

The Ethics of Human Genomic Enhancement:

A Framework for Public Health Policy



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Thesis Abstract

The pursuit of human genomic enhancement raises bioethical questions surrounding not only individual rights and the consequences of enhancement for enhanced individuals, but surrounding the interests of other groups and whole societies that might be affected by human enhancement. A thorough examination of these ‘collective-level’ morally relevant considerations is needed for bioethics that aims to inform policymaking. The question of whether a given type of human genomic enhancement should be implemented by policymakers in a given country can only be answered by undertaking more collective-oriented ethical analysis. The novel collective-oriented framework for ethical analysis that I present here treats heritable human genomic enhancements as potential public health measures. Considering enhancements as public health measures has a distinct advantage in comparison to past approaches, primarily because public health ethics is an area where a collective-oriented approach has been particularly well developed—thus, taking concepts from that area and applying them to enhancement considered as a public health measure contributes to thorough ethical analysis. I call my resulting framework for performing ethical analysis the ‘Collectivist Public Health framework’. The framework first assesses the consequences of enhancement for groups and society based on their identifiable interests, determining whether it benefits the collective, and whether the magnitude of any harms imposed on individuals or groups are acceptable. It then assesses whether the distribution of these harms and benefits across the country’s population is acceptable. Finally, it compares alternative policies for implementing a given enhancement. The framework can be effectively defended against claims that it may lead to eugenics, that it will incur a loss of human dignity, and that it poses problems surrounding public health resource allocation. Applying the framework to case studies, I find some human genomic enhancements to be ethically desirable public health measures.

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ASD:	Autism Spectrum Disorder
CER:	Duty of Collective Easy Rescue
CER*:	Modified Duty of Collective Easy Rescue
CPH framework:	Collectivist Public Health framework
GGE:	Germline Genome Editing
GGEE:	Germline Genome Editing for Enhancement
PHE:	Public Health Ethics
SCP:	Sufficiency-Constrained Prioritarianism

Chapter 1:

Introduction to the Human Enhancement Debate and Methodological Individualism

Introduction

My thesis proposes a novel framework for assessing the ethical permissibility and desirability of implementing human germline genome editing for enhancement (GGEE) interventions in a given country. GGEE consists of causing heritable modifications to the embryo or gamete cell genome (using techniques such as CRISPR-Cas9 editing), for enhancement purposes.

The permissibility of GGEE remains an open question, with academic views ranging from those that condone radical enhancements that would change the nature of humanity¹ to those that accept only a few modifications that serve the current aims of societies.² Indeed, some philosophers and policymakers reject the idea of the future pursuit of human enhancement entirely, by reference to, among other things, the spectre of Nazi eugenics.³

¹ Nick Bostrom, "Human Genetic Enhancements: A Transhumanist Perspective," *The Journal of Value Inquiry* 37, no. 4 (December 2003), <https://doi.org/10.1023/B:INQU.0000019037.67783.d5>.

² Jonathan Anomaly, *Creating Future People* (Philadelphia: Routledge Press, 2020); Allen Buchanan, "The Landscape of the Enhancement Debate," in his *Beyond Humanity?: The Ethics of Biomedical Enhancement* (Oxford: Oxford University Press, 2011), 1-34; Françoise Baylis, *Altered Inheritance : CRISPR and the Ethics of Human Genome Editing* (Cambridge, MA: Harvard University Press, 2019).

³ Robert Sparrow, "A Not-So-New Eugenics," *Hastings Center Report* 41, no. 1 (January 2011), <https://doi.org/10.1002/j.1552-146X.2011.tb00098.x>; Robert Sparrow, "Yesterday's Child: How Gene Editing for Enhancement Will Produce Obsolescence—and Why It Matters," *The American Journal of Bioethics* 19, no. 7 (July 2019), <https://doi.org/10.1080/15265161.2019.1618943>.

This diversity of views in the debate on human enhancement persists partly because the methods and assumptions used in existing ethical analyses fail to effectively integrate individual- and collective- level moral considerations. Many even define enhancement in different ways.

To begin, I must establish a reasonable definition of human enhancement, and identify the issues of key moral relevance to determining the permissibility and desirability of implementing human enhancement interventions. After doing so, I will introduce the debate on human enhancement (section I), and present problems with the dominant approach (section II). The dominant approach has historically been individualist. This has affected which moral considerations have been included in ethical analysis to date. I argue this may hinder robust ethical analysis that can inform policymaking on human enhancement.

But first, I will briefly discuss the history of enhancement and my chosen definition. Humans have been ‘improving’ in an evolutionary sense since we became a distinguishable species. This improvement began as adaptation to particular environments, at the mercy of natural selection, and was certainly no conscious aim of *Homo sapiens*. However, more recently our (humanity’s) sphere of control over our own evolution has expanded. Although it is debatable when we began *intentionally* influencing our heritable traits,⁴ there is undeniable evidence that we do so today. Examples include nutritional choices during pregnancy, genetic counselling and even compulsory blood tests for the selection of marital partners in some countries such as Cyprus.⁵ Reproductive technologies including non-invasive prenatal testing, chorionic villus sampling, and pre-implantation genetic diagnosis now allow us to

⁴Nick Bostrom and Rebecca Roache, "Ethical Issues in Human Enhancement," in *New Waves in Applied Ethics*, ed. Jesper Ryberg, Thomas Petersen, and Clark Wolf (Basingstoke: Palgrave Macmillan, 2008), 120-152.

⁵George M. Fredrickson and Ruth Schwartz Cowan, *Heredity and Hope : The Case for Genetic Screening* (Cambridge, US: Harvard University Press, 2008).

select our children based on their genes.⁶ To some extent, an individual's genes contribute to determining their traits, or phenotype.⁷ The results can be used by parents to decide whether to continue with a pregnancy, or which of a range of possible embryos to select for a pregnancy based on the future child's expected traits.

Recently, scientific breakthroughs using bacterial genetic tools to modify DNA have fast-tracked our progress towards not only *selecting* a future child, but *engineering* one. Two interventions appear especially promising. First, the bacteria-derived CRISPR-Cas9 system allows 'gene editing'. The system relies on the target cell's own repair mechanisms to change a particular genetic sequence to match an example sequence. Second, 'base editing' is performed via a modified CRISPR-Cas9 system, which avoids reliance on the cell's (sometimes inaccurate) repair mechanisms.⁸ Instead, this system uses another enzyme to help chemically convert DNA bases to different ones (for example, switching a base from an A to a T in the target nucleotide in the target gene).⁹ Using either of these mechanisms, editing somatic (mature) cells successfully would cause changes in that *one* individual, whilst editing reproductive cells successfully (including eggs, sperm, or the single-cell embryo) would produce changes in the individual which can be inherited by their descendants. This latter type of modification is termed germline genome editing (GGE). GGE might be used to

⁶ Patricia Kaufert, "Health policy and the new genetics," *Social Science and Medicine* 51 (2000): 821-829.

⁷ Note that when discussing the link between genotype and phenotype, we must be careful not to fall prone to 'genetic determinism', which overestimates the causal links between genes and traits, ignoring the epigenetic and broader environmental factors that also influence traits. For more, see: David B. Resnik and Daniel B. Vorhaus, "Genetic Modification and Genetic Determinism," *Philosophy, Ethics, and Humanities in Medicine* 1, no. 1 (June 2006), <https://doi.org/10.1186/1747-5341-1-9>. However, the role that our genetic inheritance plays in influencing our traits should also not be understated. For example, the heritability of intelligence has been shown by some recent studies to be as high as 80%. For more, see: Robert Plomin and Ian Deary, "Genetics and Intelligence Differences: Five Special Findings," *Molecular Psychiatry* 20, no. 1 (2015): 98-108, <https://doi.org/10.1038/mp.2014.105>.

⁸ Puping Liang et al., "CRISPR/Cas9-Mediated Gene Editing in Human Trippronuclear Zygotes," *Protein & Cell* 6, no. 5 (April 2015): 363-372, <https://doi.org/10.1007/s13238-015-0153-5>.

⁹ Heidi Ledford, "Gene-Editing Hack Yields Pinpoint Precision," *Nature* (April 2016), <https://doi.org/10.1038/nature.2016.19773>.

prevent a child from being born with a disease, or to change another trait, or, perhaps in the future, to introduce a new trait.

It should be noted that the effects of these genetic changes on an individual's traits always depend on more than simply changing the DNA. Epigenetic mechanisms regulate gene expression, and mechanisms like DNA methylation and histone modification can be influenced by multiple biological and cultural factors, from culture to nutrition. These mechanisms affect where proteins bind and how DNA is stored in the nucleus, among other things. The implications of epigenetics are that genome editing is never an entirely predictable process with exact results for trait changes.¹⁰ Yet, controlling our genes better does have at least some effect on our traits.

Increasing human control over genetic influences on our traits is cause for both celebration and caution. We can now edit ourselves and our future children. Whilst there are safety and efficacy concerns with GGE that keep it from being clinically used right now, the expanding circle of influence that humanity has over our traits call for 'speculative bioethics' research to be done.¹¹ That is, to ensure that law and policy are prepared for the advent of GGE in practice, research is needed that looks at prospective ethical concerns with this emerging technology. Such work must be grounded in current circumstances and systems, but it must investigate possible future uses of GGE, including preventing (sufficiently genetic) diseases, and enhancing other (sufficiently genetic) traits. Whilst biological enhancement by other means already exists, speculative work specifically on GGE for enhancement raises particularly interesting questions surrounding fair access, and has

¹⁰ Diego Molina-Serrano, Dimitris Kyriakou, and Antonis Kirmizis, "Histone Modifications as an Intersection Between Diet and Longevity," *Frontiers in Genetics* 10 (2019), <https://www.frontiersin.org/article/10.3389/fgene.2019.00192>; Lisa D. Moore, Thuc Le, and Guoping Fan, "DNA Methylation and Its Basic Function," *Neuropsychopharmacology* 38, no. 1 (2013/01/01 2013), <https://doi.org/10.1038/npp.2012.112>, <https://doi.org/10.1038/npp.2012.112>.

¹¹ For more on speculative bioethics work that ethically examines an emerging technology—in this case, artificial wombs—and its use for examining contemporary issues, anticipating future ones, and informing future policy, see: Claire Horn and Elizabeth Chloe Romanis, "Establishing Boundaries for Speculation About Artificial Wombs, Ectogenesis, Gender, and the Gestating Body" in *A Jurisprudence of the Body*, ed. Chris Dietz, Mitchell Travis, and Michael Thomson (London: Palgrave MacMillan, 2020): 227-254.

significant, society-wide prospective effects because the changes are heritable and may include effects on multiple, important traits. In this thesis, I focus on human GGE for enhancement (hereafter termed GGEE) rather than somatic alterations, or enhancement via biomedical or physical means. However, the analysis I conduct here may also help in the development of work on these other forms of enhancement, to ensure they adequately consider morally relevant effects on society and people other than the enhanced individual.

Following on from this background on GGEE, I turn to introducing the definition of human enhancement I will use throughout the thesis.

In the literature, sometimes enhancement is defined in direct opposition to treatment.¹² According to these definitions, whilst treatments aim to ameliorate an existing health deficit or problem, enhancements do not. Instead, enhancements target traits unrelated to health, or traits for which the person has no existing deficit (i.e., the trait functions normally). Yet, defining enhancement this way may be overly limiting. When considering whether to pursue GGEE, we may wish to consider, for instance, whether we should implement improvements to the immune system that prevent the contraction of a particular infectious disease.¹³ This and many other enhancements blur the lines between treatment and improvement, as I discuss further in Chapter 3. Exploring such GGEE interventions would be outside the remit of a thesis that employs a narrower definition of human enhancement. Instead, a broader definition like the one I present is needed.

¹² For more on the distinction between treatments and enhancements, see: Norman Daniels, "Normal Functioning and the Treatment-Enhancement Distinction," *Cambridge Quarterly of Healthcare Ethics* 9, no. 3 (2000): 309-322, <https://doi.org/10.1017/S0963180100903037>; David B. Resnik, "The Moral Significance of the Therapy-Enhancement Distinction in Human Genetics," *Cambridge Quarterly of Healthcare Ethics* 9, no. 3 (2000): 365-377, <https://doi.org/10.1017/S0963180100903086>.

¹³ John Harris, *Enhancing Evolution : The Ethical Case for Making Better People* (Princeton: Princeton University Press, 2007).

‘Human enhancement’ has proven particularly difficult to define when it comes to genome editing.¹⁴ The example of IQ-measured intelligence illustrates the point. Say, given the large genetic influence on intelligence,¹⁵ one uses GGE to improve one’s future child’s expected IQ of 100 to an IQ of 110. This could be, at the most basic level, defined as an enhancement simply because IQ has been raised. But what if the individual’s IQ without enhancement would have been very low (say, 65), and was improved either to an average level (100), or to an atypically high level (140), or even to a level that exceeds species maximum for the trait (200)? Different approaches to enhancement define each case differently. They are explored comprehensively in works by Julian Savulescu, Ruud ter Meulen, and Guy Kahane,¹⁶ and Chris Gyngell and Michael Selgelid.¹⁷

One of the most promising definitions of enhancement to include all the interventions we may wish to analyse focuses on one possible purpose of an intervention: improved welfare. According to this welfarist approach, human enhancement is ‘any change in the biology or psychology of a person which increases the chances of leading a good life in the relevant set of circumstances.’¹⁸ Focussing on welfare instead of normal trait functioning has two distinct advantages. The first is that it acknowledges the socially constructed nature of some aspects of disease and disability by implying that changes to the person to improve their chances of leading a good life may not correspond with increases in trait functioning or the elimination of a disability. Indeed, there may be some impairments that conceivably

¹⁴ Chris Gyngell and Michael Selgelid, "Human Enhancement: Conceptual Clarity and Moral Significance," in *The Ethics of Human Enhancement: Understanding the Debate*, ed. Stephen Clarke et al. (Oxford Scholarship Online, 2016), 111-126.

¹⁵ Eva Krapohl et al., "The High Heritability of Educational Achievement Reflects Many Genetically Influenced Traits, Not Just Intelligence," *Proceedings of the National Academy of Sciences* 111, no. 41 (2014): 15273-15278, <https://doi.org/10.1073/pnas.1408777111>.

¹⁶ Julian Savulescu, Ruud ter Meulen, and Guy Kahane, "Well-Being and Enhancement" in their *Enhancing Human Capacities*, (Chichester, England: Wiley-Blackwell, 2011), 3-18.

¹⁷ Gyngell and Selgelid, "Human Enhancement: Conceptual Clarity and Moral Significance."

¹⁸ Savulescu, ter Meulen, and Kahane, "Well-Being and Enhancement," 7.

improve wellbeing in the relevant set of circumstances for a particular child.¹⁹ The second advantage is that, by not calling trait alterations ‘enhancements’ when this involves genetic change *without* improvement in wellbeing (e.g., altering height when it does not improve wellbeing), this account tethers the definition of enhancement to the production of actual value in people’s lives. The welfarist approach does away entirely with the distinction between categories of enhancement and treatment through its focus on wellbeing.

However, the welfarist approach is inappropriate according to Gyngell and Selgelid, as it offers a normative definition of enhancement²⁰ (as is also explicitly claimed by proponents of the approach).²¹ According to welfarists, enhancements are only such if they improve wellbeing, and thus are ‘good in a predicative sense’.²² This phrase may indicate that a normative view of wellbeing is assumed, wherein wellbeing is something to be promoted and sought after, and thus, so too is enhancement—so, at least, claim Gyngell and Selgelid.

Normativity may imply there is moral, prudential, ethical or other reason to do something (e.g., undertake an enhancement). It may also imply an obligation to do something, or merely a contributing reason. If the very term ‘enhancement’ implies something is good, then the approach may be reductive: it may disqualify further ethical evaluation of enhancement interventions. After all, if enhancements are morally good by definition, what work would an ethical analysis of enhancements have to do? However, this interpretation of Gyngell and Selgelid’s may be too uncharitable. More plausibly, the welfarist definition of enhancement is intended in a more limited normative sense, wherein by linking enhancement to wellbeing, the authors assert that there is *a moral reason* to pursue enhancement. This interpretation still

¹⁹ Such a case is considered by Julian Savulescu and Guy Kahane, regarding the selection of a deaf child by deaf parents. Although they claim that in almost all circumstances, parents do not have reason to genetically select for a deaf child on welfarist definitions of disability, they do hold that there may be some cases in which the trait of deafness is conducive to leading a good life for a particular child. Julian Savulescu and Guy Kahane, "The Moral Obligation to Create Children with the Best Chance of the Best Life," *Bioethics* 23, no. 5 (2009): 274-290. See esp. at 284-289.

²⁰ Gyngell and Selgelid, "Human Enhancement: Conceptual Clarity and Moral Significance."

²¹ Savulescu, ter Meulen, and Kahane, "Well-Being and Enhancement."

²² Savulescu, ter Meulen, and Kahane, "Well-Being and Enhancement," 6.

leaves room for overall ethical evaluation of the pursuit of GGEE outside of its effects on the individual's wellbeing.

If we take the more charitable interpretation, then the welfarist definition may be a good fit for my aims here. Yet, further development of the definition is still needed. Whilst a case has been made for considering wellbeing, the target of such interventions is limited in the welfarist definition. Only the individual is considered as providing a wellbeing-based reason to consider an intervention as an enhancement, and perhaps to pursue it. Yet, we may want to include under the banner of 'enhancement' those interventions that (aim to) improve the wellbeing of groups (which may or may not include the enhanced individual). For instance, consider an intervention that makes the individual more altruistic. This more altruistic disposition may come at some small cost to the individual, but it may produce great benefit for those with whom they interact.

For the purposes of this thesis, I build on the welfarist definition of human enhancement to define it as follows:

Human enhancement: the modification of individuals to produce some wellbeing-related benefit to either the individual or the collective, regardless of whether the individual has an existing deficit in the target trait.

Note two ways that this definition is deliberately more inclusive than most.

First, it does not exclude therapeutic or treatment uses of genome editing. Rather, therapeutic and non-therapeutic interventions may be both considered as contributing to wellbeing. However, the examples I use here are primarily interventions that are non-therapeutic, to highlight the more controversial applications of the framework I present in this thesis, involving more paradigmatic cases of enhancement.

Second, it does not exclude interventions that might benefit the collective, whilst harming the individual, or vice versa. We should not necessarily pursue all the interventions I include among ‘enhancements’, because some of them, whilst providing a welfare benefit to the individual, pose too great a harm to the collective (i.e., a given population excluding the benefited individual). The reverse may be true for enhancements that benefit the wider population at the expense of the enhanced individual.²³ I have chosen to use this expansive definition in order to align with intuitions regarding what is included as an enhancement, many of which may be interventions that provide positional benefits to the individual, thus harming the collective (e.g., height or attractiveness enhancements). It also allows me to consider interventions that might seem intuitive to pursue from a state or institutional level, many of which may benefit the remaining population, whilst harming enhanced individuals (e.g., enhancements that promote individuals’ compliance with authority, leading to more societal cooperation but less individual freedom). Each of these types of enhancements is controversial and may or may not be ethically acceptable to pursue, but each is an intervention that, intuitively, should be assessed as part of a thorough-going ethical analysis of human enhancements, to determine whether, when harms *are* posed to individuals or the collective, these harms are acceptable.

Having offered a background on human enhancement and a working definition, I now turn to the debate on enhancement as it stands.

²³ This adaptation of the welfarist definition might also be framed as considering prudential enhancements, those that promote individual wellbeing, and altruistic or moral enhancements, which promote society-wide wellbeing.

Introducing the Human Enhancement Debate

The debate on human enhancement has been going on for decades—so why are further contributions to the extensive literature needed?

There are certain ways human enhancement might be pursued that increase the urgency of ethically informed policy on GGEE that provides barriers to some of the worse future scenarios. Much depends, then, on the debate producing the right approach for ethically guiding policymakers. Human enhancement could help solve problems humanity faces including climate change, existential threats from extremist individuals and groups, and increasing political polarization.²⁴ Consider each in turn. The changes to our physical environment and our societies that may result from climate change²⁵ will require urgent response. Enhancement has the potential to speed up our adaptation to these new environments. Regarding threats from extremist groups, the accessibility of dual-use technologies (including tools for genome editing) poses a problem that, it has been suggested, may be addressed through some forms of moral enhancement.²⁶ Finally, political polarization lends itself to fragmentation of views on many public issues, which can impede action to solve important problems. It may be that enhancement is one way to improve political debate, by increasing our compassion, decision-making capacities, or motivation to participate in a political community.

²⁴ Stephen Clarke, "Buchanan and the Conservative Argument against Human Enhancement from Biological and Social Harmony," in *The Ethics of Human Enhancement: Understanding The Debate*, ed. Stephen Clarke et al. (Oxford: Oxford University Press, 2016).

²⁵ Linda Marsa, "Scorched Earth, 2200AD," *Aeon*, ed. Pam Weintraub (2015)
<https://aeon.co/essays/welcome-to-earth-2200-ad-pop-500-million-temp-180-f>.

²⁶ Ingmar Persson and Julian Savulescu, "The Perils of Cognitive Enhancement and the Urgent Imperative to Enhance the Moral Character of Humanity," *Journal of Applied Philosophy* 25, no. 3 (2008): 162-177,
<https://doi.org/10.1111/j.1468-5930.2008.00410.x>.

These scenarios provide potential reasons to consider pursuing enhancement, and for aiming for results from the debate on human enhancement as soon as possible. However, overhasty acceptance of enhancement risks turning ethical debate into ‘fast ethics’, an ill-considered form that fails to consider all viewpoints.²⁷ This fast ethics, to keep up with ‘fast science’, must come up with simple, quick answers to the ethical questions, even where more consideration is needed. To allow more time for ethical deliberation, a moratorium is currently agreed on the clinical use of genome editing tools, and hence on GGEE, too. Ethicists must use the time provided by the moratorium to develop practical, action-guiding ethical advice for governments and policymakers who may implement GGEE in the future.

Current regulation as a starting point for ethical analysis

In 2015, following the first use of CRISPR-Cas9 in non-viable human embryos, four scientific agencies released a joint statement condemning use of genome editing technologies before ‘focussed basic research’ has been performed regarding its safety, possible risks and benefits, and appropriate regulation.²⁸ Yet, the statement was cautiously optimistic about the potential benefits and uses of genome editing technologies in the future, and highlighted the importance of continued research in the area.²⁹ In the same year, a global summit on GGE emphasised the need for broad societal consensus on whether and how it should be pursued. More recently, scientist He Jiankui performed GGE on human embryos that were brought to term for the first time, contravening the moratorium, in 2018.³⁰ This resulted in the birth

²⁷ Baylis, *Altered Inheritance : CRISPR and the Ethics of Human Genome Editing*.

²⁸ *The Opportunities and Limits of Genome Editing*, National Academy of Sciences Leopoldina, National Academy of Science and Engineering, Union of German Academies of Sciences and Humanities, German Research Foundation (Halle, Saale: 2015), accessed April 1, 2021. <https://www.leopoldina.org/en/publications/detailview/publication/the-opportunities-and-limits-of-genome-editing-2015/>. See esp. at 19.

²⁹ *The Opportunities and Limits of Genome Editing*.

³⁰ Baylis, *Altered Inheritance : CRISPR and the Ethics of Human Genome Editing*. See esp. at 143.

of the world's first gene-edited twins.³¹ A second global summit held at the end of 2018 condemned the action, yet it also recommended a translational pathway towards lifting the moratorium and pursuing GGE research for treatment purposes only.³² More recently, reports offered by the World Health Organization³³ and the SIENNA working group on ethical, legal and social effects of new technologies³⁴ have each advocated continued research into GGE, although neither could be considered to take a pro-enhancement stance or to be advocating for clinical implementation.

Public opinion, too, is conflicted, but perhaps becoming gradually more permissive, at least of GGE for treatment purposes, as shown in a recent study by the Royal Society in the UK. 76% of respondents were found to support GGE for treatment, whilst 60-69% of respondents were against GGEE, depending on the types of enhancements listed.³⁵ However, though support for GGEE is clearly much more limited than support of GGE for treatment, the distinction is often blurry.³⁶ There is a case to be made for considering the questions that GGEE *specifically* raises, and that individual interventions within that definition raise, before it is implemented or made accessible. A cautious approach like this is justified by reference to a version of the precautionary principle, derived from environmental ethics,

³¹ He Jiankui, "About Lulu and Nana: Twin Girls Born Healthy After Gene Surgery As Single-Cell Embryos," (Youtube, 2018). Accessed September 2, 2020.

<https://www.youtube.com/watch?v=th0vnOmFltc&app=desktop>.

³² *Statement From the Organising Committee of the Second International Human Genome Editing Summit*, Academy of Sciences of Hong Kong, U.S. National Academy of Sciences, U.S. National Academy of Medicine and the Royal Society (Hong Kong, 2018), accessed April 2, 2021.

<https://www.nationalacademies.org/news/2018/11/statement-by-the-organizing-committee-of-the-second-international-summit-on-human-genome-editing#:~:text=At%20this%20summit%20we%20heard,claimed%20DNA%20modifications%20have%20ooccurre>. See esp. at 2.

³³ *Human Genome Editing: A Framework for Governance*, World Health Organization Expert Advisory Committee on Developing Global Standards for Governance and Oversight of Human Genome Editing (Geneva: World Health Organization, 2021), accessed August 2, 2021.

<https://www.who.int/publications/i/item/9789240030060>.

³⁴ Michael Kuhler et al., *D3.7: Proposal for an Ethical Framework for Human Enhancement*, European Commission SIENNA Working Group (2020), accessed May 5, 2021.

<https://ec.europa.eu/research/participants/documents/downloadPublic?documentIds=080166e5cebf4471&appId=PPGMS>.

³⁵ Anita van Mil, Henrietta Hopkins, and Suzannah Kinsella, *Potential Uses for Genetic Technologies: Dialogue and Engagement Research Conducted on Behalf of the Royal Society* (London: The Royal Society, 2017).

<https://royalsociety.org/topics-policy/publications/2018/genetic-technologies-public-dialogue/>.

³⁶ Baylis, *Altered Inheritance: CRISPR and the Ethics of Human Genome Editing*.

which requires that in the context of technologies that pose threats to human health or the environment, ‘the proponent of an activity, rather than the public, should bear the burden of proof [for justifying use of the technology].’³⁷ In the context of GGEE, the burden of proof rests on proponents of enhancement, with justification required for implementing each individual enhancement intervention.

II

Individualism

Individualism and collectivism are two methodological approaches in ethics for assessing person-affecting moral considerations. They assign different priority or weighting to considerations relating to individuals vs groups.

Individualism as I use the term here refers to:

Individualism: Ethical analysis of an issue that solely considers the interests and concerns of individuals undertaking an act or directly affected by it, or that prioritises those interests over the interests and concerns of third parties.

This can be contrasted with ‘collectivist’ work, defined as:

Collectivism: Ethical analysis of an issue that solely considers the interests and concerns of collectives affected by an act, or that prioritises those interests over the interests and concerns of the individuals undertaking or directly affected by the act.

³⁷ "Wingspread Statement on the Precautionary Principle," The Global Development Research Centre (1998), accessed November 28, 2019. <http://www.gdrc.org/u-gov/precaution-3.html>.

An individualist approach is the dominant approach in the debate when it comes to assessing human enhancement. However, it may be problematic when individual concerns are treated not as mere contributing factors or *pro tanto* reasons for or against pursuing enhancement, but as providing an all-things-considered judgement of whether GGEE is permissible. This assumed sufficiency of an individualist approach to answer ethical questions surrounding GGEE interventions has not been thoroughly challenged in the debate. Where a collectivist approach has been favoured, *benefits* to the collective are often dismissed too quickly, or collectivism operates by simply aggregating the consequences of using GGEE for multiple individuals, which can sometimes obscure morally relevant consequences that are more visible at the population level.³⁸ These problems also hold for individualist approaches that include group-level moral considerations, as I examine in this section, which sets up the case for further development of a collectivist approach. I explore the collectivist approach further in Chapter 2, aiming to develop an account that includes both individual and collective interests in an all-things-considered ethical analysis GGEE interventions.

The histories of individualism and collectivism as methodological approaches in ethics highlight interesting parts of the conflict between the two. The divide might trace its heritage back to the ‘dualism of practical reason’—that is, the conflict between egoism and morality as methods of ethics explored by Henry Sidgwick.³⁹ Sidgwick claims that to determine what we ought to do, there are two equally defensible paths open to us.⁴⁰ The first is egoism. Egoism is the view that rational beings should do what is in their own best interests. The

³⁸ I explain these problems with collectivism further in the next chapter.

³⁹ Henry Sidgwick, *The Methods of Ethics*, 7th ed. (London: Macmillan, 1907).

⁴⁰ As David O. Brink notes, it is unclear whether Sidgwick intends these to denote equally defensible paths of *morality*, i.e., competing moral theories, or paths of *action*, i.e., normative reasons for action based either on individual prudence/rationality (for egoism) or morality (for utilitarianism). For more, see David O. Brink, "Sidgwick's Dualism of Practical Reason," *Australasian Journal of Philosophy* 66, no. 3 (1988): 291-307, <https://doi.org/10.1080/00048408812343381>.

second is morality. Its precepts dictate that rational moral beings should do what produces the most happiness (for all). The problem with discovering or deciding what one ought to do is that the paths may lead in different directions. One might resolve this problem by favouring one approach over the other, either preferring guidance from utilitarianism, or from egoism. Alternatively, one might take the action that both egoism and utilitarianism condone.

The way I discuss individualism and collectivism here mirrors Sidgwick's conception. Each concept does not refer to a substantive ethical commitment or theory, but rather a way (or lens through which) to conduct ethical analysis, a methodological approach. Individualism, then, treats the individual as the primary unit of moral concern in ethical analysis. What's more, thus far in the debate it has often seemed that the approach to solving this methodological dualism is to prefer individualism to collectivism. My concern is that individualism is inadequate to account for all morally relevant considerations in ethical analysis. The same way that egoism cannot account for our interactions with others outside of a prudential lens, individualism cannot account for the morally relevant outcomes of our actions on others. This is demonstrated in cases like those I will raise below, and in Chapter 2. Rather than preferring individualism, then, I advocate for searching for actions that are condoned both by individualist and collectivist moral considerations. Indeed, if anything, for as society-affecting an issue as human enhancement, I argue (primarily in the next chapter) that we might prefer slightly more collectivist ethical guidance.

Individualist moral theories are sometimes traced further back to their more theoretical and metaphysical (rather than methodological) roots, with Thomas Hobbes. Hobbes urges us to 'consider men as if but even now sprung out of the earth, and suddainly (like Mushromes) come to full maturity without all kind of engagement to each

other'.⁴¹ To Hobbes, the self is pre-social, not defined by connection with others. This can be contrasted with collectivist theories, which, to varying degrees, recognise people's identities as constructed *in relation to others*, rather than as independent beings. For example, Hume claims, contra Hobbes, that 'Tis utterly impossible for men to remain any considerable time in that savage condition, which precedes society; but that his very first state and situation may justly be esteem'd social'.⁴² If identity is never independent, if we are social beings, then this may provide a basis for claiming that ethical analysis must consider group-level moral concerns. This would further justify a preference for collectivism as a methodological approach. However, we must also recognise the way that a *balanced* approach protects against the risks of extreme methodological collectivism, which may inappropriately justify sacrificing individuals to the collective interest. In *Economy and Society*, Max Weber claims 'When discussing social phenomena, we often talk about various 'social collectivities, such as states, associations, business corporations, foundations, as if they were individual persons'.⁴³ Weber is concerned that this may give too much power to the collective interests in some cases.

Yet, the primary problem I identify with the debate on human enhancement as it stands is not taking collectivism too far, but the opposite. In Chapter 2 I discuss how we can employ both individualism and collectivism to formulate a thorough ethical analysis of GGEE interventions.

⁴¹ Thomas Hobbes, *De Cive, or The Citizen* (New York: Appleton-Century-Crofts, ed. 1949, 1651). See section 8:1.

⁴² David Hume, *A Treatise on Human Nature: In Two Volumes. Volume One*, ed. A. D. Lindsay, Everyman's Library, (Miami, FL.: HardPress Publishing, 2013).

⁴³ Max Weber, *Economy and Society: A New Translation*, trans. Keith Tribe (Cambridge, MA: Harvard University Press, 2019). See at 13.

A brief note on perfectionism

Before proceeding to the next chapter, a brief note is needed on another possible intersection between individualism and enhancement which will not be my primary focus here. ‘Human nature perfectionism’ refers to the conception of the human good in terms of the improvement of human nature, on an individual or species level.⁴⁴ This is not necessarily individualist, if we consider the good to consist also in the perfection of humans other than ourselves. However, in the enhancement context, some claim that perfectionism is associated with accounts that have developed exclusionary or otherwise-controversial lists of the valuable properties of human nature for individuals, that often use the concept of normality normatively, and leave little room for alternative conceptions of the good outside an idea of a perfect human specimen.⁴⁵ As Steven Wall notes, ‘human nature is not necessarily a monistic ideal, given that different trade-offs between one’s own perfection and the perfection of others may be rationally eligible and this too will contribute to the plurality and variety of modes of life consistent with the perfectionist ideal.’⁴⁶

Transhumanist ideals of redesigning humanity often seem to reduce humanity to an individual, and an individual to desirable properties that can be pursued using GGEE—intelligence, physical prowess, and other forms of excellence are often the targets of such works.⁴⁷ This may seem like a ‘vision that denigrates our humanity, calling us to improve ourselves technologically so that we could voluntarily become extinct [...] to commit collective suicide as a species.’⁴⁸ By focussing on excellence, perfectionist transhumanism may neglect the social and political interactions that people need in order to flourish. That

⁴⁴ Steven Wall, "Perfectionism in Moral and Political Philosophy," in *The Stanford Encyclopedia of Philosophy*, ed. Edward N Zalta (Summer 2019). <https://plato.stanford.edu/entries/perfectionism-moral/>.

⁴⁵ Robert Sparrow, "Egalitarianism and Moral Bioenhancement," *The American Journal of Bioethics* 14, no. 4 (2014): 20-28, <https://doi.org/10.1080/15265161.2014.889241>.

⁴⁶ Wall, "Perfectionism in Moral and Political Philosophy."

⁴⁷ See, e.g., Bostrom, "Human Genetic Enhancements: A Transhumanist Perspective."

⁴⁸ Hava Tirosh-Samuels, "In Pursuit of Perfection: The Misguided Transhumanist Vision," *Theology and Science* 16, no. 2 (March 2018), <https://doi.org/10.1080/14746700.2018.1463659>. See at 204.

is, a focus on individual perfection may not lead to happiness or other improvement that we would want from enhancement.⁴⁹ This particular concern may be more specific to perfectionism as a form of individualism (the broader category), but others that apply to individualism more broadly can motivate a shift toward a more collectivist perspective.

Conclusion

The first section of this chapter provided background on gene editing, and a working definition of human enhancement. I introduced pressures on the human enhancement debate from misuse and ‘fast science’. Yet, few plausible or practically guiding arguments have been forthcoming from the academic literature. I indicated that some of this limitation may be the result of methodological individualism, with more specific discussion to follow in the next chapter. When it comes to ethical analysis of GGEE interventions, it seems that ethical methods with overemphasis on individual-level moral considerations cannot account for all relevant concerns, and thus cannot provide an all-things-considered ethical judgement on a given GGEE intervention.

The key points from this chapter, regarding the definition of enhancement, key moves in the debate on enhancement, and the dominant approach are outlined in Summary Box 1.

⁴⁹ Tirosh-Samuelson, "In Pursuit of Perfection: The Misguided Transhumanist Vision." 207.

Summary Box

Enhancement: Definition, Debate, and Dominant Approach

DEFINITION

- Modification to individuals
- Aiming to produce wellbeing improvement
- Whether an individual has a deficit in the trait is irrelevant
- Whether the trait is health-related is irrelevant

DEBATE

- Moratorium on germline genome editing clinical research
- First genetically enhanced babies are already born
- Bioconservatives and bioliberals disagree on if genetic enhancement should ever be permitted

DOMINANT APPROACH

- Individualism: solely or primarily considers individuals in ethical analysis
- Implies concern primarily for child and parents in enhancement debate

OUTCOME: The enhancement debate has reached an impasse. A new approach (developing collectivism) is needed for effective ethical evaluation of genetic enhancement interventions.

Summary Box 1: Key points from Chapter 1 concerning the definition of, debate on, and dominant approach to human enhancement.

The next chapter shows flaws with both the dominant approach of individualism, and the proposed alternative, collectivism. I suggest that a thorough approach that combines individualism and collectivism is the best way forward in ethical analysis of GGEE interventions. My work fills a niche in the debate that is left by the problems with collectivism as it stands.

Chapter 2:

Problems with Methodological Collectivism in Human Enhancement

Introduction

Within the debate on human enhancement, interestingly, there is some alignment between the approaches mentioned in the previous chapter and stances on human enhancement: individualists tend to be in favour of individuals' pursuit of enhancement, and collectivists tend to argue against enhancement pursued either by individuals or groups. I believe that this alignment of views results from weaknesses in each side's analyses of enhancement through a single lens of either individualism or collectivism. Individualist methodological approaches highlight the benefits of enhancement because the benefits generally fall upon the individual. Thus, individualists may overestimate the benefits of enhancement compared to the harms. Collectivist methods highlight the harms that generally affect people other than the person being enhanced, and are therefore evident at the collective level. Thus, collectivists tend to place too much weight on the harms of human enhancement. In this chapter, I highlight examples of these trends, and suggest that a new approach is needed to develop robust ethical analysis that can inform policymaking on GGEE.⁵⁰

⁵⁰ This chapter was also developed into a stand-alone article on collectivism and individualism in the enhancement debate, with extensive overlap between the two versions. For more, see: Tess Johnson, "Enhancing the Collectivist Critique: Accounts of the Human Enhancement Debate," *Medicine, Health Care and Philosophy* (2021), <https://doi.org/10.1007/s11019-021-10030-7>. A much shorter version for a public audience can be found at: Tess Johnson, "Human Genetic Enhancement Might Soon be Possible – But Where Do We Draw the Line?," *The Conversation* (December 3, 2019), accessed April 1, 2022. <https://theconversation.com/human-genetic-enhancement-might-soon-be-possible-but-where-do-we-draw-the-line-127406>. The shorter article has also been translated and published in French. See: Tess Johnson,

First, I argue that it is problematic to treat the individualist approach as a comprehensive ethical analysis—that is, as determining the all-things-considered permissibility of a GGEE intervention, rather than as merely contributing *pro tanto* reasons for or against its permissibility (section I). This argument aligns with the ‘collectivist critique’, which highlights gaps in individualist methodology, and rather proposes the use of collective-oriented moral concepts and principles in ethical analysis of human enhancements, at least to supplement individualism in ethical analysis.⁵¹ Collectivist moral concepts that may be relevant in the analysis include: public participation, solidarity, collective-level welfare, a type of cost/benefit analysis, public goods, and a concept of distributive justice (these concepts will be explained fully in Chapter 4). The collectivist critique holds that using these collectivist concepts brings collective-level, morally relevant considerations to deliberations on enhancement, and that such considerations are necessary for a thorough ethical analysis. The collectivist critique may seem overly strong if it is interpreted as claiming that an individualist methodology fails to address any collective-level moral considerations at all. However, this is merely one interpretation. The form of the critique that I adhere to acknowledges that much individualist work merely *primarily* considers individual-level factors. This form, then, simply holds that *more* collective-level factors need to be considered.

The collectivist approach, as it stands, fails to fill the gap. Further development is required for collectivist work to effectively contribute to a thorough ethical analysis (as I explore in section II). I examine how some current collectivist work⁵² demonstrates two problems that

"L'Amélioration Génétique, une Question de Justice," in *22 Penseurs pour 2022*, ed. and trans. Charlotte Peytour and Julie Davidoux (Paris, France: Philosophie Magazine, 2022).

⁵¹ I acknowledge that collectivism can be understood in various ways. For example, in the case of religious groups, the term might be used to refer to the interests or commitments of their own community, rather than the interests of a broader society. Thus, we can distinguish between broader collectivism, and what we might call ‘community collectivism’. I use the former, broad understanding, as discussed further below.

⁵² Examples include: Roberto Andorno et al., "Geneva Statement on Heritable Human Genome Editing: The Need for Course Correction," *Trends in Biotechnology* (2020), <https://doi.org/10.1016/j.tibtech.2019.11.004>; *Beyond Therapy: Biotechnology and the Pursuit of Happiness* (Washington, DC: The President’s Council on Bioethics, 2003); Michael Sandel, *The Case Against Perfection: Ethics in the Age of Genetic Engineering* (Cambridge, MA:

can lead prematurely to the conclusion that pursuing GGEE is morally impermissible: failures to challenge individualist assumptions, and failures to appropriately weigh individualist *vs* collectivist ethical considerations where they conflict. Finally, I argue that to further develop collectivism in an ethical analysis of GGEE interventions, we may apply concepts from other areas, such as public health ethics (PHE), where collectivism has been developed effectively and without the problems I discuss (section III).

Before proceeding, let me define collectives and present some initial reasons for taking a more collectivist approach to human genomic enhancement, based on public goods problems and collective action problems.

Collectives, as I understand the term here, are aggregates of the individuals directly involved in GGEE interventions, other specific groups, and the public or society more broadly. That is, they are populations that have stakes in whether enhancement is pursued or not. Sometimes, a collective can refer to the individual being enhanced and all others, and sometimes the collective refers to the population excluding the individual. To illustrate the contrast, take, for instance, a case where the individual's interests align with others, perhaps where an enhancement improves an individual's immunity and contributes to protecting a community from disease spread, too. Contrast, this, then, with a case where the individual's interests conflict with everyone else's, perhaps where enhanced physical attractiveness produces a competitive advantage for the individual. I use the term collective both ways in this thesis, with the differences identifiable in the context of whether the harms/benefits to the individual and harms/benefits to the collective align.

Harvard University Press, 2007); Robert Sparrow, "Human Enhancement for Whom?," in *The Ethics of Human Enhancement: Understanding the Debate*, ed. Stephen Clarke et al. (Oxford University Press, 2016), 127-142.

Some collectives or groups can be broken down into their individual members, and in these cases, collectivist ethical analysis is merely aggregative, considering morally relevant factors for these groups as the collection of morally relevant factors for their individual members. This kind of collectivist analysis might be relevant when considering groups of otherwise-unconnected people who merely share an interest or characteristic. In some cases, however, I hold that collectives cannot be broken down into individual members without losing sight of morally relevant considerations (say, when considering the interests of an indigenous community as a whole, and then the interests of its individual members, an example discussed further below). In these cases, a different kind of collectivist analysis comes into play. Here, the morally relevant concerns cannot be accounted for on the individual level. Regardless of whether the reader agrees that it is possible for collectives to constitute self-standing entities, and not merely aggregates of individuals, a collectivist perspective is useful as a methodological tool in the aggregative form. It acts as a heuristic for including considerations in ethical analysis that may be obscured in analyses that rely on aggregation of individual interests and concerns.

On this basis, I believe there is a strong argument to be made that sometimes collectivism adds more than just a methodological tool to ethical analysis because it presents a way to consider entities above the individual—for example, a family might be considered an entity above its members as individuals. The existence of a family is reliant on its members identifying as part of that entity, and the interests of each family member, if considered individually and not as interdependent with the other family members, may not be representative of what is best for the family as a whole.⁵³ In these cases, collectivist analysis

⁵³ Indeed, it is this recognition that may have contributed to more relational and community-based approaches to consent. In Japan, consent to medical procedures is a family matter. Similarly, for many Native Peoples in the United States of America, community consent is often considered a requirement for participation in genomic research. Each of these practices allows for considering the interests of family/tribe as a whole, as well as the individual. For more, see: Roberto Abadie and Kathleen Heaney, "We Can Wipe and Entire Culture: Fears and Promises of DNA Biobanking Among Native Americans" *Dialectical*

provides a route for more holistic consideration of how the interests of communities or groups may be conceived as belonging to those communities or groups as entities in themselves. Wherever a collective as an entity in itself cannot be identified, however, collectivism is still useful. To reiterate the point on aggregative collectivism, it acts as a methodological tool for identifying the interests and concerns of groups more effectively where they are difficult to identify at the individual level—perhaps, because they appear insignificant for each individual, but when considered for a whole group, are morally significant.

Throughout this chapter, when offering examples of collectivist analysis, I use a mixture of examples where collectivist analysis plays a merely aggregative role, and when it is more holistic. In all these cases, collectivist analysis is necessary because collectives are prospectively affected by GGEE interventions. For example, any use of public funds to subsidise GGEE interventions means that there is a cost to taxpayers from the implementation of GGEE interventions, just as there is for taxpayer-supported healthcare or education. Thus, taxpayers are stakeholders in these interventions and their legitimate collective interest in interventions must be considered in ethical analysis. Collectives may also be affected by virtue of their group-wide interactions and connections with radically enhanced individuals, because enhanced people may have significantly altered natures and relationships with others.⁵⁴ This is especially clear when we consider the heritability of germline modifications, affecting relationships and group dynamics in future generations. Finally, if a GGEE intervention becomes widespread, these multiple instances of enhancement, even those with only small effects on an individual, render them morally

Anthropology 39 (2015): 305-320; Hiroyuki Nagai, "Blood Ties and Trust: A Comparative History of Policy on Family Consent in Japan and the United States," *Monash Bioethics Review* 34, no. 3 (2017): 226-238.

⁵⁴ Francis Fukuyama, *Our Posthuman Future: Consequences of the Biotechnology Revolution* (New York: Farrar, Straus and Giroux, 2002).

significant on the population level. Consider an enhancement that is in an individual's interest, and indeed in multiple individuals' interests, but not in the group's collective interest, such as height enhancement.⁵⁵ Parents repeatedly seeking to have taller children to secure the advantages of being comparatively tall for their child will place very small costs on others—say, by adding stress to a healthcare system because of the increased health risks from osteoarthritis that taller people face,⁵⁶ or from the enhanced individuals tending to outcompete other people in competitions for employment and romantic partners.⁵⁷ From the perspective of an individual, a slightly increased risk of osteoarthritis may be an insignificant cost of pursuing height enhancement. In that case, height enhancement may be beneficial, overall, for that individual. When multiple people pursue the same enhancement, however, the costs may become significant, such as by increasing the burden on healthcare systems or pushing others out of employment markets from the increased competition. Examples like this constitute 'collective action problems',⁵⁸ wherein the performance of individually beneficial actions by multiple people causes large harms to the group as a whole, when the action becomes widespread and the effects are summed.⁵⁹ The likely popularity of GGEE interventions (given their possible benefits for one's child) is one reason to take such collective action problems seriously.⁶⁰

⁵⁵ Chris Gyngell and Thomas Douglas, "Stocking the Genetic Supermarket: Reproductive Genetic Technologies and Collective Action Problems," *Bioethics* 29, no. 4 (2015), <https://doi.org/10.1111/bioe.12098>.

⁵⁶ Maiju Welling et al., "Association Between Height and Osteoarthritis of the Knee and Hip: The Northern Finland Birth Cohort 1966 Study," *International Journal of Rheumatic Diseases* 20, no. 9 (September 2017), <https://doi.org/10.1111/1756-185X.13059>.

⁵⁷ Gayle Brewer and Charlene Riley, "Height, Relationship Satisfaction, Jealousy, and Mate Retention," *Evolutionary Psychology* 7, no. 3 (2009), <https://doi.org/10.1177/147470490900700310>; Timothy Judge and Daniel Cable, "The Effect of Physical Height on Workplace Success and Income: Preliminary Test of a Theoretical Model," *American Psychological Association* 89, no. 3 (2004): 428-441.

⁵⁸ Gyngell and Douglas, "Stocking the Genetic Supermarket: Reproductive Genetic Technologies and Collective Action Problems."

⁵⁹ This was first introduced as part of a tragedy of the commons problem, by Garrett Hardin. For more, see: Garrett Hardin, "The Tragedy of the Commons," *Science* 162, no. 3859 (1968): 1243-1248.

⁶⁰ Jonathan Anomaly, "Defending Eugenics: From Cryptic Choice to Conscious Selection," *Monash Bioethics Review* 35 (2018), <https://doi.org/10.1007/s40592-018-0081-2>.

To illustrate the point about the usefulness of collectivism as a methodological tool further, consider public goods.⁶¹ These goods may provide only tiny benefit for many individual members of the public who only use them rarely—street lighting may have little effect for people who do not use roads and footpaths at night. If the benefits of street lighting are divided and distributed among members of the public, then it may seem unimportant for a state to provide lighting. However, street lighting may significantly benefit the society as a whole—say, by reducing incidences of accidents or crime.⁶² In considering only the less significant benefits to individuals, individualism fails to account for the full value of public goods. Indivisible or unpredictable goods like night-time city safety may be better accounted for at the collective level, without trying to divide the benefits among individuals. This holds in the enhancement context. Consider, for instance, intelligence enhancements that increase the public goods of knowledge or productivity in a society. Multiple studies show that increased national average IQ is correlated with national development, stability and economic outcomes (including reduced corruption),⁶³ which may be due to the effects it has on increasing saving rates, cooperation, use of high-value production technologies, and increased support for market-oriented policies.⁶⁴ Whilst a one-point IQ increase only predicts a 1% increase in income on the individual level, a one-point increase on the national level, across countries, predicts a 6% increase in GDP per capita.⁶⁵ These ‘network effects’ of

⁶¹ That is, resources in a society that are accessible by anyone (non-exclusive) and that are not depleted by many individuals trying to access the good at once (non-rivalrous).

⁶² "Economic Lowdown Episode 17: Public Goods," in *Economic Lowdown* (Federal Reserve Bank of St Louis, 2015), accessed May 11, 2020. <https://www.stlouisfed.org/education/economic-lowdown-podcast-series/episode-17-public-goods>.

⁶³ Niklas Potrafke, "Intelligence and Corruption," *Economics Letters* 114, no. 1 (2012), <https://doi.org/10.1016/j.econlet.2011.09.040>.

⁶⁴ Garrett Jones, "National IQ and National Productivity: The Hive Mind Across Asia," *Asian Development Review* 28, no. 1 (2011): 51-71.

⁶⁵ Rik W. Hafer, "New Estimates on the Relationship between IQ, Economic Growth and Welfare," *SSRN Electronic Journal* (November 2016), <https://doi.org/10.2139/ssrn.2862754>.

enhancement⁶⁶ are not adequately valued when the benefits of intelligence enhancement to individuals are considered one by one instead of at the collective level.

Collective action problems and the under-valuation of public goods are among the existing problems that individualist ethical analyses face. They serve to highlight the urgency of an effective collectivist approach in ethical analysis of human enhancement.

I

Problems with Individualism

It would be simplistic to present individualism and collectivism as binary choices of approach. It seems more plausible to assume that there is a spectrum of approaches between two extremes of pure individualism and pure collectivism, in the methodological senses I intend.

An example will highlight the difference between more individualist and more collectivist approaches when it comes to identifying stakeholders' interests. Consider an immune system enhancement that confers immunity against a specific infectious disease.⁶⁷ If a particular disease—say, malaria—is prevalent in the community, then it is in each individual's interest to be immune. A more individualist approach might then assume that all people should undergo the enhancement. However, it may be that the particular genetic variation that confers immunity via GGEE comes with certain risks that are identifiable at the population level. In the malaria case, for example, heterozygotes for sickle cell anaemia

⁶⁶ Jonathan Anomaly and Garrett Jones, "Cognitive Enhancement and Network Effects: How Individual Prosperity Depends on Group Traits," *Philosophia* 48 (2020): 1753-1768.

