Apuntes de Bioética, 2026, 9(1): AdB1425

REVIEW ARTICLE

Ethics of vulnerability and the normative limits of biomedical enhancement

Ética de la vulnerabilidad y límites normativos del mejoramiento biomédico

Andherson J. Aguirre-Lanegra[*,1]

[1]Universidad Privada del Norte, Lima, Perú.

[*] Correspondent author, andersonaguirre162000@gmail.com

Received: 12 february 2026 | **Revised:** 13 may 2026 | **Accepted:** 23 june 2026
https://doi.org/10.35383/apuntes.v9i1.1425

Abstract

The convergence of gene editing, neurotechnologies, and life-extension projects has turned the human biological condition into an object of redesign, while transhumanism reinterprets vulnerability, dependence, and finitude as correctable deficits. This article seeks to ground an ethics of vulnerability that, resting on a rigorous delimitation of this condition from fragility and weakness, enables the assessment of biomedical enhancement and the derivation of operative normative criteria for its governance; to this end it adopts a qualitative, hermeneutic-critical design supported by conceptual analysis and a critical review of the philosophical, bioethical, and normative literature. The analysis distinguishes vulnerability, fragility, and weakness, reconstructs the enhancement paradigm in its strongest version, and shows that fragility is the condition of possibility of prudence, moral agency, and solidarity, so that its eradication would cancel the very goods the project claims to promote. On this basis, the distinction between therapy and enhancement, articulated with a principle of ontological precaution with graduated conditions of activation and response, offers a criterion for governing heritable germline editing, advanced neurotechnology, and radical longevity, in the service of dignity and justice.
Keywords: Bioethics; Human rights; Biotechnology; Genetic engineering.

Resumen

La convergencia de la edición genética, las neurotecnologías y los proyectos de longevidad ha situado la condición biológica humana como objeto de rediseño, mientras que el transhumanismo reinterpreta la vulnerabilidad, la dependencia y la finitud como déficits corregibles. Este trabajo se propone fundamentar una ética de la vulnerabilidad que, sobre un deslinde riguroso de esta condición frente a la fragilidad y la debilidad, permita evaluar el mejoramiento biomédico y derivar criterios normativos operativos para su gobernanza. Con tal fin, adopta un diseño cualitativo de carácter hermenéutico-crítico, apoyado en el análisis conceptual y en una revisión crítica de la literatura filosófica, bioética y normativa. El análisis deslinda la vulnerabilidad, la fragilidad y la debilidad, reconstruye el paradigma del mejoramiento en su versión más sólida y muestra que la fragilidad es la condición de posibilidad de la prudencia, de la agencia moral y de la solidaridad, de modo que su erradicación cancelaría los bienes que el proyecto dice promover. Sobre esa base, la distinción entre terapia y perfeccionamiento, articulada con un principio de precaución ontológica de activación y respuesta graduadas, ofrece un criterio para gobernar la edición germinal, la neurotecnología y la longevidad radical, en favor de la dignidad y de la justicia .
Palabras clave: Bioética; Derechos humanos; Biotecnología; Ingeniería genética.

Introduction

Contemporary biomedicine is undergoing a transformation that extends beyond the classical horizon of therapeutics. For centuries, the art of medicine has been understood as a prudential response to illness, with its legitimacy anchored in the care of a wounded human nature. Gene editing applicable to reproduction, neurotechnologies capable of intervening in cognitive and affective processes, and projects aimed at significantly extending human life have created a scenario in which the biological condition appears as a platform for redesign (Nuffield Council on Bioethics, 2018; Yuste et al., 2017). This shift finds its doctrinal articulation in transhumanism, a movement that advocates overcoming human limitations through technoscience (Bostrom, 2005a). Accordingly, the notion of enhancement abandons any reference to the restoration of impaired functions and enters a logic of open-ended optimization, with implications that extend to the understanding of the body, identity, and the human life cycle.

The enhancement program, in its most ambitious form, holds that the human condition is an unfinished reality, open to reshaping, and that the responsible use of science and technology would make it possible to overcome biological limits and attain posthuman forms of existence endowed with capacities that far exceed those of contemporary human beings (Bostrom, 2005a). Reproductive ethics has argued, in parallel, that parents have compelling reasons to select, among possible children, the one expected to have the best life (Savulescu, 2004; Savulescu & Kahane, 2009). In response to the objection that such aspirations conceal a bias toward the existing state of affairs, a test has been proposed that reverses the burden of proof by requiring the preservation of current parameters to be justified as well (Bostrom & Ord, 2006).

