperative (2020) Bioethics Observatory.
12. Procreative beneficence, obligation, and eugenics. Journal of Bioethical Inquiry.
13. Savulescu J, Kahane G. A critical assessment of the principle of procreative beneficence.
14. Julian Savulescu and the issue of controversial choices. Procedia - Social and Behavioral Sciences.
15. Use of reproductive technology for sex selection for nonmedical reasons: an Ethics Committee opinion (2022) Fertility and Sterility.
16. The U.S. must join others in regulating embryo selection. Harvard Kennedy School Student Review.
17. "Are we not going too far?": socio-ethical considerations of preimplantation genetic testing using polygenic risk scores according to healthcare professionals (2024) Social Science & Medicine.
18. Mapping ethical, legal, and social implications (ELSI) of preimplantation genetic testing (PGT) (2024) PMC.
19. Polygenic Embryo Screening: Ethical and Legal Considerations, The Hastings Center for Bioethics.
20. Precautions for polygenic embryo selection: prohibition or cautious use (2026) Frontiers in Reproductive Health.