⁶⁷ Anomaly, *Creating Future People*; Gyngell and Douglas, "Stocking the Genetic Supermarket: Reproductive Genetic Technologies and Collective Action Problems." Insofar as my definition is concerned, this constitutes enhancement by virtue of its: 1) not eliminating a predisposition to a disease, 2) modifying a normal individual's immune function, and 3) producing benefits.

are unaffected by malaria symptoms due to the sickle cell mutation.⁶⁸ This gives sickle cell anaemia (although it is lethal for homozygotes) adaptive value in areas of sub-Saharan Africa where malaria is prevalent.⁶⁹ This aligns with individual future enhanced children's interests (and, perhaps, their parents' interests on their behalf). However, it is not in the public interest for everyone to undergo this enhancement, because the public interest depends on the effects of the enhancement for the group. In this case, too large numbers of sickle cell anaemia carriers in a population will lead to the birth of more people who are homozygous for sickle cell anaemia, who are likely to lead much shorter lives with more suffering.⁷⁰ More collectivist approaches can account for this difference between individual-level interests and the public interest, because it does not assume that the public interest is a direct aggregate of individual interests in immunity enhancement. Rather, the public interest lies in *a certain number* of individuals being immune to malaria *and* a certain number remaining susceptible to malaria but being less likely to produce children who suffer from sickle cell anaemia—that is, assuming limited availability of prenatal testing and selective abortion, which might achieve a similar effect.

The following examples show purer individualist approaches and highlight weaknesses of such approaches. The examples concern questions of whether individuals should be free to use GGEE as they see fit, whether there should be free market access to GGEE, and what types of interventions ought to be made available.

⁶⁸ Ana Ferreira et al., "Sickle Hemoglobin Confers Tolerance to Plasmodium Infection," *Cell* 145, no. 3 (2011), <https://doi.org/10.1016/j.cell.2011.03.049>.

⁶⁹ Frédéric B. Piel et al., "Global Distribution of the Sickle Cell Gene and Geographical Confirmation of the Malaria Hypothesis," *Nature Communications* 1, no. 1 (2010), <https://doi.org/10.1038/ncomms1104>.

⁷⁰ Indeed, 50% of people with sickle cell anaemia die before they reach 50 years of age, usually during acute episodes of chest pain or stroke. See: Orah S. Platt et al., "Mortality In Sickle Cell Disease - Life Expectancy and Risk Factors for Early Death," *New England Journal of Medicine* 330, no. 23 (1994), <https://doi.org/10.1056/NEJM199406093302303>.

First, Robert Nozick's *Anarchy, State and Utopia*⁷¹ supports a 'genetic supermarket' system of GGEE availability. In this system, parents are free to access GGEE if they can afford it and can use it as they see fit. That is, the key units of moral decision-making concerning GGEE are parents. State interference is only justified to maintain sex ratios and other essential balances in the human gene pool. The position implies that the development and availability of interventions is acceptably determined by market demand based on parents' individual evaluations of a given enhancement. Furthermore, this implies that individual parents' abilities to afford and otherwise access *in vitro* fertilisation (IVF, as procedurally required for GGEE) appropriately determines the distribution of enhancement interventions and the benefits thereof. Problems with this approach arise if we recognise the significant concerns with GGEE from the point of view of distributive justice. For instance, in a market system, some enhancements might deliver Rawlsian 'primary goods', which aid in the pursuit of various conceptions of the good life.⁷² Whilst Rawls only anticipated our being able to redistribute the social primary goods (basic rights, income, and social recognition), we may be able to also redistribute the natural primary goods (intelligence, imagination, health, speed) via enhancement.⁷³ Under a market scheme like Nozick proposes, these may be distributed across society according to existing trends of dis/advantage, due to enhancement access relying on individual finances. However, because of the importance of these goods, Rawls argues those goods within our control (his focus being wealth and income) ought to be distributed equally, except where unequal distribution benefits the worst-off.⁷⁴ If we accept this and apply it to all those natural and primary goods whose distribution we can affect, then perhaps natural or primary goods-producing enhancements should be distributed by the state

⁷¹ Robert Nozick, *Anarchy, State, and Utopia* (New York, US: Basic Books, 1974).

⁷² John Rawls, *A Theory of Justice, Revised Edition* (Cambridge, MA: Harvard University Press, 1999).

⁷³ Perihan Elif Ekmekci and Berna Arda, "Enhancing John Rawls' Theory of Justice to Cover Health and Social Determinants of Health," *Acta Bioethica* 21 (2015): 227-236; Dov Fox, "Luck, Genes, and Equality," *Journal of Law, Medicine & Ethics* 35, no. 4 (2007): 712-726, <https://doi.org/10.1111/j.1748-720X.2007.00193>.

⁷⁴ Rawls, *A Theory of Justice*.

according to some fair criterion. The immunity enhancement explored above might be one such enhancement, given the contributions it makes to health. An approach like Nozick's that prioritises individuals' freedoms and sees parents and children as the primary units of moral decision-making, however, may not allow for this state intervention. What's more, the genetic supermarket is not consistent with just distribution of resources, as I explore further in Chapters 5 and 7. An alternative, more collectivist approach might consider the fair distribution of primary goods-producing enhancements to justify some impositions on individual freedoms to reduce (or at least not exacerbate) unfair inequalities that might be of moral concern to society as a whole.

Similarly, with regard to the availability of enhancements, Nicholas Agar's *Liberal Eugenics*⁷⁵ and, to some extent, Nick Bostrom's *Human Genetic Enhancements*⁷⁶ each make a controversial assumption. Each assumes that it is ethically acceptable for most enhancements to be sold to individuals, in the same way as we usually accept by default lightly-regulated market access to new technologies. Although Agar does not claim *all* enhancements should be on the free market, he excludes only 'competitive enhancements'—that is, enhancements that benefit the individual only relative to others, disadvantaging those others—from the market system. This still does not adequately address concerns at the collective level.

To illustrate, take his example of a memory enhancement in the job market context. Agar recognises the plight of unenhanced individuals who are disadvantaged in their competition against an enhanced individual for a job. He argues that parents should be 'prevented from seeking enhancements that prepare their children exclusively or principally for winner-takes-all competitions'.⁷⁷ As he suggests, one option is prohibition. For an alternative simple fix to

⁷⁵ Nicholas Agar, *Liberal Eugenics: In Defence of Human Enhancement* (Oxford, UK: Blackwell Publishing, 2004).

⁷⁶ Bostrom, "Human Genetic Enhancements: A Transhumanist Perspective."

⁷⁷ Agar, *Liberal Eugenics: In Defence of Human Enhancement*.

this problem, one might suggest all enhancements should be universally regulated and subsidised for the worst-off. But universal provision in fact does not solve the problem (even if it were economically feasible within a regulating jurisdiction), as I will show. A more collectivist approach recognises that entire groups may be pressured out of the job market by widespread enhancement, not only because of the inabilities to access enhancements that would hold if access were via a regulated market, but even under conditions of universal provision, because the actual benefit of an enhancement may vary for different groups, tracking existing unfair social dis/advantage. Even if memory enhancements were universally provided, they may provide less benefit in the manual and menial jobs that are often filled by already-disadvantaged members of our society, compared to other, more desirable work that is often undertaken by the already-advantaged. For a textile manufacturing job applicant, access to memory enhancement is likely to be less valuable than for those (likely advantaged) individuals applying for, say, a high-level job on Wall Street. When this trend is multiplied as such interventions become widespread, the group of advantaged individuals who are more able to compete for Wall Street jobs is further aided in their pursuits because memory enhancement provides more benefit to them in gaining and keeping their cognitively demanding jobs. By comparison, those already disadvantaged groups of people often applying for manufacturing jobs are not helped by memory enhancements in being more successful in their work and reaping the benefits this produces. Thus, even universal provision of the memory enhancement may reinforce patterns of existing disadvantage in society even when competitive enhancements are made available to individuals. Although, in this case, Agar advocates for simple prohibition of competitive enhancements, his and others' work still highlight an inadequacy of individualist approaches to GGEE distribution. Namely, they do not adequately recognise variable benefits of GGEE distribution among existing groups, or potential collectively beneficial solutions other than prohibition. Instead, a well-developed collectivist analysis might recognise and explore the variable value of

memory enhancements for different groups, and whether there are other regulatory alternatives that avoid posing collective-level costs but still provide the individual- and collective- level benefits of increased productivity.

II

Collectivist Arguments in the Human Enhancement Debate

Earlier, I said that the collectivist critique aims to contribute to a thorough ethical analysis of GGEE interventions. In this section I contrast what I consider to be an ideal collectivist analysis with current collectivist contributions. I argue that the latter are biased toward weighing costs, losses and risks of enhancement more heavily, affecting their ability to contribute meaningfully to the collectivist part of a thorough ethical analyses. These current collectivist analyses often lead to more prohibitive stances on human enhancement. Underlying this pessimistic form of collectivism are certain problematic assumptions and processes. These are examined below, and they include the inappropriate acceptance of individualist assumptions, and the failure to appropriately weigh individualist *vs* collectivist ethical considerations where they conflict. To solve these problems, we may employ collective-considering moral principles and concepts from other areas such as public health ethics (PHE), which allow us to include positive ethical considerations (such as whether an intervention may provide collective benefit, ameliorate existing injustices, or produce public goods).

First, let me provide the standard for contrast: an ideal collectivist critique. Consider a memory enhancement again—specifically, a GGEE intervention that improves memory capacity and retrieval beyond species-typical functioning in an individual who would otherwise have normal memory functioning. Individualism might contribute to ethical

analyses here by assessing concerns surrounding the authenticity of the child's altered nature, or the side-effects of an intervention that may prevent forgetting. It might also explore the tension between, on the one hand, parents' right to independent reproductive choice, and on the other, children's future wellbeing and right to an open future.

An ideal collectivist analysis would build on what individualism provides in the ethical analysis, perhaps by assessing how widespread enhanced memory could affect important public goods. It might do so by promoting knowledge and technological advancement, but threatening the public's social cohesion, due to a reduced ability to forget others' past wrongdoings. Reduced social cohesion certainly cannot be adequately valued by considering effects merely on individuals, given that it involves relationships toward others in a group. An ideal collectivist analysis may also assess how these effects ought to be distributed, not only among individuals, but across current and future groups. To illustrate some collective-level considerations, imagine a scenario in which a memory-enhanced generation adds value in workplaces at a much younger age. The enhanced group may end up being exploited, possibly counteracting the individual benefits they experience. On the other hand, consider how enhanced memory may instead promote social cohesion, and strengthen relationships in future generations, because enhanced individuals may have clearer memories of others' lives and experience a heightened empathetic response.

Some current collectivist arguments addressing memory enhancement and other interventions neglect the benefits of and stakeholder interests in enhancing (as opposed to its risks and costs) that the ideal analysis includes. Whilst these analyses remain collectivist in nature, they are less effective at contributing to a thorough ethical analysis of GGEE interventions. The neglect of benefits of and interests in enhancement is the product of the following problems, as I argue below.

Acceptance of individualist assumptions

Some current collectivist analyses admit—either as undesirable but inevitable circumstances, or as morally acceptable—the assumptions that, (a) decisions surrounding GGEE will be made individually by parents, without state interference, and that, (b) the distribution and development of GGEE interventions will be governed by the free market. It may seem counterintuitive for current collectivist work to accept these assumptions—public education and public health are areas of policy that are often efficiently and ethically acceptably regulated by the state. Yet the acceptance persists, and is combined with a pessimistic view of enhancement at the collective level, which mostly identifies costs to groups from enhancements, more than it recognises benefits to groups. This frequently produces ethical judgements in the literature that enhancements should be prohibited.⁷⁸

Michael Sandel's work, for instance, assumes that if enhancement is permitted, parents will inevitably (though inappropriately) be left to choose among GGEE interventions without adequate regulatory limits to their decisions. In *The Case Against Perfection*,⁷⁹ Sandel's assumption that enhancement would be set in a free market paradigm partly justifies his emphasis on potential negative outcomes of GGEE for the collective. He considers challenging the market availability assumption, but claims that remedying unfairness in access to enhancements is not the main issue, though it could be remedied through subsidisation. Sandel's main focus, rather, is on the loss of parents' openness to the unbidden (that is, unexpected traits in their children) if enhancements become widespread. He also discusses issues with 'playing God', and the apparent problem of social pressure to enhance, claiming that rather than focussing on changing the market paradigm, '[t]he real question is whether

⁷⁸ For example, consider: Sandel, *The Case Against Perfection: Ethics in the Age of Genetic Engineering*; Leon Kass, "Defending Human Dignity," in *Human Dignity and Bioethics* (Washington DC: The President's Council on Bioethics, 2008); Fukuyama, *Our Posthuman Future: Consequences of the Biotechnology Revolution*.

⁷⁹ Sandel, *The Case Against Perfection: Ethics in the Age of Genetic Engineering*.

we want to live in a society where parents feel compelled to spend a fortune to make perfectly healthy kids a few inches taller.⁸⁰

This leads him to argue for prohibition of enhancement. If the emphasis here is on moral problems with social norms rather than the ‘fortune’ that parents may have to spend in a market system, then subsidisation does initially seem like a futile solution to the social norms problem. However, we might question the premise: Sandel’s argument concerning social norms is not independent; it is predicated on our accepting his other arguments against enhancement. Sandel needs to explain why enhancement is wrong before he claims that being pressured into it is a bad thing. Then he can explain why social norms are harmful in the enhancement context. But if we acknowledge the potential benefits of enhancement, social norms regarding enhancement may not themselves be a bad thing. Sandel considers the social norms discussed in the quote above only from a costs-emphasising collectivist perspective, that is, the social norms are painted as a necessarily detrimental outcome of enhancement for society at large, based on his previous arguments against it. But social norms themselves can be positive.⁸¹ If enhancement is not problematic for other reasons, then parents being socially pressured to pursue it (at minimal cost to them, as perhaps in a subsidised system) may be a good thing, encouraging them to intervene to benefit their future child and/or the collective.

So is enhancement problematic in the way Sandel suggests? Sandel’s two arguments that ground his judgement are the openness to the unbidden argument and the playing God argument. Each of these, however, have been convincingly refuted in the literature.⁸² For example, Guy Kahane objects to both arguments on the basis that it is in fact the outright

⁸⁰ Sandel, *The Case Against Perfection: Ethics in the Age of Genetic Engineering*, 84.

⁸¹ Jonathan Anomaly and Geoffrey Brennan, "Social Norms, the Invisible Hand, and the Law," *SSRN Electronic Journal* (2014), <https://doi.org/10.2139/ssrn.2527984>.

⁸² Guy Kahane, "Mastery Without Mystery: Why There is No Promethean Sin in Enhancement," *Journal of Applied Philosophy* 28, no. 4 (2011): 355-368. I do not have further space here to defend Kahane’s position, but Chapter 6 shows how my framework can account for any remaining objections based on deontological concerns like Sandel’s as risk factors to be considered in moral deliberation.

rejection of enhancement that seems to show the most drive to mastery and failure to be open to the unbidden. By contrast, it is the willingness to embrace the potential of enhancement that shows appreciation of what is within our capacity to impact, and what forces remain external to us. Kahane argues that prohibition is itself an act of attempted mastery, of playing God over scientific progress.

If we accept Kahane's argument, then it seems that in the social norms argument Sandel makes, what Sandel considers to be an overriding collectivist objection to enhancement is not necessarily an objection at all. Rather, it may be a significant case in favour of enhancement if future people are pressured to be more open to the opportunities to impact our future that scientific progress provides. Furthermore, these norms may prevent people from posturing themselves as having mastery over the extent of human development such that they can limit it by rejecting this next step of human enhancement.

Providing a second example, Leon Kass' arguments against GGEE also frequently assume a free-market paradigm. His claim is that in American society at least, if enhancement is permitted, the emergence of an enhanced aristocracy seems inevitable, as 'there is nothing in our current way of doing business that works against it'. Kass does not imply that such a situation is desirable, but he does seem to see it as unavoidable. This analysis fails to consider existing areas of effective state interference, most notably in public health, defense and education that ensure the important goods of health, safety and educational opportunity are accessible to all. In adhering to the free market assumption, Kass does not consider regulatory alternatives (perhaps including subsidisation, prioritised access, and limits on the development of certain interventions) that may even allow enhancements to be used to *address* existing injustices, rather than exacerbate them.⁸³ Based on the individualist

⁸³ Alberto Giubilini and Francesca Minerva, "Enhancing Equality," *The Journal of Medicine and Philosophy: A Forum for Bioethics and Philosophy of Medicine* 44, no. 3 (2019), <https://doi.org/10.1093/jmp/jhz002>.

assumption he accepts, negative collective-level ethical considerations seem more salient, and lead Kass to argue for prohibiting enhancement. It is questionable whether the collective-level costs of enhancement that Kass discusses would still outweigh the benefits if we considered regulatory alternatives.

Kass' approach to potential intergenerational fairness concerns with enhancements is mirrored in some of Robert Sparrow's work. Sparrow contends that 'if the genetic enhancements available to parents to choose for their children improve every year, then the enhancements provided to children in any given year will quickly become obsolete'.⁸⁴ That is, Sparrow implies that the types of benefits that future children would receive from many enhancements are positional. These benefits exist only in competitive environments; there is no intrinsic value to the enhancement. Yet, most enhancements that are beneficial in competitive environments also have intrinsic benefits (recall the national productivity-increasing effects of a hypothetical IQ-increasing enhancement). Whilst raising important issues surrounding intergenerational justice, this concern is thus problematically based on the assumption that parents will be left to choose between available enhancements freely, and that the absolute, non-competitive value of enhancements to individuals is insufficient to outweigh the costs of this obsolescence (which reduces only the relative value of enhancements, not the absolute value). There is no justification offered by Sparrow for believing it to be the case that the cost of obsolescence will outweigh the absolute value of (at least some) enhancements.

Similarly, Roberto Andorno and colleagues' recent *Geneva Statement on Heritable Human Genome Editing*⁸⁵ also initially assumes a free market. The authors examine a selection of

⁸⁴ Sparrow, "Yesterday's Child: How Gene Editing for Enhancement Will Produce Obsolescence—and Why It Matters," 8.

⁸⁵ "Geneva Statement on Heritable Human Genome Editing: The Need for Course Correction."

possible outcomes of genome editing including state eugenic uses of GGEE, widespread genetic harm to future generations, competitive pressures, and exacerbations of racism and xenophobia. Their discussion of these problems is predicated on the assumption that adequate regulation is implausible, yet they do not examine regulatory alternatives or assess corresponding possible positive outcomes, which ought to figure into a thorough analysis. Non-coercive policies encouraging uptake of collectively beneficial interventions (such as free exercise programmes or letters encouraging cancer screening) already exist in the public health context, and might be applied effectively for enhancements, as well. For example, states might subsidise interventions that enhance IQ-measured intelligence, to increase productivity and knowledge in a society. Therefore, Andorno and colleagues' arguments, which emphasise the costs of enhancement over the benefits, offer an incomplete analysis. Although the benefits of enhancement may not outweigh the costs overall, we must still give them equal attention, and not base discussion only on assumptions that make the negative side of enhancement more salient.

Failure to appropriately weigh collective- and individual-level considerations

Some current collectivist work suffers from the second problem that may lead to negatively biased collectivism: failure to adequately (or equally) weigh collectivist considerations in overall analysis, compared to individualist considerations. The examples relating to this problem differ from those presented above, in that they focus not on the assumptions behind collectivist analysis that make negative moral considerations more salient, but rather on the problem of allocating too little weight to collective-level benefits that *are* salient in collectivist analyses. This may occur even where the harms or costs to individuals of collectively-beneficial GGEE interventions are seemingly easily avoidable.

Some of Robert Sparrow's work⁸⁶ assumes that if GGEE is permitted, collectivist considerations (in Sparrow's examples, usually consisting of states' or elites' goals) will consistently override individual interests and result in unacceptable eugenic practices. He explicitly concludes that collective interests in genome editing or selection should not figure in ethical analysis at all, for fear that 'considerations of aggregate welfare in decisions about reproduction [...] threaten to outweigh any of the other interests at stake'⁸⁷ and would result in unacceptable infringement of individual liberty. This claim assumes that collective-level interests in pursuing enhancements, if they are to be considered at all, must be determinative of the permissibility of GGEE, simply in light of their affecting many more people. In that case, potentially very significant costs to individuals may apparently be imposed for the sake of a collective interest in genome editing. Sparrow proposes that these collective interests are best rejected altogether; otherwise, '[g]iven the number of third parties who might benefit from the selection of future individuals that have particular sorts of capacities, there is little that the concern for the interests of such third parties could not justify'.⁸⁸ He argues that such interests would be governed, in the end, by nationalistic state goals.

However, this slippery slope argument is not convincing if there are definite, appropriate limits incorporated into a system for weighing ethical considerations that ensures collective interests are weighed against individual interests (where they conflict) in an ethically appropriate, proportionate way. That is, barriers along a psychological slippery slope like the one Sparrow likely employs here prevent one from falling down it, to accepting an unacceptable outcome. In some cases, this will mean that collective interests are not significant enough to outweigh individual interests, and an enhancement should not be pursued. For example, imagine a 'social compliance' enhancement that increases

⁸⁶ Sparrow, "Human Enhancement for Whom?"

⁸⁷ Sparrow, "Human Enhancement for Whom?" 134.

⁸⁸ Sparrow, "Human Enhancement for Whom?" 134.

contentment in the individual. If implemented population-wide, this may increase societal stability. In a well-governed society, increased stability and contentment may be beneficial for the population.⁸⁹ However, this kind of enhancement may also significantly threaten the enhanced individuals' agency, authenticity and integrity—it may not be in their natures to be contented at the state of that society, and without the enhancement they may have engaged more politically or socially to register their discontent. In this case, the values of individual agency, authenticity and integrity, considered on an individual basis, outweigh the collective interest, given how integral these values are to our identities. It might be unreasonable to expect individuals to sacrifice these values, even for the sake of large collective benefit. Such situations are preventable, and we need not reach this point on the slippery slope. So long as society does not completely fall apart and the values of individual liberty and social justice that we hold now are not entirely rejected, then policymakers considering human enhancement can employ legal safeguards that rely on these values to set up barriers to pursuing a 'social compliance' enhancement. Some of these safeguards are included in the policies that might be considered by my proposed framework for ethical analysis of GGEE interventions.

Another way to argue against slippery slope arguments is to deny that the bottom of the slippery slope is so unacceptable, after all. For some enhancements, this kind of argument also holds against Sparrow's concerns. In some other enhancement cases where more significant collective interests pertain and less significant individual concerns conflict with them, we may be justified in imposing some small costs on individuals in providing state support for GGEE interventions—in these cases, the bottom of the slippery slope is not so bad. For example, a moral enhancement that increased our rational capacities or our empathy

⁸⁹ Contentment may be appropriate in a perfect society, but outside of that scenario, increased contentment in a population may threaten social, political and scientific progress. It may even lead to the entrenchment of authoritarian regimes. This is a highly negative collective-level consequence that would likely mean that collective-level interests in this kind of enhancement are not morally significant compared to the collective-level harms, even without considering the consequences on the individual level.

and produced fairer, more solidaristic societies generally may be acceptable and perhaps desirable. Imagine this enhancement also posed a small cost to individuals in terms of contributions for state funding of the intervention. Whilst this may seem unacceptable to individual-prioritising accounts of enhancement, according to a collectivist account this imposition of costs may be acceptable, if the collective-level benefit is much greater than the cost to individuals.

To address the weighing concern more generally, we might introduce a few requirements for collective-level interests in an enhancement to outweigh individual-level interests against implementing it. I stipulate that collective-level interests will only outweigh individual-level concerns in a proportionate weighing system when the individual costs are either:

- (a) morally insignificant or reasonably bearable in absolute terms (such as in cases of easy rescue),
- (b) plausibly avoidable by opting for a less burdensome way of implementing the intervention, or
- (c) acceptable in the proportion of overall costs they impose on the enhanced individuals *vs* overall benefits they produce for the collective.⁹⁰

This weighing system that I propose (introduced across Chapters 4 and 5) applies in the same way to individual-level interests in pursuing an enhancement and the collective-level overall costs that it may impose on others. In some cases, weighing the costs and benefits of implementing a GGEE intervention exposes the disproportionate risk that prioritising the collective may pose to individual wellbeing or liberties. Consider, for example, threats to

⁹⁰ Note that the collective might exclude the individual if they do not experience the general collective-level benefit, but that in most cases, it is more likely to include the individual, who will also experience some of these benefits that counterweigh but fail to outweigh the costs to the individual.

autonomy (for women who might otherwise be fined for non-compliance with a mandatory programme) or bodily integrity⁹¹ (if women were physically forced to have IVF for enhancement). These might outweigh significant collective-level benefits from pursuing enhancement. However, where such morally significant harms are either proportionate to the benefit produced and reasonably bearable, or only occur under some policies for implementing the GGEE intervention, the weighing system may show the policy for implementing the GGEE intervention to be permissible.

Take *compulsory* ‘genetic immunisation’, i.e., enhancement of the immune system via GGEE. This would pose a significant threat to the bodily integrity and autonomy of women forced to undergo invasive IVF treatment as part of the intervention. We might, then, think that genetic immunisation should not be pursued. However, the costs involved with the compulsory policy do not mean that the public interest in herd immunity should be disregarded *tout court*. They must be still considered, and it must be determined whether the collective interest poses an adequate benefit to justify the individual costs, rendering the compulsory intervention (or, more likely, a less coercive policy like incentivisation of genetic immunisation)⁹² permissible. In the compulsory case, I suspect the benefits would not be adequate to justify the costs, as many women would likely have their bodily integrity significantly compromised for the sake of this public good, especially considering that herd immunity can also be achieved via vaccination (which does not impose the same seriousness of infringements of bodily integrity). Using my proposed weighing system, individual and collective-level costs and benefits together determine the permissibility of a policy for implementing a given GGEE intervention.

⁹¹ I use bodily integrity here to refer to disruptions, interferences, or invasions of the body. This is discussed further below.

⁹² I explore this very policy for implementing genetic immunisation in depth in Chapter 7.

There is another problem in the collectivist literature with weighing ethical considerations, namely when the prospective costs of an intervention are weighed differently according to whether genome editing is performed for treatment or enhancement purposes.⁹³ For instance, Francis Fukuyama⁹⁴ weighs (individual) benefits more heavily when it comes to treatment interventions, but weighs (collective) risks and costs more heavily when it comes to enhancement interventions. He does not offer a reason why threats to the collective are more significant for enhancement than treatment. His view of an enhanced future leads him to reject the possibility of enhancement regulation. He holds that regulation is an implausible solution to collective-level problems with *enhancement*, but by comparison he hardly considers how editing for *treatment* purposes might harm society, or how editing for enhancement purposes might benefit society. For enhancement, Fukuyama claims we risk losing ‘Factor X’, a defining characteristic of humanity that underlies our commitment to human rights and dignity. This will ‘in some way cause us to lose our humanity—that is, some essential quality that has always underpinned our sense of who we are and where we are going.’⁹⁵ In the treatment case, however, the threat to Factor X is apparently insignificant. However, Fukuyama does not explain why the threat to the collective would be more significant in the case of enhancement (or the benefit to the individual more significant in the case of treatment). Plausibly, whether enhancement threatens to undermine valuable aspects of humanity depends on the outcomes of the intervention being considered. An alternative collectivist conception of human dignity goes further than Fukuyama’s Factor X in detailing specifically how we can justify some constraints on our pursuit of enhancements. This alternative conception, ‘human dignity as constraint’, can be considered via the framework I propose later in this thesis. As ‘one of the fundamental values of our community’, this

⁹³ Note that this approach aligns with a conceptual argument concerning the treatment-enhancement distinction, wherein treatments are descriptively different from and morally preferable to enhancements. I discuss the distinction further in Chapter 3.

⁹⁴ Fukuyama, *Our Posthuman Future: Consequences of the Biotechnology Revolution*.

⁹⁵ Fukuyama, *Our Posthuman Future: Consequences of the Biotechnology Revolution*, 101.

conception of human dignity has been developed to limit the appropriate pursuit of biotechnologies.⁹⁶ These limits are based not primarily on individual rights, but on duties to protect our shared dignity. When human dignity as constraint is applied in the human enhancement context, it does not necessarily constitute a *pro tanto* reason against pursuing enhancements, but rather can be used to argue that enhancements may pose no more threat to our human dignity than treatments, as dignity concerns not only health, but other ways in which people's moral status and human dignity can be maintained, such as via the promotion of autonomy, rationality, or empathy (all of which are plausibly able to be promoted via human enhancement).

Consider how human dignity as constraint applies to a specific case, compared to Fukuyama's conception. It is difficult to judge, for instance, whether increasing memory capacity threatens Factor X more than the treatment of congenital deafness that could result in the elimination of sign languages and Deaf culture. But when we consider human dignity as constraint, it seems clearer that memory enhancement does not pose a significant threat to human dignity, whereas the elimination of a valuable culture via GGE for treatment may do so. We might think that Deaf culture is more valuable and representative of humanity than a limited memory capacity. Correspondingly, it is unclear whether the benefit of being born hearing is necessarily greater in some contexts than the benefit of being born with much better memory. This inconsistency in weighing costs and benefits across enhancement and treatment interventions leaves Fukuyama's analysis wanting. By comparison, a weighing system which makes no reference to the purpose of the gene editing intervention, but does consider morally relevant factors like human dignity (conceived as an interest), does not suffer from this inconsistency.⁹⁷

⁹⁶ Deryck Beyleveld and Roger Brownsword, "Human Dignity and the New Bioethics: Human Dignity as Constraint," in *Human Dignity in Bioethics and Biolaw* (Oxford: Oxford University Press, 1993), 30.

⁹⁷ It does, however, involve denying the treatment-enhancement distinction. I defend this move in Chapter 3. I defend my conception of human dignity further in Chapter 6.

III

Public Health Ethics Collectivism and Relevance to the Enhancement Debate

Further development of the collectivist critique is required, if we are to avoid the two problems with the approach that I discussed above, of accepting individualist assumptions and inappropriately weighing harms and benefits. Collectivist work in public health ethics (PHE) provides examples of success, where it contributes effectively to individual-collective thorough ethical analysis to inform policymaking. The difference between this success and the failures of collectivism in the enhancement context seems to be the usefulness of the moral principles and concepts used in collectivist PHE—or more specifically, collective-oriented areas of PHE, where collective-considering analysis is appropriate.⁹⁸ Using these moral principles and concepts, the problems discussed earlier in this chapter can be avoided. Although methodological problems remain within collective-oriented PHE, it is outside the scope of this work to critique PHE collectivism.⁹⁹ Setting that point aside, then, I start by granting the assumption that the acceptance of a collectivist approach in collective-oriented PHE indicates it is appropriate and makes a useful contribution to policymaking in that area.

One assumption I do think needs defending is the claim that enhancement can be included among public health interventions. In the next chapter, I defend this claim fully, on the basis that at least some GGEE interventions and public health measures share the same

⁹⁸ By contrast, collectivist concepts and principles may be inappropriately applied in areas of public health that are more individual-oriented, such as individual healthcare and treatment decisions in settings with unlimited resources.

⁹⁹ For further discussion of, e.g., problems in choosing conceptions of justice in the healthcare context, and balancing individual and public priorities in healthcare, see: Sudhir Anand, Fabienne Peter, and Amartya Sen, *Public Health, Ethics, and Equity* (Oxford, UK: Oxford University Press, 2006); Françoise Baylis, Nuala P. Kenny, and Susan Sherwin, "A Relational Account of Public Health Ethics," *Public Health Ethics* 1, no. 3 (2008): 196-209, <https://doi.org/10.1093/phe/phn025>.

goals, both fall within the remit of public health as an area of policy and practice, and have the same focus on the collective. For now, however, I will simply use a few examples to illustrate how enhancements can fall under public health. Both public healthcare systems and publicly funded enhancement interventions may impose some acceptable costs on individuals to produce benefit for the wider public. If we set some limits concerning how widespread the outcomes of an intervention are, whether there is an identifiable public interest in them, and whether collective action is required to secure them, then it seems that some GGEE interventions fall within those limits, meaning it is both acceptable to use moral principles and concepts from PHE to analyse them, and acceptable to frame them as public health measures. Collective-oriented public health issues as delimited by these characteristics may include, for example, obesity and vaccination interventions. I use each example below to demonstrate how relevant collectivist concepts help in collectivist ethical analysis of the issues, and may similarly do so in the enhancement context.

Recent research that has focused on structural—that is, social, economic, and environmental—causes of obesity in children has shown that individual-centred approaches to combatting obesity are ineffective while corporate interests in marketing sugary foods to children continue to prevail.¹⁰⁰ Ethical analyses building on these studies in PHE have developed robust conceptions of collective moral responsibility for health outcomes.¹⁰¹ They suggest that groups of people may share moral responsibility to ensure environments are structured to promote good health choices, rather than choices that lead poor health outcomes—in this case, obesity. In environments that make healthy choices very difficult,

¹⁰⁰ Tim Lobstein and S. D. Dobb, "Evidence of a Possible Link Between Obesogenic Food Advertising and Child Overweight," *Obesity Reviews* 6, no. 3 (2005): 203-208, <https://doi.org/10.1111/j.1467-789X.2005.00191.x>.

¹⁰¹ For more on responsibility for health outcomes, see also: Rebecca Brown, Hannah Maslen, and Julian Savulescu, "Responsibility, Prudence and Health Promotion," *Journal of Public Health* 41, no. 3 (2019): 561-565, <https://doi.org/10.1093/pubmed/fty113>.

individuals cannot be held fully responsible for choices that produce negative health outcomes. This is especially the case where children are concerned (as they are often considered not yet fully autonomous).¹⁰² Fran Baum discusses¹⁰³ how issues such as obesity are more effectively and more ethically appropriately targeted using interventions that act on the group level rather than targeting individual behaviour. Collective-level interventions may better hold corporations and other groups accountable, or limit corporations' and other groups' power in health contexts as part of recognising a collective level of responsibility for negative effects on individuals' health choices.

Obesity under collective-considering ethical analysis

Where we recognise a robust collective-level responsibility for certain health-influencing decisions, we can better address factors that compromise health outcomes. In the example case, this means increased corporate accountability for the health effects of advertising unhealthy foods to children. In the case of enhancement interventions, the application of a robust concept of collective moral responsibility may allow for more thorough assessments of how widespread uses of an enhancement affect social norms, influencing individual decision-making surrounding GGEE interventions. Additionally, it may help in the identification of existing collective-level stakeholder interests in certain GGEE interventions which could help fulfil those responsibilities. This allows us to recognise collective-level benefits more clearly. For example, moral enhancements that made members of society more altruistic may reduce the capacity for corporations to target (not fully autonomous) children in order to sell their unhealthy products.¹⁰⁴

¹⁰² Cristina Traina, "Children and Moral Agency," *Journal of the Society of Christian Ethics* 29, no. 2 (2009): 19-37, <http://www.jstor.org/stable/23562796>.

¹⁰³ Fran Baum, *Governing for Health: Advancing Health and Equity through Policy and Advocacy* (New York: Oxford University Press, 2019).

¹⁰⁴ Ingmar Persson and Julian Savulescu, *Unfit for the Future: The Need for Moral Enhancement* (Oxford: Oxford University Press, 2012).

Vaccination under collective-considering ethical analysis

In the case of vaccination, PHE analysis again puts collective-level concepts to good use in the development of a thorough ethical analysis. Ethical analysis of vaccination employs the concept of public goods particularly effectively, concerning the maintenance of herd immunity. The vaccinated individual receives a direct benefit from lowered susceptibility to catching a disease. On the collective level, we see even more benefit. Herd immunity is a public good that protects anyone and everyone in a community from the harms of an infectious disease spreading. The unvaccinated, too, are protected from catching and suffering from the disease, and both the unvaccinated and the vaccinated are indirectly benefited from reduced public health spending and stress on the healthcare system (assuming a publicly funded healthcare system). The benefits of vaccinating one's child are thus not only individual, but serve the whole collective. However, interests can conflict where vaccination poses risk to the individual. The collective interest in maintaining herd immunity, thus preventing excess mortality or stress on healthcare systems must be weighed against the individual costs of the discomfort of being vaccinated.¹⁰⁵ Here I assume that where an adverse reaction to a vaccine can be expected, such individuals are not asked to comply with vaccination. For those who will experience merely discomfort, given the importance of herd immunity, the collectivist concept of 'easy rescue' may be applied, wherein contributions to public goods that impose only small individual costs are appropriately enforced.¹⁰⁶ Policies in some jurisdictions reflect this by disincentivising non-vaccination by imposing costs on parents who do not have their children vaccinated, such as limited access to child support

¹⁰⁵ Alberto Giubilini, Thomas Douglas, and Julian Savulescu, "The Moral Obligation to be Vaccinated: Utilitarianism, Contractualism, and Collective Easy Rescue," *Medicine, Health Care, and Philosophy* 21, no. 4 (2018): 547-560, <https://doi.org/10.1007/s11019-018-9829-y>.

¹⁰⁶ Alberto Giubilini and Julian Savulescu, "Demandingness and Public Health Ethics," *Moral Philosophy and Politics* 6, no. 1 (2019): 65-87, <https://doi.org/10.1515/mopp-2018-0057>.

financial benefits.¹⁰⁷ Where non-contribution to public goods such as herd immunity threatens the collective interest and allows individuals to avoid only an insignificant cost, a thorough ethical analysis may justify limited coercive government action, as argued by some.¹⁰⁸ This same concept, if applied in the enhancement sphere, may allow for further articulation of the proportionate weighing of collective and individual interests, permitting cases in which individual interests and collective interests are of a comparative significance such that the collective interest greatly outweighs an insignificant individual cost. GGEE interventions may maintain or promote public goods such as knowledge, safety, public health, and political participation. Where they do so at only an insignificant cost to individuals, they may be permissible, or even—all else equal—morally obligatory. Cognitive enhancements may increase the production of knowledge; moral enhancements may provide means to promote safety in society—the collective interest in these significant goods must be appropriately compared to the individual costs they impose. There is a public interest in these goods, which ought not be ignored in a thorough analysis—and need not be, as the successful use of concepts in the PHE sphere shows.

Conclusion

Individualism alone is inadequate to consider all morally relevant factors surrounding human enhancement via GGEE. To complement an individualist perspective in thorough ethical analysis of enhancement interventions, however, collectivist work as it stands needs further development. As demonstrated by some collectivist arguments, two common

¹⁰⁷ *No Jab, No Pay - New Immunisation Requirements for Family Assistance Payments*, (Canberra: Commonwealth Government of Australia Department of Health, 2016), accessed July 17, 2020.
<https://www.health.gov.au/sites/default/files/no-jab-no-pay-fsheet.pdf>.

¹⁰⁸ For this view, see: Jessica Flanigan, "A Defense of Compulsory Vaccination," *HEC Forum* 26, no. 1 (2014), <https://doi.org/10.1007/s10730-013-9221-5>. For more in-depth analysis, see Alberto Giubilini, *The Ethics of Vaccination* (Cham, Switzerland: Palgrave Macmillan, 2019).

problems can lead to negatively biased analyses. These problems are: first, failures to challenge individualist assumptions, and second, failures to appropriately weigh collectivist moral considerations against individualist ones. However, using collective-oriented PHE as a model, we may apply collectivist (methodological) concepts to an ethical analysis of prospective enhancements. The resulting improved collectivist critique can better inform a thorough framework for ethical analysis of GGEE interventions. A more thorough analysis, in fact, may be more permissive of GGEE interventions than approaches that consider only the individual or only harms to the collective. The contrast I drew between individualism and collectivism, and the limits of each approach when used alone are outlined in Summary Box 2 below.

Summary Box

**Collectivist Human Enhancement:
Developing the Approach**

DEFINITIONS OF INDIVIDUALISM AND COLLECTIVISM

Individualism: Ethical analysis that solely/primarily considers individuals

Collectivism: Ethical analysis that solely/primarily considers groups

LIMITS OF INDIVIDUALISM	LIMITS OF COLLECTIVISM
<ul style="list-style-type: none"> - Market system for primary goods does not distribute goods fairly - Simply prohibiting competitive enhancements fails to account for externalities - Result is over-permissive approach to enhancement 	<ul style="list-style-type: none"> - Weighs costs too heavily in comparison to benefits - Assumes/accepts individualist market paradigm - Result is over-cautious approach to enhancement

SOLUTION: In Public Health Ethics, collectivism is well-developed. Treating human genetic enhancements as public health measures allows for using moral principles and concepts from Public Health Ethics in analysis.

Summary Box 2: Key arguments from Chapter 2 concerning the distinction between individualism and collectivism, definitions thereof, limitations thereof, and a possible solution in the form of collective-oriented public health ethics.

I further justify the inclusion of enhancement among collective-oriented public health measures for ethical analysis in the next chapter, and argue against objections to its inclusion based on the treatment-enhancement distinction. I then go on in Chapter 4 to outline the most relevant collectivist moral concepts and principles from PHE that I will apply in analysis of GGEE interventions. These concepts feature in my proposed framework, where they are used for considering stakeholders' interests and the consequences of GGEE interventions for stakeholders.

Chapter 3:

Collective-Oriented Public Health Ethics and the Treatment/Enhancement Distinction

Introduction

In this third chapter, I aim to introduce public health ethics (PHE) as an area of ethical inquiry—and more specifically, collective-oriented PHE as an area within PHE, where moral principles and concepts focussed on groups or collectives have been particularly effectively developed. These principles and concepts, I contend, are also appropriately applied in an ethical analysis of GGEE interventions, when they are legitimately framed as public health measures. I anticipate the objection that GGEE should not be analysed using principles applied in PHE, because of the descriptive and normative distinction between treatment and enhancement (hereafter, the T/E distinction). If PHE (often) concerns treatment, and GGEE interventions are enhancements, then according to the distinction, it may be: 1) wrong to implement enhancements at all; and 2) inappropriate to use moral principles from a treatment-related area like public health in the analysis of enhancements. I respond that the T/E distinction is not and ought not be recognised in PHE, as public health does not concern only treatments, but also preventive measures, some of which also constitute enhancements. Given the definition of enhancement I have presented, at least some GGEE interventions also promote goals concerning population-scale wellbeing that are shared goals of public health as a discipline or policy area, too. Thus, at least some GGEE measures are legitimately considered as public health interventions. Thus, the T/E distinction holds force neither as an argument against the application of PHE-derived collectivist considerations in

the ethical analysis of GGEE interventions, nor as a general argument against the permissibility of GGEE. This chapter grounds my identification of relevant moral principles and concepts derived from collective-oriented PHE to populate my framework for ethical analysis, in the next chapter.

I begin here by defining public health in relation to the provision of primary public goods in a liberal democratic society. I first discuss various definitions of health and explore the wellbeing-related goals of some areas of public health (section I). John Coggon approaches public health by grounding it as one commonly shared interest in a liberal democratic society,¹⁰⁹ and in section II, I link this approach to the provision of Rawlsian primary goods¹¹⁰ and Jonathan Anomaly's account of public health as the provision of health-related public goods.¹¹¹ In section III, I delineate the collective-oriented area of PHE, and suggest that (at least some) GGEE interventions may be considered as public health interventions in that area. My subsequent argument against the T/E distinction (section IV) justifies considering some GGEE interventions not as cosmetic, individual-centred interventions, but as collective-oriented public health measures that can be assessed using moral principles and concepts applied in PHE.

I

Defining Public Health

¹⁰⁹ John Coggon, *What Makes Health Public?: A Critical Evaluation of Moral, Legal, and Political Claims in Public Health* (Cambridge: Cambridge University Press, 2012).

¹¹⁰ Rawls, *A Theory of Justice*.

¹¹¹ Peter Drahos, "The Regulation of Public Goods," *Journal of International Economic Law* 7, no. 2 (2004): 321-339; Paul Samuelson, "The Pure Theory of Public Expenditure," *The Review of Economics and Statistics* 36, no. 4 (1954): 387-389, <https://doi.org/10.2307/1925895>.

In the last chapter, I used the term ‘public health’ without defining it in detail, leaving that task to this chapter. Instead, I relied on paramount examples of public health issues and programmes—those of obesity and vaccination respectively. Yet, given the centrality of the public health lens in the remainder of this thesis, at this point a definition should be proposed. I will begin by breaking down the term into its two parts.

Definitions of ‘health’ may focus on the individual, or on the collective, and may range from the extremely narrow, referring only to physical health, to the enormously broad, including many aspects of a person’s wellbeing.

Definitions aligning with what Peter Underwood and colleagues term ‘the clockwork model of medicine’ propose health as consisting of an absence of specific organ malfunctions in an individual.¹¹² These narrower, medical definitions are appropriate in some contexts. There are also advantages to value-neutral, descriptive definitions concerning organ functioning. But when used in ethical analysis of public health interventions, such value-neutral, physical function-based definitions may seem inadequate. They do not encompass some programmes we typically think of as falling under public health, like provision of contraception, pollution management, or vaccination, as I explore further below.

In stark contrast to the narrow medical definitions of health, the 1946 World Health Organization (WHO) Constitution defines health very broadly. It is ‘a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity.’¹¹³ The breadth of this definition may preclude it from being useful in some public health discussions, such as programmes aiming simply to address illness via disease treatment. However, broadening the definition of health to extend outside purely physical health is intuitive when one considers public health issues and interventions like those mentioned

¹¹² Peter Underwood, Alan Owen, and Robin Winkler, "Replacing the Clockwork Model of Medicine," *Community Health Studies* 10, no. 3 (1986): 1, <https://doi.org/10.1111/j.1753-6405.1986.tb00109.x>.

¹¹³ *Preamble to the Constitution of WHO as Adopted by the International Health Conference* (New York: World Health Organization, 1946), 100.

above. Using a broad definition of health is one way in which values outside of the physical health component of wellbeing can be adequately recognised and secured.¹¹⁴ However, it has been argued that the WHO's broad definition conflates health and happiness, and that it is overly aspirational or unachievable—for who experiences a state of *complete* wellbeing?¹¹⁵ Whilst entering further into the debate over the definition of health is beyond my scope here, the exact definition of health used may be less important for my purposes than a focus on the meaning of 'public' and the actual goals of public health practice. This is because whilst definitions of health employed in public health are variously narrow or broad, the accepted remit of public health is more or less similar, and usually includes not only health-related measures, but more broadly, wellbeing-related measures. I offer some examples of these later in this chapter.

For now, though, consider how the addition of 'public' changes how we think of health. It is with the addition of the term 'public' that we expand out to consider population-wide health.¹¹⁶ Some aspects of public health are termed 'public' by virtue of their being state funded or accessible to the public broadly. Other 'collective-oriented' areas are specifically focussed on population-level health or wellbeing as either the targets of an intervention, the measure of its outcomes, or both. The broadening of health beyond the individual level, to the population level, reflects a definitional move from medical interventions (and, correspondingly, medical ethics), to public health interventions (and, correspondingly, PHE).

¹¹⁴ Or rather, an expansive definition of public health is one way among a couple of alternatives. If interventions that ought to be implemented by states because they contribute to citizens' wellbeing are to be included under the banner of public health, then either the definition of health must be expanded, as the WHO definition does, or public health as a policy area and practice must encompass more than health-supporting interventions. Perhaps, therefore, public wellbeing would be a more appropriate name for the area. Unfortunately, this is an issue outside the scope of this thesis, so I adhere to the standard name of 'public health' to term a policy area that includes interventions to support health and wellbeing.

¹¹⁵ Machteld Huber et al., "How Should We Define Health?" *BMJ* 343 (2011), <https://doi.org/10.1136/bmj.d4163>.

¹¹⁶ Marcel Verweij and Angus Dawson, "The Meaning of 'Public' in 'Public Health'," in *Ethics, Prevention, and Public Health*, ed. Angus Dawson and Marcel Verweij (New York: Oxford University Press, 2007), 13-29.

The frameworks used for ethical analysis of interventions in the latter area are necessarily broader in the moral principles and concepts they employ, because they must consider effects on individual *and* group-level health. They also tend to be applied to public health measures that are concerned with physical health, *and* to those concerned with other aspects of wellbeing. I detail the development and use of some of these principles and concepts in the next chapter. For now, let me simply define public health as the population-scale level of physical functioning. I will leave considerations of wellbeing for my discussion of the goals of public health as a policy area rather than the definition of public health as a population-wide phenomenon.

Before I proceed to discussing the important matter of the goals of public health, there is one danger with definitions of public health that deserves to be mentioned. This is the danger of over-emphasising the *public* nature of public health. Bruce Jennings claims that this risks ‘reifying’ the collective, i.e., mistakenly assuming the *intrinsic* authority of the term.¹¹⁷ When there are tensions between individual interests and collective interests regarding health, reification of the public can lead to the *assumption* that collective interests must trump individual ones, merely because there are more individuals being considered in the latter case. For instance, it may be in the collective interest that individuals returning to their native countries from areas of exposure to a serious infectious disease undergo mandatory quarantine. It may be in these individuals’ interests, however, to avoid quarantine, and instead be reunited with their communities right away. The immediate response to this conflict should not be absolute prioritisation of the collective interest—where, in this case, the

¹¹⁷ Bruce Jennings, "Public Health and Civic Republicanism: Toward an Alternative Framework for Public Health Ethics," in *Ethics, Prevention and Public Health*, ed. Angus Dawson and Marcel Verweij (New York: Oxford University Press, 2007), 30-58.

collective interest is that of the population minus the quarantining individual.¹¹⁸ In the quarantine case, there may be individuals for whom quarantine is unreasonably burdensome, and for whom reuniting with their community is particularly time-sensitive and important—perhaps, when a loved one is expected to pass away soon. In most or even all cases, it may be judged that the collective interest in avoiding the spread of a serious infectious disease in the community still *outweighs* the individual’s interest in avoiding the isolation and time burden of quarantine but engaging in the weighing process for unusual individual cases is important. (After all, some areas of public health are more concerned with healthcare on an individual basis. Whilst these are not my focus, they must not be neglected via reification of the collective.) If conflicting public and individual interests are appropriately weighed, this does not constitute reification of the collective. Thus, the danger of reifying the collective is not inherent to a collective-considering public health, but rather a possibility to be avoided in thorough ethical analysis.

Note, at this point, that there is a difference between defining what public health is and determining the goals and remit of public health *as a discipline and area of policy*. To detail how the framework I present in this thesis contributes to guiding policymakers’ decisions, more is needed in the discussion of public health as a discipline or policy area, in relation to its goals, its interventions, and whether enhancement interventions can be considered among them for the purposes of ethical analysis. To this purpose, in the next section I discuss the goals of public health, public health in relation to the role of the state, and the provision of what I call ‘primary public goods’: resources in a society that are non-excludable, non-rivalrous, and contribute to human flourishing.

¹¹⁸ For examples, see: Giubilini and Savulescu, "Demandingness and Public Health Ethics"; Alberto Giubilini et al., "Quarantine, Isolation and the Duty of Easy Rescue in Public Health," *Developing World Bioethics* 18, no. 2 (2018): 182-189, <https://doi.org/10.1111/dewb.12165>.

II

Public Health Goals and Policymaking

More important for my purposes than the specific definition of public health is the goals of the area and the remit of its interventions. There is a tension between some definitions of health and public health, and the actual practice of public health. But it is the latter that matters to me. Whether or not public health encompasses some other aspects of wellbeing, the question is whether the practice of public health includes programmes that focus on wellbeing. The answer is that it typically does. As I will argue later, we might then think that GGEE interventions can be considered as public health measures, such that they can be ethically analysed using moral concepts and principles from collective-oriented public health.