The opposing tradition has shifted the focus toward vulnerability as a structural feature of human existence. Rather than a circumstantial accident, exposure to harm is conceived as a universal and constant condition inherent in the human condition (Fineman, 2008), from which a reinterpretation of equality and of the obligations of the State follows. Moreover, dignity has been grounded in dependence and in the need for care (Watson, 2016; Macpherson & Roqué-Sánchez, 2019), and bioethics has elevated respect for vulnerability to the status of an emerging normative principle, distinguishing among inherent, situational, and pathogenic forms of vulnerability (ten Have, 2015; Rogers et al., 2012). The critique of the aspiration to master what is given, the concern for symmetry between generations, and the recognition of the agency proper to dependent rational animals further enrich this perspective (Sandel, 2004; Habermas, 2003; MacIntyre, 1999).

The state of the question nonetheless leaves several fronts open. A conceptual imprecision persists, since vulnerability, fragility, and weakness are used as synonyms, which obscures what is defended when the first is vindicated or the last denounced. To this is added an asymmetry in the treatment of the positions, for enhancement tends to appear as a schematic target rather than as a position reconstructed in its strongest version. Nor has the relationship between the ontological and the political planes, where fragility translates into solidarity and justice, been adequately articulated. Above all, the appeal to prudence has rarely been specified into criteria capable of guiding particular decisions (Kaebnick & Gusmano, 2018). It is this distance between the anthropological diagnosis and the normative response that this study seeks to close.

The relevance of the matter is not exhausted in the technical, since it redefines the anthropological categories that sustain the moral and legal order. When vulnerability, dependence, and finitude are reinterpreted as correctable deficits, human dignity and equality between generations are called into question. Heritable intervention on the genome alters the relationship between those who decide and those who are born (Habermas, 2003), and the erosion of shared fragility weakens solidarity, with the risk that unequal access to enhancement may turn social inequality into biological inequality (Prainsack & Buyx, 2011). The debate thus reveals itself as an anthropological controversy

that conditions the normative architecture of societies.

The aim of this work is to ground an ethics of vulnerability that, on a rigorous delimitation of this condition from fragility and weakness, makes it possible to assess biomedical enhancement and to derive operative normative criteria for its governance. The article is organized around three purposes: to distinguish vulnerability from fragility and weakness, as well as to show the ontological and axiological value of fragility; to reconstruct the enhancement paradigm in its most robust version in order to subject it to scrutiny; and, finally, to translate the resulting understanding into a criterion of practical application. From these purposes the central hypothesis of the inquiry follows: vulnerability is an ontological condition of human life on which prudence, the perception of value, agency, and solidarity depend, so that the project of eradicating it lacks anthropological coherence and normative justification.

The study adopts a qualitative, hermeneutic-critical design, articulated with conceptual analysis and supported by a critical review of the pertinent philosophical, bioethical, and normative literature. Interpreting the texts in their context and examining the anthropological presuppositions that sustain them defines the first procedure, while conceptual analysis clarifies, distinguishes, and orders the notions that underpin the debate. This option responds to the nature of the object, so that determining the meaning of vulnerability and the ethical-philosophical assessment of enhancement are conceptual and normative tasks that call for interpretation and argument rather than for a count of the frequency of results in a closed set of studies. The corpus was assembled deliberately for its relevance to the questions posed, on the basis of descriptors in Spanish and English that capture the core concerns of the work, and it integrates peer-reviewed articles, international normative instruments, reports of bioethics committees, philosophical monographs, and scientific literature on the biotechnologies examined.

The analytical procedure was ordered in three phases corresponding to the objectives: the first delimited the categories of vulnerability, fragility, and weakness and established their conceptual hierarchy; the second reconstructed the enhancement paradigm in its most demanding formulation and subjected it to critical scrutiny; the third translated the framework into applicable criteria, namely the distinction between therapy and enhancement and a principle of ontological precaution with graduated conditions of activation and response. To guard against bias, the design took the theses in their most robust formulation and drew on primary and peer-reviewed sources. A review conceived in this way does not, however, aspire to exhaustiveness or to statistical generalization, since its purpose is conceptual clarification and normative grounding, an aim suited to an object that is settled in the domain of meanings and principles.

Conceptual delimitation of human vulnerability

The bioethical debate on vulnerability carries a conceptual indeterminacy that compromises its normative yield. The distinctions accumulated in recent decades, far from unifying the term, fragment it (ten Have, 2015), and the notion oscillates between characteristic, accident, and principle without fixing its status (Macpherson & Roqué-Sánchez, 2019). When they are used as synonyms, each category loses its profile and its capacity to guide judgments. The assessment of enhancement therefore requires distinguishing these three notions and establishing their reciprocal order, since the meaning of dignity, prudence, solidarity, and equality depends on the hierarchy that is fixed.

In its primary sense, vulnerability designates the constitutive openness of the human being to being affected, wounded, or altered by its environment and by its own embodied condition. It thus possesses a universal and permanent character, inscribed in the human condition prior to any particular circumstance (Fineman, 2008). Against this background a taxonomy of sources and modalities is delineated (Rogers et al., 2012): the inherent

arises from corporeality, finitude, and dependence; the situational springs from social, economic, or relational circumstances that modulate exposure; and the pathogenic, of special interest here, takes shape when the institutions or interventions called to mitigate vulnerability end up generating it. This last modality anticipates a central thesis: certain enhancement practices, presented as responses to fragility, could produce pathogenic vulnerability by compromising the self-understanding of the species or the symmetry between generations.

Fragility names a kindred yet distinct reality. Whereas vulnerability points to the ontological openness to being affected, fragility expresses an axiological dimension: the condition of that whose value resides in its perishable character. Fragile is what can be lost, and its excellence is bound to that exposure to chance and to time. The goods that compose an accomplished life "are vulnerable to the uncontrolled action of external agents, such as fortune" (García, 2004, p. 231), so that human fullness coexists with the permanent possibility of its collapse. Fragility is not, therefore, a defect that ought to be suppressed, for to abolish the perishable would eliminate that which confers value on what is cherished, a point that proves decisive in the face of projects that aspire to cancel finituded.

Weakness belongs to a different order. It denotes an operative deficit, a lack measured against a norm of functioning, in principle correctable, since it is remedied by supplying what is missing, without altering the identity of the one who suffers it. The categorial equivocation that clouds the debate arises here, for treating vulnerability and fragility as modalities of weakness turns them into deficiencies to be corrected, when they designate intrinsic dimensions that neither diminish dignity nor impair autonomy (Macpherson & Roqué-Sánchez, 2019). From this confusion the enhancement paradigm draws much of its plausibility, since only by presenting the human condition as an aggregate of remediable deficits can the claim to redesign it be legitimated.

From the two constitutive notions two correlates follow. The first is dependence: by reason of its radical neediness, the human being is referred to others throughout the entire biography and not only in infancy or illness, which calls for the virtues of acknowledged dependence (MacIntyre, 1999), finding its response in the ethics of care. The second is finitude, the inscription in time and the exposure to loss, which endows fragility with its temporal tonality (García, 2004). From vulnerability emerge openness to the other and awareness of the limit, conditions of all situated moral life.

The first yield of this hierarchy concerns dignity. Far from lowering it, vulnerability grounds it: a universal dignity, an inherent and inalienable worth, finds its seat in shared vulnerability and dependence (Watson, 2016; Muñoz, 2021) and modulates the criteria of justice and legality (Schmidt, 2007). Grounding dignity in vulnerability inverts the pro-enhancement assumption, since what the latter reads as deficiency is the soil from which the unconditional worth of the person springs. The second yield is normative: if vulnerability is universal, it grounds an equality anchored in the human condition rather than in a formal identity, which calls for a State responsive to that common exposure (Fineman, 2008) and a global bioethics attentive to interdependence (ten Have, 2015).

The delimitation thus fixes the criterion for assessing whether enhancement honors or harms the condition that makes it intelligible: a universal vulnerability that grounds dignity and, with it, the solidarity owed and the equality to be demanded; a fragility whose value admits no suppression without loss; and a correctable weakness whose confusion with the former vitiates the debate.

Critical reconstruction of the enhancement paradigm

The enhancement program starts from a premise that is worth setting out in its most demanding version. It holds that the human mode of existence enjoys no privilege

exempting it from limitations, and that reason and technology make it possible to overcome them so as to extend healthy life, sharpen memory, and, on its most ambitious horizon, attain posthuman modes of capacities far superior to present ones (Bostrom, 2005a). In this light, perfecting the human condition ceases to appear as a transgression and presents itself as the continuation of the therapeutic ideal toward the expansion of the capacities of the healthy.

In reproductive ethics, this logic crystallizes into a principle of notable force. Alongside reproductive autonomy, procreative beneficence is formulated: the prima facie moral reason to select, among the possible children, the one from whom the best life may be expected according to the available genetic information (Savulescu, 2004); its most robust version presents it as the duty to bring into the world children with the best chance of the best life (Savulescu & Kahane, 2009). Reconstructed with precision, it does not impose the pursuit of any particular trait, for it directs one to choose, among equally accessible states, the one that maximizes the expected well-being of the future child (Parker, 2007).