Consider, then, one example of the goal of a public health body that shows an emphasis on wellbeing. Bodies such as the former Public Health England claimed to exist ‘to protect and improve the nation’s health *and wellbeing*, and reduce health inequalities.’¹¹⁹ In the United Kingdom, Public Health England has since been dissolved, and re-divided into, among other bodies, the Office for Health Improvement and Disparities under the Department of Health and Social Care.¹²⁰ This re-division further emphasises the importance of health and wellbeing equality in the United Kingdom, and the remit of public health bodies as including measures to prevent ill health and preserve wellbeing. Public health in this jurisdiction encompasses interventions that address social wellbeing and environmental health, and structural determinants of physical health—that is, those seemingly health-unrelated aspects of people’s lives and environments that contribute to their health status in the narrower

¹¹⁹ Wikum Jayatonga, "Contraception: Economic Analysis Estimation of the Return on Investment (ROI) for Publicly Funded Contraception in England" Public Health England (2018), accessed May 11, 2020. https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/730292/contraception_return_on_investment_report.pdf. My italics in quotation.

¹²⁰ "Office for Health Improvement and Disparities," GOV.UK (2021), accessed April 10, 2022. <https://www.gov.uk/government/organisations/office-for-health-improvement-and-disparities>.

sense. These aspects include social wellbeing (promoted through, perhaps, support groups for people experiencing certain hardships) and the state of our natural environment (protected through, perhaps, emissions-lowering schemes that protect health and environment, under the public health jurisdiction).¹²¹

We may think that, regardless of whether a narrower or broader definition of health is used, it is the job of a public health body to also promote and support values we hold outside of pure physical health. In that case, mission statements like Public Health England's seem *prima facie* appropriate. Statements of the goals of public health, ultimately, are grounded on broader, often wellbeing-related goals of public systems, including the provision of certain goods in society. It is this deeper foundation of public health that can add additional insight.

States and primary public goods

Public health policymaking can be conceived as performing a number of functions, under a number of motivations. In this thesis, I have a particular conception in mind, wherein public health policymakers, acting on behalf of the state, have a responsibility to promote public health (and wellbeing, assuming this is not included in the definition of public health already but is a goal of public health policymaking) as part of the state's responsibility to provide goods for citizens and residents. Public health, then, provides (health- and wellbeing-related) primary public goods (PPGs). Whilst I often discuss public health interventions in terms of their contributions to (or detractions from) collective-level wellbeing of a country's public, from a policymaker's or state's perspective, the benefits of a public health intervention are sometimes more effectively considered as PPGs, for reasons I outline further below.

¹²¹ For instance, in the United Kingdom, the former public health body led recent incentive schemes for buying low-emissions cars. The benefits of lower emissions befall humans, other animals, and ecosystems. The full report is available via: "Improving Outdoor Air Quality and Health: Review of Interventions," Public Health England (2019), accessed April 23, 2020. <https://www.gov.uk/government/publications/improving-outdoor-air-quality-and-health-review-of-interventions>.

To begin the discussion, I claim that the state's responsibility to support and promote public health via providing PPGs arises from the very purpose of creating liberal democratic states:¹²² to support groups of people who consent to band together under a common institution.¹²³

In banding together, people create and consent to a governing institution—a state—in order to protect and support citizens' most fundamental shared interests whilst respecting the plurality their private values and ends.¹²⁴ To maintain legitimacy, states must continue to fulfil this and other responsibilities.¹²⁵ Whilst these responsibilities are not extensive according to classical liberal doctrine, welfare liberal conceptions propose a larger role for the state in providing goods that ensure a basic level of welfare and opportunities for flourishing. John Rawls is a welfare liberal who emphasises that one responsibility of the state is to provide what he terms 'primary' goods—resources, services and conditions that would plausibly serve all valued ends or ways of flourishing which citizens could have. Rawls focuses on the social primary goods, among which he includes 'income and wealth, and above all self-respect', 'the public recognition of just institutions', and 'free choice of careers and occupations'.¹²⁶ Now, however, more natural and other primary goods have come within our sphere of control, and as such are prime for state (re)distribution.¹²⁷ Among these, some

¹²² Note that my focus is relatively narrow. The work throughout this thesis assumes a liberal democratic state, excluding authoritarian and other systems of governance. The framework comes from a liberal democratic perspective and will likely not be one that appeals or applies to public health policymakers in other systems of governance.

¹²³ John Locke, *Second Treatise on Government* (Early Modern Texts, 1689), accessed October 1, 2020. www.earlymoderntexts.com. See esp. at S2.135.

¹²⁴ Shannon Hoff, "Locke and the Nature of Political Authority," *The Review of Politics* 77, no. 1 (2015): 1-22.

¹²⁵ Hoff's extension acts as a justification for the tacit consent to governance that John Locke assumes in his discussions in the Treatises. Hoff argues we can assume tacit consent based on the assumption that it is given where citizens continue to band together under a common institution which helps them to coordinate to produce various ends more effectively (or as we might say, which provides primary public goods). For further discussion, see: Hoff, "Locke and the Nature of Political Authority."

¹²⁶ John Rawls, *Political Liberalism* (New York: Columbia University Press, 2005). Quotes at 380, 477, and 242.

¹²⁷ Michael Hauskeller, "Levelling the Playing Field: On the Alleged Unfairness of the Genetic Lottery," in *The Ethics of Human Enhancement: Understanding The Debate*, ed. S Clarke et al. (Oxford: Oxford University Press, 2016), 198-210.

have defended including the good of health,¹²⁸ and an adequate level of public or population-wide health and wellbeing.¹²⁹ Public health, after all, can contribute to flourishing, no matter what a person's overall goals are, because they facilitate achieving one's goals more generally. Applied in the public health sphere, then, a Rawlsian welfare liberal approach motivates and justifies a role for the state in considering implementing various measures to support public health—including, perhaps, GGEE interventions (as further defended below).

However, it is neither politically nor economically feasible for states to provide support in all aspects of public health.¹³⁰ There are limits to the health care and other goods that a state can provide. In the interests of offering some more realistic limits for the purposes of considering public health interventions (for funding and other types of state support via policymaking), I add an additional requirement: that the goods provided by government should be restricted to those that are also 'public'. Adam Smith proposed one of the main roles of governments as providing public goods, indicating they have a responsibility for goods 'which, although they may be in the highest degree advantageous to a great society, are, however, of such a nature, that [...] it therefore cannot be expected that any individual or small number of individuals should erect or maintain.'¹³¹

Public goods were originally defined in the economics literature by Paul Samuelson, as goods that are, first, accessible or non-excludable, in that no person can be prevented from accessing them. Second, they are non-competitive or non-rivalrous, in that any number of people can access them at once without depleting them. This latter characteristic can be

¹²⁸ Fox, "Luck, Genes, and Equality."

¹²⁹ Jonathan Anomaly, "Public Health and Public Goods," *Public Health Ethics* 4, no. 3 (2011): 251-259, <https://doi.org/10.1093/phe/phr027>.

¹³⁰ Chandran Kukathas and Philip Pettit, *Rawls: A Theory of Justice and its Critics* (Cambridge: Polity Press, 1990).

¹³¹ Adam Smith, *An Inquiry into the Nature and Causes of the Wealth of Nations*, Econlib Books (1776), accessed June 21, 2021. <https://www.econlib.org/library/Smith/smWN.html>.

conceived in opposition with those goods that are competitive,¹³² excludable,¹³³ non-renewable,¹³⁴ or positional.¹³⁵ Economically optimal policy on providing public goods involves minimal government expenditure and maximal benefit to citizens.¹³⁶ Where goods remain *somewhat* competitive or excludable, they are termed *impure*, and constitute problem cases when it comes to governments providing them.¹³⁷ Whilst discussions in terms only of collective-level wellbeing can neglect these difficulties with impure public goods, using the terminology avoids such problems. Impure goods are less efficient in benefiting citizens and provide a weaker justification for government interference in markets for providing a good.¹³⁸ For example, imagine if the good of public safety was provided through police protection, but only in cities. One might immediately think this contributes well to collective-level wellbeing. Yet, when considering the intervention using the language of public goods, policymakers can identify a problem: it is an impure public good. Those citizens living rurally would not be able to access police protection when necessary, and thus would not be provided the public good. Rather, it would be impure, and we could call into question whether state funding should be used to support the provision of police protection that only benefits city-dwellers.

Public health policy as the provision of health-related primary public goods

In the public health context, Jonathan Anomaly has advocated for considering policy in public health as the provision of health-related public goods.¹³⁹ Whilst I believe it is limited

¹³² Only a limited number of people can make use of a competitive good at once.

¹³³ Some additional capacity is required to access excludable goods, such as money to buy a good, geographic access to it, or membership of a certain group.

¹³⁴ Non-renewable goods are depleted through use faster than it can be replenished.

¹³⁵ For positional goods, the value of the good depends on others not having it, or having less of it.

¹³⁶ Samuelson, "The Pure Theory of Public Expenditure."

¹³⁷ Drahos, "The Regulation of Public Goods."

¹³⁸ Although, it should be noted that public goods alone do not provide a full justification for state interference to provide them, as they may be provided privately (e.g., via charities or assurance contracts). These possibilities are discussed further in: Jonathan Anomaly, "Public Goods and Government Action," *Politics, Philosophy & Economics* 14, no. 2 (2015): 109-128, <https://doi.org/10.1177/1470594X13505414>.

¹³⁹ Anomaly, "Public Health and Public Goods."

in not also considering wellbeing-related public goods, Anomaly's conception is a particularly appropriate one in a number of ways. First, it ensures that policymakers' overall goals continue to target the collective level: 'the case for classifying a set of health-related goals as *public* health becomes stronger as the purity of the public good and the size of the population to which it applies increase.' This helps distinguish public health interventions from individual healthcare, as is desirable for interventions that fall into the area of collective-oriented public health measures, discussed in the next section. Second, Anomaly's approach moves public health more squarely into policymakers' area of remit, under the banner of the provision of primary public goods. This provides further justification for Anomaly's conception of public health as the provision of public goods, where this may involve states taking coercive action. The provision of important public goods may justify coercive or liberty-infringing policies (although, of course, individual interests must still be considered as weighing against such interventions). Third, it can help address problems of coordination in public health. Many of the collective action problems discussed in Chapters 1 and 2 require coordinated action to be addressed, and yet it is in individuals' interests, when they consider their own actions alone, to not coordinate. This can have negative effects on public health (and wellbeing), which are naturally included in the consideration of public goods and free-rider problems (where due to the non-excludability of public goods, further actions may be needed by states to ensure their sustainability when benefiting large populations).¹⁴⁰ As James Childress and colleagues note, along similar lines:

'Government has a unique role in public health because of its responsibility, grounded in its political powers, to protect the public's health and welfare, because it alone can undertake certain interventions,

¹⁴⁰ Anomaly, "Public Health and Public Goods."

such as regulation, taxation, and the expenditure of public funds, and because many . . . public health programs are public goods that cannot be optimally provided if left to individuals or small groups¹⁴¹

Public health can provide primary public goods varying levels of purity across countries. Whilst some public health systems are poorly funded or mostly privatised, I assume throughout most of this thesis that states considering implementing GGEE interventions as public health measures have enough funding and power over public health interventions to adequately enact and enforce policy on GGEE interventions, too. I consider an objection to this assumption in Chapter 6.

I have introduced the context surrounding policymaking in public health and the approach to policymaking that grounds the ethical guidance this thesis aims to provide; I turn now to the specifics of public health. The analysis of interventions that aim to promote collective-level public health and wellbeing using the type of policymaking I outlined above constitutes a particular area of PHE: collective-oriented PHE. This area includes public health measures that serve the goals of public health policy in a population-oriented context.

I argue that we might consider some measures like GGEE as public health measures. Insofar as they fit the goals and remit of public health as a discipline or policy area, GGEE interventions, too, may contribute to public health and wellbeing, and may be appropriately ethically analysed using tools from PHE. However, I am concerned not with the whole of public health in this case, but in the part surrounding collective-level interventions. In the next section I further delineate this area.

¹⁴¹ James Childress et al., "Public Health Ethics: Mapping the Terrain," *Journal of Law, Medicine & Ethics* 30 (2002): 170-178. See quote at 170.

III

Delimiting Collective-Oriented Public Health

Not all areas of public health relate to the population-scale interventions or those that also/instead contribute to public wellbeing, and not all concepts in PHE are appropriately applied to all public health measures. Rather, ethical issues that relate to individual (often physical) health needs occur at the intersection between public health, healthcare, and clinical or medical ethics. In such areas, a more individualist approach is needed in ethical analysis. Still, there remains an area of public health dealing with population-level interventions which requires analysis using collective-oriented concepts from PHE. Angus Dawson considers this area of public health ‘a special type of social activity, with a clear focus on a particular set of aims (such as improving population welfare, reducing inequalities, reducing or removing harms and so on), methods (such as epidemiology, social survey tools and so on), actions (for example, interventions through the law, education, information, taxation and others) and outcomes (such as removing harms, improving quality of life, promoting equity and so on).’¹⁴² In-keeping with Dawson’s assessment, I delineate this area using a few conditions. The interventions assessed within this area must be: 1) significantly society-affecting, 2) inadequately analysed using individual-focussed moral principles and concepts, 3) able to be implemented at the population level in a particular (public health) jurisdiction by a public health/state authority.

These conditions delineate the area of PHE that appropriately uses collective-oriented moral principles and concepts, which, I argue next, includes among its collective-oriented public health measures some GGEE interventions. For these interventions, they may be

¹⁴² Angus Dawson, "Theory and Practice in Public Health Ethics: A Complex Relationship," in *Public Health Ethics and Practice*, ed. Stephen Peckham and Alison Hann (Bristol: Bristol University Press, 2010), 191-210, at 196.

appropriately analysed using the concepts and principles from collective-oriented public health. In the following three subsections, I explain and defend each condition in turn.

Significant societal effect

Societal effect is the impact that implementing a public health intervention may have on the likelihood of stakeholders realising their morally relevant interests. These morally relevant interests whose realisation may be impacted could be directly affected by the public health intervention, or indirectly affected by it. The impact may be significant when there are either large effects on a target individual, or small (or large) effects on other, large groups of people. To illustrate the first case of large effects on individuals, imagine, for instance, an educational campaign against obesity that uses stigmatisation to encourage healthy eating habits. Such an intervention might have a large effect on an obese person, by benefiting them via their weight-loss to a healthier weight, and/or by harming them from the experience of stigmatisation. To illustrate the second case of significant impact, where this arises from small effects on large groups, imagine the changes an obesity public health intervention might have on the society at large if population-level health improves. There might be less stress on the healthcare system from treatments and care for patients with cardiovascular disease, which is associated with obesity.¹⁴³ This would pose less cost to taxpayers and would leave more healthcare resources for other conditions requiring care. Both these negative and positive effects, arising both directly and indirectly at individual and population levels may be morally significant in ethical analysis.

For another example, consider the significant societal impact of the near-elimination of guinea-worm disease in Asia and Sub-Saharan Africa. Public health interventions led by the

¹⁴³ Tiffany M. Powell-Wiley et al., "Obesity and Cardiovascular Disease: A Scientific Statement from the American Heart Association," *Circulation* 143, no. 21 (2021), <https://doi.org/10.1161/CIR.0000000000000973>.

WHO introduced safe drinking water access and water filtration/sterilisation methods in several areas. This was an intervention that addressed a widespread population health problem in that area, targeting populations in cities and villages with poor water quality in 20 endemic countries. These measures were directly effective: whilst there were an estimated 3.5m cases of guinea worm globally in 1986, the number dropped to 28 reported cases in only 3 countries by 2018.¹⁴⁴ This represents millions of individuals whose lives were not affected by a severely incapacitating disease. Such an intervention likely has indirect beneficial effects, too, by increasing population-level health, with flow-on effects for these countries' health systems and productivity levels.

For public health measures that have significant impact, not only on individuals, but indirectly on societies, collective-considering moral principles and concepts ought to be applied in ethical analysis.

Inadequacy of individualist considerations

Individualism, I have already noted in Chapter 2, seems inadequate by itself to inform a thorough ethical analysis where other, collective-level considerations pertain. For this reason, for those public health measures that satisfy the first condition for being included in collective-oriented PHE, it is more likely that they will satisfy this second condition. Individualism in population-targeting areas of PHE has been criticised for a 'tendency to ignore or underestimate the importance of structural and social determinants of ill health that do not directly map to the beliefs, motivations and actions of individuals.'¹⁴⁵ These inadequacies in particular areas have led to a turn to a population perspective that employs

¹⁴⁴ "Dracunculiasis (Guinea-Worm Disease)," World Health Organization (2019), accessed March 12, 2020. [https://www.who.int/en/news-room/fact-sheets/detail/dracunculiasis-\(guinea-worm-disease\)](https://www.who.int/en/news-room/fact-sheets/detail/dracunculiasis-(guinea-worm-disease)).

¹⁴⁵ Adrian Viens, "Public Health and Political Theory: The Importance of Taming Individualism," *Public Health Ethics* 9, no. 2 (2016): 136-138, at 137.

collectivist considerations in recent years, at least to consider the causation of certain public health problems that occur across populations.¹⁴⁶

Using Healthy Heart campaigns in the US and Australia as an example, Fran Baum highlights differences in public health programmes' success according to emphasis on one of two factors. The campaigns either emphasised, 1) changing individual behaviour and affirming responsibility in the face of increasing deaths from heart conditions; or 2) removing structural causes of ill-health in whole populations. Baum examines cases where the latter approach was more effective, claiming that this was because they considered collective-level determinants of health relevant in ethical analysis of interventions. This is more appropriate for public health issues with collective-level (structural) causes. Structural causes include unsafe streets in some suburbs, meaning people cannot walk around or exercise outdoors safely, unhealthy social norms surrounding eating, and lack of education surrounding nutritional requirements.¹⁴⁷ Sometimes, an emphasis on individual responsibility for health is inadequate, because of the comparative force of structural, corporate, or environmental factors affecting health. Where this is so, the use of individualist concepts in ethical analysis is clearly inadequate to account for the cause of the public health problem. This justifies the inclusion of collective-oriented considerations when it comes to these public health interventions.

State-level implementation

Where large groups are the target of a given intervention, or where complying with an intervention is not in an individual's interests but is required for securing the collective interest in a successful public health intervention, state action to implement the intervention

¹⁴⁶ Fran Baum, *The New Public Health*, 4th ed. (Melbourne: Oxford University Press, 2016); Wendy Parmet, "Valuing the Unidentified: The Potential of Public Health Law," *Jurimetrics* 53, no. 3 (2013): 255-277.

¹⁴⁷ Baum, *The New Public Health*, Chapter 19.

is often practically necessary. This is another condition that delineates collective-oriented PHE. Ensuring compliance via coercive measures, distributing resources, and educating and involving the public in decision-making are all aspects in which government action may be needed to ensure the success of certain public health interventions. In turn, where state involvement becomes necessary, the state has a responsibility to consider the interests of its citizen collective. John Coggon claims this is a relevant consideration in many public health issues, where we may conceive of a community with a shared purpose of health promotion, and where health can be considered part of the public sphere.¹⁴⁸ In Coggon's words,

'[i]t is a fact with important normative implications that as part of the social environment—a public—people are part of the environment in which other people live. [...] To the extent that health is public, *we* are part of the conditions in which people can be healthy. What remains to decide is what the State should do in developing its policies.'¹⁴⁹

In such cases, the state has the task of recognising the stakeholders involved, both at the collective level and the individual level, and weighing their interests where they conflict. Thus, such analysis requires collective-considering moral principles and concepts, both in the identification of interests, and in the method of weighing them. Informed by these considerations, states then implement an intervention in a way that lies along a spectrum of coerciveness. The intervention may be implemented in such a way that it: eliminates choice, restricts choice, guides choices through disincentives, guides choices through incentives, guides choices through changing the default policy, enables choice, provides information, does nothing, or simply monitors the current situation.¹⁵⁰

¹⁴⁸ Coggon, *What Makes Health Public?: A Critical Evaluation of Moral, Legal, and Political Claims in Public Health*.

¹⁴⁹ Coggon, *What Makes Health Public?: A Critical Evaluation of Moral, Legal, and Political Claims in Public Health*, 147-148.

¹⁵⁰ *Public Health: Ethical Issues* (London, UK: Nuffield Council on Bioethics, 2007), accessed November 10, 2020. <http://nuffieldbioethics.org/wp-content/uploads/2014/07/Public-health-ethical-issues.pdf>. The ladder has been criticised for an inherently libertarian or negative conception of autonomy, which emphasises

To illustrate, consider quarantine during a pandemic. Quarantine measures may reduce individuals' free movement for the sake of reducing or delaying infectious disease spread to others. Such measures have shown variable outcomes, according to how the individual and collective-level interests at stake have been articulated and weighed when states become involved. Charles Eliot notes that in some yellow fever outbreaks around 1900-1910 in some South American countries, the public health authority seemed to place great emphasis on the collective level. It 'invades the residences of the sufferers with mosquito netting [...] just as promptly and as forcibly as the fire department invades a building on fire. In all these cases, collective action overrides the individual right; but it does so to protect from threatened injury the mass of the population.'¹⁵¹

This case demonstrates how some public health interventions require state action/implementation for practical (and/or ethical) reasons, the analysis of which will involve collective-oriented moral principles and concepts.

This concludes my defence of the three conditions delimiting collective-oriented PHE. I now turn to defending the prospective application of concepts from public health to enhancements against the most prominent objection to it, based on the T/E distinction.

IV

The Treatment/Enhancement Distinction

non-interference by third parties rather than facilitation of decision-making (the positive conceptions). For further discussion of this potential problem with the ladder's definition of autonomy (and by extension, coercion), see Paul Griffiths and Caroline West, "A Balanced Intervention Ladder: Promoting Autonomy through Public Health Action," *Public Health* 129, no. 8 (2015), <https://doi.org/10.1016/j.puhe.2015.08.007>.

¹⁵¹ Charles William Eliot, *The Conflict Between Individualism and Collectivism in a Democracy: Three Lectures* (New York: C. Scribner's Sons, 1910), 103-104.

The use of concepts from public health to ethically analyse GGEE interventions may be contested by those who advocate for the T/E distinction. Thus far, I have claimed that some GGEE interventions may be considered as public health interventions insofar as they serve the wellbeing-related goals of public health and may fit the requirements for inclusion in the specific collective-oriented area by virtue of their being significantly society-affecting,¹⁵² their necessarily involving government,¹⁵³ and their being inadequately analysed by individualist considerations alone.¹⁵⁴ Yet, objections to my view may remain.

In particular, I anticipate one objection to framing GGEE interventions as collective-oriented public health measures, and therefore using PHE moral principles and concepts in ethical analysis. It is based on the T/E distinction. This is a worry that I would like to put to rest here. To do so, I first explain the normative distinction between treatment and enhancement, then its (lack of) applicability in PHE. I provide further reasons for framing GGEE as a public health intervention, and argue that if my framing is legitimate, then the T/E distinction holds no weight. That is, it is impotent both as an objection to applying PHE-derived considerations in analysis of GGEE interventions, and as a general objection to the permissibility of GGEE.

¹⁵² GGEE interventions may significantly impact society as we know it. The transgenerational effects, the predictable popularity of interventions that benefit one's descendants, and the possibility of changes to relationships in society all justify the claim of significant societal impact.

¹⁵³ Ensuring the compliance of clinics performing GGEE interventions, distributing resources for interventions, and educating and involving the public in decision-making surrounding GGEE are all aspects of GGEE interventions that necessarily involve states.

¹⁵⁴ For details on this aspect, see Chapter 2.

Introducing the distinction

The T/E distinction has been explained by Norman Daniels as a difference between ‘interventions meant to prevent or cure (or otherwise ameliorate) conditions that we view as diseases or disabilities and interventions that improve a condition that we view as a normal function or feature of members of our species.’¹⁵⁵ It is held by advocates of the distinction that treatment interventions are at least morally preferable to enhancement ones. In the genome editing context, some further hold that the only acceptable genome editing interventions are those that aim to treat, not those that aim to enhance. For example, imagine a GGEE intervention that increases an individual’s levels of dopamine production in targeted ways, making them happier. If the person was normal in their happiness before that point, and/or is made unusually happy by the intervention, then advocates of the distinction may hold this to be a morally unacceptable use of genome editing. By contrast, the same genome edit applied to someone with depression may be held by advocates of the distinction to be morally acceptable.

There are a number of different ways these claims are defended. Sometimes, the distinction is defended by saying there are greater risks involved in enhancement than treatment, and that therefore the net benefit of a given treatment will be greater than for an enhancement.¹⁵⁶ We can imagine some cases where treatment provides enough of a benefit to outweigh the same risks that would not be outweighed by the benefits of an enhancement. Yet, this claim does not hold in all cases of either treatment or enhancement. Particularly where the mechanism of the intervention is the same, as in the example used above, an argument would need to be made that improvements from a state of illness are always greater than improvements from a normal state, in order to justify this claim. This is a hard case to

¹⁵⁵ Daniels, "Normal Functioning and the Treatment-Enhancement Distinction."

¹⁵⁶ Sparrow, "A Not-So-New Eugenics."

make when one considers, say, treatment to prevent ingrown toenails vs a highly effective cognitive enhancement.

Other times, instead, it is held that GGEE is simply ‘inherently unethical’, and treatment ‘inherently ethical’.¹⁵⁷ This second justification is often either too vaguely defined to pose a solid line between the interventions or based on the identification of potential moral concerns with certain enhancements that are in fact not inherent to enhancements. These might include, for example, concerns with inequitable access which, as discussed in Chapter 2, depend on whether enhancements are accessed via private/regulated markets or universally, via a publicly funded system.

An advocate of the T/E distinction might object to my argument in this chapter, claiming that framing GGEE interventions as public health interventions and applying PHE-derived collective-oriented moral principles and concepts in their ethical analysis is wrong. They might say: GGEE does not constitute treatment, and if it does not treat health deficits, it has no place in public health, and therefore cannot be ethically assessed using moral principles and concepts from PHE—and what’s more, it should be rejected as morally unacceptable, anyway.

I have two responses to this argument. First, consider the definitions it relies upon. It relies upon a very specific definition of enhancement that does not include improvements that address deficits. My definition *does* include such improvements, and thus incorporates treatments as potential forms of enhancement to begin with. The argument also relies upon a narrow conception of the goals of public health as a discipline or area of policy. Not all public health interventions constitute treatments of health deficits—some, in fact, might constitute enhancements, like vaccination or contraception. When we use the definitions of

¹⁵⁷ Resnik, "The Moral Significance of the Therapy-Enhancement Distinction in Human Genetics," 365.

enhancement and public health that I have proposed and defended, the T/E distinction doesn't appear to hold. In the sub-sections below, I offer some examples of interventions that fit accepted definitions of public health and that seem not to constitute treatments.

The distinction in public health

Consider an intervention that reduces air pollution. Reducing pollution protects our environment, avoiding acid rains, water algae blooms, and death and disease in vulnerable animal species. It also protects our health avoiding increased risks of heart attack, exacerbation of asthma, and increased likelihood of developing cancer from air pollution.¹⁵⁸ Yet, it does not treat an existing health deficit, as the vast majority of people are not already affected by lung diseases resulting from pollution. It is, instead, a preventive measure. In the United Kingdom in 2019, the former Public Health England gave greater powers to local authorities to support green transport, aiming to offer an 'opportunity to create a clean air generation of children'.¹⁵⁹ According to this broad wording, the aim of the intervention seems to be to enhance the environment into which that generation will be born, rather than to treat any diseases they may be born with due to continued high levels of air pollution. Such interventions are currently accepted and implemented as public health measures that do not constitute treatments.

At this point, an advocate of the T/E distinction might respond that, whilst air pollution reductions and other measures might not constitute treatments, they also do not constitute enhancements. In that case, the objector may claim, there is no reason to think that public health should extend beyond simple prevention to include interventions like GGEE.

¹⁵⁸ Patrick Deval et al., *Health & Environmental Effects of Air Pollution* (Boston, MA: Commonwealth of Massachusetts Executive Office of Energy & Environmental Affairs, 2016), accessed May 8, 2021. <https://www.mass.gov/files/documents/2016/08/v1/health-and-env-effects-air-pollutions.pdf>.

¹⁵⁹ Public Health England, "Improving Outdoor Air Quality and Health: Review of Interventions."

In response, let me provide example cases of preventive measures that *are* enhancements. Take contraception as a public health measure. Pregnancy is not a disease state, merely an undesired one for some people, so the prevention of a pregnancy in a healthy woman does not constitute treatment and does not address a health deficit. It does constitute a preventive measure (it prevents an unwilling mother from having a child). It also constitutes an enhancement, in that it biologically modifies a person (who is otherwise normal) in order to benefit them. Yet, this enhancement intervention, in the forms of contraception—and, indeed, abortion services, too—are often offered via public healthcare systems. In the UK, the National Health Service has funded family planning services and contraception since 1974.¹⁶⁰ In fact, a recent funding report by PHE notes that for contraception, ‘unlike with most medical or public health interventions, there is no direct ‘health benefit’ to the user, to be measured as a gain in life years or quality of life [...]. Instead, benefits are usually measured as the number of pregnancies averted by the use of contraception, or as the cost savings that result from these averted pregnancies.’¹⁶¹ By improving women’s reproductive autonomy and wellbeing, and perhaps in protecting their future mental health, contraception constitutes a valuable addition to public health practice, despite not treating anything, and not providing health-related benefits (at least in many cases).

Let me consider one final intervention to illustrate—this time, one that also clearly constitutes an enhancement. Vaccination is a commonly accepted public health measure that has also been termed an enhancement previously.¹⁶² It modifies an otherwise-normal individual, for their own and others’ benefit. Whilst it is health-related, it does not constitute treatment.

¹⁶⁰ Jayatonga, "Short Contraception: Economic Analysis Estimation of the Return on Investment (ROI) for publicly funded contraception in England."

¹⁶¹ Jayatonga, "Short Contraception: Economic Analysis Estimation of the Return on Investment (ROI) for publicly funded contraception in England."

¹⁶² Resnik, "The Moral Significance of the Therapy-Enhancement Distinction in Human Genetics"; Harris, *Enhancing Evolution: The Ethical Case for Making Better People*.

The intervention also fits into the collective-oriented area of public health, satisfying each of the three conditions I posed above. The implementation of vaccination programmes aims to prevent both deaths from and transmission of a serious infectious disease in a population (offering significant effect on society). These programmes require a certain proportion of a population to be vaccinated to protect the whole population from the disease, achieving herd immunity (thus necessarily involving the state for successful implementation in most cases). This may require action to encourage or even mandate vaccination. Finally, vaccination programmes are also inadequately ethically assessed through an individualist lens. There are those in a community who are unable to be vaccinated, and the value of protecting these members of society from disease must also be included. The collective-level interest in achieving herd immunity may even constitute a benefit to a group that might justify a corresponding ‘duty of collective easy rescue’ for individuals to be vaccinated, if the burdens placed on them are not too great.¹⁶³

This collective-oriented public health measure, also constituting an enhancement, even has a potential GGEE analogue: genetic immunisation, conferring immunity to a specific infectious disease via genome editing. (I explore genetic immunisation in depth in Chapter 7.) It seems unreasonable to claim that either genetic immunisation or vaccination should be rejected as a public health measure merely because they constitute enhancement.¹⁶⁴

¹⁶³ Giubilini, Douglas, and Savulescu, "The Moral Obligation to be Vaccinated: Utilitarianism, Contractualism, and Collective Easy Rescue."

¹⁶⁴ However, there may be other morally relevant differences between vaccination and genetic immunisation that render the former acceptable and the latter unacceptable, as demonstrated most clearly in the case of He Jiankui's editing of the human twins in an aim to make them immune to HIV. For further discussion, see: Henry Greely, "He Jiankui, Embryo Editing, CCR5, the London Patient, and Jumping to Conclusions," *STATnews* (April 15, 2019), accessed April 20, 2020. <https://www.statnews.com/2019/04/15/jiankui-embryo-editing-ccr5/>; Haoyi Wang and Hui Yang, "Gene-Edited Babies: What Went Wrong and What Could Go Wrong," *PLOS Biology* 17, no. 4 (2019), <https://doi.org/10.1371/journal.pbio.3000224>.

GGEE as a public health measure

Let me recap, briefly. We can and should frame some GGEE interventions as public health measures (or at the very least, as relevantly analogous to them), based on how well GGEE interventions fit the wellbeing goals of public health as a policy area. More specifically, we can and should frame collective-level wellbeing-promoting enhancements as falling into the collective-oriented area of public health. Within this area, the application of certain collective-considering moral principles and concepts in ethical analysis of interventions is entirely appropriate, insofar as the public health interventions (including GGEE interventions) share the following characteristics. These are, namely, 1) being significantly society-affecting, 2) necessarily involving the state, and 3) being inadequately analysed using only individualist moral considerations.

To illustrate how a particular GGEE intervention may fit these definitions, goals, and characteristics, take a GGEE intervention that reduces rates of antimicrobial resistance in a community. Antimicrobial resistance has been identified by the WHO and the UN as one of the most serious and challenging public health concerns in the coming decades.¹⁶⁵ The hypothetical GGEE intervention works by targeting future children's gastro-intestinal tracts to make them more hostile environments for certain drug-resistant bacteria such as multidrug-resistant *Staphylococcus aureus* (MRSA). MRSA is one of the most common causes of severe nosocomial infection and inhabits the gut reservoir. When it spreads to other regions, it can cause a host of infections, but research has shown that elevated levels of organic acids, hydrogen peroxide and possibly reuterin in the mucus makes initial colonisation less likely.¹⁶⁶ What's more, recent studies have shown that strains can be

¹⁶⁵ "No Time to Wait: Securing the Future from Drug-Resistant Infections," UN Interagency Coordination Group on AMR (IACG) (Geneva: World Health Organisation, 2019), accessed May 29, 2020. <https://www.who.int/antimicrobial-resistance/interagency-coordination-group/final-report/en/>.

¹⁶⁶ Satu Vesterlund et al., "Staphylococcus Aureus Adheres to Human Intestinal Mucus But Can be Displaced by Certain Lactic Acid Bacteria," *Microbiology* 152, no. 6 (2006): 1819-1826.

prevented from evolving resistance if the environment is changed to prevent the bacteria from performing certain oxidative reactions.¹⁶⁷ If such effects could be produced genetically, such a GGEE intervention may pose a strategy for combatting antimicrobial resistance, at least as far as MRSA is concerned. It would also satisfy the three conditions to be considered a collective-oriented public health intervention. First, it would be society-affecting in its reduction of populations' vulnerability to antimicrobial-resistant diseases. Second, its impacts are not adequately accounted for on an individual level, as the reduced spread of antimicrobial diseases benefits more than just the individual involved. This holds even without other benefited individuals undertaking the enhancement themselves. Third, it would necessarily involve state involvement to co-ordinate and regulate its implementation. The effects of intervention reach far beyond health: a future society not plagued by antimicrobial resistance is likely to be more prosperous, more socially well, and more trusting of healthcare systems and institutions.¹⁶⁸ The GGEE intervention satisfies the conditions to be considered a collective-oriented public health measure. What's more, whilst the T/E distinction denies the moral value of interventions like this, due to its not constituting a treatment, the intervention does clearly have value. This intervention would clearly significantly benefit individuals and populations, both in terms of their health and wellbeing. It is acceptable as collective-oriented public health measure. It is the distinction that is implausible and cannot hold up against the examples I have examined. I therefore reject the T/E distinction and its proposed implications for my analysis.

Conclusion

¹⁶⁷ John Pribis et al., "Gamblers: An Antibiotic-Induced Evolvable Cell Subpopulation Differentiated by Reactive-Oxygen-Induced General Stress Response," *Molecular Cell* 74, no. 4 (2019): 785-800.

¹⁶⁸ For further discussion, see: Lynette Reid, "Antimicrobial Resistance and Social Inequalities in Health: Considerations of Justice," in *Ethics and Drug Resistance: Collective Responsibility for Global Public Health*, ed. Euzebiusz Jamrozik and Michael Selgelid (Cham: Springer International Publishing, 2020), 257-278.

This chapter has defined the term public health and situated public health in terms of state responsibilities to provide goods for their citizens and residents. I have also delimited the collective-oriented area of public health and PHE, using three characteristics/conditions. Within this area, public health interventions' ethical analysis is appropriately informed by collective-oriented moral principles and concepts.

I have argued, furthermore, that some population-targeting enhancements and/or preventive measures (in addition to treatments) constitute public health measures that fall within the remit of public health as a policy area. These are appropriately ethically analysed under the umbrella of collective-oriented public health ethics. These measures include, for example, contraception, environmental initiatives, vaccination and even GGEE interventions. I defended this argument for considering GGEE interventions as public health measures against the most prominent potential objection to it, based on the T/E distinction.

The key points from this chapter are outlined in Summary Box 3, below.

Summary Box

Human Enhancement as a Collective-Oriented Public Health Measure

PUBLIC HEALTH: KEY ATTRIBUTES

- Concerned with improving health, wellbeing, and health equity
- Targets population-level change
- May supply non-excludable, non-rivalrous, flourishing-contributing goods

COLLECTIVE-ORIENTED PHE

- Analyses interventions that must be:
 - significantly society-affecting
 - inadequately analysed through individualism
 - involving state policymakers
- Can analyse treatments, preventions or enhancements

GGEE: A PUBLIC HEALTH MEASURE

- Fulfils three requirements for analysis under collective-oriented PHE
- Does not fall prone to T/E distinction objection, as PHE analyses interventions that are treatments, preventions or enhancements

OUTCOME: GGEE interventions can be considered as public health measures, and analysed using moral concepts and principles derived from collective-oriented public health ethics

Summary Box 3: Attributes of public health as a field; requirements for considering public health measures as collective-oriented and using collective-oriented moral concepts and principles to analyse them; argument for considering GGEE as a collective-oriented public health measure.

In the next chapter I introduce the relevant collective-oriented moral principles and concepts for application to GGEE interventions, as part of my proposed framework for ethical analysis of GGEE interventions and their implementation.

Chapter 4:

Collectivist Moral Concepts and Principles in Public Health Ethics

Introduction

In this chapter, I aim to identify and explain some moral concepts and principles that are appropriately used in collective-oriented public health ethics (PHE), and in my proposed framework for ethical analysis. The framework I propose in the next chapter draws on the (improved) collectivist perspective I have explored in Chapter 2, the public health framing of enhancements I have proposed in Chapter 3, and the concepts I outline in this chapter. From here onward, I term it the Collectivist Public Health (CPH) framework.

The public health framing of enhancements, involving the use of the concepts I outline here, form the methodological basis for a decision-making procedure when it comes to evaluations of prospective genetic enhancements. The concepts are by no means the only ones applied in collective-oriented PHE, and may not be the only ones useful in analysing GGEE interventions. However, they are particularly useful when undertaking ethical analysis using my CPH framework. The concepts do not necessarily express fundamental value, but are, rather, tools or ‘mid-level principles’,¹⁶⁹ which can be used to articulate stakeholders’ interests and the prospective effects of genetic enhancement upon them. Through this process, policymakers and (insofar as their involvement extends into the decision-making process) relevant stakeholders can undertake the deliberative process using these concepts,

¹⁶⁹ This term refers to those principles that fall mid-way between practical tools and ethical theories. Whilst they do not express fundamental values, they can articulate possible values that ought to be taken into account by deliberators. Whether those values are, in the end, appropriately included in ethical deliberation is a separate, deeper level of theory which is mostly outside my scope here. For more, see: Steven Coughlin, "How Many Principles for Public Health Ethics?," *The Open Public Health Journal* 1 (2008), 8-16.

to decide which (if any) policy alternatives for implementing a GGEE intervention as a public health measure are ethically acceptable, and then which are ethically desirable to implement.

In what follows, I explain each concept in turn. I first discuss public participation (section I), collective welfare (section II), collective and state responsibilities (section III), and primary public goods (section IV). In the final three sections, I discuss WELLBYs (section V), a collective duty of easy rescue (section VI) and a specific account of distributive justice, sufficiency-constrained prioritarianism (section VII) as the most relevant concepts for ethical analysis in collective-oriented PHE, as applies also to GGEE interventions. I present my CPH framework for ethical analysis and how each concept contributes to the framework in the next chapter.

I

Public Participation

Public (or smaller-group) participation centres around the idea that government policies should be analysed, developed and/or implemented in consultation with a certain group—usually, a sample representing the public quite broadly, or a specific group of people who might be affected by the policy. Including both the participation of the public and that of specific groups is essential to the identification of stakeholders in a new prospective intervention or policy, the identification of interests relating to its implementation, and possible harms and benefits to people. Public participation may also contribute to ‘community capacity development and problem-solving’ and ‘enhanced democratic

processes at local through national levels.¹⁷⁰ For these reasons, it is appropriately included as part of an ethical analysis of public health interventions, including prospective GGEE interventions.

In the public health context, the idea of community or public participation in health strategising may have begun with the WHO's Ottawa Charter in 1986, which called for enabling and empowering people and communities to make healthy choices. The charter notes that the health sector alone cannot guarantee public health. Instead, 'health promotion demands coordinated action by all concerned: [...] people in all walks of life are involved as individuals, families and communities.'¹⁷¹ Thus, for health promotion to be effective, it requires community-led initiatives and involvement in everything from priority-setting to planning strategies and implementing them¹⁷² The design and implementation of public health interventions, however, did not persistently fulfil the requirements of the 1986 charter for some time, perhaps due to an emphasis on individual health responsibilities, and de-regulatory politics in many countries at the time.¹⁷³ More recently, the Healthy Cities public health movement¹⁷⁴ has been more successful in using community recommendations on changing structural environments to better enable healthy living and adequate social interaction in urban and suburban areas. Advisory boards and 'deliberative democracy' groups are another means of representing communities in contexts such as hospitals, health

¹⁷⁰ Nina Wallerstein et al., "Reclaiming the Social in Community Movements: Perspectives From the USA and Brazil/South America: 25 Years After Ottawa," *Health Promotion International* 26, no. 2 (2011): 226-236, at 232.

¹⁷¹ "Ottawa Charter for Health Promotion: First International Conference on Health Promotion" (Ottawa: World Health Organization, 1986), accessed 10 May 2020. <https://www.who.int/teams/health-promotion/enhanced-wellbeing/first-global-conference#:~:text=The%20first%20International%20Conference%20on,health%20movement%20around%20the%20world>.

¹⁷² "Ottawa Charter for Health Promotion: First International Conference on Health Promotion."

¹⁷³ Wallerstein et al., "Reclaiming the Social in Community Movements: Perspectives From the USA and Brazil/South America: 25 Years After Ottawa."

¹⁷⁴ "Types of Healthy Settings: Healthy Cities," (Geneva: World Health Organization, 2020), accessed May 11, 2020. https://www.who.int/healthy_settings/types/cities/en/.

care planning authorities, and regional authorities.¹⁷⁵ The effectiveness of these groups depends on how accurately they represent the interests of all relevant stakeholders, and how much of a voice they are given in decision-making. Thus, to a large degree the process depends on the selection, education, and format offered to these groups.

Fran Baum notes several degrees of participation in public health policy development, ranging from consultation (a top-down approach with little power given to public groups), through participation as a means (to the end of achieving a public health goal), substantive participation (with greater involvement in determining goals of public health), to structural participation (empowering groups, with bottom-up policy-making, and seeing public participation as an end in itself, a social good).¹⁷⁶ She draws particular attention to structural participation in an Australian health context. For instance, the Victorian District Health Councils called on communities within the state of Victoria to participate in health planning and the identification of public health issues including mental health and Medicare funding priorities. The experience of working with the communities also produced guidance on better community representation through advisory boards.¹⁷⁷ In this case, the views of the communities contributed to a bottom-up, locally driven approach to identifying and addressing issues of importance, which can be expected to both encourage communities to think about their health needs and encourage compliance with community-informed health policies.

In the GGEE context, the interests of the public are relevant to an initial survey of possible GGEE interventions that are appropriate to consider as public health interventions, and to ongoing post-hoc evaluation of policies under which GGEE interventions are

¹⁷⁵ Baum, *Governing for Health: Advancing Health and Equity through Policy and Advocacy*.

¹⁷⁶ Baum, *The New Public Health*, 531.

¹⁷⁷ Baum, *The New Public Health*.

pursued. In working out interests and priorities at stake in ethical analysis, structural participation that offers more of a voice to representatives of various interest groups may be appropriate. Methods for achieving this kind of consultation may include deliberative democracy, community advisory boards or focus group samples of people from specific stakeholder groups. In this context, however, it may be very demanding for groups to achieve ‘consensus’ or universal agreement regarding controversial, value-laden GGEE interventions. What’s more, public views may tend to include religious, social, and political factors in an ethical analysis without identifying these as separate from the ethical question. For this reason, although greater public participation makes sense when identifying interests, it is questionable how heavily it should inform policymakers’ final decision-making on whether to implement a given GGEE intervention as a public health measure. Experts trained in policy, philosophy, law, economics, politics, and the relevant biomedical sciences may be more appropriate as final decision-makers.¹⁷⁸

II

Collective Welfare

Whilst ethical analyses often include concepts related to health and wellbeing, the concepts are often applied only to consider the individual, in the enhancement debate. In PHE, we see an expansion of the moral concept of welfare/wellbeing to the collective level. Wellbeing under this concept is measured on the level of communities, by considering community-level contributions to wellbeing. Employing the concept of collective welfare as I propose it here is part of an early expansion of the enhancement literature onto the

¹⁷⁸Eric Vogelstein, "The Nature and Value of Bioethics Expertise," *Bioethics* 25 (2014): 324-333.

collective level. Notable contributions to this literature are by Laura Cabrera¹⁷⁹ under the labels of a population health perspective and a social wellbeing perspective, and by Daphne Bavelier and colleagues¹⁸⁰ as collective welfarism.

Wellbeing or welfare analyses at the collective level are often underpinned by the ‘relational approach’, which recognises both how individual experiences of wellbeing are impacted by relationships with others, and how the wellbeing of a community of people depends on connections and contributions to the group. That is, group wellbeing is understood at least in part as a collective-level attribute of the group, and ‘as arising from the common life, the shared enterprise of living in community—in whatever sense—with others. Relationships thus form a central focus, [...] as intrinsic to the constitution and experience of wellbeing’.¹⁸¹ Using this conception, we can consider wellbeing as spanning across people, timeframes,¹⁸² and geography.¹⁸³ Additionally, these wellbeing conceptions often acknowledge human interdependence with the physical environment, making it a common concept in environmental ethics in relation to sustainability and environmental resilience.¹⁸⁴ These aspects of wellbeing insofar as they contribute to a welfare-based consequentialist analysis are poorly accounted for by a purely individualist approach. That is because an individual may not feel that they benefit from those things that contribute to collective welfare, such as equality of opportunity or other ‘domains’ discussed below, if they are, for

¹⁷⁹ Laura Cabrera, *Rethinking Human Enhancement: Social Enhancement and Emergent Technologies* (London: Palgrave Macmillan, 2015); Laura Cabrera, "Reframing Human Enhancement: A Population Health Perspective," *Frontiers in Sociology* 2, no. 4 (2017), <https://doi.org/10.3389/fsoc.2017.00004>.

¹⁸⁰ Daphne Bavelier et al., "Rethinking Human enhancement as Collective Welfarism," *Nature Human Behaviour* 3, no. 3 (2019): 204–206, <https://doi.org/10.1038/s41562-019-0545-2>.

¹⁸¹ Sarah White, "Relational Wellbeing: Re-centring the Politics of Happiness, Policy and the Self," *Policy & Politics* 45, no. 2 (2017), 128.

¹⁸² For instance, where there are multiple generations that might constitute a community at the same time and at different times as the community evolves.

¹⁸³ For instance, consider global communities. Sarah Atkinson et al., "Being Well Together: Individual Subjective and Community Wellbeing," *Journal of Happiness Studies* 21, no. 5 (2019): 1903–1921, <https://doi.org/10.1007/s10902-019-00146-2>.

¹⁸⁴ Tuula Helne and Tuuli Hirvilammi, "Wellbeing and Sustainability: A Relational Approach," *Sustainable Development* 23, no. 3 (2015), <https://doi.org/10.1002/sd.1581>.

instance, benefiting from unequal opportunity. Perhaps increasingly equal opportunity provides little or no benefit for that particular individual. Yet, for the community (aside from that individual, and even for that individual insofar as equal opportunity contributes to cooperation, solidarity, etc.) the promotion of equal opportunity is a good thing. For individualists, these kinds of welfare benefits are only valued insofar as they contribute ‘a resource for individual wellbeing, that is, as primarily instrumental to the independent, autonomously acting individual to realise their capacities or their potentialities’.¹⁸⁵

One pitfall of the literature on collective welfare is that it is difficult to substantiate vague concepts of common life, relationship importance, and environmental sustainability and how these relate to the wellbeing of a community as a higher-level entity. Scoping reviews identify multiple frameworks for assessing wellbeing, and many of these examine the collective level.¹⁸⁶ However, many of these frameworks are specific to particular interventions or needs in specific communities¹⁸⁷ that may be less appropriate for my analysis. Brita Roy and colleagues do propose more general so-called ‘domains’ of collective welfare, or specific divisions of what constitutes wellbeing as a whole, and it is this account from the PHE literature that I choose to build on as an ethical concept to employ in my framework.¹⁸⁸ The domains of collective welfare that Roy and colleagues suggest include vitality, opportunity, connectedness, contribution, and inspiration. An analysis of collective welfare can inform an ethical assessment of GGEE interventions and their societal consequences, building on the use of public participation to identify how an intervention may affect various domains of

¹⁸⁵ Atkinson et al., "Being Well Together: Individual Subjective and Community Wellbeing," 1914.

¹⁸⁶ "Systematic Scoping Review of Indicators of Community Wellbeing in the UK," What Works Wellbeing (2017), accessed August 4, 2020. <https://whatworkswellbeing.org/resources/community-wellbeing-indicators/>.

¹⁸⁷ "Well-Being of Future Generations (Wales) Act 2015," National Assembly for Wales (2015), accessed August 5, 2020. http://www.legislation.gov.uk/anaw/2015/2/pdfs/anaw_20150002_en.pdf.

¹⁸⁸ Brita Roy et al., "Collective Well-Being to Improve Population Health Outcomes: An Actionable Conceptual Model and Review of the Literature," *American Journal of Health Promotion* 32, no. 8 (2018), <https://doi.org/10.1177/0890117118791993>.

wellbeing for the participating group. This collective-level analysis would be supplemented by individual-level considerations of wellbeing for a hypothetical enhanced child and their parents. The domains of collective welfare proposed below are ones I have adapted to the public health context a little, building on Roy and other works¹⁸⁹ to produce the following:

- **Vitality/Environment:** Vitality comprises shared perceptions of health and positivity. Roy and colleagues' conception does not encompass environmental aspects of health or positivity, such as biodiversity and ecosystem resilience, however this is an essential aspect listed in other frameworks that similarly relates to perception of positive situation (for oneself, one's community's dynamics, or the environment).
- **Opportunity/Prosperity/Fairness:** Prosperity reflects opportunity insofar as it arises from opportunities to develop or maintain financial, social and other capital, hence my integration of the two here. Roy and colleagues' definition of opportunity also incorporates the idea of a threshold standard of living for members of a community, and I add emphasis to the importance of *equal* opportunity or fair access to resources as a determining factor.
- **Connectedness:** This aspect highlights the relationality of collective wellbeing, in terms of interpersonal relationships, reciprocity, and wider social acceptance and building of social capital within a community.
- **Contribution/Global responsibility:** Contribution can be perceived on the community scale in terms of engagement, public participation and the co-creation of common resources, or also incorporating ideas of national responsibilities for common-pool goods such as biodiversity, clean air or stable climate.
- **Inspiration:** Creativity, learning resources and opportunities within geographic communities are seen as contributing to collective life and positive perception.
- **Resilience:** This emphasises the social, economic and environmental strengths that support adaptability of a collective to change.