Against one of the most frequent objections to this position —the appeal to the naturalness of what is given— two resources reinforce its defense. The first is a reversal test: if it is deemed harmful both to increase and to decrease a given parameter, without offering a reason showing why its current level would be optimal, one may suspect the presence of a bias in favor of the status quo (Bostrom & Ord, 2006). The second defuses the charge that a radical transformation would degrade dignity, by holding that even profoundly modified beings could be bearers of it (Bostrom, 2005b), so that the burden of proof falls on the one who raises the objection, who must specify which value would be harmed.

The force of this position rests, however, on contestable anthropological presuppositions: a questionable idea of human nature, a dispensable regard for corporeality, a thinned notion of autonomy as the satisfaction of preferences, and an instrumental valuation of quality of life (Casas, 2023). When confronted with the ends of the medical art —to prevent illness, to care for those who cannot be cured, and to watch over a peaceful death—, a considerable distance emerges with respect to a program that aspires to perfect the healthy, and the question becomes teleological. To this is added an objection concerning the attitude toward what is given: to remake one's own nature expresses a drive for mastery that displaces the disposition to welcome life as a gift (Sandel, 2004). If talents are recognized as the fruit of chance rather than as merit, no one is entirely responsible for their fortune, and genetic mastery, by dissolving that perception of contingency, would weaken the bonds of reciprocity that communal life requires.

The challenge deepens as it reaches the self-understanding of the species. To program in advance the traits of a future person introduces an irreversible asymmetry between the one who designs and the one who is designed, who can no longer understand himself as the sole author of his own history (Habermas, 2003), which disturbs the reciprocity between equals and breaks the symmetrical condition that birth had hitherto guaranteed. To preserve the contingency of what is born as against what is made thus reveals itself as a condition of moral autonomy. Moreover, once the legitimacy of overcoming limits in the name of well-being is admitted, a non-arbitrary criterion to halt the advance toward ever more radical goals is lacking, whereby the problem of slippery slopes reappears (McNamee & Edwards, 2006).

On the reproductive plane, the duty to select the best possible child faces two substantive objections. The first proceeds from the principle of procreative non-maleficence, which places the avoidance of harm before the maximization of well-being (Saunders, 2017). The second points to a logical difficulty, for the non-selected child is not the same person as the selected one, so that it is hard to maintain that omitting the choice of the one with the best life harms any determinate individual (Parker, 2007). Neither closes the debate, although both deprive procreative beneficence of the immediate evidence it appeared to possess.

The reconstruction displays the program in its most persuasive expression, and the contrast reveals that this persuasiveness rests on assumptions that do not withstand careful examination, for goods bound to contingency, to dependence, and to the symmetry between generations come to light. To exhibit these tensions does not yet ground why fragility merits protection rather than amendment; that grounding, of an ontological order, calls for the examination that follows.

Ontological grounding of human fragility

The enhancement proposal rests on an ontological thesis that must be examined at its root. It conceives biological limitations as correctable technical obstacles, so that finitude ceases to be understood as a constitutive structure and comes to be treated as a functional deficiency; suffering and aging are read as failures of the organic system, and the body is reduced to a provisional support for an optimization governed by performance. Personal dignity refers, however, to the intrinsic worth of the human being and not to the indefinite expansion of its capacities (Fukuyama, 2002), so that the aspiration runs into a contradiction: by dissolving the conditions that make moral identity possible, the promise of fullness cancels itself.

In the background pulses a dualist anthropology that opposes spirit to matter. The person is reduced to transferable information, severable from its corporeal support, and, in its extreme version, this view describes the body as a contingent envelope, replaceable by inorganic substrates that would house the digitized mind (Lombard, 2023). Such a representation neglects an elementary phenomenological fact: the experience of the self always occurs embodied, in the sensory and vulnerable fabric of a lived body whose temporality articulates the meaning of the world. To detach subjectivity from that matrix strips it of its context, so that the promised liberation reveals itself as loss.

Against this disembodying tendency, fragility shows itself as the very texture of human life, part of our nature and not a correctable accident (Marcos, 2016). To be woundable does not express an error of biological design, for fragility names the condition of that whose value resides in its being able to be lost or extinguished (García, 2004); finitude, far from impoverishing existence, structures its horizon of meaning. From this follows a yield that the ideal of invulnerability overlooks: only the one who can suffer develops a practical intelligence oriented toward care. Prudence, embodied wisdom and not instrumental calculation, arises from the awareness of finitude, since ethical deliberation demands sensitivity to the particular and the contingent; a full invulnerability would dismantle that perception, for the one who cannot be harmed lacks the horizon from which suffering and compassion are understood.