¹⁸⁹ "Well-Being of Future Generations (Wales) Act 2015"; Isaac Prilleltensky, "Wellness as Fairness," *American Journal of Community Psychology* 49, no. 1-2 (2012), <https://doi.org/10.1007/s10464-011-9448-8>; Helne and Hirvilammi, "Wellbeing and Sustainability: A Relational Approach"; "Growing Healthy Communities: The Health and Wellbeing Index," Grant Thornton UK (2015), accessed August 6, 2020. <http://www.grantthornton.co.uk/globalassets/1.-member-firms/united-kingdom/pdf/publication/2015/growing-healthy-communities-health-and-wellbeing-index.pdf>.

In the health context, wellbeing extending beyond considerations for the single target individual has been referred to in contexts such as genetic selection for altruistic children who can improve others' wellbeing,¹⁹⁰ or by reference to selected or engineered children destined to become 'saviour siblings', contributing to another's wellbeing—their sibling's. Saviour siblings are chosen for their genetic match to an existing sibling that gives them the ability to donate bone marrow to a sibling with conditions such as some cancers or Fanconi anaemia.¹⁹¹ These approaches take the first steps toward including collective-level welfare in ethical analysis, but they are often limited to considering the family as the collective unit for consideration, which does not go far enough for considering public health interventions.

In the broader public health context, wellbeing is often included in literature surrounding the social determinants of health.¹⁹² According to a social determinants model, health- and wellbeing- related benefits and risks may befall whole groups, as a result of the environment, social conditions and state policies that affect those groups' health indirectly. The concept can be used as a prospective guiding tool, in that connecting social determinants of health to social justice may give us reason to pursue or prioritise public health interventions that address social determinants of health, as these often befall large groups, and are thus the target of collective-oriented public health. For example, poor housing conditions are a structural determinant of ill-health that may befall groups of people in social housing or poor suburbs. Addressing housing crises may improve health and wellbeing in a way that also best addresses social justice concerns. In Roy and colleagues' model, evaluating such measures in

¹⁹⁰ Thomas Douglas and Katrien Devolder, "Procreative Altruism: Beyond Individualism in Reproductive Selection," *Journal of Medicine and Philosophy* 38, no. 4 (2013): 400-419; Jonathan Herring and Charles Foster, "Welfare Means Relationality, Virtue and Altruism," *Legal Studies* 32, no. 3 (2012): 480-498.

¹⁹¹ Michelle Taylor-Sands, *Saviour Siblings: A Relational Approach to the Welfare of the Child in Selective Reproduction*, (Abingdon, UK: Routledge, 2013); Anita Ho, "Relational Autonomy or Undue Pressure? Family's Role in Medical Decision-Making," *Scandinavian Journal of Caring Sciences* 22 (2008): 128-135.

¹⁹² Paul Farmer et al., "Structural Violence and Clinical Medicine," *PLoS medicine* 3, no. 10 (2006): 449.

terms of their wellbeing-associated benefits would come under the collective welfare domains of prosperity and connectedness. It may affect prosperity, insofar as housing affects the ability to develop and maintain, for instance, financial capital (considering rental costs in housing crises). It may affect connectedness, too, insofar as housing conditions affect opportunities for social interaction and building relationships with neighbours and friends. Some of these welfare benefits can be seen at the individual level. But for others, the collective welfare model provides a language, through its domains, to better express the wellbeing-associated harms and benefits of implementing a prospective public health measure (including GGEE interventions).

As Laura Cabrera suggests, an approach to enhancement that considers wellbeing at the collective level ‘could help us to balance individualistic preferences with social needs.’¹⁹³ These social needs might include distributive or social justice, or the production of public goods, or other society-level benefits. Cabrera argues that this approach favours enhancements that improve wellbeing for whole societies: “Thus, social enhancement brings to the fore a more inclusive, equitable, sustainable way in which human enhancement can be understood and pursued.”¹⁹⁴

III

Collective and State Responsibilities

In exploring the ethical concepts of collective and state responsibility, we must be sure to distinguish between two forms of collective responsibility: backward-looking and forward-looking. Backward-looking collective responsibility attributes moral responsibility to groups

¹⁹³ Cabrera, *Rethinking Human Enhancement: Social Enhancement and Emergent Technologies*, 86.

¹⁹⁴ Cabrera, *Rethinking Human Enhancement: Social Enhancement and Emergent Technologies*, 86.

of people for past harms as a sort of liability or basis for retribution.¹⁹⁵ Forward-looking collective responsibility is less concerned with liability, and more with future desirable outcomes, capacities to act, and duties. (That said, there are connections between the two types which mean that backward-looking responsibility can inform the attribution of forward-looking responsibility). In the context of ethically assessing GGEE or other public health interventions, forward-looking collective moral responsibility is the most pertinent ethical concept. We may judge whether a state has a responsibility to implement a certain public health measure under its broader responsibilities to protect and promote the wellbeing of its citizens and provide public goods (as discussed in Chapter 3). The state, then, appears to have a particular responsibility,¹⁹⁶ linked to its purpose in providing goods for its citizens, and its increased ability to co-ordinate collective action via policy, compared to un-coordinated groups of individuals.¹⁹⁷

And yet, individuals too may bear forward-looking moral responsibility to undertake certain actions, by virtue of their membership of a group with that responsibility. Indeed, in the public health context, Alberto Giubilini and Julian Savulescu claim that in some cases, there may be a collective responsibility to avoid taking actions that may produce or exacerbate collective action problems, such as contributing to the overuse of a shared limited resource. In these cases, individuals may be obliged by fairness considerations to ‘take on themselves their fair share of burdens entailed by the fulfilment of a collective

¹⁹⁵ Marion Smiley, "Collective Responsibility," in *The Stanford Encyclopaedia of Philosophy*, ed. Edward N Zalta (Summer 2017), accessed May 12, 2021. <https://plato.stanford.edu/archives/sum2017/entries/collective-responsibility/>.

¹⁹⁶ David Schmidtz and Robert Goodin, *Social Welfare and Individual Responsibility, For and Against* (Cambridge: Cambridge University Press, 1998).

¹⁹⁷ Although, note that Virginia Held has proposed that random groups of individuals who can prevent harm but fail to do so are each individually morally responsible for this failure, justifying individual punishment. For more, see Virginia Held, "Can a Random Collection of Individuals Be Morally Responsible?," *The Journal of Philosophy* 67, no. 14 (1970): 471-481, at 480. However, she notes that where the group is organised as such, with official representation and a hand in decision-making, then the organised group's *representatives* are morally responsible, and individual punishment according to an equal distribution to individuals of collective-level responsibility is unwarranted.

responsibility'.¹⁹⁸ The individual burdens that are created by collective responsibility can be more or less demanding of individuals, and the authors claim that in terms of the individual implications of collective responsibility, obligations are uncontroversial so long as the cost to the individual is small enough that it would constitute a case of 'easy rescue'.¹⁹⁹ In more demanding cases, they note we must consider the value of the good being maintained and the cost to an individual fulfilling the obligation. Where fulfilment is overdemanding, individuals may be exempted from the enforcement of burdensome policies. For example, consider a collective responsibility to protect the antimicrobial commons. There may exist a forward-looking collective moral responsibility to not take antibiotics unnecessarily. Insofar as the state has a responsibility to coordinate action on these efforts, it may enact a policy to heavily tax antibiotics. To ensure that this policy isn't overdemanding, those individuals who are immunosuppressed and actually need the antibiotics may be exempted from the tax, reflecting their exemption from the collective responsibility, as well, due to the personal overdemandingness of not taking antibiotics for them. For all others, the collective responsibility holds, as does the state's responsibility to collect the tax, to ensure the public does not suffer in the future from the effects of antimicrobial resistance.

In the GGEE context, collective moral responsibility may be relevant to considering the interests of the public as a stakeholder, and state responsibilities may act as proxy-interests in themselves, given a state's need to fulfil its purposes for continued legitimacy (see Chapter 3 for further details).

Finally, the moral concept of collective moral responsibility is importantly associated with seeing GGEE as a society-level intervention, as appropriate for a collective-oriented public

¹⁹⁸ Giubilini and Savulescu, "Demandingness and Public Health Ethics," 71-72.

¹⁹⁹ For more, see: Julian Savulescu, "Concise Argument—Wellbeing, Collective Responsibility and Ethical Capitalism," *Journal of Medical Ethics* 42, no. 6 (2016): 331.

health measure. Mark Coeckelbergh claims that '[i]f the individual level is seen as ontologically primary, responsibility for technology will be seen as an individual matter', and vice versa for seeing the collective level as primary and responsibility for the ethically appropriate use of technology as a collective matter.²⁰⁰ Individual decision-makers cannot and should not be held responsible for ensuring the proper implementation of a GGEE intervention, but they can as a state-coordinated collective group. As Coeckelbergh goes on to note, although 'as *individuals* we have limited influence on the whole',²⁰¹ as a collective we have the power and the responsibility to ensure that these technologies are developed and used appropriately.

IV

Primary Public Goods

In the previous chapters, I defined primary goods, public goods, and primary public goods (PPGs). I have the term already, but so far, I have not introduced it as a separate moral concept. This sub-section explains the concept fully.

It seems that both GGEE interventions and public health interventions can contribute to PPG promotion and maintenance. This sub-section is short because of my previous discussion, but its aim is to emphasise how PPGs are an important ethical concept to include in the CPH framework, particularly under the stakeholder interest of states' responsibilities to provide PPGs.²⁰² Peter Drahos suggests that '[i]n a world where self-interest is the dominant motive of citizens, game theory says that the dominant strategy of individual

²⁰⁰ Mark Coeckelbergh, "Technology and the Good Society: A Polemical Essay on Social Ontology, Political Principles, and Responsibility for Technology," *Technology in Society* 52 (2018), 5.

²⁰¹ Mark Coeckelbergh, "Technology and the Good Society: A Polemical Essay on Social Ontology, Political Principles, and Responsibility for Technology," 8.

²⁰² For more on this responsibility, see: Paul Samuelson, "Indeterminacy of Governmental Role in Public-Good Theory," *Public Choice* 3 (1967): 47; Samuelson, "The Pure Theory of Public Expenditure"; Drahos, "The Regulation of Public Goods"; Anomaly, "Public Goods and Government Action."

citizens will be not to contribute to public goods.²⁰³ In an account that leaves more room for government intervention surrounding PPGs, free-rider problems can be better addressed through regulatory measures and the use of social norms to discourage non-contribution.²⁰⁴ In some cases, complying with public health measures produces a PPG (either directly or indirectly), such as a healthy average body-mass index, and thereby, and lowered stresses on the healthcare system and higher productivity. This might result from healthy eating educational interventions in a population. But the PPGs cannot be secured if there are too many free-riders, who rely on others' healthy eating to maintain good average body-mass index in the population, and thereby, an unstressed healthcare system and high nation-wide productivity.²⁰⁵

The same may be true of certain GGEE interventions, wherein free-rider problems must be avoided in order to secure the PPG-type benefit from a given intervention. The ethical concept that can account for this benefit being contingent on a certain level of uptake in a population is the notion of a PPG itself.²⁰⁶ Where individual-level benefit is low, PPGs cannot be secured and maintained via private markets, because there is little to incentivise uptake of the measure (GGEE intervention or otherwise). Dan Beauchamp appeals to the concept of 'collective goods' in a similar manner, to address challenges with securing these sorts of benefits via private markets: 'market competition undervalues collective goods like a clean environment or worker safety. Using social organization to secure collective goods like public health [...] is the proper rationale for [...] regulations'.²⁰⁷

²⁰³ Drahos, "The Regulation of Public Goods," 336.

²⁰⁴ Elinor Ostrom, *Governing the Commons: The Evolution of Institutions for Collective Action* (Cambridge: Cambridge University Press, 2015).

²⁰⁵ Of course, these individuals will be at greater risk of developing obesity-related illnesses, and so cannot free-ride on all the benefits of healthy eating campaigns, but the point remains for the healthcare system and nation-wide productivity.

²⁰⁶ See Chapter 7 for a more detailed look at the case study of genetic immunisation and how the benefit of herd immunity depends on a threshold level of uptake in the population.

²⁰⁷ Dan Beauchamp, "Community: The Neglected Tradition of Public Health," in *Public Health Ethics: Theory Policy and Practice*, ed. Ronald Bayer et al. (New York: Oxford University Press, 2007), 54.

To illustrate, consider maintaining herd immunity in a population via vaccination—or, in the GGEE context, perhaps genetic immunisation (discussed further in Chapter 7). Vaccination may have little or no benefit for an individual, if they are certain they will not be exposed to the disease in question, so simply offering vaccination is unlikely to result in high enough uptake for herd immunity. A policy of mandatory vaccination may be appropriate, *if* exemptions are provided for individuals who are immuno-compromised or are allergic to a given vaccine, for whom contribution to this PPG is overdemanding, as discussed in the responsibility context, above. Similar policies may be needed in cases of mandatory quarantine measures for contribution to the PPG of reduced disease spread, where, again, the good cannot be secured and maintained without public goods regulation from the state. Whilst the contribution to vaccination did not seem overdemanding for most people, however, the quarantine case may require compensation for those who have to quarantine. The good's maintenance necessitates absolute individual compliance, because an individual's failure to quarantine can have significant effects on the spread of an infectious disease, so the mandatory policy is needed, but the burdens it places on individuals are significant, too. The moral concept of PPGs allows consideration, too, of how contributions to the good may require mitigating losses for the individual.

By considering PPGs contributions, we can form a thorough ethical analysis of the appropriateness of non-/coercive policies for implementing a public health measure like a GGEE intervention of genetic immunisation.

V

WELLBYS

When considering the collective- and individual- level effects of implementing a GGEE intervention, a metric is required to effectively weigh up costs and benefits. Expressing threats to stakeholder interests as harms or costs, and the promotion of interests as benefits, cost/benefit ratios can be produced. Metrics for this type of analysis have been introduced in PHE and are useful concepts for my assessment of GGEE interventions, as well. I have chosen a metric for my account that is based on a recent development of some of the most common metrics used for cost/benefit analyses and questions of resource allocation in healthcare settings. The established metrics in this area are Disability-adjusted life years (DALYs) and Quality-adjusted life years (QALYs).²⁰⁸ One QALY equates to one year of life gained in perfect health, without disability or disease. One DALY equates to one year of life saved from being affected by disability or disease. Both measures are often used in cost effectiveness analyses of public health interventions. Often, treatment resources are allocated either in such a way that total QALYs gained are maximised across individuals (or DALYs lost are minimised), or in such a way that priority is given to maximising QALYs (or minimising DALYs) for those who are worst-off.²⁰⁹ Both QALYs and DALYs are useful metrics, and I might have chosen either of them for my purposes here. Yet, both QALYs and DALYs have been criticised more recently, in part for neglecting more subjective understandings of wellbeing by those who may not have ‘perfect health’ but still count themselves as having a high quality of life, such as members of certain Disability communities.²¹⁰

²⁰⁸ For more on these metrics, see Richard Ashcroft, "Quality of Life as the Basis of Health Care Resource Allocation: A Philosopher's Perspective on QALYs," *The Virtual Mentor: VM* 7, no. 2 (2005), <https://doi.org/10.1001/virtualmentor.2005.7.2.pfor4-0502>. For a more detailed comparison of the two, see: Franco Sassi, "Calculating QALYs, Comparing QALY and DALY Calculations," *Health Policy and Planning* 21, no. 5 (2006): 402-408.

²⁰⁹ Govind Persad, "Justice and Public Health," *The Oxford Handbook of Public Health Ethics* ed. Anna Mastroianni et al. (Oxford: Oxford University Press, 2019), 33-46.

²¹⁰ Trude Arnesen and Erik Nord, "The Value of DALY Life: Problems with Ethics and Validity of Disability Adjusted Life Years," *BMJ* 319 (1999), <https://doi.org/10.1136/bmj.319.7222.1423>.

Engaging fully with the debate on wellbeing or resource allocation metrics is beyond my scope. However, I do have one proposal to make, which is the use of one measure that adapts the QALY and DALY models to account for subjective measures of wellbeing. This is a new measure called the WELLBY: the number of years at a particular level of subjectively measured wellbeing. The Centre for Economic Performance developed these during the first COVID-19 lockdown in the UK, in 2020. The authors of the paper advocate WELLBYs as enabling ‘us to evaluate all changes in human experience in terms of a single metric: their impact on individuals’ satisfaction with their lives.’²¹¹ This is achieved by asking people in a population how they rate their life satisfaction on a scale from 0-10. This is then averaged out across the population. For the UK, the average is 7.5. For the US, it is 7. For one year’s loss of life in the UK, then, 7.5 WELLBYs would be lost, and 7 would be lost in the US. If an intervention lengthens life by a year, that’s the same number of WELLBYs gained. As measures of life satisfaction are commonly incorporated into nation-wide studies and censuses already, the measure is accessible, and representative of the population whilst being assessable at the individual level, as well.

Theoretically, one could empirically measure the change in life satisfaction that people experience by having access to a new technology, or by moving house, or by an increase in income, and calculate how many WELLBYs are gained (either across the population or per individual) by the implementation of that measure. As such, WELLBYs are an effective tool for cost/benefit analyses for implementing new measures, insofar as the population can be surveyed or sample-surveyed, whether these be lockdowns (as in the original context where WELLBYs were introduced) or a new GGEE intervention. Furthermore, the WELLBYs

²¹¹ Richard Layard et al., *When to Release the Lockdown: A Wellbeing Framework for Analysing Costs and Benefits* (London: Centre for Economic Performance, 2020), accessed November 10, 2021. <https://cep.lse.ac.uk/pubs/download/occasional/op049.pdf>. See at 3.

metric is useful in considering the just distribution of costs and benefits of a new intervention, as discussed more below.

Then again, the measure has some drawbacks, as well. For instance, people often have adaptive preferences, wherein significantly harmful occurrences (say, getting hit by a car and losing both arms and both legs) are adapted to, such that measurements of life satisfaction before the event and a few years after the event are roughly the same. One may not want to neglect the harm that these events cause.

Each measure has its drawbacks, and the drawback of vulnerability to adaptive preferences seems marginally less serious, to me, than that of neglecting subjective accounts of wellbeing, so I use the WELLBYs measure in my CPH framework. Another could be substituted in quite easily if a different account were preferred by public health policymakers.

VI

Duty of Collective Easy Rescue

Having a metric for measuring costs and benefits is important for ethical analysis of any new public health intervention, including GGEE interventions. Yet, more is required. A moral concept or tool that provides a weighing system or rule is needed to determine what harm/benefit or cost/benefit²¹² ratios are acceptable. That is, when are the costs imposed on some people justified by the benefits to all (or to other people)? Without a weighing system or rule, WELLBYs alone are of little use.

²¹² I use harm and cost interchangeably throughout this thesis. I consider costs like financial costs to still harm the individual in terms of a lack of money that could otherwise go toward furthering their other interests; I consider harms like loss of autonomy to be able to be accounted for as costs of going through with an intervention.

I have mentioned already in this chapter one contender for a weighing system: the collective duty of easy rescue, proposed by Julian Savulescu²¹³ and developed in collaboration with others.²¹⁴ The principle is based on Peter Singer's earlier conception of an individual duty of easy rescue. As put by Savulescu,

'When the cost to X of performing some action, V, is small, and the benefit to Y is large, then X ought to V. [...] This principle can take a collective form. Call this Collective Easy Rescue or Collective Responsibility: If a group of people ($X_1 \dots X_n$) could all perform some act, V, which would collectively provide a large benefit to Y, then this group ($X_1 \dots X_n$) ought to V, provided that the cost to each of them of V-ing is small.'²¹⁵

In the context of vaccination, the concept of collective easy rescue has been applied by Alberto Giubilini and colleagues to claim that individuals may have a moral obligation to contribute to herd immunity via vaccination.²¹⁶ It is argued that, for most individuals, harms such as the invasion of the body and the low risk of vaccination side-effects are outweighed by the benefits of immunity to an infectious disease for the whole community, as well as fairness considerations. This justifies the moral obligations for individuals (who are not medically contra-indicated) to be vaccinated.

What the vaccination case of easy rescue shows is that individual contributions to collective-level interests (and thereby, the resulting collective-level benefits) can easily outweigh insignificant harms to individuals. This is a clear case of easy rescue. However, it is not the only situation in which it may be morally acceptable to allow harms to individuals or

²¹³ Savulescu, "Concise Argument—Wellbeing, Collective Responsibility and Ethical Capitalism."

²¹⁴ Giubilini et al., "Quarantine, Isolation and the Duty of Easy Rescue in Public Health"; Giubilini and Savulescu, "Demandingness and Public Health Ethics."

²¹⁵ Savulescu, "Concise Argument—Wellbeing, Collective Responsibility and Ethical Capitalism," 331.

²¹⁶ Giubilini, Douglas, and Savulescu, "The Moral Obligation to be Vaccinated: Utilitarianism, Contractualism, and Collective Easy Rescue."

groups. Other situations may arise in which we think it morally acceptable to allow significant harm to individuals—even, under some circumstances, death. I am not concerned with public health settings in which extreme harms like death are allowed, as these usually concern the allocation of life-saving treatments/resources (such as ventilators during a pandemic). This kind of situation is not so relevant to GGEE interventions, as implementing GGEE interventions is unlikely to impose the harm of death on anyone.²¹⁷ Another situation is where an action causes greater harms alongside very large benefits. A comparative form of easy rescue is more controversial,²¹⁸ as it may, if unlimited, justify very great harms in exchange for extremely large benefits, but it may be defensible in some cases, if limits are applied. These would be cases where harms to individuals or smaller groups are not insignificant, but still reasonable, and the benefits to the society are very large. Let's try applying this comparative form of the duty in the vaccination case. It would imply that even with a morally significant harm to the individual from vaccination, if the risks of harm to a population from an extremely serious prevalent disease are adequately large and avoidable via vaccination, then the individual still has a moral obligation to take on those harms of vaccination.

Comparing harms and benefits relative to each other can help consider when it is appropriate to impose quite significant, yet still reasonably bearable harms on individuals. Comparative weighing may be appropriate in some clinical research trials, including challenge studies for public health interventions. Research participants in challenge studies are faced with plausible, significant (yet, let us assume, bearable) harms from exposure to a disease, for the purpose of initial research into vaccine developments and cures. Although they pose

²¹⁷ For those GGEE interventions that prevent a child from being born with an illness that otherwise would have killed them, these considerations may be relevant, and thus additional considerations may be involved in policymakers' decisions regarding this particular subset of enhancements. This level of detail is beyond my scope, but might be considered in a full analysis, where a lifesaving GGEE intervention was considered that would be made available to some people, but not others, thereby seeming to impose death (by omission of allocating that person a life-saving resource) on some people.

²¹⁸ Giubilini et al., "Quarantine, Isolation and the Duty of Easy Rescue in Public Health."

potential significant harms to individuals, challenge trials may produce extremely significant benefits to populations for whom the serious disease can then be treated or prevented.²¹⁹ One might argue that individuals have a moral obligation to volunteer for such trials. To mitigate these significant potential harms, however, it has been suggested that participants might be compensated for harms to them that do eventuate from the research trial. Whilst this does not reduce the harm side of the harm/benefit ratio for an individual, it does reduce net harm to them (the overall result of the harm/benefit ratio).²²⁰ Whilst it cannot make up for the imposition of not reasonably bearable harms on individuals or groups, compensation is a regulatory option that might be used to ensure the overall harms to individuals from fulfilling moral obligations to undertake certain public health interventions or volunteer for research are not so great.

I expand and formalise a comparative variant of the collective duty of easy rescue further in Chapter 5 and apply the concept to GGEE case studies in chapters 7 and 8.

VII

Distributive Justice

This final section examines a collectivist moral concept of distributive justice, as applied in PHE. Justice concerns the acceptable differences between people in a society. Questions of distributive justice often concern individual entitlements to goods, or which individuals have access to what in a society. We might also consider how distributive justice applies to groups of people entitled to certain goods.

²¹⁹ Franklin Miller and Christine Grady, "The Ethical Challenge of Infection-Inducing Challenge Experiments," *Clinical Infectious Diseases* 33, no. 7 (2001), <https://doi.org/10.1086/322664>. Miller acknowledges this, whilst pointing out remaining ethical challenges with the trials.

²²⁰ Olivia Grimwade et al., "Payment in Challenge Studies: eEthics, Attitudes and a New Payment for Risk Model," *Journal of Medical Ethics* 46, no. 12 (2020), 815.

Any conception of distributive justice contains a metric or measurement of justice, and an account or rule for distribution. I choose to use a WELLBYs metric, with a mixed sufficientarian-prioritarian account. The scope of the conception I use is inter-generational and bounded to apply only within the jurisdiction of the policymakers considering implementing a GGEE intervention.²²¹ Each of these choices are defended below.

Metrics of justice are the units of measurement for determining whether an intervention promotes a just society. A ‘resourcist’ metric considers the distribution of goods and resources—for example, how water fluoridation promotes the good of health for a population.²²² This approach may, however, neglect differences between individuals in abilities to benefit from a particular resource. If the resource is not itself a primary good, there is a further step for individuals to convert it to something valuable to them in their pursuit of flourishing. The metric of capabilities aims to take this into account, by measuring not only access to resources, but how they can support the choices people value. For example, it might ask whether subsidised access to ARTs sufficiently promotes an individual’s capability to have a child, where this is valued by the individual. However, this approach has been criticised for being an individualistic account, as acknowledged by its proponents,²²³ which may make it inadequate when it comes to recognising group-level value. Instead of either of these metrics, I use WELLBYs, as discussed earlier, to take into account subjective measures of value that can be applied individually or across a population to consider the distribution of outcomes from a GGEE intervention.

²²¹ For a critique of this scope as bound to a single jurisdiction, see Chapter 6. This objection leads me to later adapt the conception of distributive justice I use, to account for injustices across jurisdictions, as demonstrated in Chapter 7.

²²² Persad, "Justice and Public Health."

²²³ Ingrid Robeyns, "Capabilitarianism," *Journal of Human Development and Capabilities* 17, no. 3 (2016): 408.

Along with a metric, an account is needed of what just distribution entails. Some consequentialist or utilitarian accounts aim simply to maximise the total sum of the metric. However, this can lead to problems like pro-natalism, wherein simply increasing the population is the best way to maximise some metrics, and thus satisfy utilitarian requirements of justice. This risks advocating overpopulation, and may also risk falling prone to Derek Parfit's repugnant conclusion,²²⁴ wherein a world with a vast number of individuals with low levels of wellbeing but lives that are just worth living is preferable to a world with fewer individuals with high levels of wellbeing.

Egalitarian accounts²²⁵ aim, instead, to ensure equal distribution of the metric (or opportunity to access it), up to the point where there is no gap between the worst-off and the best-off. Yet egalitarian accounts deem actions to improve the metric for the worst-off wrong, if they benefit everyone equally, because they maintain the same gap between the worst-off and the best-off. Rather, it would be better even to reduce the metric for the better off, to promote equality, according to strict egalitarian accounts.

This 'levelling down' is denounced and avoided by a prioritarian account, according to which increasing the metric for the better-off is acceptable as long as *priority* goes to increasing the metric for the worst-off.²²⁶ Where increasing benefit to the better off is necessary for increasing benefit to the worst off, it is acceptable. However, determining how much priority should be given to individuals, and whether differences between the better-

²²⁴ Derek Parfit, *Reasons and Persons* (Oxford: Clarendon Press, 1984). See Chapter 16.

²²⁵ Separate from this is an instrumentalist approach to egalitarianism, wherein equality is valued for the justice-related good it brings rather than for its own sake. Strict egalitarians claim that equality is intrinsically valuable. For more, see: David Miller, "Justice," in *The Stanford Encyclopaedia of Philosophy*, ed. Edward N Zalta (Fall 2017), accessed October 20, 2020. <https://plato.stanford.edu/cgi-bin/encyclopedia/archinfo.cgi?entry=justice>.

²²⁶ Some accounts include John Rawls' work as prioritarian rather than egalitarian, because he considers limited inequalities to be acceptable *if and only if* they exist under conditions of fair equality of opportunity, and they provide the most benefit to the most disadvantaged members of a society, according to the Difference Principle. Rawls, *A Theory of Justice*.

off and the worse-off become irrelevant at a certain point is difficult under prioritarianism, which has been criticised as too vague on these points.²²⁷

Finally, a sufficientarian account specifies a minimum threshold of the chosen metric, below which no one should be allowed to fall, and above which inequalities in the metric are morally irrelevant. Alternatively or additionally, sufficientarian requirements can be interpreted as making a ‘negative’ claim, that inequalities above the threshold are irrelevant to distributive justice (contrasting with the claims of egalitarianism and prioritarianism).

Critics of pure sufficientarianism like Paula Casal claim it is a flawed theory because, first, it may justify pushing people who are *already* below a threshold of wellbeing further below it if it is difficult to bring them above it. Sufficientarianism allows this, if harming those far below the threshold occurs in exchange for benefits that would move people already close to the threshold to above it. The lack of justice considerations above the threshold level may render sufficientarianism alone too minimalist. A second objection to forms like Roger Crisp’s sufficientarianism²²⁸ is that it may justify bringing a large group of better-off people right down to the threshold for a non-trivial benefit to someone below the threshold.

Considering the advantages and disadvantages of these accounts, sufficientarianism and prioritarianism come out the strongest, but each alone remains problematic. I turn to consider, then, hybrid forms that mix sufficientarianism and prioritarianism.

Paula Casal suggests a sufficientarian-prioritarian mixed account (SCP). SCP is ‘a hybrid which prohibits leaving some below a critical threshold to serve the interests—including the trivial interests—of those above it.’²²⁹ The sufficientarian part of this account holds that individuals ought to be distributed benefits in a way that maximises the number of people

²²⁷ Liam Shields, "Sufficientarianism," *Philosophy Compass* 15, no. 11 (2020), <https://doi.org/10.1111/phc3.12704>.

²²⁸ Roger Crisp, "Equality, Priority, and Compassion," *Ethics* 113, no. 4 (2003): 745-763.

²²⁹ Paula Casal, "Why Sufficiency Is Not Enough," *Ethics* 117, no. 2 (2007): 320.

whose level of wellbeing is above a particular critical threshold level. It can be extended, as I do here, to also imply that harms should be distributed to avoid pushing individuals below the threshold level of wellbeing.

The prioritarian part of the account holds that *some* priority is due to the worst off, such that they should be benefited by preference, yet that may be outweighed where distributing benefits this way would prevent very large benefits from befalling many people who are better off. Many, but not all prioritarian accounts have this caveat relating to the utility of a distribution.²³⁰ Prioritarianism can also be extended into the distribution of harms, the implied claim being that harms should not be distributed to befall the worst off. When considering the asymmetry of suffering and pleasure, we may articulate the distribution of harms as a requirement. That is, they must not befall the worst off or those below a threshold level of wellbeing but are irrelevant above that threshold. We might then articulate the distribution of benefits as a preference. That is, they should, preferably, primarily befall the worst off, with distribution above the threshold irrelevant.

Put together, we might express SCP as consisting of a requirement of justice, and a preference for justice, as follows:

SCP Requirement: Individuals/groups must be distributed harms in a way that minimises harms to people whose level of wellbeing is below a particular critical threshold level, and particularly the worst off among them.

SCP Preference: Individuals/groups ought to be distributed benefits in a way that maximises the number of people whose level of wellbeing is above a particular critical threshold level, and benefits should particularly befall the worst off among them.

²³⁰ Derek Parfit, *Equality or Priority?* (Lawrence, KA: University of Kansas, 1995).

I defend this conception of SCP further in Chapter 5, where it is applied in the GGEE context. For now, note only that SCP seems to overcome some of the drawbacks of other proposed accounts of distributive justice.

Firstly, Alberto Giubilini and Francesca Minerva consider various applications of egalitarian and sufficientarian accounts of distributive justice in the enhancement sphere, and present a new alternative account for those committed to equality. Their proposal is a strictly prioritarian account, where ‘people from disadvantaged socio-economic backgrounds should be given access to biological enhancements while people from privileged socio-economic background should be prohibited from using them.’²³¹ One might question this account if one is not already strictly committed to equality, and ask, what about advantages to better-off people that provide collective benefit in WELLBYs terms that also befalls the worst-off? SCP overcomes this limitation by considering advantages to better-off people as acceptable, as they fall above a threshold of wellbeing, and merely maintains a preference concerning their distribution below the threshold level. Rather, it is more concerned with requirements for the distribution of harms.

To allow for larger benefit to be produced whilst also still prioritising the worst-off, an alternative account proposed by Dov Fox²³² also aims to overcome the counterintuitive conclusions of Giubilini and Minerva’s account. Fox rejects purely egalitarian and prioritarian accounts, but does so in a less efficient way than Casal does via SCP. Fox, rather, proposes a mixed prioritarian-sufficientarian account that consists of two principles:

²³¹ Giubilini and Minerva, "Enhancing Equality," 335.

²³² Fox, "Luck, Genes, and Equality."

(1) Natural primary goods²³³ are to be distributed so as to (contribute the hereditary bases of crucial human functionings that) bring individual offspring up above a decent genetic minimum of internal basic capability deprivation;

(2) Natural primary goods are to be distributed (so as to contribute the hereditary bases of crucial human functionings that is) to the greatest benefit of the least advantaged.²³⁴

Fox's account implies that as many future children as possible should be ensured a decent minimum level of, in his case, natural primary goods. Above this threshold, as a second consideration, access should be allocated according to where the greatest benefit will be produced for the disadvantaged. The account has some of the advantages of a hybrid sufficientarian-prioritarian account, but it is concerned with too narrow an area of distribution—merely natural primary goods like genetic inheritance, and not with the other non-natural goods that enhancement may indirectly produce. Given the flexibility in SCP by comparison in considering harms and benefits more generally, it seems more compatible with the metric of WELLBYs I have chosen. I outline further details of the account in Chapter 5, where it features in Step 3 of the ethical analysis of GGEE interventions.

Following from a metric (WELLBYs) and an account (a variation on Casal's SCP), it remains only to determine the appropriate scope of distributive justice—that is, to what population it should apply. We may consider scope as geographic, demographic and temporal. According to some approaches, the appropriate scope of distributive justice is determined by who shares a certain morally relevant relation. For example, this might include members of the same political community,²³⁵ the global population, or those subject to the same state-governed coercive laws.²³⁶ As public health measures are implemented by national

²³³ That is, Rawlsian primary goods that contribute to flourishing, and are naturally endowed, like genetic inheritance that predisposes one to, say, increased sociability, productivity, or health.

²³⁴ Fox, "Luck, Genes, and Equality," 719-720.

²³⁵ Miller, "Justice."

²³⁶ Thomas Nagel, "The Problem of Global Justice," *Philosophy & Public Affairs* 33, no. 2 (2005): 113-147.

public health systems in most cases, it makes sense that considerations of distributive justice are applied on the level of a national jurisdiction.²³⁷ Scope may, however, be less *temporally* limited, if we assume a society's continuity with its members born into similar relations with others to the current society. Thus, accounts of distributive justice may apply intergenerationally, such that they consider the distribution of outcomes of implementing a public health measure that befall future people in a given nation.²³⁸

Conclusion

This chapter has explored how moral principles and concepts applied in collective-oriented PHE can help articulate morally relevant considerations for ethical analysis when it comes to considering public health measures, including GGEE interventions.

The moral concepts and principles, along with their definitions, are outlined in Summary Box 4.

²³⁷ I consider an objection to this approach on that basis that it is not cosmopolitan enough and neglects the requirements of international justice, in Chapter 6. I concede the point in that chapter but find no better alternative to leaving the framework as it is.

²³⁸ Miller, "Justice."

Summary Box

Collectivist Moral Concepts and Principles for Ethical Analysis of Public Health Measures

CONCEPTS AND THEIR DEFINITIONS:

- Public participation: involvement of non-state groups in policymaking regarding which they are stakeholders
- Collective welfare: wellbeing of a community as an entity, according to achievements in identifiable domains
- Collective and state responsibilities: obligations to take certain coordinated actions or secure certain goods
- Primary Public Goods (PPGs): goods that states are obliged to secure for the public that are non-excludable, non-rivalrous, and contribute to flourishing
- WELLBYs: a metric for articulating magnitude and distribution of benefit and harm arising from implementing an intervention, based on changes caused to life satisfaction ratings
- Duty of Collective Easy Rescue (CER): a weighing system for comparing harms and benefits for stakeholders in an intervention
- Distributive Justice: specifically, a sufficiency-constrained prioritarian account (SCP) for judging prospective distribution of harms and benefits from implementing an intervention

OUTCOME: GGEE can be analysed using moral principles and concepts from collective-oriented PHE

Summary Box 4: Moral concepts and principles from collective-oriented public health ethics, with brief definitions.

I have considered collective-oriented concepts here, and, it may seem, somewhat neglected individual-oriented counterparts to the concepts. Indeed, there are important individual-oriented moral principles and concepts that I employ in the CPH framework in Chapter 5, including individual-level wellbeing,²³⁹ reproductive autonomy,²⁴⁰ and a (child's)

²³⁹ Atkinson et al., "Being Well Together: Individual Subjective and Community Wellbeing."; Bjørn Hofmann, "Human Enhancement: Enhancing Health or Harnessing Happiness?," *Journal of Bioethical Inquiry* 16, no. 1 (2019): 87-98; Savulescu and Kahane, "The Moral Obligation to Create Children with the Best Chance of the Best Life." For a broader examination than these, see Roger Crisp, "Well-Being," in *The Stanford Encyclopedia of Philosophy*, ed. Edward N Zalta (Fall 2017), accessed May 14, 2021. <https://plato.stanford.edu/entries/well-being/>.

²⁴⁰ Dan Brock, "Shaping Future Children: Parental Rights and Societal Interests," *Journal of Political Philosophy* 13, no. 4 (2005): 377-398; Rhonda Copelon, "Losing the Negative Right of Privacy: Building Sexual and Reproductive Freedom Nation Institute Conference," *New York University Review of Law & Social Change* 18 (1990): 15-50; John Harris, "Rights and Reproductive Choice," in *The Future of Human Reproduction*, ed. John Harris and Soren Holm (Oxford: Oxford University Press, 1998); Catherine Mills, "Reproductive Autonomy as Self-Making: Procreative Liberty and the Practice of Ethical Subjectivity," *The Journal of Medicine and Philosophy: A Forum for Bioethics and Philosophy of Medicine* 38, no. 6 (2013): 639-656; John Robertson, *Children of Choice: Freedom and the New Reproductive Technologies* (Princeton: Princeton University Press, 1994); Tess Johnson, "Free to Decide: The Positive Moral Right to Reproductive Choice," *Kennedy Institute of Ethics Journal* 31, no. 3 (2021), <https://doi.org/10.1353/ken.2021.0013>.

right to an open future.²⁴¹ However, as with much of the individualist literature, these concepts are already well-developed and explored. I see no reason to rehash them here, as the references above provide enough of an introduction before they are applied in the next chapter.

In Chapter 5, I present the CPH framework for my thorough ethical analysis of GGEE interventions, which uses the concepts presented here.

²⁴¹ Elizabeth Cooke, "Germ-line Engineering, Freedom, and Future Generations," *Bioethics* 17, no. 1 (2003): 32-58; Dena S. Davis, "Genetic Dilemmas and the Child's Right to an Open Future," *The Hastings Center Report* 27, no. 2 (1997): 7-15; Joel Feinberg, "The Child's Right to an Open Future," in *Freedom & Fulfillment: Philosophical Essays* (Princeton: Princeton University Press, 1992). Davide Battisti, "Genetic Enhancement and the Child's Right to an Open Future," *Phenomenology and Mind* 19 (2020): 212-223.

Chapter 5:

A Framework for the Ethical Analysis of GGEE Interventions

Introduction

The ethical permissibility and desirability of GGEE remains an open question in ethical analysis,²⁴² despite an extensive array of discussions surrounding human enhancement to date. In this chapter, I propose my CPH framework that may contribute to answering this question, by including *both* individual- and collective- level moral considerations, and aiming to assess both the potential consequences of GGEE interventions and the distribution of harms and benefits, via a public health framing of enhancements. Consistent with previous chapters, I use an inclusive definition of enhancement, as the modification of individuals to produce some benefit to either the individual or the collective, regardless of whether the individual being modified has an existing deficit in that trait. This definition does not necessarily exclude therapeutic uses of genome editing (and thus denies the relevance of the treatment-enhancement distinction). Still, I mostly refer to paradigmatic enhancements that improve wellbeing from a normal level, and do not centre around health-related traits, to highlight how the framework can assess more controversial cases.

My CPH framework assesses the permissibility of implementing GGEE interventions as public health measures, and considers policy alternatives for implementation along a scale of coerciveness. I look to collective-oriented public health ethics (PHE) for better-developed

²⁴² For proposed areas where further development is needed, and affirmations of its controversial nature, see: Anomaly, *Creating Future People*; Buchanan, "The Landscape of the Enhancement Debate"; Baylis, *Altered Inheritance: CRISPR and the Ethics of Human Genome Editing*.

moral concepts and principles employed as mid-level principles²⁴³ for deliberation via collectivist analyses. The CPH framework consists of three key questions, and an iterative final step. Each key question has been identified in the enhancement literature to date as important for determining the permissibility of GGEE. They are:

1. Who are the stakeholders in implementing a GGEE intervention, and what are their interests?
2. What are the potential consequences of implementing a GGEE intervention, for stakeholders, and are harms imposed on individuals and groups acceptable?
3. Does implementing the GGEE intervention fulfil the requirements of distributive justice?

These key questions act as the first three steps of analysis, followed by Step 4 of the framework:

4. Comparison between alternative policies for implementing the given GGEE intervention other than the assumed middle-ground policy, to determine which policy alternative maximises benefit or better fulfils requirements of distributive justice.

I describe each step of the CPH framework in detail, through sections I-IV. In the next chapter, I address potential objections to it.

Before I describe the steps, a couple of notes on my intentions here.

²⁴³ Recall that this term refers to those principles that fall mid-way between practical tools in analysis, and ethical theories. They do not express fundamental values. For more, see: Coughlin, "How Many Principles for Public Health Ethics?"

I frame *specific* GGEE interventions as *public health measures* that a state may consider *implementing*, via policy alternatives with different levels of coercion. This framing emphasises three key points.

First, on ‘specific’ GGEE interventions: The CPH framework provides a deliberative tool for policymakers, with the aid of stakeholders, to assess GGEE interventions separately, for each type of trait alteration. Thus, a GGEE intervention for consideration may be memory enhancement via editing a particular set of genes, or it may be moral enhancement via different edits. The morally relevant concerns differ between types of enhancement, so by separating the interventions out, I avoid making inappropriate blanket judgements about ‘the enhancement enterprise’ as a whole.

Second, the GGEE interventions considered here are framed as ‘public health measures’: the CPH framework assesses only those interventions that are intended to (and will plausibly) benefit a population or collective. This aligns with the goals of collective-oriented public health measures, to improve collective wellbeing, as well as with the relevant responsibilities of states toward their publics. My definition of enhancement is more expansive than this, so the framework does not aim to assess every type of enhancement. Whilst the framework could possibly assess individual-benefiting GGEE interventions instead of those intended to provide benefit at the collective level, some of these interventions aren’t appropriate for *states* to implement. That might be because the interventions actually harm people other than the individual; alternatively, they may be neutral for the collective and beneficial for the individual, but in such a way that does not justify the use of state resources for their pursuit. Of course, the fact that these individual-oriented enhancements lie outside the remit of this framework does not imply they are impermissible for individuals to pursue independently. I merely remain silent on these cases.

Third, states may consider ‘implementing’ these GGEE public health measures using various policies for implementation. These policy alternatives lie on a spectrum of coerciveness (how much they deprive individuals of the choice whether to comply).²⁴⁴ At one end are mandatory and compulsory policies for a GGEE intervention, where the state may effectively oblige prospective parents to undertake the GGEE intervention by removing alternatives or force women to undergo IVF and GGEE.²⁴⁵ At the other end are entirely non-coercive policies (say, an educational campaign on the benefits of GGEE). To allow for thorough consideration of both the consequences inherent to a type of GGEE intervention, *and* consequences that are the result of a policy alternative, I make certain assumptions at the start of the framework. In Steps 1-3 of my CPH framework, I assume what I term a ‘middle-ground’ policy alternative for implementing a GGEE intervention. A policy must be chosen that includes both the type of enhancement in question, and *how* access to it is to be regulated. The ‘middle-ground’ policy I choose here acts as an initial policy for consideration, which can be compared to other ways that the enhancement might be implemented/regulated in Step 4. That is, for now, I assume that a GGEE intervention is implemented in such a way that prospective parents’ choices to undertake it (and the required *in vitro* fertilisation) are *enabled by the state*, a policy alternative that is likely to fall around mid-way along the spectrum of coerciveness. This hypothetical policy includes educating parents on the interventions, ensuring the accessibility of clinics, and offering means-tested subsidisation. In Step 4, an iterative process is applied to consider implementing the GGEE intervention in question via

²⁴⁴ This is sometimes also termed intrusiveness, as discussed in the Nuffield Council on Bioethics’ ‘ladder of intrusiveness’ for public health interventions. See their: *Public Health: Ethical Issues*. (London: Nuffield Council on Bioethics, 2007), at Chapter 3.

²⁴⁵ Note that it is highly unlikely that the costs to individuals of complying with highly coercive GGEE policies like this could ever be reasonably bearable. Whilst the framework can theoretically consider such policies, I do not focus on them much here, but rather consider more plausible middle-ground and non-coercive policies.

alternative policies, which may be more or less coercive than the original middle-ground policy.

Finally, it is worth noting that while state policymakers primarily decide whether to implement GGEE (as the regulators and funders of public health measures and other population-targeting interventions), they cannot do so alone. As is particularly emphasised in Steps 1, 2, and 4, identifying stakeholders' interests and assessing potential consequences of GGEE requires the public's and specific groups' participation. (In Step 3, this applies less. When considering a just distribution of the harms and benefits of GGEE interventions the state can make this assessment as it involves the work only of applying the chosen account of distributive justice, rather than recognition of subjective values and outcomes of GGEE.) Therefore, the framework cannot be applied as a deliberative tool by states *alone*.

With these intentions of the following analysis in mind, I now explain the CPH framework.

I

Who are the stakeholders in implementing a GGEE intervention, and what are their interests?

This step functions to identify all morally relevant stakeholders and their existing interests whose realisation may be affected by the GGEE intervention in question. As an initial illustration, Figure 1 shows the stakeholders in the debate, as I conceive them. Each is discussed further below.

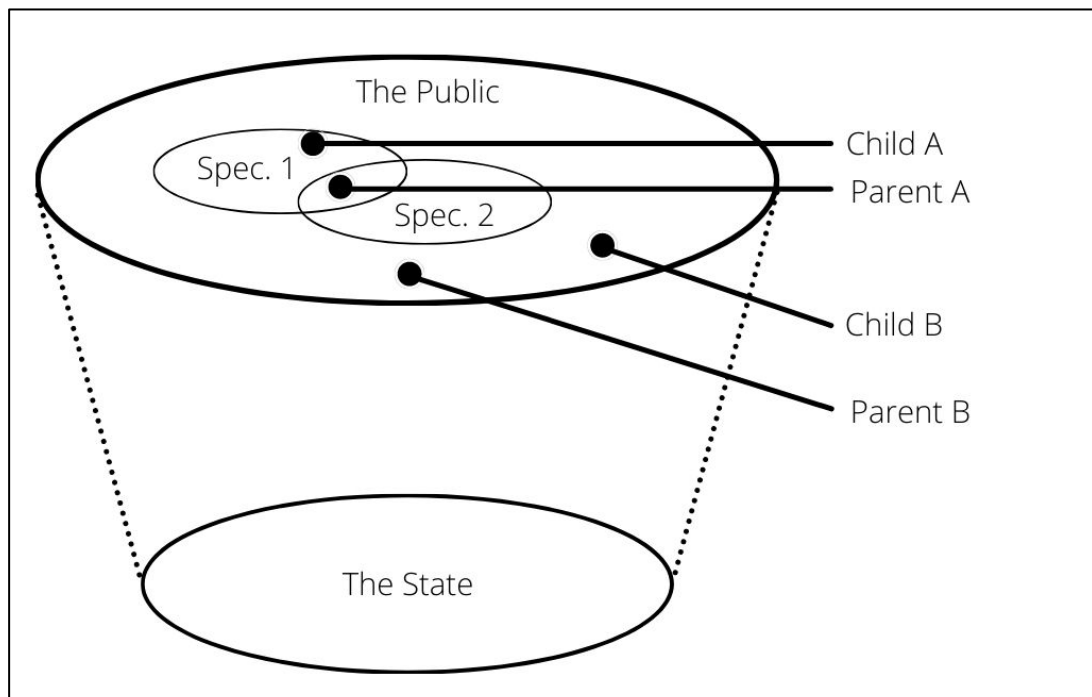


Figure 1: Stakeholders in a GGEE intervention. The Figure shows, at the collective level (circles), the State, the Public, and Specific Groups (e.g. Spec. 1 may be future unenhanced people competing with the memory-enhanced in an employment market). It identifies the state's role as supporting the public, where the public encompasses all individuals, and multiple, sometimes-overlapping specific groups. At the individual level, the Figure identifies stakeholders (dots): the prospective parents (e.g. Parent A corresponding to one couple or single parent planning to have a child using GGEE) and the future child (e.g. Child A, the future child of Parent A couple). These are all members of the public, and possibly members of specific groups.

Each stakeholder in the above Figure is an individual, represented by a point, or a group of people, represented by a circle. I define groups, not as particular protected categories, but as any group of people who share a common interest, group identity, or are affected in the same ways by a GGEE intervention. Each individual, then, is also necessarily a member of multiple groups. To accommodate all interests in analysis, potential interests must be assessed for those individuals likely to be particularly affected, and those groups likely to be particularly affected by a GGEE intervention. Whilst an individualist analysis can account for individuals and groups insofar as they are merely aggregates of individuals, there are some groups that are specially affected *as a whole* by GGEE, perhaps via the effects of collective action problems, group stigmatisation, etc. It is at this point that a more holistic collectivist

approach to ethical analysis is also needed. The people with these interests have both interests relating to themselves as individuals, and interests relating to the groups of which they are members.

Whilst I mostly set it aside, I must still add one note of substantive theory here on the values enhancement should promote. When applying this step of the framework, policymakers should conceive of stakeholders' interests normatively, as those desires and ends relating to their pursuit of flourishing lives.²⁴⁶ The WELLBYs gained from the fulfillment of these interests are then considered in the next step. This is so that neutral or bad values that people hold (however these are defined) are excluded from being considered morally relevant interests that are promoted or threatened by the implementation of GGEE. To explain further, good health and social engagement, for example, are interests that may enable a person 'to pursue the various goals and projects in life that she has reason to value [i.e. her flourishing].'²⁴⁷ I also include among interests those aspects of a flourishing life proposed by plausible objective list theories of wellbeing, such as social interactions, health (mental and physical), employment opportunities, and political participation.²⁴⁸ Interests can include the protection of individuals' rights and freedoms, which is also conducive to their flourishing. By conceiving of interests normatively but without specifying valued interests further than flourishing, my CPH framework aims to confine itself to *morally relevant* considerations, whilst not straying from its intentions to focus on mid-level principles for a deliberative tool for policymakers. For example, consider applying the mid-level principle of representation to considering a group as a stakeholder. Representation is not in itself

²⁴⁶ Note that, whilst some collectives cannot be appropriately considered as entities with interests, even in these cases, the individuals who are members of these groups share interests in common. I use the shorthand 'group' or 'collective' interests throughout, to represent the shared nature of these interests by members of a group, in relation to the group.

²⁴⁷ Sudhir Anand, "The Concern for Equity in Health," in *Public Health, Ethics, and Equity*, ed. Sudhir Anand, Fabienne Peter, and Amartya Sen (Oxford, UK: Oxford University Press, 2006), 17-18.

²⁴⁸ Crisp, "Well-Being."

valuable, it is merely the mid-level principle that should be applied if representation of that particular group is valuable because the group itself or the interests of its members are morally valuable. If the group is one that is defined by a morally undesirable or unacceptable value or goal, then its representation is also not morally valuable.²⁴⁹ Consider how a tobacco companies' interests in continued susceptibility to nicotine addiction might be undermined by an enhancement that reduced how addicted people can become. The representation of tobacco companies in ethical analysis of the intervention may not be considered morally valuable (perhaps because fulfilling their interest predictably incurs much greater harm to others). The same goes not only for the representation of stakeholders, but also for the identification and inclusion of their interests in moral deliberations. If a person's interests are not in themselves valuable—perhaps, if they do not align with that individual's flourishing—then these interests ought not be included.²⁵⁰ Consider, in this case, a person who develops an anti-vaccination stance, despite being medically vulnerable to a prevalent infectious disease, and not expected to experience any side-effects of vaccination. The mid-level principles like representation are not useful in all contexts, then, though still in others. Work is required (beyond the scope of this thesis) to build an account of the values within a society in order to determine when the mid-level principles I use here actually apply. Hereafter, I simply use 'interests' to denote the interests that have been determined in the

²⁴⁹ Note that this is a possible position for anyone who is not a pure utilitarian, and for whom, then, to *whom* costs and benefits are allocated matters as a justice concern, or on another basis. In this way, benefiting certain groups can be less morally valuable than benefiting others. For instance, Ronald Dworkin holds that including in our accounting preferences regarding others, as opposed to oneself, inappropriately double-counts some preferences. There is the preference someone has about themselves, and if the preferences others have about them are also counted, then this corrupts our moral accounting. Both anti-vaxxers and tobacco companies have these 'external preferences' that ought not be counted in accounting consistent with Dworkin's view. For more, see: Ronald Dworkin, *Taking Rights Seriously* (London, UK: Bloomsbury, 2013), 280-286.

²⁵⁰ This statement is controversial, and we might think it only applies where there is adequate understanding of what constitutes or contributes to individuals' flourishing, and where the state is trustworthy enough to be left to make and act on these judgements via the policy it implements. For now, let us simply assume these conditions hold in a state considering implementing GGEE.

jurisdiction to be morally relevant, and ‘stakeholders’ to denote the groups that have been determined in the jurisdiction to be appropriately considered.

Previously, individualist analyses of stakeholders have commonly focused on the prospective parents and the future child.²⁵¹ Existing collectivist work like Robert Sparrow’s²⁵² has built further on stakeholder accounts. Sparrow identifies possible collective-level stakeholders as ‘the world’, ‘the species’, a ‘nation’, and a ‘race’ of people. However, the divisions identified in his analysis cannot distinguish smaller group interests within a society. Consider, for example, how a specific group—say, elite athletes—may be affected by widespread physical enhancement (and thus is relevant to consider in analysis). Their interests concerning the continued existence of athletic competitions and the watching of sports (which may conceivably be impeded by widespread physical enhancement) cannot be assessed when we consider collectives to be divided only into the world, species, nations or races. For an analogy in collective-oriented public health more broadly, consider how smokers’ interests may be affected by anti-smoking campaigns. Current smokers may suffer from repeated separation from others because of limits on smoking areas. Over time, heavy smokers may then experience stigmatisation or isolation, despite this measure benefiting the rest of the population, by reducing exposure to second-hand smoke and uptake of smoking.²⁵³ (Note that this case is different from the one raised earlier, concerning the irrelevance of considering a tobacco company as a morally relevant stakeholder in ethical analysis, because of the insupportable goals of that kind of entity. In this case, by contrast, smokers are people who do not necessarily have the goal of continuing to smoke. Even if they do, this is not a goal of harming others.)

²⁵¹ For further discussion, see: Brock, "Shaping Future Children: Parental Rights and Societal Interests"; Allen Buchanan et al., *From Chance to Choice: Genetics and Justice* (Cambridge: Cambridge University Press, 2000).

²⁵² Sparrow, "Human Enhancement for Whom?"

²⁵³ As evidenced in ethical analyses of non-smoking policies. See: Bryan Thomas and Lawrence Gostin, "Tobacco Endgame Strategies: Challenges in Ethics and Law," *Tobacco Control* 22, (2013): 55-57.

The interests of these groups must be included in ethical analysis, and so, in-keeping with the remit of the national policymakers who would use this framework, I focus on people's interests identified only within a given national jurisdiction. Within that jurisdiction, I propose three different divisions of the collective for consideration.²⁵⁴ 'The public' constitutes all people in a jurisdiction, both those currently existing, and future generations. Within the public are 'specific groups', whose interests may not align with those of the public, as in the smokers' case, or the athletes' case. Finally, 'the state' is the institution whose responsibility it is to protect individuals' legal rights, and provide certain goods for the public, broadly speaking. The state's responsibilities toward its public act as 'proxy interests' and may also conflict with specific groups' interests, where these run counter to the public's, or where they conflict with the protection of individuals' rights.²⁵⁵ It may seem that including the state as a stakeholder, and their responsibilities among interests, is unnecessary and counterintuitive. I have made this move for a very particular reason. Whilst it may be a stretch to consider responsibilities of a state as a proxy for the interests of its public, I believe this is necessary due to some difficulties in accounting for certain benefits to the public. Whilst the state only has a stake in GGEE interventions to the extent that they affect the public's interests, benefits like the provision of PPGs, increasing globally shared resources, or increasing state stability and legitimacy are difficult to include under the banner of public interests in securing collective welfare. Whilst these things do provide benefit, they are much more easily visible in ethical analysis when considered under the banner of state responsibilities. As the fulfilment of a state's responsibilities via GGEE implementation has the same effect in a cost/benefit analysis as the promotion of the public's interests via

²⁵⁴ In the next chapter, I consider an objection to my framework, concerning the narrowness of this local rather than global view of distributive justice

²⁵⁵ Although tensions should not occur between state and public interests, this remains a risk, practically speaking, where corrupt or authoritarian states no longer properly serve their publics. However, these cases lie outside my scope. Here I assume the legitimate, representative governments of liberal democratic societies.

GGEE, only more easily accounted for in ethical analysis, I choose to include the state as a stakeholder, and its responsibilities as responsibilities under the banner of ‘interests’.

In Step 1, I first consider collective-level stakeholders—whom I sometimes refer to simply as ‘the collective—, then individual-level stakeholders.

Collective-level stakeholders

For each collective-level stakeholder, I use moral principles and concepts from collective-oriented areas of PHE to identify the stakeholder group’s existing interests that may be affected by implementation of a given GGEE intervention. Stakeholders and their interests (that can be anticipated in advance) are shown in Figure 2.

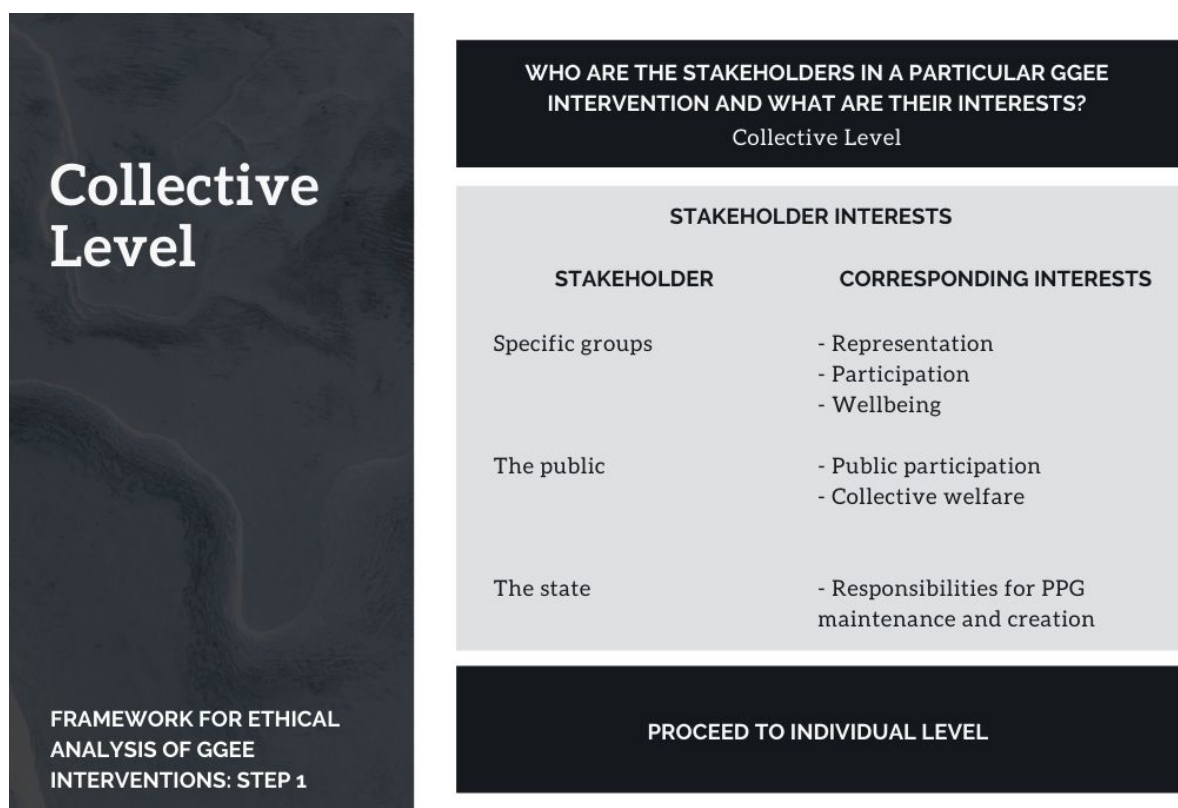


Figure 2: Collective level identification of stakeholders and their interests. For each stakeholder, the corresponding interests can be articulated using moral principles and concepts often applied in PHE. Note that for the state, responsibilities are not interests as such, but I do claim, below, that a state has a kind of proxy-interest in its ability to fulfil its responsibilities. This

allows for the later identification of harms and benefits to stakeholders based on how their existing interests may be better or worse realised if GGEE is implemented.

Specific groups' interests

For any GGEE intervention, there are some specific groups which will be particularly relevant stakeholders in ethical analysis. Their interests may be affected by implementation of a GGEE intervention, and especially so when their morally relevant interests are already poorly represented in decision-making. For example, groups within the disability community are often under-represented in decision-making surrounding the regulation of reproductive technologies. Reproductive decisions affect both the number of people who will be born with a given disability, and, possibly, the level of support that current and future people in that group may receive. Members of disability communities are already more vulnerable to infringement of their reproductive autonomy—they may be *unable* to access fertility treatments, preventing them from having children with their condition, particularly where their access is actively hindered by carers.²⁵⁶ If GGEE interventions are implemented, this group may be a particularly relevant stakeholder, insofar as a societal expectation and pressure may develop that they *do* undertake GGEE, for the same reason: to ensure they do not have children with their condition (where these are heritable). Representation in these cases is clearly an important mid-level principle for articulating interests, and its usefulness will depend on the extent to which a group's defining, GGEE-affected trait is linked to flourishing.²⁵⁷

²⁵⁶ For further discussion of such cases, see: Amber Knight, "Disability and the Meaning of Reproductive Liberty," *Politics, Groups, and Identities* 5, no.1 (2017): 67-83.

²⁵⁷ It should be acknowledged, equally, that whilst these specific groups should play a role in decision-making and participate in discussions of how certain GGEE interventions may affect members of their groups, there are limitations to how representative the recruits are of the population as a whole. It has been noted that advocates in, for example, the Autism community variously term autism as a disease, disorder, disability, or merely an aspect of neurodiversity. Those who see it as a non-disease state tend to be those for whom autism has a less severe effect on their day-to-day lives. When advocates represent only a subset of the population, this is 'partial representation'. The risk is that this leaves the views of others in the population neglected in participatory decision-making. This problem may be mitigated by using evaluative criteria for selecting advocates of a group. For more, see Matthew McCoy et al., "Ethical Advocacy Across the Autism Spectrum:

Participation is a mid-level principle used in PHE and related to representation, and outlined in the previous chapter, but with emphasis placed on active involvement rather than a group's mere presence in decision-making. It also acts as a method used in the CPH framework for the identification of further interests. Participation methods can empower minority groups in ethical discussion surrounding public health measures, and are applicable here.²⁵⁸ I do not specify further interests here, other than by mentioning group-level wellbeing in a broad sense. Rather, the framework requires specific groups' participation to proceed in identifying these interests.²⁵⁹

Public interests

The public, too, has an interest in participating in decision-making. Indeed, public participation is essential to ensure that a state continues to serve its public. 'Enlightened democratic governance' of genetic interventions is one proposed method for ensuring adequate public participation in decision-making surrounding GGEE interventions, discussed in the previous chapter.²⁶⁰ It involves educating a sample of the public on the intervention and using their subsequent debate to inform decision-making. This method or ones like it might be appropriately used in the GGEE context to further inform an assessment of public interests surrounding GGEE.

Beyond Partial Representation," *The American Journal of Bioethics* 20, no. 4 (2020): 13-24. For a summary of responses, see: Nanette Elster and Kayhan Parsi, "Like Autism, Representation Falls on a Spectrum," *The American Journal of Bioethics* 20, no. 4 (2020): 4-5.

²⁵⁸ See Baum, *The New Public Health*, at Chapter 20.

²⁵⁹ Note that specific groups' interests may conflict with public or state interests. These conflicts are particularly apparent where (otherwise collectively beneficial) widespread enhancement would affect the future number of group members, or the state support it receives. These effects must be considered in ethical analysis, as argued by Ryan Tonkens, in his recent work: "Vulnerable Groups and the Hollow Promise of Benefit from Human Gene Editing," *Bioethics* (2021), <https://doi.org/10.1111/bioe.12882>. However, the resulting harms to the group from implementation are unlikely to outweigh significant benefits to the collective, according to the weighing system I develop in Step 2.

²⁶⁰ Giulia Cavaliere, Katrien Devolder, and Alberto Giubilini, "Regulating Genome Editing: For an Enlightened Democratic Governance," *Cambridge Quarterly of Healthcare Ethics* 28, no. 1 (2019): 76-88.

Collective welfare is a concept employed in collective-oriented PHE, focussing on the aggregated wellbeing of groups. Collective welfare as a concept goes further than many discussions of wellbeing in the enhancement debate,²⁶¹ in detailing the domains (that is, the component aspects) of wellbeing at the community level, and in its acknowledgement of the interdependence of wellbeing between individuals and communities.²⁶² Building on the account of collective welfare proposed by Roy and colleagues,²⁶³ in the previous chapter I explained each of the domains of collective welfare, including vitality/environment, opportunity/prosperity, connectedness, contribution/global responsibility, inspiration, and resilience.²⁶⁴ Each of these is a part of the level of overall welfare in the community conceived as an entity itself. The public has an interest in its collective welfare. For example, contribution/global responsibility as a domain of collective welfare partly concerns the creation of common resources in a community, or globally. An intervention to protect biodiversity in a given setting would contribute to collective welfare of the community in that setting by providing a means of fulfilling the community's global responsibilities. It is in that public's interest that this occurs. Similarly, if a GGEE intervention enables the nation to better fulfil global responsibilities, it serves the public's interest in collective welfare. A GGEE intervention might do this by, say, making enhanced individuals' digestive tracts more hostile an environment for the development of drug-resistance in bacteria,²⁶⁵ thereby contributing to the global common good of continued antimicrobial effectiveness.

²⁶¹ See, for example, Bavelier et al., "Rethinking Human Enhancement as Collective Welfarism."

²⁶² For more discussion of relational wellbeing, see: Sarah Atkinson, "Beyond Components of Wellbeing: The Effects of Relational and Situated Assemblage," *Topoi* 32, no. 2 (2013): 137-144; Atkinson et al., "Being Well Together: Individual Subjective and Community Wellbeing."; White, "Relational Wellbeing: Re-centring the Politics of Happiness, Policy and the Self."

²⁶³ Roy et al., "Collective Well-Being to Improve Population Health Outcomes: An Actionable Conceptual Model and Review of the Literature."

²⁶⁴ Although I provide only a brief list here, refer to Chapter 4 for a more detailed discussion of my adaptation of Roy et al.'s collective welfare concept, and its applications in the public health sphere.

²⁶⁵ Although this may seem far-fetched, it was recently found that an FDA-approved drug used in transgenic mice altered the gut environment to reduce the bacteria's ability to evolve resistance to certain antibiotics. If such effects could be produced genetically, such a GGEE intervention may pose a strategy for combatting antimicrobial resistance. For more, see: John Pribis et al. "Gamblers: An Antibiotic-Induced Evolvable Cell Subpopulation Differentiated by Reactive-Oxygen-Induced General Stress Response."

State interests

The state, as an institution that exists merely to serve the public—at least in liberal democracies—does not have its own interests, as such. However, it does have *responsibilities* toward its public. These can be treated as proxy interests, wherein the stability and legitimacy of a state depends on it fulfilling its responsibilities, and therefore insofar as we *can* assume that there is an interest (perhaps, ultimately, the public's) in a stable and legitimate state, the fulfilment of responsibilities is a kind of proxy interest. These proxy interests are a simpler way of including states' responsibilities in analysis at the appropriate point of considering stakeholder interests. Although they are a little different to the other stakeholder interests discussed, as they are produced not from a human goal of flourishing, but rather an assumed institutional goal of stability and legitimacy, this does not affect how well they can be integrated into analysis. What the state level of analysis adds is consideration both of responsibilities to individuals regarding the protection of fundamental rights, and responsibilities to collectives, particularly concerning the primary public goods (PPGs) it provides for the benefit of its public. As introduced in Chapters 3-4, PPGs are shared resources in a society that are non-rivalrous and non-excludable (public), and that serve any plausible conceptions of a flourishing life (primary). In this context, a GGEE intervention may help a state to provide a PPG, or threaten the maintenance of that PPG. It is within a state's remit to provide these types of goods, even when this involves some interference in citizens' lives (e.g., via taxation), because of the important role these goods play in the sustainable cooperation and functioning of a liberal democratic society.

Consider adequate opportunities for employment as a PPG.²⁶⁶ Whilst an employment *market* is certainly not a PPG (as it is not non-rivalrous or non-excludable), state support that intervenes in that market to create opportunities may be a PPG. That is, a state may have a responsibility to maintain reasonable opportunities for entering the employment market, by offering skills development for its workforce, job security mechanisms for when work is temporarily unavailable, and the removal of unfair barriers to employment, such as hiring discrimination. States intervene, in this case, to ensure sufficient employment opportunities and fair wages across a society as a whole. This has the additional effect of working to at least make employment opportunities *less rivalrous and less excludable*. Now consider how a productivity enhancement may affect the provision of this PPG. Imagine employment opportunities were flooded with productivity-enhanced individuals, perhaps all wishing to work at an earlier age. These new, enhanced workers increase the requirements for what constitutes being a productive worker. They may add pressure on job security mechanisms and employment structures; they may make workplaces more competitive. All these factors significantly impact the adequate state provision of employment opportunities and related PPGs in a society.

Individual-level stakeholders

People may also be affected by a GGEE intervention *as individuals* as opposed to as members of wider groups with shared interests and characteristics. Individual-level stakeholders' interests may conflict entirely with the collective's, or with their own interests

²⁶⁶ John Rawls counts it as a responsibility of a branch of a state institution to maintain levels of employment opportunities. For more, see his *A Theory of Justice*, 244. It has since been argued that employment opportunity ought to explicitly be included as a primary good: Larry Udell, "Rawls, Libertarianism, and the Employment Problem: On the Unwritten Chapter in A Theory of Justice" *Social Philosophy Today* 34 (2018): 133-152. Public health bodies also involve themselves in the maintenance of adequate employment opportunities. See: "Increasing Employment Opportunities and Improving Workplace Health" (Public Health England, 2014), accessed July 20, 2020. <http://www.instituteofhealthequity.org/resources-reports/local-action-on-health-inequalities-promoting-good-quality-jobs-to-reduce-health-inequalities->

when considered *as members of a collective*.²⁶⁷ The realisation of individuals' self-concerned interests must not be *unacceptably* threatened by a given GGEE intervention, or it ought to be deemed impermissible to implement by state policymakers. Individual stakeholders' interests are identified in this step, and the threshold at which they are unacceptably threatened is considered further as potential harms that impose limits on the pursuit of collective-level benefits in Step 2. This flips the common individualist approach to enhancement, where priority is given to the pursuit of individuals' interests via GGEE, and collective-level interests are considered only secondarily, as a limiting factor on the pursuit of individual benefit. Instead, I consider the pursuit of collective-level benefits first, as a public health-related goal of the state, and then consider limits to pursuing that goal based on individual consequences (and consequences for smaller divisions of the collective level), second. This is justified by my public health framing of GGEE interventions. Where the goal of a state's implementing a GGEE intervention is to benefit a collective, limits to pursuing this benefit according to effects on individuals are necessarily considered second.

Relevant individuals include the future child and prospective parent(s) (Figure 3).

²⁶⁷ For examples, see Christopher Gyngell and Thomas Douglas' work on collective action problems with enhancements like height, discussed further here: Gyngell and Douglas, "Stocking the Genetic Supermarket: Reproductive Genetic Technologies and Collective Action Problems."

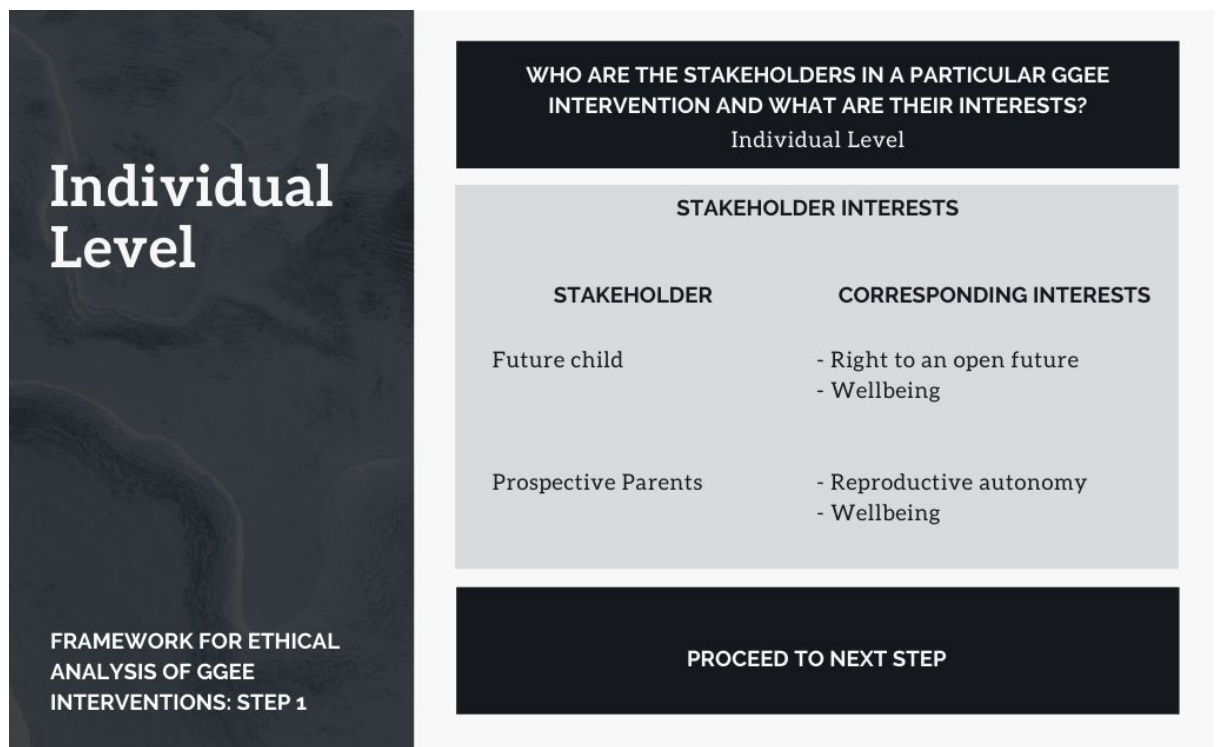


Figure 3: Individual level identification of stakeholders and their interests using moral concepts and principles often applied in PHE. As with the collective-level stakeholders and interests, these go on to inform the identification of possible harms and benefits in Step 2.

Future child's interests

The principle of a child's right to an open future was originally developed by Joel Feinberg,²⁶⁸ who claimed that future people possess rights held in trust for them by existing adults. These can be violated before the future person exists or can exercise their rights. Some rights relate to the future child's self-determination according to the *range* of choices available to them, and some relate to the child's *capacity* to make those choices. GGEE interventions may limit the range of choices that the future child has access to, if the enhancement makes them better suited to a particular role in society at the exclusion of other roles. For instance, the choices a person has access to may change in accordance with certain abilities they have. (Imagine an enhancement that makes a child in a Deaf family Deaf, and

²⁶⁸ Feinberg, "The Child's Right to an Open Future."

therefore better suits them to certain roles and not others that rely on hearing.) Alternatively, it may impact their capacity for choice if it affects their future reasoning abilities (or perhaps their preferences). This view aligns with some recent discussion²⁶⁹ of whether genetic enhancement threatens the child's right to an open future, in which it is claimed that some enhancements do not foreclose enough of the options a future child might have to significantly harm them. Among the GGEE interventions listed as not threatening these rights may be life extension, vision enhancement and even general intelligence enhancement.

Regarding the future child's wellbeing, GGEE interventions may take valuable capacities away from children, whether these be physical, emotional, or social. If so, these interventions threaten their wellbeing. Alternatively, GGEE interventions that may improve these capacities can be expected to promote wellbeing.²⁷⁰ The future child cannot, of course, participate in the decision-making process, articulating their own wellbeing interests. Rather, it is the responsibility of prospective parents to identify their future child's likely wellbeing interests, and represent them, as is standardly the case before the point at which children can give informed consent.

Prospective parents' interests

Parents may have a morally relevant interest in protecting their right to reproductive autonomy. Reproductive autonomy may be conceived merely as freedom from interference with prospective parents' decision-making,²⁷¹ implying that no one prevents prospective parents from undertaking GGEE. Alternatively, it may be conceived as more demanding,

²⁶⁹ Battisti, "Genetic Enhancement and the Child's Right to an Open Future."

²⁷⁰ For further discussion of individual-level wellbeing and enhancement, see: James Hughes, "After Happiness, Cyborg Virtue," *Free Inquiry* 32, no. 1 (2011), <https://secularhumanism.org/2011/12/cont-after-happiness-cyborg-virtue/>.

²⁷¹ Robertson, *Children of Choice: Freedom and the New Reproductive Technologies*; Harris, "Rights and Reproductive Choice."

requiring third parties to ensure the right to undertake GGEE is exercisable.²⁷² Protecting this right is a morally relevant interest insofar as it promotes prospective parents' flourishing. Depending on the type of policy implemented (and this holds for the middle-ground policy), a GGEE intervention may offer parents the additional reproductive choice to have an enhanced child, and thus promote their reproductive autonomy.²⁷³ This does not hold for policy alternatives that restrict choice by requiring or prohibiting an intervention.

Additionally, the prospective parents' wellbeing may be affected by a GGEE intervention in two ways. First, insofar as their own wellbeing depends on the wellbeing of their future child: where an intervention harms the child, this may also affect the parents' interest (and *mutatis mutandis* for benefits to the child). Second, insofar as the burdens of supporting and raising the future child are increased or reduced according to how the GGEE intervention affects the future child.²⁷⁴ Where a child is rendered more capable or independent by a GGEE intervention, parenting burdens may be reduced.

At the end of this step, collective- and individual- level stakeholder interests have been identified, and can then inform the next step: assessment of the consequences of implementing the given GGEE intervention for the realisation of these interests.

²⁷² Mills, "Reproductive Autonomy as Self-Making: Procreative Liberty and the Practice of Ethical Subjectivity"; Johnson, "Free to Decide: The Positive Moral Right to Reproductive Choice According to the Capabilities Approach."

²⁷³ Whether or not the choice not only *to have a child*, but to have *a child with particular traits* can be defined as a reproductive choice is controversial, however further discussion is outside my scope here.

²⁷⁴ Atkinson, "Beyond Components of Wellbeing: The Effects of Relational and Situated Assemblage."

II

What are the potential consequences of implementing a particular GGEE intervention?

Step 2 assesses the potential consequences of implementing a GGEE intervention for stakeholders. Here I build on previous work²⁷⁵ by recognising differences in whether an enhancement is, overall, harmful or beneficial, for *different divisions of* (or groups within) the collective. I also use a new system for weighing harms and benefits, in the form of a modified duty of collective easy rescue.

I should acknowledge that we cannot tell in advance the actual harms and benefits of an intervention, as the consequences only come after implementation. However, the *likely* harms and benefits (and their magnitudes) can be anticipated, with thorough analysis of potential outcomes, and reference to similar interventions that have produced consequences we could expect GGEE interventions to produce. (For example, genetic selection may have similar effects, or there may be intervention-specific analogues such as vaccination for genetic immunisation, detailed further in Chapter 7). Some GGEE interventions may benefit all stakeholders. Often, however, the implementation may pose harm to one division of the collective (or individual-level stakeholders), whilst posing net benefit to the collective-level stakeholders considered as a whole. This step aims to determine when these trade-offs between harms to some stakeholders and benefits to others are acceptable.

²⁷⁵ Bavelier et al., "Rethinking Human Enhancement as Collective Welfarism."; Kevin Smith, "Time to Start Intervening in the Human Germline? A Utilitarian Perspective," *Bioethics* 34, no. 1 (2020): 90-104; Anomaly, *Creating Future People*; Allen Buchanan, "Enhancement and Human Development," *Beyond Humanity?: The Ethics of Biomedical Enhancement* (Oxford: Oxford University Press, 2011), 35-68; Julian Savulescu, "Justice, Fairness, and Enhancement," *Annals of the New York Academy of Sciences* 1093, no. 1 (2006), 321-338; Joao Fabiano, "Virtue Theory for Moral Enhancement," *American Journal of Bioethics Neuroscience* (2021): 89-102.

To illustrate briefly, consider how certain IQ-increasing cognitive enhancements²⁷⁶ may necessitate changes to future education systems, accelerating learning for enhanced students. This may benefit the society as a whole, but it may also divert educational resources away from supporting lower-IQ students. The magnitudes of harms and benefits to each set of students as specific groups partly inform the permissibility of implementing the GGEE intervention.

Consequences and a duty of easy rescue

To begin Step 2, harms or costs (threats to realising interests), and benefits (promotion of interests), are assessed for each stakeholder. This produces harm/benefit ratios²⁷⁷ that show whether implementing the intervention poses net harm or net benefit to each stakeholder. When aggregated, these show harm or benefit to the whole stakeholder level.

Interventions that do not produce net benefit at the collective level do not fit the goals of public health measures. If they are (practically) neutral at the collective level, whilst benefiting a few individuals, these interventions may still be permissible for parents to pursue independently, but this analysis is beyond my scope. With such tiny levels of collective-level benefit, the costs involved in creating and maintaining public health policy on GGEE are likely to outweigh these benefits to a few individuals. The threshold for considering such interventions using my framework is that they produce enough benefit at the collective level to more than outweigh the costs of public health policy creation and maintenance.

²⁷⁶ Note that increasing IQ is only one measure of intelligence, and remains controversial. Increasing IQ may come with a reduction in creativity or emotional intelligence. See: Walter Veit et al., "Recognizing the Diversity of Cognitive Enhancements," *AJOB Neuroscience* 11, no. 4 (2020): 250-253.

²⁷⁷ The harms and benefits I assess are considered to have equal weight, although there are side-constraints in which the consideration of harm is also involved, discussed further below. Whilst the harm:benefit ratios produced are intended to present plausible harms and benefits of a GGEE intervention, I do not assign likelihoods to each of the risks and benefits. Whilst this would be practically useful, it is a job for economists, and is outside the scope of this thesis, but would apply were the framework actually used by policymakers.

By contrast, some interventions initially seem as though they would benefit the collective, but upon further analysis, will plausibly harm the collective. These fall within the scope of my analysis, and should be deemed impermissible for states to implement, as they constitute public health measures that are likely to fail. For instance, an enhancement might better adapt humans to live in warmer conditions by changing temperature regulation, but if weather becomes more extreme generally, then this may mean more people die in periods of extreme cold weather than might be saved from better adaptation to generally warmer conditions.

Among interventions that *do* produce collective-level net benefit, a system is needed for weighing these benefits against potential (gross) harms to other divisions of the collective, or to individual-level stakeholders. Figure 4 shows a weighing system to consider these trade-offs, building on the duty of collective easy rescue previously introduced (CER, modified form CER*²⁷⁸).

²⁷⁸ Giubilini, Douglas, and Savulescu, "The Moral Obligation to be Vaccinated: Utilitarianism, Contractualism, and Collective Easy Rescue"; Giubilini and Savulescu, "Demandingness and Public Health Ethics"; Savulescu, "Concise Argument—Wellbeing, Collective Responsibility and Ethical Capitalism."

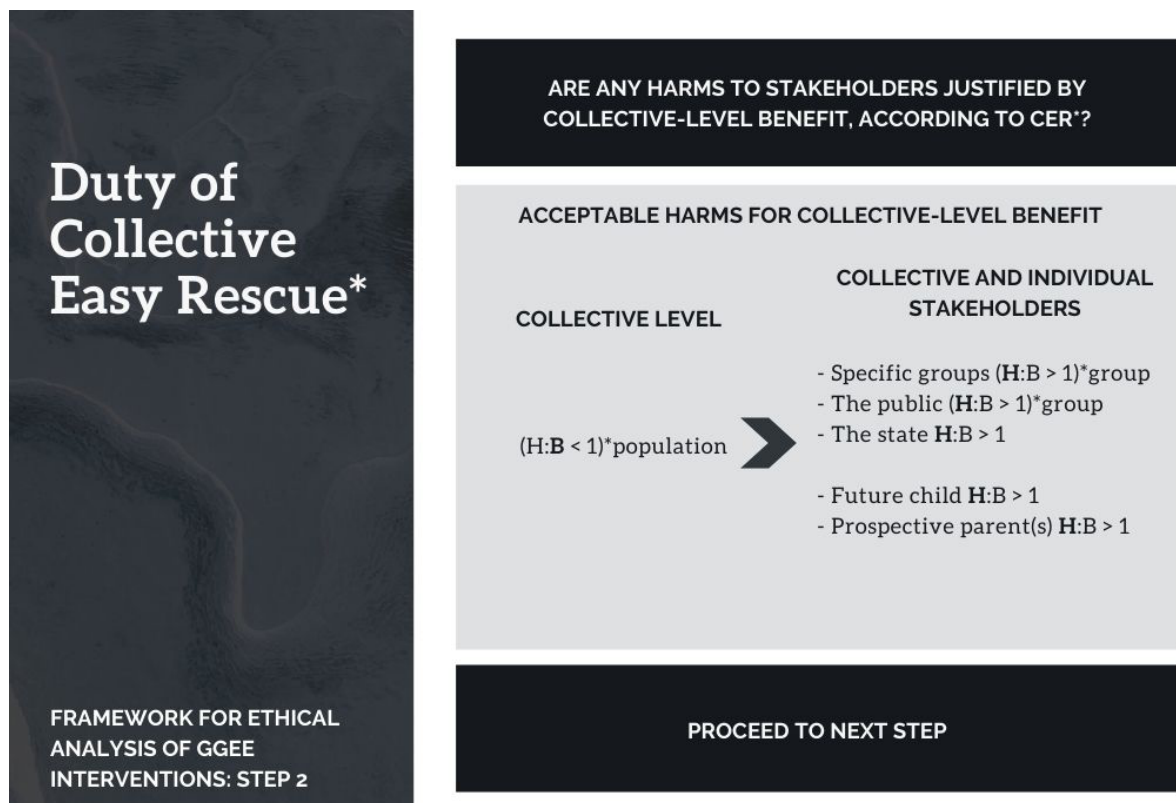


Figure 4: Assessing whether harms of implementing a GGEE intervention for particular groups or individuals are justified by a modified duty of collective easy rescue. The collective level must be benefitted, overall (that is, benefits B must be greater than harms H across the population), and any gross harms to stakeholders (H) must be acceptable according to CER*. This means both that net harm must be small in comparison to the collective-level net benefit produced, and that gross harm must be reasonably bearable in an absolute sense) in order for implementing the GGEE intervention under the middle-ground policy to be ethically acceptable.

The figure aims to present a weighing process. In order for a particular GGEE intervention to be acceptable, first, the net benefit (expressed as $H:B < 1$) for the collective level must be significant compared to net harms (expressed as $H:B > 1$) imposed on any stakeholder. Performing this set of pairwise comparisons between all combinations individuals and groups is the comparative part of CER. Second, gross harms must be reasonably bearable. This is the absolute part of CER. A plausible reformulation (derived from Peter Singer's proposed duty of easy rescue²⁷⁹) states:

²⁷⁹ Peter Singer, "Famine, Affluence, and Morality," *Philosophy & Public Affairs* 1, no. 3 (1972): 229-243.

CER: 'If the cost (including foreseeable risk of significant disability or death) to someone of performing an action X (or of refraining from performing an action Y) is sufficiently small to be reasonably bearable, and the resulting benefit to other people (or harm that is prevented) is large relative to the cost, then the agent ought to do X (or not do Y).'²⁸⁰

In this form, whether a cost is reasonably bearable is considered only on the individual level. I explain the advantage of an addition to this formulation below.

The duty was originally considered as a justification for coercive measures that *impose* harms on a group, where those measures that enforce an existing duty are better justified than those measures that do not enforce fulfilment of a duty to the collective. I use it here to consider the acceptability of implementing a particular GGEE intervention, in this case via the middle-ground policy assumed in analysis thus far, which does not in all cases *impose* harms, but merely allows them to be taken on. I hold that GGEE is permissible when the intervention's implementation enables groups or individuals to fulfil a duty of easy rescue.²⁸¹ My altered form considers comparative net benefit and harm, and absolute reasonable bearability of gross harms both to individuals and to groups. It is termed CER*:

CER*: If the cost (including foreseeable risk of significant disability or death) to someone *or a group of people* of performing an action X (or of refraining from performing an action Y) is sufficiently small, *individually and for the group as a whole*, to be reasonably bearable, and the resulting benefit to other people (or harm that is prevented) is large relative to the cost, then the agent ought to do X (or not do Y).

²⁸⁰ Giubilini et al., "Quarantine, Isolation and the Duty of Easy Rescue in Public Health." Quote at 186.

²⁸¹ States' responsibilities to enable members of the public to fulfil duties to others is a familiar idea in the governance of collective goods. For more, see: Hardin, "The Tragedy of the Commons"; Ostrom, *Governing the Commons: The Evolution of Institutions for Collective Action*.

Applying CER*, we accept interventions that allow a group or individual to fulfil their duty to take on a net harm that is small in comparison to the benefit it produces. This applies if and only if the gross harm is reasonably bearable, both for them individually, and for the group as a whole, as a side-constraint²⁸² on the weighing process.

Advantages of my formulation of the duty

This form of CER* avoids two possible problems with previous formulations.

First, a purely comparative formulation of CER may demand an agent take on too large harms, where these are the cost for massive benefits. Rather, CER* proposes both absolute measures of harm, and comparative measures of harm in exchange for benefit.

CER* builds on CER further, by requiring the gross harm/cost to the *group as a whole* as well as individual members to be reasonably bearable. Without this addition, the duty may demand unacceptably large sacrifices of a group, if the cost of acting for *each individual member of that group* is small.²⁸³ Whilst it is not immediately clear how costs that are bearable for each member of a group could be unbearable for the group as a whole, I can explain it via the aggregation of actions. Whilst the cost of one act to one person may be small, in some cases, we cannot merely multiply this cost by the number of acts, because when that number of acts is performed, there are unexpected costly effects. For example, consider a GGEE intervention that eliminates a group of people who share a valued culture—say, neurodiverse people on the autism spectrum. As this neurodiverse culture is associated with having autism spectrum disorder (ASD), members of the group may impose costs on the public to support them. It may, then, benefit the public to eliminate ASD in future people. Assume that being

²⁸² Note that the reasonable bearability consideration may be counted either as a *part* of the weighing system, or as a side-constraint on it, that does not actually enter the weighing process, and cannot be outweighed by other factors. It is in this latter sense that I intend to include the reasonable bearability consideration, which cannot be outweighed by any amount of collective-level benefit. For further discussion of side-constraints, see: John Broome, "Discounting the Future," *Philosophy & Public Affairs* 23, no. 2 (1994): 128-156.

²⁸³ I am indebted to Thomas Douglas for the identification of this potential problem with the collective duty of easy rescue.

born neurotypical constitutes, however, a small cost to many of the people who would, without GGEE, have been members of the neurodiverse community, and would have highly valued their community. This type of overall cost is plausible, because there may be cases where a future child is slightly benefited by not having ASD, but overall worse off, because of how valuable participation in this neurodiverse culture would have been for them.

If the support costs of ASD to the public are high enough, some formulations of CER would hold the intervention should be implemented, to allow the group of future people who would otherwise be born on the spectrum to fulfil a duty to the collective more broadly. However, if enough prospective parents pursue the intervention in line with this duty, a valued neurodiverse culture may be entirely eliminated in the next generation, posing a harm that is not reasonably bearable to the neurodiverse community as a whole. The elimination of a culture is an unexpected, large cost that is not predictable simply by multiplying the cost for individuals of not being born on the spectrum. It is only by considering the costs to the group of *people on the spectrum as a whole* as well as individually—as CER* requires—that we realise full cost of implementing the GGEE intervention. Whilst this will not be relevant in all cases, it may apply in cases like the ASD one, wherein there is a valuable good (neurodiverse culture) whose existence is threatened via numerous individual actions of undertaking GGEE for individual children, in a way that must be anticipated by the weighing system and its side-constraints.²⁸⁴

The second problem that CER* avoids is one that befalls some formulations of the duty that are too absolute. These may fail to defend a duty for an individual or group to take on quite large harms, even where the benefits to the collective are *much, much* larger. CER* avoid this problem by combining comparative and absolute formulations. Consider a GGEE

²⁸⁴ Elizabeth Kahn uses examples relating to biodiversity and the extinction of species in her examination of these problems. For further discussion, see her: "The Tragedy of the Commons as an Essentially Aggregative Harm," *Journal of Applied Philosophy* 31, no. 3 (2014), 226.

intervention that massively benefits the collective—perhaps an incentivised moral enhancement that renders everyone more empathetic. Let us say that undertaking this intervention poses a significant harm to the prospective mother, because whilst she benefits from the incentive, she would not otherwise have had *in vitro* fertilisation (IVF). Now that IVF is mandatory as a part of undertaking GGEE, her body will be invaded through the procedure, and she will undergo ovarian hyperstimulation when she otherwise would not have. This harm may be *absolutely* significant, but still reasonably bearable, but it may also be *comparatively* insignificant when it produces a large enough collective benefit. That might occur by the woman’s future child contributing to a morally enhanced collective that, *ex hypothesi*, will do massive amounts of good in the world. We may say, then, that the prospective mother at least has a moral duty to undertake the intervention. (Although, that does not necessarily imply that she should be coerced into fulfilling that duty, as the harms of undertaking forced IVF may be much larger for a prospective mother if they do not come with an incentive and are enforced upon her.) CER* accounts for these cases.

Solving difficult cases using the modified duty

When applying CER* as part of Step 2, there may be two types of difficult cases, which I address here.

The first difficult case occurs where comparatively large sacrifices would have to be shouldered by members of a group who *do not* undertake GGEE. Consider that when individual members of a specific group decide to undertake a GGEE intervention in fulfilment of CER*, they may impose comparatively large costs on other individual members of that group (though, necessarily not on the group as a whole, if CER* applies). Perhaps this would happen by some individuals’ use of GGEE altering the group’s future population size (as in the loss of ASD community and culture case discussed above). Whilst the side-constraint regarding gross harm remains firm, consider too that the individuals having these

harms imposed on them might be compensated, to reduce the net harm of comparatively large harms. This should not be a controversial way of getting around the first type of difficult case where there is significant but reasonably bearable harm. Compensation is a common way of reducing net harm in research ethics. For example, research participants in some challenge studies sometimes are significantly harmed by exposure to infectious diseases, for vaccine development. Although they can cause significant harm to individuals,²⁸⁵ challenge trials may produce extremely large benefits to populations for whom the serious disease can then be prevented.²⁸⁶ Such research is deemed *permissible* where the participants are compensated adequately for any *actual* harms that arise, and where there is adequate collective-level benefit expected to be produced because of the trial and where the harms are still reasonably bearable. Compensation may also be appropriate to reduce the net harms of quarantine and isolation public health measures.²⁸⁷ Where compensation is not possible for comparatively large harms of a GGEE intervention, then the intervention ought not be implemented if this means the collective net benefit is not large enough in comparison to those large harms. This outcome is in-keeping with CER*, as those considering doing X or not doing Y are required to consider harms *to each member* of the specific group.

As a second difficult case, consider harms of GGEE at the individual level. In the usual case, prospective parents have a duty to undertake a collectively beneficial GGEE intervention where net harm to them is comparatively small and gross harm reasonably bearable. They may also wish to undertake larger harms, to act altruistically, producing

²⁸⁵ I assume, here, that one can still be harmed by interventions that one consents to. This may be a controversial claim, because it assumes an objective theory of wellbeing, wherein wellbeing is not merely the fulfilment of one's desires. This aligns with the account of flourishing that I use to develop the idea of interests. It is necessary for states to take this perspective in policymaking, due to the impracticalities of asking every member of the public what they want. It also seems defensible considering how many (basic) interests and goals people seem to share.

²⁸⁶ Miller and Grady, "The Ethical Challenge of Infection-Inducing Challenge Experiments."

²⁸⁷ Giubilini et al., "Quarantine, Isolation and the Duty of Easy Rescue in Public Health."

benefit at the collective level. However, parents should not be helped (through the permitting of certain GGEE interventions) to ‘altruistically’ impose gross harms that are not reasonably bearable on their children or net harms that are too large in comparison to the collective net benefit. A future individual child is a stakeholder who cannot consent to take on significant harms, and therefore cannot themselves make the decision to behave altruistically. Yet they may end up having not reasonably bearable harms imposed on them by parents wishing to benefit the collective, if this is not guarded against in ethical analysis.²⁸⁸ CER* does not defend a duty in such cases. If states were to allow or even incentivise (as the middle-ground policy under consideration may do) parents to undertake GGEE interventions that pose potential unreasonably bearable harm to their future child, this would violate the side-constraint of CER, and would also encourage the violation of their special duties toward their children, which may arise by their causing child to exist.²⁸⁹ GGEE interventions that pose these harms to future children are impermissible.

At the end of Step 2, the potential magnitude and some of the distribution of consequences of implementing a specific GGEE intervention have been assessed. This can then inform a judgement of the fair distribution of those harms and benefits according to existing levels of advantage and disadvantage in the society considering implementing the intervention.

²⁸⁸ Note that prospective parents’ duties toward their children may prevent them from volunteering their future child for this demanding sacrifice. See: Elizabeth Brake and Joseph Millum, "Parenthood and Procreation," in *The Stanford Encyclopedia of Philosophy*, ed. Edward N Zalta (Spring 2018), accessed December 1, 2020. <https://plato.stanford.edu/entries/parenthood/>. However, it may be the case that parents can appropriately take on *small* harms on behalf of their children, acting in accordance with the principle of procreative altruism, where this is appropriately weighed against individualist principles of procreation (see Douglas and Devolder, "Procreative Altruism: Beyond Individualism in Reproductive Selection").

²⁸⁹ David Archard, "The Obligations and Responsibilities of Parenthood," in *Procreation and Parenthood: The Ethics of Bearing and Rearing Children*, ed. David Archard and David Benatar (Oxford: Clarendon Press, 2010).

III

Does implementing the GGEE intervention using the middle-ground policy fulfil
the requirements of distributive justice?

Distributing harms and benefits of GGEE across groups and individuals is a prominent issue in the enhancement literature. This is particularly the case where it is claimed that some enhancements could result in the emergence of new genetic classes, or the exacerbation of existing unfair inequalities.²⁹⁰ This step of analysis aims to determine whether a middle-ground policy for implementing a GGEE intervention acceptably distributes harms and benefits when taking into account (and trying to reduce) existing unfair advantage and disadvantage in the society in question.

One of the virtues of my public health framing of GGEE interventions is that many of the interventions whose harms and benefits are intrinsically unfairly distributed are already rejected by the CPH framework at this point in analysis. This is because interventions with unfair distributions of harms and benefits are often also less likely to produce collective-level net benefit. For example, consider GGEE interventions that are available on a regulated market and that provide individuals with positional benefits—that is, with benefits that are only valuable relative to the disadvantage that they produce for others. Height enhancements are positionally good, at least to the extent that being taller is advantageous only *compared to others* in finding jobs and partners.²⁹¹ The disadvantage of being rendered comparatively short by others' enhanced height may be particularly serious for those who already struggle in

²⁹⁰ Maxwell Mehlman, *The Price of Perfection: Individualism and Society in the Era of Biomedical Enhancement* (Baltimore: Johns Hopkins University Press, 2009); Giubilini and Minerva, "Enhancing Equality"; Baylis, *Altered Inheritance: CRISPR and the Ethics of Human Genome Editing*.

²⁹¹ Gyngell and Douglas, "Stocking the Genetic Supermarket: Reproductive Genetic Technologies and Collective Action Problems." Of course, being tall may have some absolute benefits as well, perhaps running faster and climbing better. However, these skills are no longer useful in and of themselves for most people, and the main advantage of height (for men) is likely to be the positional good discussed.

competitive settings where height is an advantage, and whose families, if they have also experienced these disadvantages, may be less able to afford the enhancement. Such people may be disadvantaged in competition for employment and for partners. The benefits of this enhancement fall on an enhanced individual who was already better off than others and can afford the enhancement, then, and the greatest harms are imposed on those who are already worse off. This distribution would be counted unfair according to some accounts of distributive justice (including the account I introduced in the previous chapter). Yet, without even considering distributive justice, this enhancement would have already been deemed impermissible according to my CPH framework. It does not plausibly cause collective-level net benefit, because the benefit it produces for a height-enhanced individual is positional in nature; benefiting the individual disadvantages everyone else. Thus, many positional goods-type enhancements are not appropriately considered as a collective-oriented public health measures to begin with. (This will not hold for those enhancements that, in addition to providing positional benefit, also have significant intrinsic value. This may include some cognitive enhancements.)

As a second advantage, the CPH framework also already accepts, so far, those interventions that would distribute harms and benefits fairly. Many of the types of interventions that will pose collective benefit—and, thus, are appropriately considered as population-oriented public health measures—are those that promote public goods. Public goods-producing interventions confer non-excludable benefit within a jurisdiction. For example, herd immunity might be produced or maintained via genetic immunisation as a GGEE intervention. Involving genetic modification that renders an individual immune to a certain infectious disease, this enhancement, if widespread in a population, protects all members of the population, whether immune or not, from the spread of an infectious disease.

Distributive justice according to sufficiency-constrained prioritarianism

Distributive justice issues may remain, however, with some enhancements that provide non-positional benefits to an individual or group. In such cases, this step is necessary for determining the permissibility of implementing the GGEE intervention. As with previous steps, I draw on the collective-oriented area of PHE for moral principles and concepts—in this case, the Sufficiency-Constrained Prioritarian account of distributive justice (SCP).²⁹² The account was first considered (among other sufficientarian hybrids) by Paula Casal, as introduced in Chapter 4, earlier. This account can be applied by the state considering implementing GGEE, with less public participation necessary in this step of analysis than the previous two. SCP is simply applied, based on the information about interests and consequences previously gathered via public participation.

Recall the requirement and preference that are each expressed via SCP:

SCP Requirement: Individuals/groups must be distributed harms in a way that minimises harms to people whose level of wellbeing is below a particular critical threshold level, and particularly the worst off among them.