The connection between vulnerability and rationality is clarified by considering moral agency in terms of dependent rational animals (MacIntyre, 1999). Practical autonomy does not spring from an original self-sufficiency, since it is the fruit of a prolonged insertion into networks of care; the dependence evident in infancy, illness, and old age reveals an anthropological constant that shapes the identity of the person. From this convergence a preventive normative intuition takes shape: if fragility is the condition of possibility of moral identity, of prudence, and of the perception of value, the interventions that aspire to abolish it would foreclose the goods they claim to promote. Hence the requirement of a precaution of an ontological order, distinct from caution in the face of physical risk, since it bears on the suppression of that which renders moral life intelligible.

The ontological itinerary issues in a clear conclusion: fragility is not a defect that technology must amend, for it sustains the embodied identity, the practical intelligence, the perception of value, and the dependent agency in which moral life is grounded, so that whoever aspires to suppress it cancels the conditions that give meaning to his own project. The dependence shown here points, moreover, toward a web of relations that exceeds the individual, where common vulnerability translates into interdependence

and into demands of solidarity and justice.

Political dimension of solidarity-based interdependence

The ontological grounding of dependence opens onto a political consequence. If human life is inscribed in a dense web of interdependencies, the figure of the sovereign subject that liberal modernity placed at the center of political theory loses its self-evidence. Existence does not appear as the autarkic property of the individual, since it is sustained by a network of biotic and social supports that precede and exceed it (Cely, 2001). Autonomy then reveals itself as a late achievement, resting on an assumed dependence, and political agency turns out to be derived from the prior care that made it possible (MacIntyre, 1999).

From this matrix a redefinition of solidarity follows. It acquires structural thickness and is established as an organizing principle of communal life. Respect for vulnerability, recognized as an emerging normative principle, calls for an institutional translation into structures of justice and social protection that prevent precariousness from turning into exclusion (ten Have, 2015), without conditioning that burden on an immediate calculation of reciprocity (Prainsack & Buyx, 2011). This conception has found expression in the international law of bioethics: the instrument that articulates bioethical principles in terms of human rights enshrines that "solidarity among human beings and international cooperation towards that end are to be encouraged" (Organización de las Naciones Unidas para la Educación, la Ciencia y la Cultura [United Nations Educational, Scientific and Cultural Organization - UNESCO], 2006, art. 13). Human dignity, read as the common basis of a global bioethical horizon, offers the point of convergence from which to articulate shared obligations among diverse traditions (Andorno, 2009).

The axis of justice confers on this approach its greatest practical density. Equality among human beings does not rest on an equivalence of capacities, for it finds its root in the vulnerable condition that all share (Fineman, 2008). Hence a decisive consequence: an enhancement distributed unequally threatens to transform social inequality into biological inequality and would erode the foundation of solidarity by replacing the common condition with a stratification inscribed in the body. The ethics of fragility opposes to this risk a demand of distributive justice that calls for stable structures of solidarity and a preferential attention to the most exposed, ordinarily the poorest (Prainsack & Buyx, 2011; Cely, 1999).

The political dimension entails, finally, a warning about the destiny of technoscience. When the web of interdependencies is ignored in favor of particular interests, biotechnological development tends to detach itself from the common good and runs the risk of turning into an instrument of domination. Interdependence thus reveals that the shared vulnerable condition grounds dignity and sustains a demand of solidarity and justice that no responsible community can disregard. It remains to translate these foundations into criteria capable of guiding concrete decisions on enhancement, the task to which the final development is directed.

Operative normative framework for biomedical enhancement

The transposition of fragility into operative criteria requires, above all, a strict delimitation between therapeutic intervention and the project of enhancement, for in it the legitimacy of biomedical praxis is decided. Therapy is ordered to restoring, sustaining, or alleviating the functions that allow the subject to unfold his life plan within the margins proper to the species, and it finds its justification in the response to factual vulnerability (Daniels, 2000). Enhancement, by contrast, shifts the purpose of medicine toward an optimization without intrinsic limit, whereby clinical practice risks its prudential character by approaching a will to mastery over the biological substrate.

On this basis a principle of precaution of an ontological order is erected, called to govern the cases in which the foregoing delimitation does not suffice. Its object differs from the clinical evaluation of risks, for it is not exhausted in safety or in measurable harm; rather, it asks whether the modification compromises the conditions of possibility of personal identity and the self-understanding of the species (Habermas, 2003). Human dignity is thus bound to the integrity of a nature not produced according to the will of third parties, from which the moral symmetry between generations follows. Technical power over the living calls, by its reach over those who do not yet exist, for a responsibility oriented toward the future (Jonas, 1979/1995).