SCP Preference: Individuals/groups ought to be distributed benefits in a way that maximises the number of people whose level of wellbeing is above a particular critical threshold level, and benefits should particularly befall the worst off among them.

The way I employ it, SCP does not limit the better off from benefiting from enhancements, even when this means that the very worst off are not benefited. But, it does prefer alternatives. What the proposed intervention *must not do* is harm the worst off or those

²⁹² Casal, "Why Sufficiency Is Not Enough."

below a threshold level of wellbeing. The distinction between distributing harms (by requirement) and benefits (by preference) is defensible on the basis that distributive justice may have one of two aims. First, it may impose certain minimum requirements that should be fulfilled, in order for distribution to be fair. Second, it may dictate how distribution can be better, beyond those minimum requirements. Following Karl Popper and other theorists, I hold that where justice is concerned, there limited ‘symmetry between suffering and happiness.’²⁹³ Therefore, minimum requirements for distributive justice may relate to the distribution of harms; an intervention that distributes harms so as to befall the worst off is unfair. However, when it comes to benefits, their distribution constitutes merely an additional preference, such that a weaker form of SCP is appropriate. Whilst there may be reason to prefer an alternative way of distributing benefits such that they befall the worst off, a policy may still be acceptable that benefits better off people. Whether the middle-ground policy option fulfils these requirements in harm distribution, and is preferable in its benefit distribution, can be determined by applying SCP in the following way (Figure 5).

²⁹³ Karl Popper, *The Open Society and Its Enemies*, Revised Edition (Princeton: Princeton University Press, 2020), 570-571.

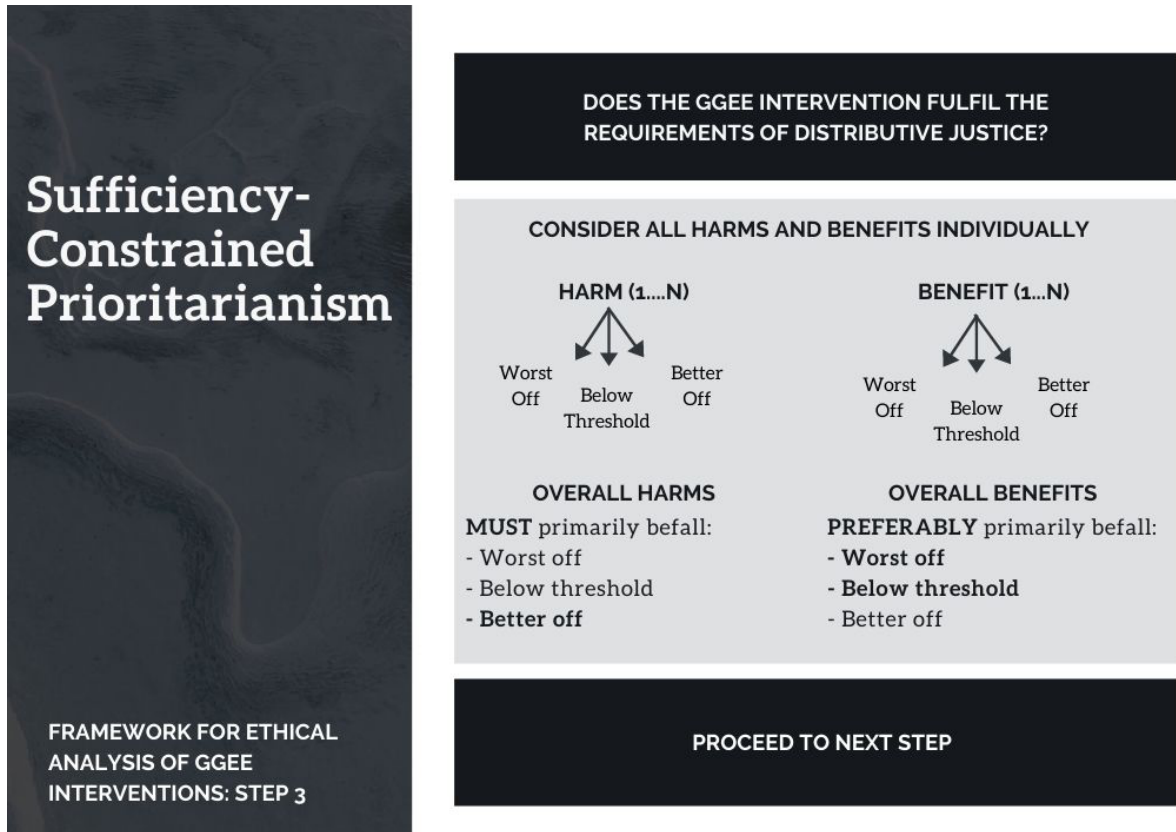


Figure 5: Sufficiency-constrained prioritarianism as applied to consider the permissibility of a prospective GGEE intervention under the middle-ground policy. Each harm is considered separately in terms of which category of people it befalls, and then harms are aggregated to see where they primarily fall. Harms must primarily befall the better off according to SCP, as a minimum requirement. The process is repeated for benefits, and SCP gives reason to prefer when benefits primarily befall the worst off and/or those below the threshold level of wellbeing.

As the figure shows, each harm and benefit of the GGEE in question (identified in Step 2), must be assessed in turn. Harms and benefits can be categorised as befalling either the worst-off members of society (those *furthest* below the threshold), all those below the threshold, or the better off (those above the threshold already). Some harms or benefits may befall people in these categories equally.

The line itself between the better-off and the worse-off, the threshold critical to the sufficientarian part of the account, must be to some extent an arbitrary line. It is difficult to set such a measure, but using the chosen metric of WELLBYs may help. Using WELLBYs, we can determine not only how much harm or benefit in wellbeing terms befalls individuals

or groups from the implementation of a GGEE intervention, but also whether those people fall above or below the threshold level of WELLBYs and the implications for distributive justice. The average life satisfaction score in the United States (US) is 7 on a 0-10 scale, as mentioned in the previous chapter. Most critical thresholds set for sufficientarian purposes are intended to express a level of having ‘enough’. In high-income countries with comparatively high levels of wellbeing like the US, what is ‘enough’ may be less than the average life satisfaction rating in the population. Thus, whilst still falling prone to some amount of arbitrariness,²⁹⁴ we might set the critical threshold at 6 WELLBYs. This level has two benefits. First, it falls around the middle of the 0-10 life satisfaction scale, thereby seeming to represent some medium level of wellbeing. Second, it sits a reasonable level below the average in high-income countries, thereby seeming more accurate in terms of what we usually consider enough and the proportion of people who have ‘enough’ in these populations. To work this out on a population scale, proxies like income and household wealth that roughly correlate with life satisfaction²⁹⁵ may be useful, at least where data on life satisfaction is only available on the individual level or not widely available at all. In that case, we might expect that most people with an income level below USD20,000 in a country like the US would fall below the critical threshold.²⁹⁶

At this point, each individual harm_(1...n) as a loss of WELLBYs and each individual benefit_(1...n) as a gain in WELLBYs has been considered. Next, we can determine whom they

²⁹⁴ Casal, "Why Sufficiency Is Not Enough," 312-313.

²⁹⁵ Frank Clemente and William J. Sauer, "Life Satisfaction in the United States," *Social Forces* 54, no. 3 (1976): 621-631; Roberto Fernandez and Jane Kulik, "A Multilevel Model of Life Satisfaction: Effects of Individual Characteristics and Neighborhood Composition," *American Sociological Review* 46, no. 6 (1981): 840-850; Max Roser, "Self-Reported Life Satisfaction Across the Income Distribution, Country by Country," *Our World in Data* (2017), accessed February 2, 2022. <https://ourworldindata.org/happiness-and-life-satisfaction>.

²⁹⁶ The data correlating life satisfaction and income is inadequate to supply these numbers with certainty, but following the trends available, the numbers are plausible, based on: Roser, "Self-Reported Life Satisfaction Across the Income Distribution, Country by Country." The trend is highly dependent on the country in question, where a lower income in lower and middle-income countries is needed to reach the critical threshold.

befall among the categories. When these results are aggregated on a population scale, it can be determined where harms primarily fall and where primarily benefits fall. The lower part of Figure 5, above, represents the requirements for where harms and benefits primarily fall, by the bolded option in each case.

First, consider distribution of harms as imposing a minimum requirement of distributive justice. As mentioned earlier, SCP requires that, overall, the harms of a GGEE intervention implemented under the given policy not befall those below the threshold. It also requires they not befall people who are just above the threshold, but for whom these harms would push them below it. In particular, the harms must not befall the worst off, according to SCP.

Second, consider benefits. The distribution of benefits is not a requirement as such, but will determine whether a distribution is preferable *when compared to others*.²⁹⁷ SCP prefers that, overall, these benefits befall those with life satisfaction below 6 WELLBYs (as the sufficientarian part demands), and within that range, primarily with the worst off (as the prioritarian part demands).

If a GGEE intervention fulfils the harm distribution requirements of SCP, then it is permissible insofar distributive justice is concerned. If it fulfils the optimal benefit distribution, all the better. But if not, it may still be permissible, only not necessarily preferable to alternative policies that might alter benefit distribution whilst still distributing the harms as required.

Failures to fulfil requirements of distributive justice

There are three ways that GGEE interventions might fail to fulfil the requirement and preference articulated via SCP.

²⁹⁷ As such, considering benefit distribution is not immediately necessary in Step 3, as only the one policy for distributing the benefits of a GGEE intervention, that is, the middle-ground policy, is being considered. However, following Step 4, other alternative policies are considered in comparison to the middle-ground policy by running them through Steps 1-3. Thus, considering the benefit distribution is relevant.

First, interventions may primarily impose harms, as WELLBYs losses, on the worse off—those who rate their life satisfaction below the 6 WELLBYs threshold already. The GGEE intervention as implemented under that policy is impermissible; however, it may be that an alternative policy for implementing the intervention redistributes the harms appropriately, as considered in Step 4.

Second, an intervention may primarily confer benefits on the better off. This is not preferable in distributive justice terms. However, it is acceptable, if there are no alternatives that better distribute benefits.

Finally, GGEE interventions may have either harms or benefits befalling the worse off and better off equally in several ways. For instance, a GGEE intervention may impose harms equally among the categories, whilst primarily benefitting the worst off and those below the threshold, or may impose harms on the better off, whilst conferring benefits equally among the categories. Both cases are permissible, according to SCP, *if and only if* the harms imposed on the worst off are counteracted by the benefits conferred on them, such that they are not, overall, harmed by the implementation of a GGEE policy.²⁹⁸

At the end of this step, we know whether the implementing the GGEE intervention in question using a middle-ground policy for implementation fulfils the requirements of distributive justice.

²⁹⁸ Note that, regardless of where initial harms and benefits fall when a policy is initially being considered for implementation, these effects may even out over generations. As a GGEE intervention becomes more widespread in a population, it may cross these lines of the better off and worse off, and either side of the wellbeing threshold, simply via the procreative choices of those who have received the enhancement.

IV

Iterative process for comparison of alternative policies for implementing a GGEE intervention

Before concluding that a given GGEE intervention should be implemented according to the middle-ground policy, this final step assesses policy alternatives. By changing how GGEE is implemented, we may find that collective-level net benefit is maximised, or that a fairer distribution of the harms and benefits of GGEE is achievable under an alternative policy. Less coercive policies, for instance, may better promote prospective parents' interests in their reproductive autonomy. Promoting reproductive autonomy on a large scale may maximise benefit. Then again, more coercive policies may better secure collective-level benefits like the maintenance of public goods.

Figure 6 describes the comparison between policy alternatives, according to an iterative process, which involves assessing the alternative policies for implementing a GGEE intervention, using Steps 1-3 of the CPH framework:

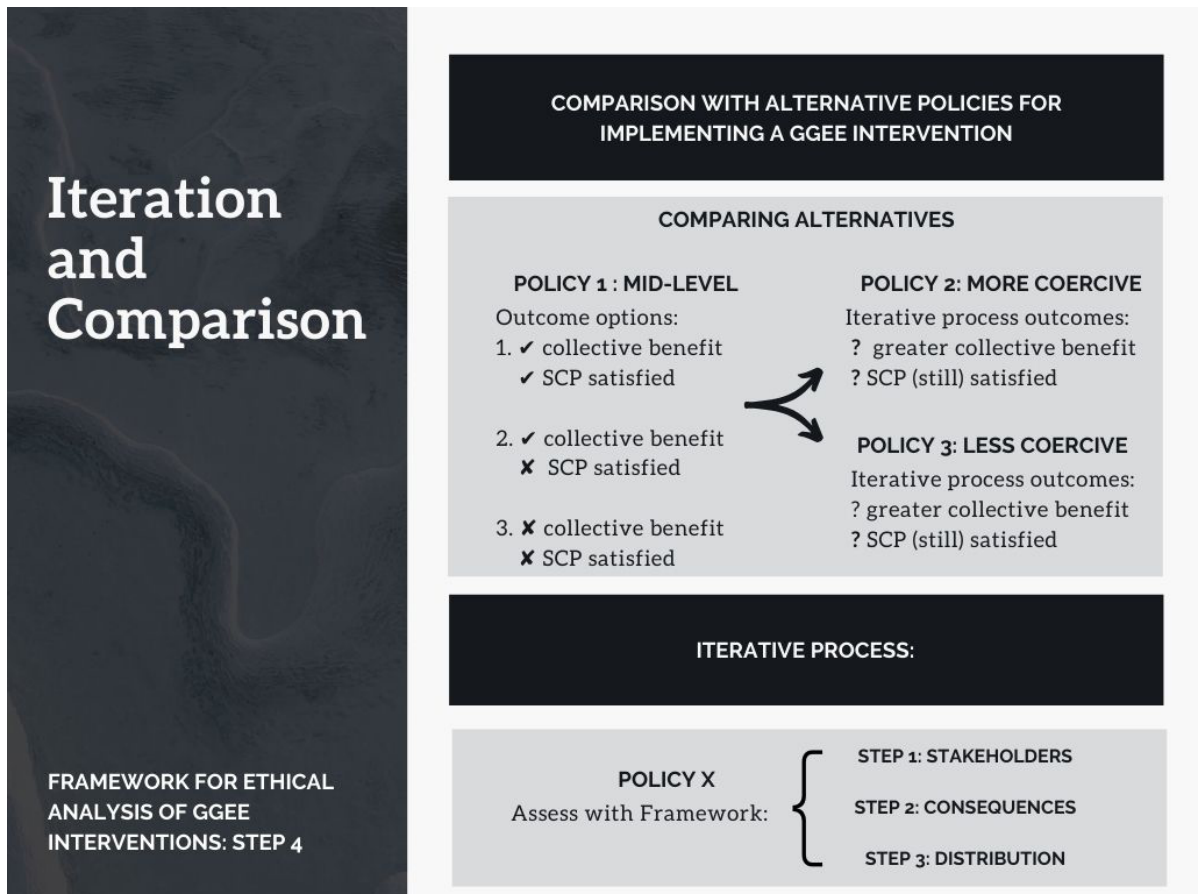


Figure 6: Comparing a middle-ground policy to more or less coercive alternatives, by considering them iteratively, using Steps 1-3 of the CPH framework. The preferable policy is determined via considering which produces the most benefit with acceptable level of harm to stakeholders, and which produces the best distribution of benefit (with acceptable distribution of harms).

Assuming the middle-ground policy considered thus far in the framework is Policy 1, the state policymakers know three things at this point. They know, 1) whether implementing the GGEE intervention provides adequate benefit to the collective or not, 2) whether it has justifiable harms, and 3) whether it results in appropriately distributed harms and benefits according to SCP.

Policy 1 is only acceptable overall if it has acceptable consequences, distributed acceptably (employing only the minimum standard of harm distribution under SCP). If it does not provide adequate benefit, an alternative policy may better secure these benefits; if it does not fulfil the harm distribution requirements of SCP, an alternative policy may yet fulfil these

requirements. Hence, a comparison is needed, with alternative policy options that are more or less coercive, represented by Policies 2 and 3 in Figure 6. Where a policy alternative benefits the collective more, imposes better justified harms, or fulfils the requirements of SCP whilst also resulting in a preferable distribution of benefits, it is preferable to Policy 1. This is determined via the iterative process. Policy X for implementing the same GGEE intervention is assessed using the framework's Steps 1-3.

Any GGEE intervention that either does not produce comparatively significant collective-level benefits with reasonably bearable harms, or does not fulfil the requirements of SCP under any policy alternative is impermissible. Such GGEE interventions ought not be implemented by states.

Illustrations of the iterative process

To illustrate why considering policy alternatives is necessary, consider IQ-increasing cognitive enhancement that, if implemented more coercively, would better maximise benefits to the collective. In this case, net collective-level benefit is produced only where cognitive enhancement is not so widespread as to significantly reduce cognitive diversity in the population.²⁹⁹ If almost everyone in a population is 'IQ-intelligent', but there are few people with creative intelligence, the benefits of cognitive enhancement for that population are reduced. To ensure the desired level of uptake, more coercive implementation of cognitive enhancement may be necessary compared to the middle-ground proposed policy. It may maximise benefits to disincentivise IQ-increasing cognitive enhancement beyond the threshold proportion of the population after which the harms of cognitive diversity loss become significant. I investigate this policy as applied to a similar case—memory

²⁹⁹ That is, the various types of intelligence in a population. For further discussion on preserving cognitive diversity, see: Jonathan Anomaly, Chris Gyngell, and Julian Savulescu, "Great Minds Think Different: Preserving Cognitive Diversity in an Age of Gene Editing," *Bioethics* 34 (2020): 81-89.

enhancement—in Chapter 8. This applies equally to other GGEE interventions where net benefit is increased by implementing the intervention a certain way. However, due to the coercive nature of such interventions, we may see a similar or greater loss in WELLBYs from those being coerced to undertake the intervention or prevented from undertaking it, for whom this burden may not be reasonably bearable.

Furthermore, an alternative policy may be preferable because it results in a just distribution of harms where the original policy did not, or because it results in a preferable distribution of benefits, where both alternatives justly distribute harms. Where an alternative policy avoids concerns with the original policy's distribution of harms, this is a more important factor than maximising net benefit, if the alternative policy also provides less benefit. For example, ensuring a just distribution of harms according to SCP may require implementing the IQ-increasing cognitive enhancement, say, in a more coercive way. Consider the outcomes of a policy providing equal, subsidised access to IQ-increasing cognitive enhancement. This enhancement may primarily benefit the better off in, say, improving their chances on the job market for high-power jobs. It may also impose costs primarily on the worst off, by disadvantaging them in a competitive job market. In that case, an alternative policy for implementing cognitive enhancement might be better, if it restricts access to cognitive enhancement for the better off, instead only offering it to the worst off.³⁰⁰ If this distribution of harms fulfils the requirements of SCP, and the distribution of benefits is preferable, then the policy alternative may be better.

Finally, one of the most salient moral considerations that may arise when considering, in particular, more coercive policies, is infringement of bodily integrity and/or autonomy.

³⁰⁰ This possibility is discussed further in Giubilini and Minerva, "Enhancing Equality."

Where alternative policies are preferable in maximising benefit or better fulfilling the requirements of distributive justice, and these are more coercive, we must also consider countervailing harms of such policies, relating to infringements. Consider if the chosen policy for IQ-increasing cognitive enhancement not only prevented the better off from accessing the GGEE intervention, but also made its use mandatory for those below a threshold level of wellbeing. Mandatory policies impose penalties for non-compliance, essentially removing feasible options for prospective mothers who are below the threshold level of wellbeing to refuse to have IVF as a part of GGEE. This constitutes an infringement of the mother's bodily autonomy, or the right not to have one's body interfered with without one's consent.³⁰¹ Harms to prospective mothers via the infringement of their bodily autonomy may outweigh the additional benefits of a coercive memory enhancement policy. In cases like this one, the distribution or magnitude of WELLBYs losses arising from the infringement of bodily autonomy may also be unacceptable, as the infringement harms fall primarily on the worst off and below-threshold prospective mothers, or if they impose a burden that is not reasonably bearable.

At the end of this step, the most ethically preferable policy for implementing the GGEE intervention in question is identified, according to its maximising benefit to the collective, and fulfilling the requirements and preferences of distributive justice.

Conclusion

Here, I have presented the core element of my thesis: a Collectivist Public Health framework for ethical analysis of GGEE interventions. I wish to conclude with a reminder

³⁰¹ Jonathan Herring and Jesse Wall, "The Nature and Significance of the Right to Bodily Integrity," *The Cambridge Law Journal* 76, no. 3 (2017): 568.

of why this detailed process, concerning stakeholders, consequences, distributive justice and an iterative process is needed. The motivation for the framework and the contributions it makes are listed in Summary Box 5.

Summary Box

Framework for Ethical Analysis of GGEE Interventions	
MOTIVATIONS	CONTRIBUTIONS
<ul style="list-style-type: none"> - Need for more collective-level ethical analysis of enhancements - Need for divisions of collective that acknowledge tensions between interests affected by enhancements - Unexplored parallel between collective-oriented enhancement and collective-oriented public health - Calls for frameworks for analysing various specific enhancements 	<ul style="list-style-type: none"> - Development of framework applying collective-considering moral concepts and principles - Development of new tripartite collective-level stakeholder division - Exploration of appropriateness of some GGEE interventions framed as public health measures - Proposal of framework for analysing specific GGEE interventions individually
OUTCOME: Novel collectivist ethical framework for assessing the permissibility of implementing GGEE interventions as public health measures	

Summary Box 5: The CPH framework is motivated by gaps in the enhancement debate, and provides contributions to it.

The CPH framework achieves its contribution goals by undertaking a thorough analysis. This involves, first, identification of stakeholders and their interests (Step 1). Second, stakeholders' interests inform an assessment of the consequences of a GGEE intervention and their justifiability according to CER* (Step 2). Third, the distribution of these harms and benefits is considered according to SCP (Step 3). Finally, in Step 4, alternative policies for implementing the GGEE intervention are compared to determine the ethically preferable option.

The framework offers a new, collective-oriented way of considering enhancements as potential future public health measures. In the following chapter (Chapter 6), I defend the framework against four significant objections. Afterwards, I apply it to both more and less paradigmatic cases of enhancement, including genetic immunisation and memory enhancement, in Chapters 7 and 8.

Chapter 6:

Addressing Objections

Introduction

In the previous chapter, I presented my CPH framework for intervention-specific ethical analysis of prospective human enhancements. Some readers may be uncomfortable with the implications of that framework. It implies that at least some relatively radical germline genome editing for enhancement (GGEE) interventions may permissibly be implemented by states as public health measures. The CPH framework does not categorically reject interventions that might bring to mind associations with ‘designer babies’, or a ‘yuck factor’ reaction.³⁰² For instance, imagine a GGEE intervention to give future people gills, enabling us to adapt to living underwater (thereby escaping inhospitable conditions on land, perhaps). Imagine it was implemented in such a way that it produced significant benefit for collective-level stakeholders, imposed no unreasonable harms, and distributed harms and benefits appropriately. According to my framework, it would be morally acceptable for a state to implement the intervention.

In this chapter, I acknowledge the reaction readers may have to examples like that above. In response, I defend the CPH framework against four key possible objections, each addressed in a separate section. These include:

³⁰² For more on ‘designer babies’ in the legal context, see: Tandice Ossareh, "Would You Like Blue Eyes With That? A Fundamental Right to Genetic Modification of Embryos," *Columbia Law Review* 117, no. 3 (2017): 729-766. For more on moral repugnance in the enhancement debate, see Joshua May, "Repugnance as Performance Error: The Role of Disgust in Bioethical Intuitions," in *The Ethics of Human Enhancement: Understanding The Debate*, ed. Stephen Clarke et al. (Oxford: Oxford University Press, 2016), 43-57; Doug McConnell and Jeanette Kennett, "Reasons, Reflection and Repugnance," in *The Ethics of Human Enhancement: Understanding The Debate*, ed. Stephen Clarke et al. (Oxford: Oxford University Press, 2016), 58-74.

1. GGEE either constitutes or will lead to eugenics through my CPH framework;
2. A consequentialist or interests-based framework cannot address deontological concerns, such as loss of human dignity via genetic modification;
3. To be treated like other public health interventions, GGEE must be funded according to resource allocation in public health, in which system it is unlikely to receive funding;
4. The CPH framework fails to answer pressing questions concerning distributive justice at an international or global level.

Each of these objections poses an important challenge to my CPH framework. Each is addressed here, in turn. By the end of this chapter, I will have either rebutted or accepted each of the objections.

I

Eugenics

Francis Galton coined the term ‘eugenics’ late in the 19th century. He defined it as the cultivation of human fitness or excellence. Galton observed that heritable traits run through the human gene pool, some of which may be more or less conducive to the development of certain human abilities. Yet Galton’s conception of traits that correlate with the development of important human abilities is held to have been elitist.³⁰³ Galton proposed ‘judicious mating’³⁰⁴ to ‘improve the inborn qualities of a race’.³⁰⁵ He wanted to see the increased reproduction of people whose genetic traits led them to success, and the decreased

³⁰³ John Jackson and Nadine Weidman, "The Origins of Scientific Racism," *The Journal of Blacks in Higher Education*, no. 50 (2005): 66-79.

³⁰⁴ Francis Galton, *Inquiries Into Human Faculty and Its Development* (New York: Macmillan, 1883), 24.

³⁰⁵ Francis Galton, "Eugenics: Its Definition, Scope and Aims," *The Sociological Review* 1, no. 1 (1904): 43-51.

reproduction of people whose traits might not serve those goals, thus constituting a threat to the quality of the human gene pool.³⁰⁶

In the early 20th century, eugenic programmes in the US forcibly sterilised people who were suspected of carrying genes for ‘mental defectiveness’ and ‘criminality’.³⁰⁷ The Nazi genocide of millions of Jewish people in WWII was also stimulated by eugenic goals to eliminate ‘inferior’ races and expand the Aryan race.³⁰⁸

Today, defendants of the core idea of improving the human gene pool tend to argue that both of these 20th century cases are examples of eugenics poorly defined and practiced.³⁰⁹ They argue that these programmes did not correctly identify un/desirable genetic traits, and that they equate an individual’s worth with the desirability of these genetic traits. Furthermore, the programmes had morally unacceptable elements including coercion, practices of sterilisation and murder, and the imposition of values by the state (amounting to totalitarianism). Eugenics does not have these characteristics by definition, and is therefore not morally unacceptable by definition, so it is claimed. Rather, it is a subset of eugenic programmes that involve vilification or discrimination on the basis of certain characteristics, and/or coercion,³¹⁰ or the infringement of fundamental individual liberties that is unacceptable.³¹¹ Eugenics is contingently wrong, then.

This perspective is initially appealing, but it may take an inappropriately a-historical view of eugenics, not acknowledging the reality that eugenics may be practiced this way again.

³⁰⁶ Karen Norrgard, "Human Testing, the Eugenics Movement, and IRBs," *Nature* 1, no. 1 (2008): 70.

³⁰⁷ Norrgard, "Human Testing, the Eugenics Movement, and IRBs."

³⁰⁸ Jackson and Weidman, "The Origins of Scientific Racism."

³⁰⁹ For example, see: Agar, *Liberal Eugenics: In Defence of Human Enhancement*; Nicholas Agar, "Why We Should Defend Gene Editing as Eugenics," *Cambridge Quarterly of Healthcare Ethics* 28, no. 1 (2019): 9-19; Anomaly, "Defending Eugenics: From Cryptic Choice to Conscious Selection"; Walter Veit et al., "Can ‘Eugenics’ be Defended?," *Monash Bioethics Review* 39, no. 1 (2021): 60-67.

³¹⁰ Wrong coercion as I define it is when there is inadequate ethical justification for coercive measures.

³¹¹ Anomaly, "Defending Eugenics: From Cryptic Choice to Conscious Selection"; Agar, "Why We Should Defend Gene Editing as Eugenics."

Indeed, under other views eugenics *necessarily or intrinsically* involves or will end up involving these unacceptable practices.³¹² It is, then, always wrong.

Although disagreement remains on whether eugenics is always wrong or only contingently so,³¹³ I will assume for now the view that eugenics is always wrong, a view which I will question later in the section.

Let me turn now, then, to the objection itself. It is that my CPH framework either already accepts or will lead to accepting eugenics. The objection has two possible strands contained within it:

Strand 1) claims that the framework presented here wrongly accepts eugenic practices, as it accepts estimates of value (in interest terms) associated with different human traits.

Strand 2) starts off by allowing that the framework only accepts GGEE interventions that do not constitute eugenics. However, the claim is that implementing these interventions *leads down a slippery slope* to accepting eugenics via GGEE.

Eugenics objection strand 1

First, let me introduce this strand of the objection and some background.

Robert Sparrow is one philosopher who has written extensively on the threat of a return to eugenics via GGEE, and who would likely object to the permissiveness of my framework on this basis.³¹⁴ He particularly takes aim at Nicholas Agar's 'new' or 'liberal' eugenics, as well as Julian Savulescu's and John Harris' work on genetic interventions, claiming that such work fails to differentiate itself from 20th century eugenic programmes. Thus, he seems to hold that all eugenics is wrong eugenics, in-keeping with the stronger, historically embedded view

³¹² Sparrow, "A Not-So-New Eugenics."; Dónal O'Mathúna, "Human Dignity in the Nazi Era: Implications for Contemporary Bioethics," *BMC Medical Ethics* 7 (2006), <https://doi.org/10.1186/1472-6939-7-2>.

³¹³ For an argument that the wrongs of eugenics are contingent and that it could be performed unproblematically, see Buchanan et al., *From Chance to Choice: Genetics and Justice*, 27-30.

³¹⁴ Robert Sparrow, "Liberalism and Eugenics," *Australasian Journal of Philosophy* 89, no. 3 (2011): 499-517; Robert Sparrow and Catherine Mills, "Genome Editing: From Bioethics to Biopolitics," *BioSocieties* (2021), <https://doi.org/10.1057/s41292-021-00229-5>.

I employ here. Agar claimed that by leaving the choice of traits using GGEE to parents, and by limiting the available interventions to those that are conducive to flourishing regardless of one's life plan, the new liberal eugenics would be unproblematic.³¹⁵

Sparrow counters that Agar's limits on liberal eugenics are ineffective as a differentiator from the old eugenics. Even if individual parents are left to decide about enhancements, we still leave room for wrongful coercion via parents being socially pressured. What's more, we may also still see claims concerning genetic traits' desirability that lead to discrimination, in line with the biases of societies that might be racist, homophobic or otherwise prejudiced. Francis Fukuyama takes Sparrow's argument even further. He foresees the eugenic pursuit of genetic goals by the state or privileged groups as creating genetic classes of slaves and masters. He asks, 'What will happen to political rights once we are able to, in effect, breed some people with saddles on their backs, and others with boots and spurs?'³¹⁶

Such philosophers may fear that a framework like mine condones eugenics, even when the policies being considered are not coercive. Social coercion may be at play, particularly in social contexts that already privilege some traits over others. For example, consider societies with racial discrimination, where certain race-related traits may be avoided via GGEE by parents who wish to save their children from being the targets of discrimination. Indeed, governments may wish to save future citizens from this harm, and implement GGEE policies that would reduce certain race-related traits in the population. Clearly, the perpetuation of racist values via genetic alteration is unacceptable, whether performed by individuals, according to social pressures, or via state implementation. The wrongness of state coercion in this context is more obviously wrong, but we may also hold that parents making this choice is wrong insofar as they perpetuate racist norms in a society (although perhaps this wrong might be outweighed by consideration for their child's interests if the

³¹⁵ Nicholas Agar, "Liberal Eugenics," *Public Affairs Quarterly* 12, no. 2 (1998): 137-155. Agar's initial work on the topic is further developed in Agar, *Liberal Eugenics: In Defence of Human Enhancement*.

³¹⁶ Fukuyama, *Our Posthuman Future: Consequences of the Biotechnology Revolution*, 10.

harm the child would suffer if they had that trait is extreme.) Perhaps my CPH framework would accept such eugenic GGEE interventions even more readily than Agar's liberal eugenics, because of its emphasis on the pursuit of collective-level—rather than individual—benefit.

Let me now respond to strand 1) of the eugenics objection. The objection rests on scepticism about there being, really, *any* way that eugenics could be practiced that might be acceptable. Sparrow thinks it is impossible to 'improve any of the list of desirable capacities we settle upon, without sacrificing others' without 'detailed empirical investigation of the diversity of actually existing life plans'.³¹⁷ That is, we cannot pursue some valued goals without undermining others, and decisions surrounding which goals to pursue, without empirical investigation, will likely fail to acknowledge the diversity of individual goals. They will, rather, impose a set of values constrained by the state's goals or views of its citizens wellbeing, which may be mistaken.

But I argue that the task is feasible, and likely effective, if we employ an ethical framework that only accepts GGEE interventions based on a process of decision-making including public participation to determine their value. That is, the CPH framework does find some enhancements permissible, and these may be defined into eugenics, but may not be morally wrong.

In Step 1 of the framework, specific groups and the public at large discuss and advocate for their interests and values concerning certain traits. Any threatened imposition of others' values or threat to the interests they identified in Step 1 is incorporated into analysis in Step 2. Step 2 holds that these sorts of harms to groups must be reasonably bearable according to a modified collective duty of easy rescue (CER*). They must be reasonably bearable both to

³¹⁷ Sparrow, "Liberalism and Eugenics," 508.

each specific at-risk group, and to each member of each group. As such, the imposition of a state's values is rendered much more difficult by the participatory system. There is more room for diversity and (collective) subjective valuations of various traits with public participation, as well. If a proposed enhancement involved the elimination of a certain valued trait, and this would harm individuals or a group more than is reasonably bearable, then pursuing the enhancement would not be acceptable. This means that attempts to eliminate groups that some consider inferior would be unacceptable: the harms to these people that would arise from eliminating these groups is unlikely to be reasonably bearable. Furthermore, there may be additional harms to the wider population if the group in question made valuable contributions to population-wide wellbeing. These outcomes are less likely to occur as unintended side-effects of pursuing enhancement due to the safeguard put in place by including these groups in deliberations on enhancement. It seems that with these safeguards in place, the kinds of changes to the human gene pool that GGEE would produce do not come with morally unacceptable methods or outcomes with which eugenics is usually associated. The view that eugenics is always wrong cannot hold.

Objectors may maintain that, certainly, GGEE lacks the problems associated with *breeding out* 'undesirable' traits, but that it may still be wrong to *breed in* traits in alignment with state-imposed or socially imposed values. This is the pursuit of positive eugenics—that is, breeding 'desirable' traits *into* a population instead of aiming to breed out 'undesirable' traits.³¹⁸ My CPH framework essentially relies on our collective judgement of existing and new traits to determine what is desirable, when we may cross a line into post-humanism, and whether this is an inappropriate genetic goal. Whilst standards may change, I hold that standard-change is acceptable, if those standards remain in line with what is conducive to a population's (and

³¹⁸ For more on the positive/negative distinction and the non/coercive distinction in eugenics, see Anomaly, "Defending Eugenics: From Cryptic Choice to Conscious Selection."

individuals?) flourishing.³¹⁹ Insofar as we remain able to make these judgements, genetic goals that are actually based on flourishing, and informed by structural public participation are not a negative outcome of implementing GGEE interventions.

If this is a type of eugenics, it seems acceptable. Sparrow's fear of collectively succumbing to social pressures or state-imposed values in the use of GGEE should be precluded by public participation (Step 1). Fukuyama's fear that we might breed in a genetic underclass is avoidable so long as we consider the interests of the groups of people who (and whose children) might become that underclass and consider the significant harms this represents to them (Step 2).

Eugenics objection strand 2

Let me now turn to strand 2) of the eugenics objection: that allowing some GGEE interventions might constitute acceptable eugenics, if Strand 1) objectors concede to my response, but it *will lead down a slippery slope* to unacceptable eugenics as practiced in the 20th century. I assume that objectors would think of this contingently unacceptable eugenics as liberal eugenicists do—that is, as involving involuntary sterilisation and other eugenic techniques, and/or the incorrect classification of genetic traits as un/desirable. It seems, then, that we can in fact distil Strand 2) of the eugenics objection down into two concerns with the bottom of the slippery slope, necessary and jointly sufficient to render the bottom of the slippery slope unacceptable. The first is infringement of individual liberties, and the second, pursuit of the wrong genetic goals.

³¹⁹ In some ways, this position follows Agar's defense of liberal eugenics, but with a basis of collective judgement and collective flourishing, rather than that of individual parents. For further discussion, see: Linda Barclay, "A Natural Alliance Against A Common Foe? Opponents of Enhancement and the Social Model of Disability," in *The Ethics of Human Enhancement: Understanding The Debate*, ed. Stephen Clarke et al. (Oxford: Oxford University Press, 2016): 75-86.

Slippery slope arguments³²⁰ can be addressed in one of three ways: by claiming that the end outcome of the slippery slope is, in fact, acceptable; by claiming that, whilst the end outcome may be bad, the costs of the end outcome are outweighed by other benefits; or by claiming that there are barriers such that the slope is, in fact, not so slippery after all.³²¹

A concern with slippery slopes leading to the infringement of individual liberties is one that has been effectively addressed in another debate: the euthanasia debate. In that area, a famous objection concerns the slip away from morally acceptable euthanasia, which involves allowing doctors to help patients to end their lives when they fulfil certain conditions, including having made the voluntary and informed decision to die. Proponents of the slippery slope objection claim that voluntary euthanasia will lead, eventually, to involuntary euthanasia, with doctors killing patients who do not wish to die.³²² If slippage is inevitable, then this renders even voluntary euthanasia unacceptable. In the euthanasia debate, the strategy of claiming that there are barriers to the slope is frequently employed. The slippery slope from a voluntary practice to an involuntary practice is in fact not so slippery, as long as there are measures in place that make voluntary informed consent to euthanasia a requirement for the practice to be accepted. In the euthanasia case, this is enshrined in the laws governing euthanasia (where it is permitted).³²³

In my two-pronged defence for my framework's acceptance of GGEE interventions, I claim, first, that the slope to wrongly coercive GGEE policy, and thus the infringement of individual liberties, is not so slippery. I argue this by again emphasising the requirement for harms to be reasonably bearable. This part is analogous to the response in the euthanasia

³²⁰ Note that here, I consider only a moral slippery slope argument, not the argument that the slope can get more slippery due to the political context in which it might be implemented. This political slipperiness remains a risk, but is outside my scope. I thank Jonathan Anomaly for raising this important point.

³²¹ Eugene Volokh, "The Mechanisms of the Slippery Slope," *Harvard Law Review* 116, no. 4 (2003): 1026-1037.

³²² David Benatar, "A Legal Right to Die: Responding to Slippery Slope and Abuse Arguments," *Current oncology* 18, no. 5 (2011): 206-207.

³²³ Luc Deliens and Gerrit van der Wal, "The Euthanasia Law in Belgium and the Netherlands," *The Lancet* 362, no. 9391 (2003): 1239-1240.

debate. In the second prong of my defence, I claim that in the remaining cases not prevented by reference to reasonable harms, the harms of liberty infringement via GGEE policy are acceptable because they are still reasonably bearable.

The defence of euthanasia does not apply in quite the same way to the GGEE case. Instead, two more GGEE-specific points of objection might be raised. First, unlike the euthanasia case, where individuals consent voluntarily to euthanasia on their own behalf, it is only the parents who can be asked to consent to undertake a GGEE intervention to affect the future child. Liberty infringements, then, might be more of a risk when it comes to those rights held in trust for future people.³²⁴ However, this lack of protection of the future child's liberties seems less problematic when we consider that the future child has no autonomy at the point when the decision must be made. Also, we might consider other cases where parents engage in substitute decision-making on behalf of their children, whilst the children lack capacity to consent. An additional layer of protection is put in place to protect future children, by the CPH framework requiring that GGEE interventions are not permitted where they would allow parents to 'altruistically' take on not reasonably bearable harms on their future child's behalf.³²⁵ Let us say, then, that the GGEE interventions the framework permits are still undertaken voluntarily by prospective parents and, by proxy, the future children. Whilst the framework does not explicitly state a requirement for voluntariness, it is assumed that the infringement of reproductive autonomy, especially on a population-scale, is so likely to constitute a level of harm that is not reasonably bearable, that policies to implement GGEE interventions in this way would never be acceptable. As such, these aspects of the framework act as barriers to the infringement of individual liberties by enforcing GGEE interventions in an old eugenics-like fashion.

³²⁴ For more on rights-in-trust, see Feinberg, "The Child's Right to an Open Future."

³²⁵ See Chapter 5, Section II for details.

A second concern with GGEE that doesn't apply as well to the euthanasia case may be that the process for identifying harms, including those associated with liberty infringements, is too vague. Reasonably bearable harms are considered justifiable in exchange for large benefit by the CPH framework. Where benefits are larger or more justly distributed under alternative, coercive policies for implementing GGEE, *and where the harms remain reasonably bearable*, then the policy is preferable. This leaves us with the concern that liberty infringements could be accepted by the framework, if they posed only reasonably bearable harms. This leads to the second part of my defence. If the harms are reasonably bearable, then the types of eugenics accepted (if still employing my framework) seem to only ever be the acceptable type. We have assumed up to this point that infringements of individual liberty are part of what makes some forms of eugenics unacceptable. However, we accept coercive policies in other areas of life. Most of us already accept coercive policies when it comes to quarantine, isolation, taxation, and other areas without considering ourselves wronged. The analogue up to this point, euthanasia, may not be a case where non-voluntary intervention is acceptable. However, if parents and the public consider the infringement of individual reproductive choice a reasonably bearable harm, then a GGEE intervention that imposes only these reasonably bearable harms on parents or future children whilst providing much larger net benefit at the collective level may be acceptable.

The slippery slope argument I have rebutted here highlights an important advantage of my CPH framework, over some previous collectivist work. When considering potential harmful outcomes of GGEE interventions, such as liberty infringements, we must guard against falling into the trap that some previous collectivist work has fallen into. That is, we must not be too risk averse, and show a negative bias where analysis is more sensitive to potential negative outcomes for the collective than the positive. I argued in Chapter 2 that work such as Fukuyama's, and to some extent, Sparrow's, risks falling into this trap. By

considering equally the potential benefits of GGEE for the collective, and accepting *reasonably bearable harms* when exchanged for large benefits, the framework seems to provide a balanced (i.e., not negatively-biased) ethical analysis.

I have addressed two strands of the eugenics objection, one focussing on immediately unacceptable effects of allowing GGEE interventions such as the imposition of state values surrounding various genetic traits, and one focussing on a slippery slope to eugenics, where eugenics is wrong because of its coerciveness and infringement of individual liberties. I turn now to a second important challenge to my framework, from a deontological perspective.

II

Deontology and Human Dignity

Looking quite broadly at the CPH framework as presented in Chapter 5, it's clear that the bulk of the framework is concerned with the prospective consequences of implementing a given GGEE intervention in a given way, and how the costs and benefits of implementation are distributed. In this way, the framework has a consequentialist lean to it: ethical evaluation is primarily based on an assessment of the consequences of intervention. The first step of the framework makes it clear that to identify these possible consequences, we refer to the interests of the stakeholders. Thus, it is also an interests-based framework. Deontologists may take issue with a consequentialist and interests-based framework, fearing that it cannot account for all morally relevant factors in its assessment. Might there be some concepts that cannot be distilled down to interests and consequences? In this section, I argue that the morally relevant concepts deontologists are concerned about having included in ethical analysis can indeed be addressed using my framework. I illustrate using an example of a

deontological ethical concept frequently brought up in the enhancement literature: the potential loss of human dignity.

The human dignity objection

Human dignity is one deontological concept often invoked by objectors to human enhancement.³²⁶ We might expect the objection to run something like this: Allowing or implementing some GGEE interventions (according to a framework like this one) poses a threat to human dignity. Therefore, any framework that accepts GGEE interventions without considering human dignity (in non-consequentialist terms) is flawed.

The argument clearly rests on key assumptions regarding the definition of human dignity, and the importance of preserving it, each of which I aim to outline in the following explanation of the objection.

There are multiple conceptions of ‘dignity’ as a moral concept, though most centre around a natural equality of status for moral consideration among human beings. Dignity is what gives the individual or group a standing (equal within a group) compared to non-members of the group (usually considered as either non-human animals or non-persons, which lack human dignity, or beings who may be due more or different dignity—for example, gods).³²⁷

Whilst many definitions of dignity make religious references, there are interpretations that are commensurate with secular bioethics that could ground the objection as I’ve outlined it. For example, Britta van Beers analyses how dignity is used in the Oviedo Convention, both implicitly and explicitly, to categorically prohibit genome editing for reproductive purposes. The convention’s preamble expresses a commitment to ‘respect the human being both as an

³²⁶ For example, Kass, "Defending Human Dignity"; Fukuyama, *Our Posthuman Future: Consequences of the Biotechnology Revolution*.

³²⁷ For an introductory discussion of these distinctions, see Alberto Giubilini and Sagar Sanyal, "Challenging Human Enhancement," in *The Ethics of Human Enhancement: Understanding The Debate*, ed. Stephen Clarke et al. (Oxford: Oxford University Press, 2016): 1-24.

individual and as a member of the human species and recognising the importance of ensuring the dignity of the human being'.³²⁸ It is this understanding that grounds a concern that heritable genome editing 'may endanger not only the individual but also the species itself'.³²⁹ This would be achieved by changing the parts of human nature that ground human dignity, and thereby, ethical and legal protections against harming people. Van Beers takes human dignity in this context as 'the view of the person as an end in himself, endowed with an intrinsic and absolute value, who is to be distinguished from things, animals, instruments, and commodities'.³³⁰ In this sense, dignity may be violated on an individual or collective level wherever the lines are blurred between persons and things via commodification, or instrumentalization. What's more, dignity may be violated if GGEE were to change how we view enhanced people—perhaps not as things, but as some new entity. It seems plausible that GGEE might be unacceptable in a way that is not accounted for by my framework.

Responses: defending dignity

Proponents of GGEE may respond to dignity objections in a few ways. First, they may simply reject the relevance of human dignity as a concept.³³¹ This is an unsatisfying response to those with deontological commitments. To appeal to as broad an audience as possible, I have two alternative ways of responding to this objection. The first is to question what 'human nature' means, and whether changes to it—whether these blur the lines between animals and humans or create something new that seems worth less than a human—

³²⁸ "Convention for the Protection of Human Rights and Dignity of the Human Being with Regard to the Application of Biology and Medicine: Convention on Human Rights and Biomedicine," Council of Europe (1997), accessed May 2, 2021. <https://rm.coe.int/168007cf98>. See at 1.

³²⁹ "Explanatory Report to the Convention for the Protection of Human Rights and Dignity of the Human Being with regard to the Application of Biology and Medicine: Convention on Human Rights and Biomedicine," Council of Europe (1997), accessed May 2, 2021. <https://rm.coe.int/16800ccde5>. See at 14.

³³⁰ Britta van Beers, "Imagining Future People in Biomedical Law: From Technological Utopias to Legal Dystopias within the Regulation of Human Genetic Modification Technologies," in *Risk and the Regulation of Uncertainty in International Law* (Oxford: Oxford University Press, 2017), 129.

³³¹ Ruth Macklin, "Dignity is a Useless Concept," *BMJ* 327, no. 7429 (2003), <https://doi.org/10.1136/bmj.327.7429.1419>; Steven Pinker, "The Stupidity of Dignity," *The New Republic* (May 28, 2008), accessed May 2, 2021. <https://newrepublic.com/article/64674/the-stupidity-dignity>.

undermine human dignity (and thus ethical and legal protections). The second is to challenge the assumption that human dignity can't be adequately expressed as an interest in a consequentialist framework.

First, then, to the meaning of human nature. Scholars in the area usually do not refer to human nature in exactly biological terms. They are not concerned with biological changes, which occur anyway at the genetic, epigenetic, and even cultural levels over time, regardless of whether GGEE is undertaken.³³² Rather, the concern is with something deeper—plausibly, the valued aspects of humanity. It is these (universally shared) valued aspects of what it is to be human that are the source of human dignity. Recently, Brian Chance has used a Kantian perspective on human dignity. He claims, “The source of our dignity for Kant is not Fukuyama’s ‘Factor X’ or what Kass calls the ‘dignity of endurance’ or the ‘dignity of human activity’ but rather our ability to legislate and follow the moral law.”³³³ I follow Chance’s account, having rejected Fukuyama’s and Kass’ alternatives in Chapter 2, in part for their vagueness surrounding these concepts. What’s more, the Kantian account is widely assumed, particularly in policymaking,³³⁴ and therefore will likely address more readers’ objections. For Kant, it is our autonomy, that is, our freedom to obey our own self-legislated moral law that constitutes human dignity. And for Chance, this means that enhancements do not threaten our dignity unless they reduce our freedom to act from our own reasons. In fact, for some enhancements, ‘just as enhancing these abilities is a way of ‘harmonizing’ our actions with the ‘humanity in our person,’ it seems that these kinds of enhancements increase

³³² van Beers, "Imagining Future People in Biomedical Law: From Technological Utopias to Legal Dystopias within the Regulation of Human Genetic Modification Technologies."

³³³ Brian Chance, "Kant and the Enhancement Debate: Imperfect Duties and Perfecting Ourselves," *Bioethics* 35 (2021): 806.

³³⁴ Rachel Bayefsky, "Dignity, Honour, and Human Rights: Kant's Perspective," *Political Theory* 41, no. 6 (2013): 809-837; Thomas Hill, "Kantian Perspectives on the Rational Basis of Human Dignity," in *The Cambridge Handbook of Human Dignity: Interdisciplinary Perspectives*, ed. Dietmar Mieth et al. (Cambridge: Cambridge University Press, 2014): 215-221.

the number and quality of reasons on which we are able to act.³³⁵ If we agree with Chance, and take a Kantian conception of human dignity and which aspects of human nature ground it, then a blanket ban on enhancements would be unjustified. Instead, what is needed to adequately account for this concern surrounding human dignity is a framework for analysis that considers whether a given GGEE intervention may threaten our freedom to act from our own reasons, or to self-legislate.

Concerns may remain, as van Beers notes, with dignity conceived differently, as being violated by the commodification or instrumentalization of enhanced people that may result from pursuing GGEE interventions.³³⁶ This may constitute blurring the lines between person and thing, and it may be one unacceptable way to subtly alter human nature. Although it may not relate to the freedom to self-legislate discussed above, it is worth discussing. So, consider how cultures of commodification may arise surrounding reproduction once GGEE is introduced. How can we avoid such situations?

With human dignity distilled down to these two core ethical questions concerning the freedom to self-legislate and commodification, I turn to my second line of rebuttal. I argue that, indeed, human dignity in these forms can be included in a consequentialist-leaning, interests-based framework. When we consider the interests of (current and future) stakeholders, it is hard to see how an interest in self-legislation or in non-commodification could be neglected.

For starters, self-legislation has links to rationality and to autonomy. Autonomy is specifically listed as an example concept in the CPH framework as I presented it, particularly in relation to parents' reproductive choice, and the future child's range of options. Rationality

³³⁵ Chance, "Kant and the enhancement debate: Imperfect duties and perfecting ourselves," 806.