The application of the principle requires fixing its threshold of activation: therapeutic interventions, or those with reversible effects circumscribed to the individual, admit ordinary evaluation. Reinforced scrutiny is triggered when indicators of erosion of the constitutive concur, namely irreversibility, transmission to descendants, the alteration of the capacities on which identity rests, or the fracture of the common condition that sustains equality. To such cases a graduated response corresponds: therapeutic actions and reversible enhancements of low impact admit the usual clinical supervision; those that touch capacities sensitive to identity are subjected to reinforced conditions and to qualified consent; when uncertainty about identity- or species-level effects is high and their reversibility difficult, a moratorium is in order; and prohibition is reserved for interventions that are irreversible, heritable, or capable of altering the structure of the species. This gradation translates the priority of a public benefit understood as care for the shared conditions of existence (Kaebnick & Gusmano, 2018).

La edición de la línea germinal ofrece el banco de prueba más exigente. La introducción germline editing offers the most demanding test bed. The introduction of heritable modifications in the genome irreversibly alters the relationship between the one who designs and the one who results as designed, so that birth is transformed from a received event into the product of a technical decision (Nuffield Council on Bioethics, 2018), to the detriment of the future individual's right to an open future. Article 13 of the Oviedo Convention captures this caution in positive law, for it provides that "an intervention seeking to modify the human genome may only be undertaken for preventive, diagnostic or therapeutic purposes and only if its aim is not to introduce any modification in the genome of any descendants" (Consejo de Europa [European Council], 1997, art. 13). Germline enhancement is therefore situated at the level of prohibition, while the therapeutic correction of severe pathologies could be weighed under reinforced conditions.

An analogous reasoning governs the neurotechnologies aimed at expanding cognitive capacities beyond the human range. Specialized reflection demands that such developments respect and preserve the privacy, identity, agency, and equality of persons (Yuste et al., 2017), since the integration between the mind and external algorithmic systems can compromise mental privacy and psychological continuity, which explains the emergence of neurorights. The Chilean constitutional reform of 2021 offers a regulatory precedent, for it mandates "to specially safeguard brain activity, as well as the information derived from it" (Ley N.° 21.383, 2021, art. 19). Cognitive vulnerability houses the space where moral deliberation and personal responsibility germinate, so that its preservation belongs to the level of reinforced guarantees.

The indefinite prolongation of life calls, finally, for its own examination, since it disregards that the life cycle, with its decline and its term, fixes the temporal horizon from which personal commitments acquire seriousness and the political community is renewed (Lombard, 2023), and it threatens to engender stagnation and distributive asymmetries, given that its access would be concentrated in a minority, so that it remains subject to reinforced precaution. The resulting framework does not impose an indiscriminate veto, since it orders interventions according to a proportionality attentive to their reversibility, their scope, and their incidence upon that which renders life human, and it redirects the care of health to its proper end.

Conclusions

The study set out from a problem that the convergence of emerging technologies has rendered unavoidable: whether abolishing human vulnerability and finitude through technology is anthropologically and normatively defensible, and how to draw the frontier between a medicine that cares and an enhancement without limit. The inquiry addressed that question from an ethics of vulnerability, attentive both to the structure of the human being and to the demands of justice that derive from it.

From these itinerary articulated findings follow. The conceptual delimitation showed that vulnerability, fragility, and weakness designate distinct realities, and that their confusion enables the equivocation on which the rhetoric of enhancement rests, namely treating as a correctable defect that which is constitutive openness and exposed value. The reconstruction of the pro-enhancement paradigm, taken in its most demanding version, made it evident that its persuasive force coexists with a deficient anthropology. On the ontological plane, fragility revealed itself as the condition of possibility of prudence, of the perception of value, and of dependent agency, so that suppressing it would cancel the goods the project invokes; its political projection showed that the shared vulnerable condition sustains solidarity and a demand of justice that the unequal distribution of enhancements threatens to break.

The position that follows from this can be stated without ambiguity. The claim to eradicate human fragility lacks anthropological coherence and normative justification, since it attacks the conditions that give meaning to moral life and cracks the equality on which the political community rests. Fragility merits recognition and protection by virtue of the value that everything which can be lost contains, far from any exaltation of suffering.