³³⁶ With thanks to Britta van Beers for raising this objection to my argument in discussions.

and autonomy may not map exactly on to each other (at least for non-Kantians, for whom autonomy may have less to do with the will, and more to do with rationality or lack of external coercion). Yet, some aspects of autonomy certainly overlap with self-legislation. Free reproductive choice for parents, for instance, requires both that they not have their choices impeded by third parties, structural barriers, or certain internal barriers to their decision-making. Third party interference may consist of a state's prohibition of parents' reproductive choice; structural barriers may include the cost of GGEE; internal barriers may include a lack of understanding of the risks and benefits of GGEE. Importantly, some qualification is required in relation to this final category. Whilst promoting autonomous decision-making surrounding GGEE is likely to benefit individuals and their aggregate, it has been questioned recently whether the removal of internal barriers to decision-making constitutes the promotion or, rather, the undermining of autonomy. For example, the feminist scholar Nancy Hirschmann has pointed out how we may see individual identity as constructed in relation to others with whom a person interacts, employing a collectivist, relational conception of the self. In these cases, Hirschmann argues, the nature of supposedly 'internal' barriers to one's will like a lack of understanding or self-confidence to act is exposed to be more complex.³³⁷ 'Internal' barriers are still mediated and influenced by external factors—a lack of understanding may be the result of a lack of education, and a lack of self-confidence may result from insufficient social support. The failure to acknowledge this complex nature, according to Hirschmann, can lead to autonomy-undermining paternalism, in efforts by third parties to change the person themselves, to remove their 'internal' barriers to autonomous decision-making, instead of addressing the external factors that, in fact, ultimately influence these states in them. Applying this idea in the context of GGEE, it may be that, in order to avoid undermining autonomy in the very pursuit of it, policymakers ought not infer and/or

³³⁷ For further detail, see Nancy Hirschmann, "Toward a Feminist Theory of Freedom," *Political Theory* 24, no. 1 (1996): 51-54.

attempt to remove individuals' internal barriers. Rather, they should address external barriers to decision-making about whether to undertake GGEE. For example, lack of education concerning GGEE may create internal barriers to deciding whether to undertake it, and the external barrier can be removed. The promotion of autonomy as self-legislation is particularly salient when it comes to educational measures that will tend to promote prospective parents' rational decision-making surrounding whether to pursue a given GGEE intervention for their prospective child. Insofar as autonomy and self-legislation relate to human dignity as deontologists conceive it, certain measures policymakers may put in place alongside GGEE interventions may, then, promote human dignity.

In response to concerns about human dignity as non-commodification and non-objectification, consider, also, how human dignity is supported in Step 2 of the framework. The cost/benefit language of Step 2 is amenable to considering effects on individuals (and, in aggregate, collectives) from population-level pursuit of enhancements. For instance, a GGEE intervention that provided very large collective-level benefit by morally enhancing future individuals might be counted by deontologists as commodifying and instrumentalising those individuals. It would likely seem unacceptable. Yet, this holds for my consequentialist account, too. Insofar as individuals have an interest in being treated as autonomous beings, and not as means to others' ends, they have an interest in non-commodification that can be expressed as a potential harm of that GGEE intervention on the individual level. And insofar as a culture of commodification risks imposing this kind of harm on individuals more often than a society without a commodifying culture, the harm can be accounted for, too, as a harm at the collective level. Say that this moral enhancement reduced people's abilities to adequately weigh their own prudential interests against potential altruistic actions. Not only would this count as a cost in terms of undermining those individuals' rational capacities, but it would count as harming them by threatening to undermine their interest in being treated

as autonomous ends in themselves, as opposed to mere means to others' ends. In such cases, the GGEE intervention would be rejected for not fulfilling the requirements of CER*, if this cost outweighed the significant benefits of moral enhancement at the collective level. It is plausible that when this individual cost, and the collective-level cost of a culture of commodification is included in analysis, it might outweigh the benefits. As such, this means of undermining human dignity is also accounted for by the framework.³³⁸ Whilst I lack the scope to address other deontological concepts here, I hold that the CPH framework can similarly reduce the core aspects of these concepts down to consequentialist or interests terms.

III

Public Health and Resource Allocation

In this thesis, I frame GGEE interventions as potential public health measures that the policymakers of a state may consider implementing. This framing of enhancement is motivated by the need to include population-level moral considerations in analysis, and the strength of public health ethics (PHE) in doing so, using particular moral principles and concepts. I justify the framing with reference to the lack of relevant distinction between treatments and enhancements, and the applicability of moral principles and concepts applied in collective-oriented PHE to enhancement, in Chapter 3.

Throughout this thesis, I assume that GGEE interventions are being considered only in states where implementing them is politically and economically feasible. Yet, all public health

³³⁸ Some proponents of enhancement have gone further than this, claiming that enhancements could, in fact, increase our human dignity by increasing rationality, willpower, and other capacities that contribute to self-legislation. I suggest that we may hold a threshold view of human dignity, that confers equal moral status to all self-legislating persons, without proposing that posthumans may have more dignity. For more, see: Nick Bostrom, "Dignity and Enhancement," *Contemporary Readings in Law and Social Justice* 1, no. 2 (2009): 84-115.

systems must make decisions about how to allocate resources among public health measures, because they all have limited resources, and cannot fund every measure. As Bruce Jennings notes,³³⁹ 'In the past, we [the public] have rarely said no to any potentially promising medical or technological advance. In the future, it will be necessary to be more discerning and more discriminating about the new therapies and procedures'.

In these resource-limited systems, only prioritised measures will receive (adequate) funding. Several principles or systems for allocation have been considered, and most refer to: addressing urgent (health) needs,³⁴⁰ maximising benefit,³⁴¹ imposing low costs,³⁴² and reducing injustices.³⁴³ The UK National Health Service adheres to each of these principles to some extent, in its allocation of funds to health commissioners.³⁴⁴

The resource allocation objection

There may be a dilemma that arises from framing GGEE interventions as public health measures. My analysis of GGEE is irrelevant if enhancements are included amongst other public health measures in resource allocation decisions, because they are so unlikely to be preferred over other public health interventions when it comes to the funding priorities listed above. Why analyse an intervention that will not be implemented? Yet, if I try to avoid this irrelevance objection by re-framing GGEE measures as falling into another funding area, or

³³⁹ Bruce Jennings, "Health Policy in a New Key: Setting Democratic Priorities," in *Public Health Ethics: Theory, Policy and Practice*, ed. Ronald Bayer et al. (New York: Oxford University Press, 2007), 235.

³⁴⁰ Norman Daniels, "Is There a Right to Health Care and, If So, What Does It Encompass?," in *A Companion to Bioethics*, ed. Helga Kuhse and Peter Singer (Chichester, UK: Wiley-Blackwell, 2012), 362-372; Justine Burley, "The Price of Eggs: Who Should Bear the Costs of Fertility Treatments?," in *The Future of Human Reproduction*, ed. John Harris and Soren Holm (Oxford: Oxford University Press, 1998), 127-149.

³⁴¹ Ashcroft, "Quality of Life as the Basis of Health Care Resource Allocation: A Philosopher's Perspective on QALYs."

³⁴² Allan Gibbard, "Health Care and the Prospective Pareto Principle," *Ethics* 94, no. 2 (1984): 261-282.

³⁴³ Nigel Rice and Peter Smith, "Ethics and Geographical Equity in Health Care," *Journal of Medical Ethics* 27 (2001): 256-261.

³⁴⁴ David Buck and Anna Dickson, "Improving the Allocation of Health Resources in England: How to Decide Who Gets What," *The King's Fund* (2008), accessed June 8, 2021. https://www.kingsfund.org.uk/sites/default/files/field/field_publication_file/improving-the-allocation-of-health-resources-in-england-kingsfund-apr13.pdf

as being appropriately privately funded and accessed (i.e., not considering them as public health measures) so that they are not considered via public health resource allocation decisions, then my analysis is inconsistent. That is, an intervention (GGEE) that has been assessed as fitting the public health framing—being rightly considered as a public health measure—is not treated the same as other public health measures when it comes to resource allocation, but rather moved to a different area. Hence, the dilemma: ethical analysis of GGEE interventions as public health measures is either irrelevant or inconsistent. This is an *apparent* dilemma in that either option *appears* unacceptable.³⁴⁵ In response to the dilemma, I will first try to grasp it by the horns, showing it to not be a genuine dilemma. That is, I will try to deny one part of the dilemma's conjunction, and in doing so, either:

- 1) grasp the first horn, and deny that framing enhancements as public health measures will leave them low priority in a resource allocation system, and therefore unfunded, rendering ethical analysis irrelevant; or
- 2) grasp the second horn, and deny that it is inconsistent (or otherwise objectionable) to frame enhancements as public health measures in ethical analysis and not in the process of resource allocation, so that they are fundable outside the resource allocation system.

After considering each option and finding neither too attractive, I instead present a counterdilemma, which shows grasping the first horn to be the least bad option among either grasping that horn, grasping the second, or accepting the counterdilemma I present. I conclude that whilst my ethical analysis in this thesis may be irrelevant for some un-fundable

³⁴⁵ For more on dilemmas, see: Terrance McConnell, "Moral Dilemmas," in *The Stanford Encyclopedia of Philosophy*, ed. Edward N Zalta (Fall 2018), accessed May 9, 2021. <https://plato.stanford.edu/entries/moral-dilemmas/>.

GGEE interventions, for those that might be priorities for resource allocation, it remains useful.

The response

Grasping the first horn is not an initially promising response. Certainly, some enhancements may not be the *last* priority for resource allocation, but many are likely to be *low* priority in a system based on the principles employed by state institutions like the UK National Health Service. That said, some GGEE interventions, whilst expensive, will address existing needs in the kinds of collective benefit they provide, and may also reduce unfair inequalities. Imagine a GGEE intervention to prevent the spread of disease, addressing existing health care needs in a community. Or imagine an intervention like moral enhancement, which may make people more sensitive to inequalities, as provided with means-tested subsidies by the state. This intervention could place burdens on the better off whilst benefiting those below the threshold level of wellbeing in a jurisdiction, helping reduce inequalities. These interventions, at least, may rank relatively high in resource allocation.

The point remains that some interventions will be a lower priority. Interventions that are approved by my CPH framework, in posing overall collective benefit without imposing not reasonably bearable harms on any stakeholder, still do not necessarily address existing urgent health or wellbeing-related needs. Existing deficits in health or wellbeing are not necessarily ameliorated via GGEE, as benefit may be increased from a baseline or positive (as opposed to negative) level of wellbeing, in areas where there aren't deficits. Nor do interventions necessarily reduce inequality, as this is not a *requirement* of sufficiency-constrained prioritarianism (SCP). Whilst SCP *requires* that burdens do not primarily befall the worst off, it places only a *preference* on not primarily benefiting those above a threshold level of wellbeing. Given that enhancements are likely to be expensive and will not necessarily

maximise benefit compared to other health interventions, at least some enhancements will likely fall low down on a resource allocation ladder for public health measures.

For low-ranking interventions, there is a further problem. Whilst low-ranking measures may attract a small amount of funding, many GGEE interventions may be more expensive to implement in ways that satisfy the requirements of distributive justice (often involving subsidies and possibly financial incentives for those undertaking GGEE). Even if *some* funding could be allocated to them, then, this might be insufficient. Compromises that lead to cheaper policy alternatives—such as merely allowing parents to pursue GGEE interventions—are likely to violate distributive justice requirements.

It seems then, that in resource allocation systems based on existing principles, some enhancements would either not be able to be implemented acceptably, in terms of being sufficiently funded or fulfilling the requirements of distributive justice. In that case, at this point, ethical analysis of these low-priority interventions and guidance on their implementation may seem irrelevant.

Perhaps, then, I should turn to the second horn instead, and deny any problematic inconsistency in not treating GGEE interventions as public health measures when it comes to funding and resource allocation, yet still ethically analysing them using concepts from PHE. But grasping the second horn of the dilemma is also an unattractive option. Although bypassing the resource allocation system may be desirable, it raises two important questions. First, what use would a resource allocation system be, if it were not applied to all public health measures? Taking the argument further, it is absurd to think of simply reframing any public health measure that seems unlikely to receive funding as fitting into a different policy area or being appropriately privately funded, instead. This approach merely shifts the problem. The funding allocated to education policy, defense and public safety, environmental

interventions, etc., are all similarly limited in resources. As such, shifting public health measures into these systems simply moves them to a different resource allocation system in which they will not necessarily perform any better in comparison to other measures in that area.

A counterdilemma

A more fruitful response than immediately grasping either horn of the dilemma—at least at this point—might be to present a counterdilemma that would make grasping one of the horns I present above appear a more attractive option over accepting the counterdilemma. The hypothetical objector to the framework presents a dilemma between, first, maintaining consistency in PHE framing but accepting irrelevance and lack of funding, or second, sacrificing consistency in PHE framing to maintain relevance. Instead of directly denying either premise, a proponent of the framework can present a counterdilemma that is worse than grasping either horn. The counterdilemma is as follows: If GGEE is not framed as a public health measure for state implementation and funding, and if it is not ethically analysed in an analysis like mine, the policy alternatives come down to these: prohibition, or variously regulated/free markets that are not ethically assessed.³⁴⁶ I will argue that each option is unacceptable, and that, therefore, this is a genuine counterdilemma, posing a strong reason to accept grasping one of the horns of the original dilemma.

In the first horn of the counterdilemma, one accepts prohibition of GGEE interventions, and the plausible outcomes associated with prohibition, which I explore below. This is a plausible scenario either if various GGEE interventions considered in the public health resource allocation system are ranked too low to receive adequate funding, or if considering

³⁴⁶ Thanks are due to Sophie Johnson for helping develop this response to the dilemma.

funding them outside the resource allocation system is not accepted for consistency reasons. The original dilemma, then, seems to lead us to this alternative outcome. Yet, in this scenario, the scientific advances that are already being made today³⁴⁷ would still have occurred. Indeed, funding is already being offered for genome editing for research purposes. In the US, funding is projected at \$190 million (USD) over 6 years (although, this is specifically for somatic gene editing for curing diseases).³⁴⁸ Undertaking GGEE interventions will, in the coming decades, be technically possible.³⁴⁹ Some parents will want to access these interventions for their children. If GGEE is prohibited, there is a significant risk that black markets will crop up, as has occurred with banning the use of emerging technologies in the past. For instance, the prohibition of medical and reproductive interventions including commercial surrogacy and commercial organ transplants has not prevented their being pursued via global black markets.³⁵⁰ Where there is enough demand, an international economy, and countries that are less vigilant in penalising criminal practices within their bounds, black markets seem to arise where prohibition leaves a gap in legal pursuit of the service. A black market for GGEE interventions would have predictably bad consequences for prospective parents who may undergo unsafe IVF or expose the future child to unsafe gene editing. This is, I argue, an

³⁴⁷ For examples, see: Michael Crowther et al., "Genome-Wide CRISPR–Cas9 Screening Reveals Ubiquitous T Cell Cancer Targeting via the Monomorphic MHC Class I-Related Protein MR1," *Nature Immunology* 21, no. 2 (2020): 178-185; Arun Dangi et al., "Cell Line Techniques and Gene Editing Tools for Antibody Production: A Review," *Frontiers in Pharmacology* 9 (2018): 630; Xiangjin Kang et al., "Introducing Precise Genetic Modifications into Human 3PN Embryos by CRISPR/Cas-Mediated Genome Editing," *Journal of Assisted Reproduction and Genetics* 33, no. 5 (2016): 581-588; Hong Ma et al., "Correction of a Pathogenic Gene Mutation in Human Embryos," *Nature* (2017), <https://doi.org/10.1038/nature23305>.

³⁴⁸ "NIH Awards \$89 Million for Additional Projects to Advance Genome Editing," National Center for Advancing Translational Sciences (2019), accessed March 17, 2020. <https://ncats.nih.gov/news/releases/2019/somatic-cells>. Similarly, in Europe, funding already exists, even for enhancement interventions, though only in animals and agriculture. Horizon Europe is allocating €5 million in the next two years for projects assessing risks and benefits of genome editing in agriculture. "Horizon Europe to Fund Research on Genome Editing in Agriculture," Science Business (2021), accessed December 21, 2021. <https://sciencebusiness.net/framework-programmes/news/horizon-europe-fund-research-genome-editing-agriculture>.

³⁴⁹ Dana Carroll, "Genome Editing: Past, Present, and Future," *The Yale Journal of Biology and Medicine* 90, no. 4 (2017): 653-659.

³⁵⁰ Jack Glaser, "Womb for Rent: Regulating the International Surrogacy Market," *Brown Political Review* (2016), accessed May 14, 2021. <https://brownpoliticalreview.org/2016/11/womb-for-rent-regulating-international-surrogacy-market/>; James Taylor, "Black Markets, Transplant Kidneys and Interpersonal Coercion," *Journal of Medical Ethics* 32, no. 12 (2006): 698-701.

inevitable outcome of prohibition, and presents a worse option than those discussed in the original dilemma. That is, the pursuit of GGEE via such markets is worse than under-funded, ineffective implementation of GGEE interventions by the state.

To illustrate, consider the black market for surrogacy arrangements. Often, such markets operate across borders, with couples from high-income countries who wish to have a child using the surrogacy services of gestational mothers from low-income countries. Setting aside concerns with exploitation of the gestational mothers and concerns with ‘selling babies’,³⁵¹ some ethical concerns with this black market could be shared by a black market for GGEE interventions. First, exorbitant prices can be charged for practices that are prohibited in prospective parents’ home countries when cross-border markets arise. This constitutes not only possible exploitation of the couple, but it increases inequality of access, as only wealthy couples will be able to afford the black-market prices of GGEE interventions.

Lack of safety is another concern. For children of surrogacy, black market safety standards may be such that a gestational mother’s poor treatment affects the health of the baby, in the surrogacy case. Similarly, for enhanced children, the standards for performing GGEE interventions may be low, and increase the chances of poor practices that may lead to ineffective genetic edits, off-target effects, or dangers in the IVF process. In both cases, operating within a black market leaves little recourse for parents or children who suffer bad outcomes or face safety risks.³⁵² If my public health framing is not employed, and instead enhancements are merely prohibited, then the outcomes may be bad indeed. This horn of the counterdilemma highlights potential extreme safety risks, lack of recourse, and exacerbation of unfair inequalities.

³⁵¹ Stephen Wilkinson, "Exploitation in International Paid Surrogacy Arrangements," *Journal of Applied Philosophy* 33, no. 2 (2016): 125-145.

³⁵² Rajendra Parsad Gunpath and Kartina Aisha Choong, "Surrogacy Tourism: The Ethical and Legal Challenges," *International Journal of Tourism Sciences* 15, no. 1-2 (2015): 16-21.

The other horn of the counterdilemma, and the only remaining alternative, is for GGEE to be implemented without state funding, and rather, via a regulated or unregulated market. In this alternative, whilst GGEE interventions are not implemented by the state, they are also not prohibited. Indeed, private funding for US start-ups focussing on gene editing already amounts to \$1 billion since 2013.³⁵³ Whilst free markets and, to a greater extent, regulated markets avoid many of the ethical concerns raised by black markets, some issues remain. These have already been discussed in much of the collectivist literature on enhancement, as I noted in Chapter 2. In particular, work that assumes enhancements would be accessed on the free market raises concerns with genetic inequalities due to the costs of GGEE interventions. Even with some price regulation and licensing standards for those operating clinics offering GGEE, if only wealthy couples can afford to access GGEE interventions, then existing inequalities between the better off and those below a threshold level of wellbeing will be exacerbated.³⁵⁴ What's more, free market-GGEE may pose collective action problems, wherein parents pursuing enhancements that benefit their children individually, in fact collectively cause bad outcomes for the society as a whole.³⁵⁵ Examples of such interventions can be found in Chapter 2. Finally, many of the collective benefits of GGEE interventions that I have assessed relate to state provision of primary public goods (PPGs) for their citizens via population-wide implementation of certain enhancements. PPGs are often poorly secured and maintained by the free market, because often the individual-level benefits that prospective parents would secure for their children are small, in comparison to the large benefits that 'free-riders' would experience from the positive

³⁵³ Katelyn Brinegar et al., "The Commercialization of Genome-Editing Technologies," *Critical Reviews in Biotechnology* 37, no. 7 (2017): 924-932.

³⁵⁴ Kass, "Defending Human Dignity."

³⁵⁵ For example, in Chapter 2, I discussed the case of height enhancement. More examples are given in: Robert Sparrow, "Enhancement and Obsolescence: Avoiding an "Enhanced Rat Race"," *Kennedy Institute of Ethics Journal* 25, no. 3 (2015): 231-236; Gyngell and Douglas, "Stocking the Genetic Supermarket: Reproductive Genetic Technologies and Collective Action Problems."

externalities of a PPG-producing enhancement. To solve this problem, goods on the market are usually those whose benefits are excludable. Therefore, securing those benefits depends on wealth.³⁵⁶ This second horn of the counterdilemma, then, shows how leaving GGEE interventions to free or even regulated markets raises serious concerns with exacerbating existing inequalities and failing to secure important PPG-type benefits of enhancements.

This counterdilemma provides an effective response to the original dilemma. It highlights an important point: when we compare the results of using my CPH framework and framing enhancements as public health interventions vs not doing so, it seems that it is worse not to act. Certainly, there are important issues with either including GGEE interventions in a public health resource allocation system or bypassing the system (the original dilemma). However, the alternative (the counterdilemma) either creates problems with securing the benefits of enhancements and exacerbating existing inequalities, or prohibiting GGEE interventions, resulting in a black market. Ultimately, either of these two latter outcomes of *not* using the framework is likely worse than the outcomes of using the framework and facing some problems with adequately subsidising some GGEE interventions by the state.

Of the two horns of the original dilemma, the first was more attractive. GGEE interventions should be considered, for consistency's sake, to be public health measures for purposes of ethical analysis and of funding. Some will be low-priority, and ethical analysis of those will be irrelevant, but analysis remains useful for those that could be sufficiently funded, and of sufficiently high priority in comparison to other public health measures.

³⁵⁶ Anomaly, "Public Goods and Government Action."

IV

Global Distributive Justice

In this section, I consider one final objection. It concerns the scale on which my CPH framework considers distributive justice. Objectors may claim that the framework does not consider justice at the international or global level, only within a given jurisdiction, even though distribution concerns apply globally.

Consider the most significant implications of the argument. Perhaps the CPH framework I have presented adequately ensures that those GGEE interventions that are pursued via a particular policy in one jurisdiction would produce burdens and benefits that are fairly distributed within the population of that jurisdiction. I employ my chosen account of distributive justice, SCP, to try to ensure this is the case. It requires that the worst off and those below a standard of living required for flourishing are the primary recipients of the benefits of an enhancement (optimally), and (necessarily) those above the threshold are the primary recipients of any burdens. The distribution is not, however, necessarily fair on the international or global scale. If the intervention is only implemented in this one jurisdiction, benefiting only that population, then what of the global worst-off? Fulfilling the requirements of SCP on a national level does not imply distributive justice on the global level. This holds unless the population of the jurisdiction in question consists of the *global* worst-off and those below a threshold standard for flourishing. Even worse, if the burdens of pursuing a GGEE intervention fall across borders, then people in other jurisdictions will bear these burdens. Examples may include the use of global resources, or threats to other jurisdictions from enhancing another jurisdiction's population and, perhaps, the enhancing jurisdiction's power in international affairs. We already know that many of the countries that would be least able to implement widespread technological changes due to lack of resources, poor infrastructure, and more pressing concerns are also those that have more of the world's

worst-off people.³⁵⁷ If imposing burdens on the worst-off is impermissible on the single-jurisdiction level, according to my framework, a reader may ask: why not consider distributive justice on the global scale?

Before addressing the objection, a quick note. I will remain agnostic as to whether the term *global* justice or *international* justice is to be preferred in the following discussion. Whilst global justice usually refers to the appropriate distribution of resources *for individuals* as residents of various countries on a global scale,³⁵⁸ international justice usually refers to distribution of resources *between nations*.³⁵⁹ That is, the unit of analysis is the individual in global justice, but the state, nation or jurisdiction in international justice. I am primarily concerned with outcomes for worst-off individuals around the world. However, the interactions that mediate these outcomes may well occur at the state level, and indeed it is the state that considers whether to implement a given GGEE measure using my proposed framework. Both of the terms, then, are applicable in some way.

Assumptions

I turn now to the assumptions on which the objection rests. These concern, first, a moral cosmopolitan standpoint, and second, the feasibility of alternative actions a state can take. I will outline the case for each assumption here before responding to the objection.

³⁵⁷ "Technology and Innovation Report 2021: Catching Technological Waves," United Nations Conference on Trade and Development (2021), accessed May 17, 2021. https://unctad.org/system/files/official-document/tir2020_en.pdf.

³⁵⁸ Gillian Brock, "Global Justice," in *The Stanford Encyclopedia of Philosophy*, ed. Edward N Zalta (Fall 2017), accessed July 30, 2021. <https://plato.stanford.edu/archives/spr2017/entries/justice-global/>.

³⁵⁹ Michael Blake and Patrick Taylor Smith, "International Distributive Justice," in *The Stanford Encyclopedia of Philosophy*, ed. Edward N Zalta (Summer 2021), accessed July 30, 2021. <https://plato.stanford.edu/archives/sum2021/entries/international-justice/>.

First, consider moral cosmopolitanism. Some Rawlsian philosophers have asked why *A Theory of Justice* considers justice only at the national level.³⁶⁰ These moral cosmopolitans hold that individuals are citizens of the world, and the ultimate units of moral consideration regardless of their national affiliations.³⁶¹ Thus, moral considerations like distributive justice should be considered on the global scale. This position assumes that we do, indeed, have moral obligations toward those outside our state's jurisdiction. In that case, we may even be obligated to ignore all preference for our compatriots—*contra* moral nationalists' views³⁶²—and instead treat others the same as we treat members of our own state. Most moral cosmopolitans accept at least some limits on this impartiality. For example, Thomas Pogge limits moral cosmopolitanism to when agents are involved in designing or administering international practices.³⁶³ This means that states, when introducing national policy, are justified in acting to benefit their own citizens (over others).

Relating this assumption to my CPH framework, then, the question arises: to what extent are the effects of a state implementing a given GGEE intervention international, or merely national? The biggest effect may be widening of global inequalities. Let us assume that the states likely to consider implementing GGEE interventions are also those whose citizens are among the global better-off.³⁶⁴ In that case, the global gap between the better-off and those below a threshold level of wellbeing will predictably increase from the implementation of

³⁶⁰ Blake and Taylor Smith, "International Distributive Justice." In response to his critics, Rawls supplied some initial principles governing international justice, which, if we accept the moral cosmopolitan viewpoint, may be useful in considering the obligations that states have toward other states (if not other individuals within those states). For more, see: John Rawls, *The Law of Peoples* (Cambridge, MA: Harvard University Press, 1999).

³⁶¹ Brock, "Global Justice."

³⁶² For more on moral and political nationalism, see: David Miller, "Nationalism," in *The Oxford Handbook of Political Theory*, ed. John Dryzek, Bonnie Honig, and Anne Phillips (Oxford: Oxford University Press, 2008).

³⁶³ There are alternative approaches to limiting the scope of moral cosmopolitanism. These may include an argument that there is a lack of the international legal structures that are necessary to produce coercive policy to ensure action is taken. Yet, within a state, the existence of these structures can justify egalitarianism. For more, see: Nagel, "The Problem of Global Justice."

³⁶⁴ Note that this is not only predictable, but in fact necessary. Due to the need for structures surrounding the implementation of GGEE including assisted reproductive technologies, clinics, and adequate, trained medical staff, it is necessary that a state have this (expensive) infrastructure already, in order to plausibly consider implementing GGEE interventions.

enhancements that benefit the implementing jurisdiction's population. It seems, then, at least *prima facie*, that there is good reason to take a moral cosmopolitan view, and think about justice on a global scale when it comes to the state-based implementation of GGEE interventions.

I turn now to the second assumption. Consider the feasibility of alternative actions a state can take, other than implementing GGEE and thereby—at least for argument's sake—threatening to exacerbate global inequalities in wellbeing. The exacerbation of existing inequalities by harming the worst off is unacceptable according to SCP. Yet, it is a basic tenet that 'ought implies can', and a state cannot have an obligation to avoid a given action that might exacerbate inequalities unless feasible alternatives exist. One alternative is the implementation of GGEE interventions at the international level. This system would consider all individuals as part of the one jurisdiction, and so they would be counted among the better-off or those below the threshold level of wellbeing, and distributed burdens and benefits accordingly. Yet, it is clearly questionable the extent to which this is, in fact, feasible. Following Thomas Nagel, Richard Miller claims that the (coercive) structures of shared governance that bind us together, and that are therefore necessary to produce special moral obligations between compatriots, are simply lacking at the international level.³⁶⁵ Without a body that can make and enforce policy surrounding GGEE implementation at the international level, the idea of international regulation is simply not feasible. Sparrow puts it succinctly, and specifically in the enhancement context: 'While, in theory, national governments could legislate to defend the interests of *Homo sapiens* or to promote aggregate welfare at a global level, historically governments have tended to legislate in the national interest. [...] Moreover, the transnational institutions required in order to regulate human

³⁶⁵ Richard Miller, "Cosmopolitan Respect and Patriotic Concern," *Philosophy & Public Affairs* 27, no. 3 (1998): 215-219.

enhancement in the interests of the world neither exist nor look very appealing once we start to imagine what sorts of powers they would require.³⁶⁶

It seems, then, that this first option is infeasible. The only alternative, other than implementation at the international or national level, seems to be prohibition of enhancements. Yet, as discussed in relation to previous objections, blanket prohibitions seem even worse when we consider that they may lead to black markets. Allen Buchanan emphasises the point, claiming that due to the lack of regulatory capacities in many countries, for genome editing, ‘worldwide prohibition, while conceivable in principle, is unlikely in the foreseeable future.’³⁶⁷ If prohibition is infeasible in even a few countries, then the same problems remain with the exacerbation of inequalities. It seems that the assumption that there are feasible alternatives to implementing GGEE interventions in a country-specific manner is flawed, then. I will go on to attempt a response to the objection, but this flawed assumption becomes relevant again at the end of my response.

The response

I am assuming that it is right to take a moral cosmopolitan—and not nationalist—perspective on this issue. This and the feasible alternatives assumption ground a seemingly pressing objection that my framework fails to fulfil the requirements of global justice.

I will consider one tempting response to the objection, before conceding that it does raise problems for the CPH framework, but that there are two flaws with the objection that justify my continuing on with the framework as is. These are, first, the flawed nature of the feasible alternatives assumption raised already, and, second, our history of accepting some levels of

³⁶⁶ Sparrow, "Human Enhancement for Whom?" See at 136.

³⁶⁷ Allen Buchanan, *Beyond Humanity?: The Ethics of Biomedical Enhancement* (Oxford University Press, 2011), 253.

competitive advantage, some overuse of globally shared resources, and some lack of international aid in other contexts.

First, however, consider a possible response.

Take, as a reminder, the current requirements and preferences of SCP. The sufficiency constraint necessitates there being a sufficient level of wellbeing that acts as a threshold. Those individuals whose wellbeing lies below the threshold should not have further burdens imposed on them by GGEE being implemented. Burdens, then, must primarily be imposed on those whose wellbeing lies above the threshold. Benefits should primarily befall those below the threshold. The prioritarian part concerns the distribution of burdens and benefits by priority: below the threshold level of wellbeing, the worst off should be the primary recipients of the benefits of GGEE, and must especially not have burdens imposed on them. On my interpretation, whilst the distribution of burdens is treated as a strict requirement of SCP, the distribution of benefits is treated as a preference, as benefiting some does not necessarily make others worse off, in absolute terms.³⁶⁸ Those interventions that benefit those above the threshold do not, then, flout the requirements of distributive justice, so long as any burdens also primarily befall those above the threshold. It is merely preferable that the benefits befall those below the threshold, and most preferably, the worst off. This distinction between requirement and preference allows SCP to avoid the ‘levelling-down’ objections to which teleological egalitarian doctrines are prone. The levelling-down objection claims that for strict egalitarians, in order to ensure equality is maintained, it must be better to burden the better off, or not benefit them, than to allow the gap between the better off and worst-off to increase by benefiting the better off. This is problematic because there is an overall benefit and no cost in the case of interventions that benefit the better off and burden

³⁶⁸ For further details, see Chapter 5, Section III.

no one, yet this is deemed impermissible by strict teleological egalitarianism.³⁶⁹ SCP side-steps this objection in its preference-requirement distinction. Let me turn, then, to an initially promising response that employs SCP, simply expanded out to the global level.

Enhancements as I have defined them necessarily provide collective-level benefit, overall. The populations of the jurisdictions where the resources and infrastructure exist already to support the implementation of GGEE interventions will, then, be benefited. Those that do not (the populations of countries lacking the infrastructure to implement GGE and often, containing more of the global worst-off) are not benefited. In that case, on the global scale, enhancements are likely to benefit the global better off. Yet, the distribution of benefits is, as stated, merely a preference. As Buchanan states when considering justice issues with enhancements, ‘the mere fact that some might lack access to valuable enhancements cannot in itself be a sufficient reason to refrain from creating them, any more than the mere fact that some now lack access to modern healthcare systems, the rule of law or literacy means that no one should enjoy these benefits.’³⁷⁰ And yet, as Buchanan goes on to note, the problem of diffusion is a real one, if beneficial interventions fail to diffuse fast enough globally, and this imposes burdens on those without access to the interventions.³⁷¹ The objection, then, must concern the *requirement* of justice, i.e., imposing *burdens* on people in other countries from implementing GGEE in another.

To provide an initially tempting response to the adapted objection, I note, first, that any enhancements that are individually beneficial but collectively harmful (e.g., competitive enhancements) have already been rejected using the framework. Individuals participating in

³⁶⁹ For more on levelling-down objections, see: Nils Holtug, "Egalitarianism and the Levelling Down Objection," *Analysis* 58, no. 2 (1998): 166-174. For an enhancement-specific discussion, see: Fox, "Luck, Genes, and Equality."

³⁷⁰ Buchanan, *Beyond Humanity?: The Ethics of Biomedical Enhancement*, 243.

³⁷¹ Buchanan, *Beyond Humanity?: The Ethics of Biomedical Enhancement*, 253.

international competitions, then, such as global job markets, will not be disadvantaged in comparison to other individuals by the implementation of enhancements. However, it is more plausible that the collective benefits gained by one country implementing certain GGEE interventions advantage it, as a whole, over other countries, and to their detriment. Consider, as a blatant example, a GGEE intervention that increased the capacity of one country to bring war to others. Perhaps this could occur in a jurisdiction that universally provided GGEE interventions for increased strength, night-vision, and a lesser need for sleep.³⁷² Whilst this may provide collective benefit to the population of the country with a stronger defence force and the potential to benefit from the spoils of war, it imposes burdens on those other countries that might become targets. In that case, it seems that the framework's limit to single jurisdictions does have the potential to neglect burdens imposed on others, internationally.

Examples like this expose a problem with the CPH framework. An initial possible response, then, is that the framework can incorporate additional international elements in Step 3 (concerning distributive justice). We might want three additions, and the first addition might state:

GGEE interventions must not impose significant burdens on other jurisdictions with individuals below the threshold level of wellbeing via the pursuit of internationally competitive population-level enhancements in one jurisdiction.

³⁷² Whilst we may be some way from considering night-vision enhancements, there are single genes already identified that contribute to, for instance, the ability to build muscle, and the requirement for less sleep per night, as detailed by research by Harvard University's Molecular Technologies team. Details are available at: "Harvard Molecular Technologies," (2021), accessed August 13, 2021. <https://arep.med.harvard.edu/gmc/protect.html>.

The addition may seem very demanding initially, as we do accept some interventions in countries that give them a competitive advantage over others. I will refer to this problem again later. For now, consider how including this threshold, that burdens must be *significant*, can mitigate this concern. This significance level can be set in a context-specific manner to allow enhancement to the level of other competitive advantages seen as acceptable in the future between countries. After all, we already accept international differences in levels of infrastructure, military power, etc. Setting this limit would simply not allow enhancements like, perhaps, a greatly increased tribalism trait, which might lead to individuals from one nation aiming to advantage their compatriots above others for work, shared resources, or military advantage. This enhancement might go beyond an acceptable context-specific limit in burdening the worst off in other countries.

We may also consider other ways that the pursuit of GGEE in one jurisdiction may affect others, through, perhaps, overuse of internationally shared resources. Say that, through the process of undergoing GGEE in the future, it is decided that prospective mothers undertaking GGEE should be treated with antibiotics, to avoid bacterial infections when the embryo is implanted in the uterus. This additional, preventive use of antibiotics, when considered at the population level, may have a significant impact on antimicrobial on the global level. Antimicrobial stewardship is a global collective good: we all have the responsibility to contribute to protecting the effectiveness of existing antibiotics via ensuring their use is kept to a minimum, and we all suffer from failure to maintain this collective good.³⁷³ The burdens of one jurisdiction's pursuing GGEE as imposed on other jurisdictions may, then, be significant in terms of the antimicrobial resistance-associated costs. The same

³⁷³ For brief further discussion, see: Richard Smith and Joanna Coast, "Antimicrobial Resistance: A Global Response," *Bulletin of the World Health Organization* 80, no. 2 (2002): 126-133.

principle would hold if GGEE required the use of some other resource, such as limited supplies of natural minerals.

An initial response to cases like this, too, might be to add another element to Step 3:

GGEE interventions must not impose burdens on other jurisdictions with individuals below the threshold level of wellbeing via the pursuit of population-level enhancements in one jurisdiction that require significant additional use of internationally-shared limited resources.

Let us consider one final way that enhancements in one jurisdiction might threaten those below the threshold level of wellbeing in other jurisdictions. This is via the redirection of a country's resources away from financial aid, in order to support GGEE. A national duty to fund and implement GGEE interventions may conflict with international duties. Earlier, I accepted the assumption that a moral cosmopolitan outlook is justified when it comes to considering the implementation of enhancement. In that case, international duties have a place in discussion, and may justify a requirement that states not fund GGEE in their jurisdiction by redirecting funds away from foreign aid. This might motivate a final addition to Step 3 to ensure international distributive justice:

GGEE interventions must not impose burdens on other jurisdictions with individuals below the threshold level of wellbeing via the pursuit of population-level enhancements using resources they would usually direct to helping (the worst off in) other jurisdictions.

The counter-response

Each of the additional elements proposed in my initial response faces a practical problem.

Whilst the response may seem initially strong, it is too demanding. Extending Casal's SCP to the international level in the form of these additions to my framework would demand remedying conditions that we already accept, and might defend. Whilst cosmopolitanism is

important, there is some room for a pluralist approach, which recognises some level of national preference, wherein a state has greater responsibilities toward its own citizens and residents. We do not believe that all competitive advantages between countries with worse-off people and better-off people must be eliminated. Similarly, we do not believe that no decisions should be made at the national level that involve the use of globally shared resources. Nor do we require countries to offer extensive international aid. Yet a globally extended version of Casal's account like the response I proposed would render many of these conditions unacceptable. A world that fulfilled these requirements of justice would be one with little technological progress or other important forms of human development. Whilst there is a place, I would argue, for greater international obligations, the extent to which this should be a reason to prohibit technological progress in advantaged countries is at least questionable.

As I discussed when considering the feasible alternatives objection, prohibition is likely not feasible on the international scale, and the outcomes of black markets may be worse than regulated implementation in (likely) high-income liberal democratic countries. This is already acknowledged by international bodies like the WHO, whose recommendations for the governance of human genome editing³⁷⁴ already state that 'germline human genome editing research should only take place in jurisdictions with domestic policy and oversight mechanisms.' GGEE cannot be pursued globally, and nor can it be prevented globally. I would argue that the best way forward, then, is implementation that ensures the requirements of justice are fulfilled on the national level.

³⁷⁴ "Human Genome Editing: Recommendations," World Health Organization Expert Advisory Committee on Developing Global Standards for Governance and Oversight of Human Genome Editing (Geneva: World Health Organization, 2021), xi.

Conclusion

This chapter has addressed four key objections to my CPH framework for ethical analysis of GGEE interventions.

The first concerned a slippery slope from allowing some enhancements to eugenic programmes reminiscent of the atrocities of the 20th century. I responded to this objection that whilst the bottom of the slippery slope is, indeed, unacceptable, there are barriers to reaching this outcome inbuilt into my framework. The imposition of a state's values is avoidable using the framework, due to the emphasis on including considerations of autonomy within calculations of costs and benefits, and public participation and the involvement of specific groups in decision-making.

The second objection concerned the neglect of deontological concerns such as loss of human dignity using my CPH framework, with its cost/benefit analysis. I rebutted this objection with reference to how the framework can account for losses of what we may value as human dignity, including freedom and equal moral status among humans.

The third objection concerned the rationing of healthcare resources among enhancements and other interventions in a public health system, and whether enhancements might be prioritised over more deserving interventions. To this, I responded that the alternative (not funding GGEE interventions, and leaving them to the private market or the black market) is worse. In fact, many GGEE interventions may aid in reducing existing (health) inequalities, thus justifying public funding for at least some interventions.

The final objection concerned international or global distributive justice, claiming that some states implementing GGEE might impose burdens on the global worst-off. I conceded the point, but held that there are not feasible alternatives to this kind of implementation, and that a response that considered expanding out justice considerations to the global level is inconsistent with the global burdens on other countries that we currently accept.

The objections and my responses are outlined in Summary Box 6.

Summary Box

Objections to my Framework for Ethical Analysis of GGEE Interventions

<p>EUGENICS</p> <p>Objection: GGEE constitutes/will lead to eugenics</p> <p>Response: The framework employs public participation and considers harms from coercion, so eugenic uses will be unacceptable</p>	<p>DEONTOLOGY/DIGNITY</p> <p>Objection: The framework fails to account for deontological concerns like undermining human dignity</p> <p>Response: Relevant concerns are considered as stakeholder harms</p>
<p>RESOURCE ALLOCATION</p> <p>Objection: GGEE is either a low priority for public health funding, or the framing is inconsistently applied</p> <p>Response: To avoid black markets and inconsistency, GGEE is accepted as low priority</p>	<p>GLOBAL JUSTICE</p> <p>Objection: The framework fails to consider issues of distributive justice outside the jurisdiction</p> <p>Response: Expanding SCP to the global level is inconsistent with currently accepted global burdens. Yet, prohibition is also infeasible.</p>

OUTCOME: My Framework for the Ethical Analysis of GGEE interventions responds successfully to all objections except that of global injustice, which raises problems outside the scope of this thesis.

Summary Box 6: Objections to my framework for ethical analysis of GGEE interventions as public health measures, with successful responses to all bar the final objection, which raises questions regarding accepted burdens that lie outside my scope here.

In the remaining chapters, I apply my CPH framework to case studies, including genetic immunisation (Chapter 7) and memory enhancement (Chapter 8).

Chapter 7:

Case Study 1 - Genetic Immunisation

Introduction

Imagine a future where an enhancement intervention, namely genetic immunisation against a certain disease, is being considered for implementation by a state. Let us assume that the state in question is the United States of America (US), and the disease in question is HIV, with a disease burden and distribution similar to current levels. HIV and AIDS pose a global threat and disease burden. Of the almost 38 million people living with HIV in 2020, the vast majority (20 million) were in eastern and southern Africa. However, across western and central Europe and North America, there were still 2.2 million people living with the disease.³⁷⁵ With a forecast mortality rate for 2030 of 6163 HIV/AIDS deaths, we can expect HIV to pose a persistent, if small, disease burden for the US in the future.

To protect the future population from continued suffering from HIV, the US of the future is considering implementing genetic immunisation as a public health measure. In this future scenario, off-target effects and other safety concerns with genetic immunisation have been addressed. The US of the future has sufficient, well-geographically distributed reproductive clinics to offer genetic immunisation to its population, and a re-vamped healthcare system that allows it not only to provide genetic immunisation, but to implement a policy that would incentivise uptake of genetic immunisation. The US government will subsidise the intervention and offer additional child support payments for already-eligible

³⁷⁵ "Global HIV & AIDS Statistics — Fact Sheet," UNAIDS (2021), accessed December 18, 2020. <https://www.unaids.org/en/resources/fact-sheet>.

parents who undertake the intervention—call this the ‘incentivisation policy’. If a large enough number of prospective parents undertake the intervention, then genetic immunity to HIV may protect the future population—not only genetically immunised individuals, but others as well, by producing herd immunity,³⁷⁶ thereby reducing spread of the disease. Should the US implement this policy for genetic immunisation against HIV?

The CPH framework I have presented in this thesis aims to answer questions like the above. Genetic immunisation is a form of germline genome editing for enhancement (GGEE), hypothetically being considered for implementation as a public health measure. Having presented my framework for assessing such measures and defended it against objection in the previous two chapters, it remains only to demonstrate how the CPH framework applies. This chapter’s structure follows the steps in the framework, with Step 1 applied in section I, Step 2 applied in section II, and so forth. Unfortunately, there is not space here for a full analysis. However, I use at least one applicable moral concept or principle for each part of each step in the ethical analysis, to illustrate.

Before going further, let me add two brief notes on genetic immunisation.

First, genetic immunisation modifies people with normal immune systems, for some benefit to that person and/or other people. It constitutes enhancement according to my definition. Yet, to subscribers of the treatment-enhancement distinction, it may seem more akin to a treatment than an enhancement, as a measure to prevent future ill-health. After all, its traditional analogue, vaccination, may constitute both a preventive measure and an enhancement; its goal is to prevent future health deficits too.³⁷⁷ It may seem, then, odd to

³⁷⁶ That is, conferring protection to the whole group through there being a threshold proportion of the population immune to the disease.

³⁷⁷ Again, this is according to my definition and other discussion, including John Harris’ terming vaccination enhancement in his: *Enhancing Evolution: The Ethical Case for Making Better People* (Princeton: Princeton University Press, 2007). This contrasts with preventive public health measures that are not enhancements by

choose genetic immunisation as a case study to apply my CPH framework. What makes genetic immunisation an appropriate case study, despite its being a less paradigmatic case of enhancement, is the way a less paradigmatic example can ease readers into use of the framework and act as an intuition pump, before it is applied to more controversial, paradigmatic examples of enhancement. After establishing this baseline, certain intuitions may then be challenged more in the case of memory enhancement in Chapter 8.³⁷⁸

One may ask how genetic immunisation is really any different to vaccination, in that case, and why a new ethical framework is necessary. In fact, the two are not perfect analogues, and even if they were, the aim of the framework is to be applicable to a wide range of potential enhancements. That means that relying on ethical judgements of vaccination for judging genetic immunisation would still leave the full range of other, disanalogous genetic enhancements lacking an ethical framework. Whilst genetic immunisation and vaccination share many morally relevant characteristics, genetic immunisation raises new questions regarding the heritability of modifications and effects on future people, reproductive autonomy, and a prospective mother's bodily integrity, depending on how genetic immunisation might be implemented. These differences highlight the need for a separate ethical framework for GGEE interventions, rather than reliance on ethical analyses of analogous interventions in public health, education, and other areas.

As a second and final note, let me highlight why I chose the example of genetic immunisation against HIV, in particular. Genetic immunisation against HIV has already been discussed in the enhancement context, most notably in relation to scientist He Jiankui's

virtue of their altering the environment, not the individual. Consider, for example, measures to reduce air pollution such as tree-planting or electric car subsidisation.

³⁷⁸ Memory enhancement is discussed further in: Deheng Wang et al., "Genetic Enhancement of Memory and Long-Term Potentiation but Not CA1 Long-Term Depression in NR2B Transgenic Rats," *PLOS One* 4, no. 10 (2009): e7486.

attempted use of it to enhance a set of twins in 2018-19.³⁷⁹ The CCR5 gene encodes an immune-cell receptor that HIV commonly exploits to enter cells. When a certain mutation occurs, CCR5-delta 32, the immune-cell receptor is no longer functional, and the HIV virus cannot enter the cell via that receptor (although, some cells have another type of receptor that HIV can still exploit for entry, hence why the mutation confers resistance, not complete immunity).³⁸⁰ He attempted to induce the desired mutation on CCR5, but the attempt was likely unsuccessful. One twin has an un-altered copy of the gene, and the other has the edit in some, but not all, of her cells.³⁸¹ They will likely be monitored for the rest of their lives to determine the effects of these faulty edits.³⁸² The technology is not ready. Premature, dangerous and ineffective uses of GGEE like He's experiment ought to be condemned. However, genetic immunisation, if safe and effective in the future, may not face these problems. Indeed, instead it may face other interesting ones that ought to be discussed here and considered by future policymakers. For example, notably, CCR5 displays antagonistic pleiotropy—that is, changes to the gene affect multiple traits, in ways that are both beneficial to, and detrimental to, the fitness of the individual. First, the CCR5-delta 32 mutation in humans renders individuals immune to HIV, but it also increases their susceptibility to West Nile virus, plausibly causing both benefit and threat at once. Perhaps, genetic immunisation via the CCR5-delta 32 mutation may not constitute an enhancement at all, if it does not produce net benefit for the individual or collective because of the disease trade-off. Yet,

³⁷⁹ Antonio Regalado. "Exclusive: Chinese Scientists are Creating CRISPR Babies," *MIT Technology Review* (2018), accessed April 20, 2021. <https://www.technologyreview.com/2018/11/25/138962/exclusive-chinese-scientists-are-creating-crispr-babies/>. Indeed, it has been noted already in the context of basic research that genetic interventions for resistance to communicable diseases could be seen as a public health measure. See: Derek So et al., "Disease Resistance and the Definition of Genetic Enhancement," *Frontiers in Genetics* 8 (2017): 4. Regardless of whether the reader agrees with my use of the genetic immunisation case as an enhancement example, it is useful simply to illustrate the CPH framework's application.

³⁸⁰ "HIV Resistant Mutation," Scitable by Nature Education (2013), accessed August 26, 2021. https://www.nature.com/scitable/blog/viruses101/hiv_resistant_mutation/.

³⁸¹ Jon Cohen, "Did CRISPR Help or Harm the First Ever Gene-Edited Babies?" *Science Magazine* (2019), accessed September 10, 2021. <https://www.sciencemag.org/news/2019/08/did-crispr-help-or-harm-first-ever-gene-edited-babies>.

³⁸² Smriti Mallapaty, "How to Protect the First 'CRISPR Babies' Prompts Ethical Debate," *Nature* 603 (2022), <https://doi.org/10.1038/d41586-022-00512-w>.

CCR5 also plays a role in neural development. It is this role that may explain recent evidence that the CCR5-delta 32 mutation improves cognition and memory.³⁸³ This particular example of genetic immunisation, then, allows us to explore how the morally relevant outcomes of antagonistic pleiotropy can be included in ethical analysis.

I now turn to applying the framework to the case study.

I

Applying Step 1: Who are the stakeholders in implementing genetic immunisation, and what are their interests?

Collective-level interests concerning genetic immunisation

Step 1 assesses stakeholders in genetic immunisation and identifies their interests. At the collective level, consider specific groups, the public, and the state.

Specific groups may include people who share certain characteristics and interests that group them together—say, by living with HIV/AIDS. In the US, this population is expected to continue increasing, with incidence cases forecast to rise from around 39,500 in 2010 to nearly 74,000 in 2030.³⁸⁴ A specific group may also be those populations more vulnerable to contracting HIV. For many people, protection against HIV from genetic immunisation may be irrelevant, given low chances of exposure and the specific modes of transmission for HIV, via bodily fluid transfer. Yet, there are some populations that have historically been at higher risk of HIV. These groups include those who inject drugs, transgender women, sex workers,

³⁸³ This effect was shown in 2016 when the removal of CCR5 from mice resulted in improved learning and memory formation. For more, see: Miou Zhou et al., "CCR5 is a Suppressor for Cortical Plasticity and Hippocampal Learning and Memory," *eLife* 5 (2016): e.20985.

³⁸⁴ Tahvi Frank et al., "Global, Regional, and National Incidence, Prevalence, and Mortality of HIV, 1980, 2013, 2017, and Forecasts to 2030, for 195 Countries and Territories: A Systematic Analysis for the Global Burden of Diseases, Injuries, and Risk Factors Study 2017," *The Lancet HIV* 6, no. 12 (2019): appendix 2.

gay men, and other men who have sex with men.³⁸⁵ Members of each of these specific groups share a particular interest in the intervention's implementation.