The principal contribution of the study lies in the formulation of a normative criterion with two components. On the one hand, the distinction between therapy and enhancement fixes the threshold of legitimacy of biomedical praxis. On the other, the principle of ontological precaution, with graduated conditions of activation and response, adjusts the regulatory requirement to the risk of erosion of what is constitutive of the human condition, from ordinary authorization to the prohibition of interventions that are irreversible, heritable, or capable of altering the species. From these concrete implications follow: a medicine reoriented toward the care of wounded nature; a proportionate regulation that protects the common genetic heritage and mental integrity; and a scientific policy subordinated to the demands of dignity and distributive justice. The ethics of vulnerability thus directs biotechnological power to the service of care, without halting progress, since it aspires to keep open the question of that which renders life human, so that the decisions of the present do not foreclose the moral future of those who will have to inherit them.

References

AAndorno, R. (2009). Human dignity and human rights as a common ground for a global bioethics. *Journal of Medicine and Philosophy, 34*(3), 223–240. https://doi.org/10.1093/jmp/jhp023

Bostrom, N. (2005a). Transhumanist values. En F. Adams (Ed.), *Ethical issues for the twenty-first century* (pp. 3–14). Philosophy Documentation Center. https://doi.org/10.5840/jpr_2005_26

Bostrom, N. (2005b). In defense of posthuman dignity. *Bioethics, 19*(3), 202–214. https://doi.org/10.1111/j.1467-8519.2005.00437.x

Bostrom, N. & Ord, T. (2006). The reversal test: Eliminating status quo bias in applied ethics. *Ethics, 116*(4), 656–679. https://doi.org/10.1086/505233

Casas, M. L. (2023). ¿Es el transhumanismo un fin de la medicina? *Persona y Bioética, 26*(2), e2629. https://doi.org/10.5294/pebi.2022.26.2.9

Cely, G. (1999). *La bioética en la sociedad del conocimiento: los pobres del tercer milenio son los que no acceden al conocimiento*. 3R Editores. http://hdl.handle.net/10554/3525

Cely, G. (2001). *El horizonte bioético de las ciencias* (5.ª ed.). CEJA; 3R Editores.

Consejo de Europa. (1997). *Convenio para la protección de los derechos humanos y la dignidad del ser humano con respecto a las aplicaciones de la biología y la medicina (Convenio de Oviedo)* (Serie de Tratados Europeos n.º 164). https://archivos.juridicas.unam.mx/www/bjv/libros/5/2290/37.pdf

Daniels, N. (2000). Normal functioning and the treatment-enhancement distinction. *Cambridge Quarterly of Healthcare Ethics, 9*(3), 309–322. https://doi.org/10.1017/S0963180100903037

Fineman, M. A. (2008). The vulnerable subject: Anchoring equality in the human condition. *Yale Journal of Law and Feminism, 20*(1), 1–23. https://ssrn.com/abstract=1131407

Fukuyama, F. (2002). *Our posthuman future: Consequences of the biotechnology revolution*. Farrar, Straus and Giroux.

García, P. (2004). Martha C. Nussbaum: la fragilidad del bien. Azafea: *Revista de Filosofía, 6*(1), 231–260. https://doi.org/10.14201/4738

Habermas, J. (2003). *The future of human nature*. Polity Press.

Jonas, H. (1995). *El principio de responsabilidad: ensayo de una ética para la civilización tecnológica* (J. M. Fernández Retenaga, Trad.). Herder. (Obra original publicada en 1979).

Kaebnick, G. E. & Gusmano, M. K. (2018). Making policies about emerging technologies. *Hastings Center Report, 48*(S1), S2–S11. https://doi.org/10.1002/hast.816

Ley N° 21.383. [Congreso Nacional de Chile] Modifica la Carta Fundamental, para establecer el desarrollo científico y tecnológico al servicio de las personas. 25 de octubre de 2021. https://www.bcn.cl/leychile/navegar?idNorma=1166983

Lombard, J. (2023). Ageing and death: A focus on how to transcend diseases for transhumanist movements. FORUM: *University of Edinburgh Postgraduate Journal of Culture & the Arts*, (34). https://doi.org/10.2218/forum.1.9154

MacIntyre, A. (1999). *Dependent rational animals: Why human beings need the virtues*. Open Court.

Macpherson, I. & Roqué-Sánchez, M. V. (2019). Análisis ético del principio de vulnerabilidad sanitaria. *Cuadernos de Bioética, 30*(100), 253–262. https://doi.org/10.30444/CB.37

Marcos, A. (2016). Vulnerability as a part of human nature. En A. Masferrer & E. García-Sánchez (Eds.), *Human dignity of the vulnerable in the age of rights: Interdisciplinary perspectives* (pp. 29–44). Springer. https://doi.org/10.1007/978-3-319-32693-1_2

McNamee, M. J. & Edwards, S. D. (2006). Transhumanism, medical technology and slippery slopes. *Journal of Medical Ethics, 32*(9), 513–518. https://doi.org/10.1136/jme.2005.013789

Muñoz, J. M. (2021). Vulnerable dignity, dignified vulnerability: Intertwining of ethical principles in end-of-life care. International Journal of Environmental Research and Public Health, 18(2), 482. https://doi.org/10.3390/ijerph18020482

Nuffield Council on Bioethics. (2018). *Genome editing and human reproduction: Social and ethical issues.* Nuffield Council on Bioethics. https://cdn.nuffieldbioethics.org/wp-content/uploads/Genome-editing-and-human-reproduction-report.pdf

Organización de las Naciones Unidas para la Educación, Ciencia y la Cultura (UNESCO). (2006). *Declaración Universal sobre Bioética y Derechos Humanos*. https://unesdoc.unesco.org/ark:/48223/pf0000146180

Parker, M. (2007). The best possible child. *Journal of Medical Ethics, 33*(5), 279–283. https://doi.org/10.1136/jme.2006.018176

Prainsack, B. & Buyx, A. (2011). Solidarity: Reflections on an emerging concept in bioethics. Nuffield Council on Bioethics. https://www.nuffieldbioethics.org/publication/solidarity-reflections-on-an-emerging-concept-in-bioethics/

Rogers, W., Mackenzie, C. & Dodds, S. (2012). Why bioethics needs a concept of vulnerability. *International Journal of Feminist Approaches to Bioethics, 5*(2), 11–38. https://doi.org/10.3138/ijfab.5.2.11

Sandel, M. J. (2004). The case against perfection. The Atlantic Monthly, 293(3), 51–62.

Saunders, B. (2017). First, do no harm: Generalized procreative non-maleficence. *Bioethics, 31*(7), 552–558. https://doi.org/10.1111/bioe.12366

Savulescu, J. & Kahane, G. (2009). The moral obligation to create children with the best chance of the best life. *Bioethics, 23*(5), 274–290. https://doi.org/10.1111/j.1467-8519.2008.00687.x

Savulescu, J. (2004). Procreative beneficence: Why we should select the best children. Bioethics, 15(5-6), 413–426. https://doi.org/10.1111/1467-8519.00251

Schmidt, L. (2007). La dignidad como fundamento de la biopolítica. *Revista Latinoamericana de Bioética, 7*(12), 126–155.

ten Have, H. (2015). Respect for human vulnerability: The emergence of a new principle in bioethics. *Journal of Bioethical Inquiry, 12*(3), 395–408. https://doi.org/10.1007/s11673-015-9641-9

Watson, J. D. E. (2016). A universal human dignity: Its nature, ground and limits [Tesis doctoral, University of Exeter]. https://hdl.handle.net/10871/25977

Yuste, R., Goering, S., Agüera y Arcas, B., Bi, G., Carmena, J. M., Carter, A., Fins, J. J., Friesen, P., Gallant, J., Huggins, J. E., Illes, J., Kellmeyer, P., Klein, E., Marblestone, A., Mitchell, C., Parens, E., Pham, M., Rubel, A., Sadato, N., Specker Sullivan, L., Teicher, M., Wasserman, D., Wexler, A., Whittaker, M. & Wolpaw, J. R. (2017). Four ethical priorities for neurotechnologies and AI. *Nature*, 551, 159–163. https://doi.org/10.1038/551159a

How to cite this article

Aguirre-Lanegra, A. J. (2026). Ethics of vulnerability and the normative limits of biomedical enhancement. *Apuntes De Bioética, 9*(1), AdB1425. https://doi.org/10.35383/apuntes.v9i1.1425

Acknowledgements

To Evelyn Haro Bello, whose companionship has been, throughout these pages, the most silent and most steadfast form of support, and whose faith in this work often preceded my own.

Author Contributions (CRediT)

CRediT: Andherson J. Aguirre-Lanegra: Conceptualization, Data Curation, Formal Analysis, Investigation, Methodology, Project Administration, Resources, Supervision, Validation, Visualization, Writing – Review & Editing.

Funding

This article did not receive specific funding from funding agencies in the public or private sectors for its development and/or publication.

Conflict of interest

The author of the article declares that there is no conflict of interest in its preparation.

© 2026 The Author. Published by Apuntes de Bioética Journal of the Instituto de Bioetica, Universidad Catolica Santo Toribio de Mogrovejo. This is an open-access article distributed under the terms of the Creative Commons Attribution 4.0 Licence (CC BY 4.0), which permits unrestricted use, distribution and reproduction in any medium, provided that the original work is properly cited. The publication terms of this article allow the author, or others with the author's consent, to deposit the accepted manuscript in a repository.