Take the population living with HIV/AIDS. They are invested in further funding for access to antiretroviral therapies to treat HIV. In fact, forecasts published in 2019 show that the US is expected to just miss the UNAIDS target of 90% coverage for access to antiretroviral therapy for those living with HIV/AIDS in 2030 (at 89% forecast coverage).³⁸⁶ That means that 11% of those living with the condition can be expected to lack access to treatment. This is an improvement on current conditions, wherein, globally, only 73% of those living with HIV/AIDS have access to antiretroviral therapy. Yet, those living with HIV/AIDS may be concerned that the resources that would otherwise have been dedicated to expanding access to antiretroviral therapies may, if genetic immunisation against HIV were to become a priority, be redirected. The funds may go to supporting genetic immunisation, or to other diseases against which genetic immunisation is not yet possible.

Consider, too, the specific interests and concerns of the populations at greater risk of contracting HIV. They may similarly be concerned that funds currently dedicated to the development of vaccines against HIV will also be redirected to genetic immunisation or other healthcare priorities.³⁸⁷ If this were the case, then vaccines that may otherwise have been developed and offered to them to reduce their risk of contracting HIV might not be developed.

³⁸⁵ "Global HIV & AIDS Statistics — Fact Sheet."

³⁸⁶ Frank et al., "Global, Regional, and National Incidence, Prevalence, and Mortality of HIV, 1980, 2013, 2017, and Forecasts to 2030, for 195 Countries and Territories: A Systematic Analysis for the Global Burden of Diseases, Injuries, and Risk Factors Study 2017." Full data available in Appendix 2.

³⁸⁷ Two late-stage multinational clinical trials for HIV vaccines are currently running, and their funding depends on the National Institute of Allergy and Infectious Disease, and the Bill and Melinda Gates Foundation. For more, see: "HIV Vaccines," HIV.gov, National Institutes of Health (2021), accessed June 16, 2021. <https://www.hiv.gov/hiv-basics/hiv-prevention/potential-future-options/hiv-vaccines>.

This concern may not apply for future generations. Herd immunity may protect future generations from the risks of contracting HIV. Still, herd immunity may take a long time to be achieved, even if uptake of genetic immunisation is high, if the US is considering implementing the enhancement only as a germline intervention, not as a somatic one that could be offered to the current population. Especially if the birth rate in the US is negative and in decline, as projected for most countries worldwide by 2050, then the existing population of the US may not experience the benefits of herd immunity.³⁸⁸ Members of the identified specific groups and others ought to participate in policymakers' deliberations concerning whether to implement genetic immunisation. They must be allowed to identify their own further interests relating to their flourishing.

The public is another collective-level stakeholder. Their representation and participation in the decision-making process surrounding genetic immunisation is similarly important. Public participation via enlightened democratic governance may help the public identify their own interests related to collective welfare. During this participation, each domain of collective welfare should be assessed by participants in turn; but to illustrate just one, consider collective resilience.

Collective resilience can be expressed as the ability of a community to adapt effectively to future changes in circumstance. For the community as a whole, this is an aspect of wellbeing. Resistance to HIV may promote the resilience of the US public, by reducing the effects of exposure to HIV. However, we already know that in the case of genetic immunisation against HIV via the CCR5-delta 32 mutation, there is a side-effect: significantly increased susceptibility to West Nile virus (shown in mouse models)³⁸⁹ and possibly to tick-borne

³⁸⁸ Stein Emil Vollset et al., "Fertility, Mortality, Migration, and Population Scenarios for 195 Countries and Territories from 2017 to 2100: a Forecasting Analysis for the Global Burden of Disease Study," *The Lancet* 396, no. 10258 (2020): 1285-1306.

³⁸⁹ William Glass et al., "Chemokine Receptor CCR5 Promotes Leukocyte Trafficking to the Brain and Survival in West Nile Virus Infection," *Journal of Experimental Medicine* 202, no. 8 (2005): 1087-1098.

encephalitis.³⁹⁰ In that case, whether the US population is, overall, more resilient or less resilient to disease depends on the risk of exposure to HIV compared to West Nile virus and other encephalitic diseases, as well as on the treatability and symptom severity of each disease. I leave a final assessment of whether collective resilience is in fact promoted or threatened to Step 2, as this step aims to merely identify such issues as relevant to stakeholder interests. Such an assessment will also have to consider emerging diseases to which the population of the US may be more susceptible, among them, perhaps, drug-resistant HIV, but also other neuro-inflammatory diseases that the CCR5-delta 32 mutation seems to make worse.³⁹¹ The more widespread this genetic susceptibility to other diseases becomes, the greater the threat from reduced immunodiversity in the population, with more copies of CCR5-delta 32 in the gene pool.

Finally, for the collective level, consider the state. The US government has a responsibility to its population to provide and maintain certain goods. One of these is an adequate level of public health. Public health itself may be well-supported by the maintenance of herd immunity³⁹² in the population.

Herd immunity to HIV would protect not only the genetically immunised, but all future citizens of the US, including those unable to be genetically immunised. In this way, it constitutes a primary public good (PPG), in providing the non-excludable, non-rivalrous, important-for-flourishing benefit of immunity to a serious infectious disease. This may reduce stress on the healthcare system if the management of HIV/AIDS would otherwise have resulted in treatment burdens and high levels of hospitalisation in the future US. Herd

³⁹⁰ Sambor Grygorczuk et al., "The Expression of the Chemokine Receptor CCR5 in Tick-Borne Encephalitis," *Journal of Neuroinflammation* 13 (2016): 45.

³⁹¹ For more on drug-resistant HIV, see: "HIV Drug Resistance," World Health Organization (2021), accessed March 25, 2022. <https://www.who.int/news-room/fact-sheets/detail/hiv-drug-resistance>.

³⁹² Herd immunity refers to the protection from the spread of infectious disease in a given community that is conferred when a sufficient proportion of the population is immune. This protection extends beyond those who have had the disease or been immunised against it.

immunity to HIV may further contribute to solidarity in a society,³⁹³ by creating a solidarity-supporting system³⁹⁴ where the US public has a greater feeling of sharing a common lot and responsibility for each other's health by sharing in herd immunity. It is individuals' contributions to herd immunity, either via genetic immunisation or vaccination, that protects both them and vulnerable members of their community. They are reliant on others' contributions, too, for the maintenance of this good. The fact that the action of individuals protects a whole community has been proposed as a mechanism supporting solidarity in the vaccination context.³⁹⁵

Furthermore, genetic immunisation may lead to a society's increased economic productivity and decreased social stigmatization of minority groups, each of which are concerns relevant to the US' governance responsibilities. Genetic immunisation against HIV may result in reduced leave-taking from workplaces during flu season and other periods of increased infection, to which the immunosuppressed are particularly prone.³⁹⁶ Even as far back as 2002, the economic costs of HIV/AIDS in the US were significant, estimated at \$36.4 billion, including \$6.7 billion in direct medical costs and \$29.7 billion in productivity losses.³⁹⁷

Genetic immunisation may also support equality and reduce the discrimination and stigmatisation that is experienced by members of minority groups such as the LGBT+ community, drug users and sex workers, in part as a result of the historical association

³⁹³ I define solidarity here, following Joel Feinberg, as a moral relation between people that binds them to a collective interest and a collective responsibility for that interest, by virtue of their sharing in a common interest or common lot. For more, see: Joel Feinberg, "Collective Responsibility," *The Journal of Philosophy* 65, no. 21 (1968): 674-688.

³⁹⁴ For more on solidarity-supporting systems and shared health responsibilities and outcomes, see: Ben Davies and Julian Savulescu, "Solidarity and Responsibility in Health Care," *Public Health Ethics* 12, no. 2 (2019): 133-144.

³⁹⁵ Ming-Jui Yeh, "Solidarity in Pandemics, Mandatory Vaccination, and Public Health Ethics," *American Journal of Public Health* 112, no. 2 (2022): 255-261.

³⁹⁶ For further discussion of the effects of immunisation on economic growth, see: Sibilia Quilici, Richard Smith, and Carlo Signorelli, "Role of Vaccination in Economic Growth," *Journal of Market Access & Health Policy* 3 (2015), <https://doi.org/10.3402/jmahp.v3.27044>.

³⁹⁷ Angela Hutchinson et al., "The Economic Burden of HIV in the United States in the Era of Highly Active Antiretroviral Therapy: Evidence of Continuing Racial and Ethnic Differences," *Journal of Acquired Immune Deficiency Syndromes* 43, no. 4 (2006): 451-457.

between these populations and the spread of HIV/AIDS which would be eliminated if HIV were no longer a risk for these groups and others.³⁹⁸ This type of contribution to social stability, equality and safety is a priority for the governments of liberal democracies.

Individual-level interests concerning genetic immunisation

At the individual level, consider the future child's and prospective parents' interests.

The child has an interest in the protection of their right to an open future. This could be secured by genetic immunisation against HIV: especially for at-risk individuals, immunity may increase their range of safe sexual interactions, and may prevent restricting decisions that those living with HIV/AIDS often find restricted, such as decisions regarding contact with others every flu season, when their immunocompromised status renders them more susceptible to serious infection,³⁹⁹ and whether to have a child and risk transmission to that child (for mothers in particular, this can occur during pregnancy, childbirth, or breastfeeding).⁴⁰⁰ If we consider the stringent medical regimen required for antiretroviral therapy to manage HIV/AIDS, genetic immunisation may have even longer-term effects on the child's range of choices. The child's wellbeing may also be served by protecting their health as a component of their flourishing.

The prospective parents' reproductive autonomy is another interest that may be affected: it is promoted by their being able to exercise their reproductive choice to have a child genetically immune to HIV, if desired. This interest is morally relevant insofar as it is important for their flourishing. Their wellbeing more broadly may also be affected. They may be saved from worry about the child's exposure to HIV (especially if their child is transgender

³⁹⁸ For a comprehensive review on stigmatization and HIV/AIDS, see: Ian Coulter and Carl Maida, "Destigmatization of HIV: Progress or Regress?," *International Journal of Self-Help and Self-Care* 3, no. 3-4 (2005): 213.

³⁹⁹ "Flu & People Living with HIV," Centers for Disease Control and Prevention (2021), accessed August 26, 2021. <https://www.cdc.gov/flu/highrisk/hiv-flu.htm>.

⁴⁰⁰ "HIV and Pregnant Women, Infants and Children," Centers for Disease Control and Prevention (2021), accessed August 25, 2021. <https://www.cdc.gov/hiv/group/gender/pregnantwomen/index.html>.

or gay, in which case their risk of contracting HIV may be greater). They may also avoid the care responsibilities that may otherwise have burdened them if they had to care for someone living with HIV, or if they were themselves living with HIV and having to take care not to expose their child to the disease. It should be noted that, when recruiting for his experiment, He Jiankui found couples where the father had HIV, and thus whose children may have been at slightly greater risk of contracting HIV. Although the risk was not great enough to justify undertaking an unsafe, untested GGEE intervention, in a future where the intervention was safe and effective, this may be a contributing factor to parents' pursuit of genetic immunisation against HIV.

This step of analysis informs further assessment of the permissibility of implementing genetic immunisation against HIV as a public health measure. Whilst Step 1 focussed on identifying stakeholders and certain interests that may be affected by genetic immunisation, Step 2 goes further, in assessing the plausible magnitudes of harms and benefits to each stakeholder from implementing incentivised genetic immunisation.

II

Applying Step 2: What are the plausible consequences of implementing genetic immunisation?

We can already identify possible conflicts between stakeholders' interests identified above, and thus both harms and benefits that will arise as a result of implementing this GGEE intervention. As noted in Step 1, the realisation of specific groups' interests in continued vaccine and treatment research may be threatened by widespread genetic immunisation, if it results in reduced motivation to undertake this research. However, widespread genetic

immunisation may be in a state's interest, where this protects its healthcare system from stress.

Expressing these and other conflicts of interest identified in Step 1 as harm/benefit ratios in Step 2 allows consideration of when net harm to a stakeholder may be justified, and when it is not, resolving the conflict of interests one way or the other. For this purpose, I use two tools I explained in previous chapters. The first is a modified duty of collective easy rescue (CER*). The second is WELLBYs (losses and gains) as measure of harms and benefits.⁴⁰¹ Analysts using the CPH framework will need to allocate WELLBYs lost and gained as a measure of each of the harms and benefits identified below, and use these for the ratios and calculations of net harm or benefit to stakeholders. I outline this process after considering, first, plausible harms, and second, plausible benefits of genetic immunisation for each stakeholder, in the sub-sections below.

First, however, an additional note on WELLBYs. Surveys in the US have shown that individuals rate their lives on average 7 on a scale from 0-10 in terms of life satisfaction.⁴⁰² One year of life lost, then, is a loss of 7 life satisfaction points, or 7 WELLBYs. One year of life affected negatively by a certain situation or condition will constitute a number of WELLBYs lost according to the impact on life satisfaction through that year (up to a maximum of 7 in the US). The advantage of a flexible measure for assessing genetic immunisation policy is that it is adaptable for the extreme uncertainties that may later be resolved. With additional information, we may be able to make WELLBYs estimates concerning the emergence of new diseases, impacts on the continued pursuit of universal access to antiretroviral therapies, and other new developments.

⁴⁰¹ Layard et al., *When to Release the Lockdown: A Wellbeing Framework for Analysing Costs and Benefits*.

⁴⁰² "How's Life? 2020: Measuring Wellbeing," OECD (2020), accessed May 16, 2021. https://www.oecd-ilibrary.org/economics/how-s-life/volume-/issue-_9870c393-en.

Harms of genetic immunisation

Collective-level harms

Consider each stakeholder in turn.

As already mentioned, specific groups of those vulnerable to contracting HIV or those already living with HIV/AIDS may be harmed if genetic immunisation is implemented. It seems plausible that funding for vaccine research and access to antiretrovirals may decrease as attention shifts to preventing the spread of HIV via genetic immunisation. The smaller future population of people vulnerable to contracting HIV may reduce the incentive for pharmaceutical companies to develop and produce conventional vaccines.

Whilst the WELLBYs lost for each of the following plausible harms cannot be determined with certainty in many cases, we can base our estimates on past data. Relevant past data concerns, in this case, the disease burden of HIV in the US, the burden of West Nile virus, parental attitudes toward reproductive autonomy and IVF, and other related areas affecting life satisfaction. For instance, in this case, we know that there were 2.2 million people living with HIV/AIDS in western Europe and North America in 2020. The numbers have risen globally around 1.5% over the past five years.⁴⁰³ By 2030, then, there might be 2.24 million people living with HIV/AIDS. Say that, from the point at which genetic immunisation is being considered for implementation, instead of increasing access to antiretroviral therapies, the US directs its funding elsewhere because of the decreasing number of people at risk of contracting HIV as the first genetically immune people are being born. In that case, if the US caps out its antiviral coverage rate in 2030, at the forecast 89%, then around 2 million people will have access to treatment. However, the proportion of the population living with HIV/AIDS who have access to antiretrovirals will decrease from then on, as their population slowly increases, but access does not. That is, 240,000 people will go

⁴⁰³ "Global HIV & AIDS Statistics — Fact Sheet."

without treatment in the first year, 270,000 people in the second year, with a 1.5% increase in the uncovered population, year on year. This trend will disappear as the later generation passes and is replaced by the next, genetically immune generation. For that prior period, however, a few hundred thousand people living with HIV will suffer from lack of treatment access, and likely earlier death. It is these numbers that would contribute to WELLBYs lost by implementing genetic immunisation. A year earlier death per person living with HIV/AIDS and unable to access treatment constitutes a loss of 7 WELLBYs, according to the standard use of the measure in the US. A 2014 study showed that men living with HIV/AIDS (at 30-35 years of age) have a life expectancy over 7 years lower than the general population before beginning antiretroviral therapy.⁴⁰⁴ Multiplying the loss in life expectancy across the expected untreated population in the US, then, genetic immunisation could cause 11.8 million WELLBYs lost for this specific group in the first year ($7 \times 7 \times 240,000$). This might increase year on year, until the population begins to dwindle and the number of WELLBYs lost each year decreases. Of course, this WELLBYs estimate is counting only reduced life expectancy. A full analysis should also assess the WELLBYs lost from any decreased life satisfaction for members of this group. This might result from a lack of access to treatment forcing people with HIV/AIDS to make changes to their lifestyle to reduce exposure to colds and flus, as well as their experiencing increased worry, etc.

Similar analysis is needed to assess plausible harms for other specific groups, which may include women unable to undergo GGEE and IVF and their children, who may face stigmatisation as the un-immunised in a largely enhanced population.

The public's interests may also highlight plausible harms.

⁴⁰⁴ Margaret May et al., "Impact on Life Expectancy of HIV-1 Positive Individuals of CD4+ Cell Count and Viral Load Response to Antiretroviral Therapy," *AIDS* 28, no. 8 (2014): 1193-1202.

For example, collective welfare may be threatened, counterintuitively, by making the US public genetically immune to HIV. The immunodiversity problem outlined in Step 1 highlights a plausible loss of collective resilience resulting in reduced life satisfaction across the public, or lost WELLBYs. In this case, the disease of greatest concern (as identified so far) is West Nile virus. In the US, we might expect the harms resulting from early deaths from West Nile virus to be low, because the disease burden of West Nile virus in the US is low, and up to 80% of people infected do not show symptoms of the disease.⁴⁰⁵ In 2020, cases were reported in states across the country, but totalled 664 cases and only 52 deaths.⁴⁰⁶ For comparison, there were 6885 deaths from HIV/AIDS in the US in 2020.⁴⁰⁷ In that case, it is plausible that the collective welfare of the US public is not greatly harmed (in resilience terms at least) by the implementation of genetic immunisation against HIV. Whilst less data is available to make an accurate estimate here, we can expect that WELLBYs loss to the general US population in this case would be low, at least compared to the WELLBYs loss suffered by the specific group of those living with HIV/AIDS. Taking the loss of collective resilience into account *as far as possible* given the difficulty of anticipating susceptibility to future emergent diseases, the future US government may find that loss of immunodiversity results in 0.005 WELLBYs lost overall per person. This would leave life satisfaction at 6.995, down from 7 for members of the US population, multiplied by the population of 330 million people, i.e., a loss of 1.65 million WELLBYs. The harms side of the harm/benefit ratio would also be contributed to by the expected number of early deaths from emergent diseases to which genetically immunised members of the population are rendered more susceptible. This

⁴⁰⁵ "West Nile Virus," Newsroom Factsheets, World Health Organization (2021), accessed August 24, 2021. <https://www.who.int/news-room/fact-sheets/detail/west-nile-virus>.

⁴⁰⁶ "West Nile Virus Statistics & Maps," Centers for Disease Control and Prevention (2021), accessed November 20, 2021. <https://www.cdc.gov/westnile/statsmaps/preliminarymapsdata2020/disease-cases-state-2020.html>.

⁴⁰⁷ "Global HIV & AIDS Statistics — Fact Sheet," appendix 2.

is one harm to consider of implementing genetic immunisation for the public, if enough people were undertaking the intervention to significantly reduce immunodiversity.⁴⁰⁸

Finally, the state may be harmed by supporting genetic immunisation. Certainly, genetic immunisation could help maintain herd immunity to HIV in the US and could also help reduce stress on the healthcare system from treating HIV/AIDS and associated complications of immunosuppression that those with the disease suffer from. However, the plausible side-effect of susceptibility to another disease may also threaten to destroy these very goods. If West Nile virus were to become prevalent in the community, then population-wide susceptibility to that disease may have a significant effect on public health. This would also threaten the healthcare system if it results in increased hospitalisations. There may be ways in which the proportion of genetically immune people could be controlled at such a level that a threshold level of genetic immunodiversity could be maintained. However, the policy under initial consideration by the US government, that of incentivising uptake, is unlikely to control uptake effectively, and thereby protect against these harms. The spread of West Nile virus in the US is still a remote possibility, so this harm to healthcare systems, too, will be relatively low in terms of the number of WELLBYs lost.

Individual-level harms

At the individual level, consider plausible harms to the child first.

Counterfactual harm can befall the future child if their future is less open and their wellbeing lower in the case where genetic immunisation is implemented (and undertaken by their parents) compared to a situation where they were born without being genetically

⁴⁰⁸ For further discussion of the feasibility of concerns regarding losses of genetic diversity in traits such as immune functioning, cognition and appearance, see Ossareh, "Would You Like Blue Eyes With That? A Fundamental Right to Genetic Modification of Embryos."

immunised.⁴⁰⁹ Genetic resistance to HIV will not plausibly narrow the range of valuable choices in a future child's life. However, if the child is rendered, in addition, more vulnerable to West Nile virus or another emerging disease, then the plausible harm depends on how likely that child is to be exposed to these other diseases in the pursuit of valued life choices. For example, the child should perhaps avoid travelling to certain regions of Latin America, where incidence of West Nile virus is higher.⁴¹⁰ This may pose a small harm to the child, reducing their life satisfaction due to inability to travel.

As for the child's interest in their future wellbeing, this is threatened if genetic immunisation would plausibly reduce the chances of the child leading a flourishing life. Aside from the concerns with side-effect susceptibility to other diseases as discussed above, however, it is hard to conceive of plausible threats to wellbeing resulting from genetic immunisation against HIV. I will not speculate on these harms further here, due to lack of data.

Other plausible harms at the individual level may befall the prospective parents. Under the incentivisation policy being assessed, the parents' reproductive autonomy is not plausibly threatened by their having the additional option to have a genetically immunised child. Similarly, the prospective mother's bodily autonomy and bodily integrity⁴¹¹ is not plausibly directly threatened by mere incentivisation. However, social pressures to genetically

⁴⁰⁹ Note this is a particular choice of counterfactual scenario, which may be controversial: in some cases, the child would not have been born at all unless the parents undertook IVF, and in some of these cases, the parents would only have undertaken IVF *with* GGEE intervention. For further discussion of possible counterfactuals to being born genetically enhanced, see: César Palacios-González, "Reproductive Genome Editing Interventions are Therapeutic, Sometimes," *Bioethics* 35, no. 6 (2021): 557-562. In such cases, we face the 'non-identity problem', wherein, seemingly, the child cannot be counterfactually harmed, because if they had not been harmed by the existence-associated intervention, they would not have been born at all. I avoid considering such complex cases here, but for more, see: Thomas Douglas and Katrien Devolder, "Gene Editing, Identity and Benefit," *The Philosophical Quarterly* (2021): 305-325.

⁴¹⁰ "West Nile Virus."

⁴¹¹ That is, her moral right not to have her body invaded, and her moral right to have control over what happens to her body. For more, see: Herring and Wall, "The Nature and Significance of the Right to Bodily Integrity."

immunise one's child may result from an incentivisation policy. Thus, the policy may risk infringing both the parents' reproductive autonomy and the mother's bodily autonomy, indirectly. If the parents are socially pressured to have a genetically immunised child, to the extent that the choice *not* to have one is effectively removed, then they may feel that their options to not have a genetically immunised child are effectively eliminated. For the prospective mother, this harm extends beyond threats to reproductive choice, to her choice concerning whether to undergo an invasive IVF procedure. Whilst benefits to the future child and others may outweigh these harms, they ought, nevertheless, to be considered.

The prospective parents are otherwise unlikely to be harmed. However, the stronger the relational connection between parent and child—where impacts on one person affect the other—the more parents' wellbeing will be threatened by any negative impacts of genetic immunisation on their future child. This might constitute another loss of WELLBYs, but I will avoid calculating here.

As well as considering harms, benefits ought to be estimated, and expressed as additional WELLBYs gained per stakeholder, to be used for later calculations. As with estimations of harm in terms of WELLBYs lost, it is impossible to know the exact number of WELLBYs gained in advance. However, we can make educated guesses in some cases, based on past practices and benefits in similar areas such as vaccination to treat diseases with burdens similar to HIV, parents' attitudes, etc.

Benefits of genetic immunisation

Collective-level benefits

Next, consider plausible benefits at the collective level.

If genetic immunisation is implemented in the US as a public health measure, we can expect some specific groups' interests to be promoted. More particularly, future people who

may be more vulnerable to contracting HIV/AIDS because of their membership of certain risk groups may be benefited. Members of this specific group will face lower risk of contracting HIV because of widespread genetic immunisation, whether it is they who are genetically immunised, or others. The specific group may gain a certain number of WELLBYs as a community that faces less disease transmission. If, say, genetic immunisation were fully effective and widespread by 2050, then these future people would experience the bulk of the benefit of dramatically reduced rates of HIV infection, or even possible elimination, saving thousands of people each year from contracting the virus. Whilst forecasts to 2050 are unavailable, even if only the volume of new cases forecast for 2030 were prevented, this would be almost 74,000 people fewer contracting HIV per year. Assuming that, under current capped access to antiretroviral treatment, these people would have a life expectancy of 7 years less on average, that's 7 WELLBYs per person per year x 7 years x 74,000 people, or 3.26 million WELLBYs gained per year. Unlike the loss in WELLBYs imposed on people living with HIV/AIDS from the redirection of funds that otherwise may have been spent on antiretroviral therapies, this benefit continues increasing over time when compared to a counterfactual case of continued HIV spread. By contrast, the loss of 11.8 million WELLBYs that is imposed on the other specific group of at-risk people who may be harmed by reduced research and development on HIV ends with their deaths. This may not be the right trade-off to make, all things considered, between the lives of those currently living with HIV/AIDS and the protection of future people who may be vulnerable to contracting it. However, that remains to be seen according to analysis in the second part of this step.

As far as benefit to the public is concerned, public participation can help identify collective wellbeing benefits like increased resilience, increased sexual freedom, reduced

discrimination, etc., which will result in a gain of a certain number of WELLBYs. These should all be calculated in a full analysis.

Finally, states have responsibilities to maintain PPGs including public health itself, as well as healthcare, education, and other systems. As discussed, the state may, then, be benefited by widespread genetic immunisation against HIV where that directly supports public health, and indirectly supports healthcare systems, too. These systems are protected from added stress from treating HIV/AIDS.

Individual-level benefits

At the individual level, genetic immunisation against HIV will plausibly offer the future child a wider range of valued choices in their life, benefiting them. In particular, consider the counterfactual case of an individual who might have been at greater risk of contracting HIV without genetic immunisation. The way that an individual may have to make accommodations for their compromised immune system might severely restrict their future choices. This is avoided via genetic immunisation.

Similarly, consider benefits in terms of protecting the child's health as a component of wellbeing. A particular child, then, may experience benefit of however many WELLBYs gained if they would otherwise have contracted HIV. Alternatively, if they would not have been exposed, they may experience no individual benefit. The number of WELLBYs gained is dependent on the individual, their membership of certain at-risk groups, and other factors that can't be known in advance. Still, considering a hypothetical person in analysis is necessary, in order to ensure that plausible benefits and harms that occur most visibly at the individual level are not neglected in ethical analysis. For example, the population as a whole may not experience any significant increase in valued life choices from the implementation

of genetic immunisation, yet for some individuals, this difference may be significant, and ought therefore to be included in ethical analysis.

Other individual-level benefits of genetic immunisation may befall the prospective parent(s). Their reproductive autonomy may be promoted by their having the additional choice available to have a child who is genetically immunised. Finally, plausible benefits to the future child may also affect the parent(s), insofar as there is a strong relational connection between them.

Harm/benefit ratios and the collective duty of easy rescue

At the collective level, the most significant plausible harms of genetic immunisation against HIV that I have identified are threats to current vaccination research and treatment distribution efforts, a loss of immunodiversity in the population, and increased susceptibility to West Nile virus. These harms to specific groups, the public, and the state's maintenance of the healthcare system (if West Nile virus or an emergent disease were to spread) weigh on the harm side of a harm/benefit ratio. They can be expressed as the number of WELLBYs lost by implementing genetic immunisation.

On the benefit side, however, collective-level stakeholders may have increased social and mental wellbeing from protection against the spread of HIV in the community, and the reduced burden on the healthcare system from HIV/AIDS-related care needs. Protection of the specific groups of people at greater risk of contracting HIV particularly contributes to collective-level benefit. Overall, consider the comparatively large number of people suffering from HIV/AIDS in the US, and the significant impacts it can have on their lives because of the resulting immunosuppression. Consider, too, the small proportion of people living with HIV who may be unable to access treatment. Implementing genetic immunisation would benefit these groups, causing an increase in WELLBYs.

Given the magnitudes of identified harms and benefits, combined with the less significant risks of the spread of West Nile virus and its impact on US communities, it seems plausible that, overall, the harm/benefit ratio for implementing genetic immunisation against HIV provides net benefit at the collective level. That is, the harm/benefit ratio, i.e. the number of WELLBYs lost over the number of WELLBYs gained is less than 1.

Just because the intervention benefits the collective, however, does not mean it is ethically acceptable. Any net harms posed to stakeholders must be acceptable in terms of their magnitude, and, in the next step, in terms of distribution. For instance, it may be that the harm/benefit ratios for one stakeholder shows net harm for that specific group or individual. In that case, the harm must be either avoidable, or small compared to the collective benefit produced *and* reasonably bearable, for genetic immunisation to be acceptably implemented.

This can be assessed using CER*.

Recall CER*: If the cost (including foreseeable risk of significant disability or death) to someone *or a group of people* of performing an action X (or of refraining from performing an action Y) is sufficiently small, *individually and for the group as a whole*, to be reasonably bearable, and the resulting benefit to other people (or harm that is prevented) is large relative to the cost, then the agent ought to do X (or not do Y).

Say that, considering both harms and benefits to all collective-level stakeholders, the collective-level harm/benefit ratio for implementing genetic immunisation in the US is 1:10 (or around 80 million WELLBYs lost: 800 million WELLBYs gained) over the first 20 years after implementation. This ratio would take into account, on one side, the high but diminishing harm of 11.8 million WELLBYs lost per year to those living with HIV/AIDS, and reduced access to treatment due to genetic immunisation, plus the WELLBYs lost from

other harms considered. On the other side of the ratio would be the 3.26 million WELLBYs gained per year (and increasing) to those prevented from contracting HIV and suffering the associated reduced life expectancy, as well as the additional benefits of reduced burdens on the healthcare system and other benefits considered. The ratio shows that for every 1 WELLBY lost, a corresponding 10 WELLBYs are gained. This seems like an acceptable proportion: there is large benefit exchanged for comparatively small harm, in relative terms.

This fulfils one requirement of CER*, regarding the exchange of relatively small costs for relatively large benefits—and only on the collective level as a whole. However, CER* requires policymakers to consider harms in absolute terms, and for each stakeholder, as well, such that any net harms to a group or person are considered comparatively, and gross harms absolutely, as either ‘reasonably bearable’ or not. In this case, collective-level stakeholders all together experience 80 million WELLBYs lost in exchange for the 800 million WELLBYs gained. The net benefit of 720 million WELLBYs gained is large in absolute terms. However, perhaps the gross 80 million WELLBYs lost is also large in absolute terms, such that it is a loss that is not reasonably bearable. Consider that, in the calculations supplied, 80 million WELLBYs lost is equivalent to 11.4 million years of life lost, when we divide by the average life satisfaction rating used in WELLBYs calculation, 7. (Although, some of the harms included in that number will have been losses of wellbeing as opposed to actual years of life, e.g. accounting for financial costs). Across a population of 330 million, this is only about 11 days lost per person. Upon a first assessment, then, genetic immunisation seems to have acceptable consequences.

The harms identified here are not spread equally, however. As such, US policymakers and analysts employing the CPH framework will need to determine whether the number of WELLBYs lost is ‘reasonably bearable’ and relatively small for each stakeholder at the

collective level, starting with each specific group, using CER*. Note that here, I am concerned not with the distribution of harms and benefits in terms of whether they fall fairly, but merely in terms of whether they fall such that no individual or group experiences harms that are not reasonably bearable in their absolute magnitude. (Questions of distributive justice are left to Step 3.) Genetic immunisation may pose net benefit for, say, most specific groups, the public, the US state, and the future child. Yet, it may be that the 80 million WELLBYs lost fall mostly on a particular specific group in US society, and, say on the prospective mother(s) who is to undertake IVF and the genetic immunisation of her child.

Consider the first of these stakeholders, those currently living with HIV/AIDS whose access to treatment may be hindered by the implementation of genetic immunisation and the associated redirection of funding away from R&D on treating existing cases of HIV. As already noted, the group as a whole suffers a loss of 11.8 million WELLBYs per year. (Note also, that the specific group may also experience some benefits from genetic immunisation being implemented, such as reduced stigmatization associated with having HIV, if their HIV-positive status then poses no threat to the genetically immunised.) In that case, the *net* harm to this group may be less. Say the harm is reduced to 7 million WELLBYs per year, when we account for other benefits. This net harm must be compared to the net benefit for the population of 36 million WELLBYs gained (720 million WELLBYs / 20 years). The net harm to this specific group seems of an acceptable magnitude, at least relative to the benefit produced.

Next, let us consider absolute terms, the side-constraint to the weighing process. The question CER* asks is: is 7 million net WELLBYs lost per year for this group a reasonably bearable harm? If not, no amount of benefit produced will justify imposing or asking that harm of the stakeholder. This can only be determined by comparison with WELLBYs calculations for other harms that we see as reasonably bearable in the given society. Whilst

we may allow larger harms to be voluntarily taken on by individuals pursuing genetic immunisation or choosing not to, the effects on the specific group of people living with HIV/AIDS are *imposed on them* indirectly, by others' pursuit of genetic immunisation and the resulting reduction in R&D funding. I will not make a judgement of whether the 7 million WELLBYs lost per year for this group is reasonably bearable, but I will say that I believe this amount could be reduced to reasonably bearable levels, if it does not fall within the bounds already, via compensation. Compensation effectively adds extra WELLBYs to the harm/benefit ratio, to offset harms such that the net harm is reduced to a reasonably bearable level. People living with HIV/AIDS could be offered additional services that would make up for the loss in their wellbeing from reduced R&D, if this was unavoidable.

I will not go into as much detail and describe the process for considering net harms to individuals, as my purpose here is merely illustrative. Let me merely say that the same weighing process applies. I will note two important points, however.

The first is that prospective mothers, considered as individuals undertaking GGEE for genetic immunisation, may initially be assumed to take on any net harms voluntarily under the incentivisation policy, so long as they do not, in fact, experience extreme social pressures to have genetically immunised children. If this were the case, then the possibility of their acting highly altruistically by taking on harms of invasive IVF that are *not* reasonably bearable may seem acceptable. Whilst CER* would not support their having a duty to do so, prospective mothers may wish to benefit the collective at a physical or bodily cost to themselves. However, as discussed, the incentivisation policy may make this choice less than voluntary. If the policy can be expected to either result in extreme social pressures for mothers to undertake GGEE, or if it provides incentives that, some would argue, constitute

an undue inducement for prospective mothers,⁴¹² then the mothers cannot be said to act altruistically, because voluntariness is an essential component of altruism.⁴¹³ Their actions, in these social pressure cases, may be sufficiently non-voluntary that any harms to them from undertaking GGEE that are not reasonably bearable would render implementing genetic immunisation (via incentivisation) unacceptable.

My second point concerns individual future children. They cannot consent to genetic immunisation, and so, are reliant on their parents acting in their best interests in deciding whether or not to pursue genetic immunisation against GGEE. Whilst the prospective parents may, to some extent, be able to take on significant harms altruistically, these ought not be imposed on the future child, who cannot *themselves* take on the harms altruistically.

We have now compared gross and net harms to stakeholders to the net benefits of genetic immunisation for the collective. Let us assume the following, for the purposes of continued analysis. The gross harm of implementing genetic immunisation to the specific group of those living with HIV/AIDS is reasonably bearable. Let us also assume that in the future US society, social pressure to pursue GGEE is highly unlikely to occur, based on the implementation of other emerging technologies in that future society. In that case, the net harm to prospective mothers is likely also reasonably bearable or avoidable. That means that the current policy considered for implementing genetic immunisation is acceptable, at this point. With this in mind, let us continue to the next step.

⁴¹² Undue inducement is often discussed as a potential problem wherein people in vulnerable circumstances are offered a benefit that they cannot refuse, in exchange for taking on a harm that they should not be asked to take on in the first place. This is considered most frequently in debates concerning international organ and surrogacy markets. For a surrogacy example, see: Wilkinson, "Exploitation in International Paid Surrogacy Arrangements." Objectors to this view maintain that large incentives constitute incentives alone, *not* undue inducement. For example, consider healthcare workers' remuneration in the COVID-19 context: Alberto Giubilini and Julian Savulescu, "Stopping Exploitation: Properly Remunerating Healthcare Workers for Risk in the COVID-19 Pandemic," *Bioethics* 35, no. 4 (2021), <https://doi.org/10.1111/bioe.12845>.

⁴¹³ Michael Vlerick, "Explaining Human Altruism," *Synthese* 199, no. 1 (2021): 2395-2413.

III

Applying Step 3: Does implementing genetic immunisation using the incentivisation policy fulfil the requirements of distributive justice?

Not only do the magnitudes of harms and benefits of genetic immunisation matter in ethical analysis, but their distribution along existing lines of advantage and disadvantage does, too. As discussed in chapters 4 and 5, a sufficiency-constrained prioritarian (SCP) account of distributive justice is appropriately applied here.

Recall the core tenets of SCP:

SCP Requirement: Individuals/groups must be distributed harms in a way that minimises harms to people whose level of wellbeing is below a particular critical threshold level, and particularly the worst off among them.

SCP Preference: Individuals/groups ought to be distributed benefits in a way that maximises the number of people whose level of wellbeing is above a particular critical threshold level, and benefits should particularly befall the worst off among them.

As discussed in Chapter 6, the requirements of distributive justice cannot be extended internationally without inconsistency. Therefore, there are no additional requirements I propose here.

SCP requirement

The requirement of SCP concerns the appropriate distribution of harms among three identified groups in the US population: the worst off, those below a threshold level of wellbeing, and those above the threshold (the better off).

SCP requires that net harm from implementing genetic immunisation neither primarily befalls the worst off (a prioritarian requirement), nor those below the threshold (a sufficientarian requirement). Therefore, harms must primarily befall the better off in US society.

Identifying the better-off citizens of the US requires that its policymakers determine the acceptable threshold level of wellbeing. I assumed, in Chapter 5, that this would be around 6 WELLBYs, based on national and international life satisfaction ratings. This can be further contextualised by considering the relationship between wealth and life satisfaction. In the US in 2019, the median annual household income was \$68,703.⁴¹⁴ The poverty line, calculated for varying household sizes, was \$25,926 for a household of four people with two children under 18 years of age in 2019.⁴¹⁵ 10.5% of the US population lay below their household-specific poverty line in 2019, or 34 million people.⁴¹⁶ The poverty line, however, is unlikely to represent a standard of living above which citizens can flourish and be termed 'better off'.⁴¹⁷ It is unlikely that those living barely above the poverty line would rate their life satisfaction a mere 1 point below the US average for life satisfaction.

⁴¹⁴ Jessica Semega et al., "Income and Poverty in the United States: 2019," United States Census Bureau (2020), accessed September 18, 2021. <https://www.census.gov/library/publications/2020/demo/p60-270.html>.

⁴¹⁵ For more detail, see "Poverty Thresholds: 2019", appended to: Semega et al., "Income and Poverty in the United States: 2019."

⁴¹⁶ Semega et al., "Income and Poverty in the United States: 2019."

⁴¹⁷ For example, the more demanding measure employed by the OECD, relative income poverty, defines the standard of living below which people live in poverty as a disposable income below half the national median. For this measure, over 17% of people in the US fall below the line. For more, see "Section 2: Income and Wealth," in: "How's Life? 2020: Measuring Wellbeing."

Let us say, then, that those 34 million Americans constitute, not those below the threshold level of wellbeing for flourishing, but those who are the worst off, another measure relevant for SCP. The harms of genetic immunisation should not befall these people, by priority, or, indeed, those who lie above the poverty line but below that 6 WELLBYs critical threshold. To determine whether harm primarily befalls them, each prospective harm of genetic immunisation must be assessed—for example, the harms of reduced access to treatments for those living with HIV, as discussed in the section above. These people will fall above and below the threshold, in a certain proportion. In particular, more members of this group may fall below the threshold, because currently, groups like sex workers who are more likely to fall below the poverty line are also 26 times more likely to contract HIV.⁴¹⁸ Thus, of the 7 million WELLBYs lost per year by those living with HIV/AIDS without treatment in the future, perhaps one third of this group are sex workers and others who may be more likely to fall below the poverty line like those who inject drugs. In that case, let us say that 2.3 million WELLBYs are lost by people below the poverty line, and 4.6 million WELLBYs are lost by people above it. (These people could be further divided between those who are still below the 6 WELLBYs, and those ‘better off’ who are above it.) Harms primarily befall the better off so far, then.

The process can be repeated for each harm, and the WELLBYs lost can be aggregated for each category to determine whether either those below the poverty line, those below the threshold level of wellbeing for flourishing, or the better off primarily experience the harms of genetic immunisation against HIV. Say that, plausibly, once the process is complete, we have found that the harms of implementing incentivised genetic immunisation against HIV primarily befall the worst off in the US population (given there may be more of these people

⁴¹⁸ "Global HIV & AIDS Statistics — Fact Sheet."

who fall into the specific group of those living with HIV/AIDS). In that case, the policy for implementing genetic immunisation is unacceptable, according to the requirement of SCP.

Policymakers may expect that the benefits of genetic immunisation, too, will befall the worst off, and may then intuit that it would be acceptable to impose some harm on a group for the sake of greatly benefiting them. However, this is not the case. As shown with the specific groups discussed in this chapter, it is not necessarily the same people who can be expected to experience harms and benefits of genetic immunisation against HIV. Rather, harm would befall some people who are already worst off, for the sake of *other* people who are also worst off. SCP holds that we ought not harm those already worst off.

The incentivisation policy for implementing genetic immunisation against HIV, then, must be rejected on distributive justice grounds. However, analysis should be completed, regardless, as other policy alternatives may avoid imposing harms on the worst off (as explored in Step 4).

SCP preference

After considering the harms and the minimum requirement of SCP, we can apply SCP to consider preferences for the distribution of benefits. According to SCP as I employ it, we have reason to *prefer* that the benefits of genetic immunisation (i.e., gains in WELLBYs) primarily befall the worst off, or, failing this, that they befall people below the threshold level of wellbeing.

One of the primary benefits of genetic immunisation is the maintenance of herd immunity against HIV (at least, within a generation of the policy being implemented). These benefits are distributed equally within a society because herd immunity is a PPG, and its benefits are therefore non-excludable and non-rivalrous. This may not align with our preferences for the allocation of benefit primarily to the worst off, according to SCP.

However, when we consider specific groups, it is those who are at greater risk of contracting HIV who will benefit the most from individual immunity, and, in some cases, who will more likely fall below the wellbeing threshold. For example, transgender women are 34 times more likely to contract HIV compared to the wider population, and 29% of transgender people in the US live in poverty.⁴¹⁹ If this 29% of transgender people were protected from contracting HIV, the benefit to them would contribute to the portion of the total benefit of genetic immunisation that befalls the worst off.

Other benefits should also be assessed in turn, to determine where they fall overall among these populations. Say that we find that overall, the worst off and those below the minimum threshold level of wellbeing are those who are most benefited by genetic immunisation against HIV. In that case, the policy fits the preferences expressed by SCP, but these preferences are rendered void by the fact that, overall, genetic immunisation failed the requirement of SCP at the national level. There were harms primarily befalling the worst off. If policymakers were to find, in the next step, that alternative policies (say, mandating genetic immunisation instead of incentivising it) alter the distribution of harms such that they befall those above the threshold level of wellbeing (the better off), then the alternative policy for implementing genetic immunisation may be acceptable.

IV

Applying Step 4: Iterative process for comparison of alternative policies for implementing genetic immunisation

⁴¹⁹ M. Lee Badgett, Soon Kyu Choi, and Bianca Wilson, "LGBT Poverty in the United States: A Study of Differences Between Sexual Orientation and Gender Identity Groups," UCLA School of Law Williams Institute (2019), accessed September 20, 2021. <https://williamsinstitute.law.ucla.edu/publications/lgbt-poverty-us/>.

In this final step, consider whether alternative policies for implementing genetic immunisation against HIV in the US are acceptable.

The policy considered thus far is incentivisation. More specifically, the proposed policy subsidises the costs of genetic immunisation, and offers additional child support benefits to those already eligible to receive them, if they undertake the intervention. Alternative policies should now be considered. One way to outline alternatives is to use a public health intervention ladder⁴²⁰ that compares policies in terms of coerciveness. Alternative, less coercive policies may include simply permitting genetic immunisation and educating parents on its benefits. More coercive alternatives to incentivisation may be disincentivisation or mandating the intervention. Disincentivising the choice *not* to undertake genetic immunisation is more coercive, as it penalises the undesired action instead of rewarding the desired action. Mandating the intervention is more coercive still, as it heavily penalises those who refuse to undertake genetic immunisation. In the iterative process, I will consider first the alternative of disincentivisation, but a full analysis should also consider a mandatory policy, and other alternatives on the public health ladder like simply permitting genetic immunisation.

One option for disincentivisation may be to levy a tax on use of assisted reproductive services *without* undertaking genetic immunisation. In that case, any prospective parents who wish to access pre-natal checks, fertility treatments such as IVF, or other services such as preimplantation diagnosis for genetic selection may have a financial penalty imposed if they refuse genetic immunisation at the time.

Step 4 allows a comparison of this new policy alternative to incentivisation, using the first steps of the CPH framework as already employed. Disincentivisation may have significant

⁴²⁰ *Public Health: Ethical Issues*. See Chapter 3.

effects on other groups not already identified as stakeholders in genetic immunisation, and it may cause there to be different magnitudes and distributions of harms and benefits. To assess whether it is acceptable to implement genetic immunisation via disincentivisation, the policy therefore must be assessed using Steps 1-3 of analysis.

Iterative process

I do not have the space here to demonstrate the iterative process fully, however consider illustrative differences between the two policy alternatives.

Step 1: First, an additional stakeholder group to consider may be people with low fertility. These people are more in need of assistance for reproduction, and therefore will be heavily penalised by a disincentivisation policy if they do not wish to undertake genetic immunisation. Their interests will be threatened.

Step 2: In terms of magnitude changes for harms and benefits and the CER* calculation, we may identify slightly larger harms, overall, associated with a disincentivisation policy, compared to incentivisation. Specifically, prospective mothers may have their right to bodily autonomy more threatened by disincentivising policies that reduce their reproductive options by imposing a tax where they do not undertake genetic immunisation, thus harming them. Then again, in a voluntary system, these harms are avoidable. And there may also be greater benefits. A more coercive policy may lead to a larger proportion of people undertaking genetic immunisation, thus better protecting the population as a whole—and a larger number of future genetically immunised people—from contracting HIV.

Step 3: The distribution of these harms and benefits may also be altered, compared to an incentivisation policy. A disincentivisation policy may shift plausible infringements of bodily and reproductive autonomy from prospective parents who may fall below the threshold level of wellbeing, to those above. The incentivisation policy used childcare benefits to incentivise uptake. This targets those who are eligible for such benefits already (often due to low

income), and as such, locates some proportion of the harms associated with social pressures undermining reproductive autonomy on those who are already worst off. Yet, disincentivisation of the use of IVF without genetic immunisation distributes those harms very differently. That is, these harms may fall to a greater extent upon the better off, who can afford and seek IVF. The harms of infringements of reproductive and bodily autonomy would befall those with access to IVF—primarily still low-fertility heterosexual couples,⁴²¹ rather than members of the LGBT+ community, or those reliant on welfare benefits, or others who might be more likely to fall below the threshold level of wellbeing. There is an inverse correlation between SES background and fertility, in part because those who are more advantaged tend to have children at a later age, and therefore require more assistance with reproduction as their fertility declines.⁴²² It is these people who are more pressured to undertake genetic immunisation if pursuing IVF, according to a disincentivisation policy. If the difference is significant enough, then this alteration in the distribution of harms will render genetic immunisation acceptable according to the requirements of SCP.

If genetic immunisation against HIV under the disincentivisation policy also does not impose unreasonable harms on any stakeholders (according to CER*), and still provides collective benefit overall, then the alternative policy is acceptable for the US to implement and should be implemented.

Problem cases

For some GGEE interventions, we may have two acceptable policy alternatives. In such cases, preference for one over the other is determined by which produces the greatest net

⁴²¹ Note that this study was conducted in Canada, however, not the US. For more, see: Michelle Tam, "Queering Reproductive Access: Reproductive Justice in Assisted Reproductive Technologies," *Reproductive Health* 18, no. 1 (2021): 164.

⁴²² Thea van Roode et al., "Life-Course Relationship between Socioeconomic Circumstances and Timing of First Birth in a Birth Cohort," *PLoS One* 12, no. 1 (2017), <https://doi.org/10.1371/journal.pone.0170170>.

benefit *and* which is preferable in its distribution of those benefits (primarily on those below the threshold level of wellbeing). With two factors determining preference, they must be weighed against each other in cases where one policy maximises net benefit, but the other better distributes benefit.

In states with relatively equal societies, with state support for (at least) the worst off, the distribution of benefits arising from GGEE may be of less importance than their magnitudes. The US example may not fit this description, lying among the worst countries for inequality measures in the OECD rankings.⁴²³ Whether the magnitude of benefit or its distribution should be regarded as most important for preferring one policy over another depends on the state implementing the policy, and its levels of inequality at the time. Whilst the lack of an acceptable alternative to the disincentivisation policy means that choosing between policies is unnecessary in the case of genetic immunisation against HIV in the US, this concern may become relevant in other cases.

Conclusion

In this chapter, I found genetic immunisation against HIV to be ethically acceptable in this specific context, under a policy of disincentivisation for not undertaking it. The process leading to this conclusion is very briefly outlined in Summary Box 7.

⁴²³ "How's Life? 2020: Measuring Wellbeing."

Summary Box

**Applying the Framework:
Incentivised Genetic Immunisation against HIV**

<p style="text-align: center; margin: 0;">STEP 1</p> <p>Stakeholders: specific groups e.g. immunocompromised and LGBT+ community; public; state; future HIV-immune child; parents</p> <p>Interests: autonomy, wellbeing, open future, others identified via public participation</p>	<p style="text-align: center; margin: 0;">STEP 2</p> <p>Harms: reduced R&D on HIV; vulnerability to West Nile Virus</p> <p>Benefits: reduced HIV spread</p> <p>CER*: Benefits outweigh harms at collective level. No stakeholders expected to have unreasonably bearable harms imposed.</p>
<p style="text-align: center; margin: 0;">STEP 3</p> <p>Harms: mostly befall worst-off</p> <p>Benefits: mostly befall worst-off</p> <p>SCP: requirement not fulfilled. Incentivisation policy unacceptable.</p>	<p style="text-align: center; margin: 0;">STEP 4</p> <p>Policy alternative: disincentivisation of not undertaking genetic immunisation</p> <p>Differences: similar magnitude benefits and harms. Redistributes harms to mostly befall better-off.</p>

OUTCOME: My Framework ethically assesses genetic immunisation as a GGEE intervention. It is unacceptable if incentivising uptake, but acceptable under a policy that disincentivises not undertaking it.

Summary Box 7: Application of my CPH framework for ethical analysis of GGEE interventions to the case of genetic immunisation against HIV in the future US. Items under each step are merely indications of some main considerations, and do not represent the full analysis.

Genetic immunisation is one possible GGEE intervention among many; the US is one country among many. The conclusions drawn in this chapter, therefore, are highly specific to this case. They cannot be generalised either to apply to other GGEE interventions, other target diseases than HIV, or to other jurisdictions. Rather, each GGEE intervention must be considered in turn, within the specific context of the jurisdiction in which it may be implemented.

Having considered the case of genetic immunisation, then, let me next apply the CPH framework to a more controversial, paradigmatic example of enhancement: memory enhancement.

Chapter 8:

Case Study 2 - Memory Enhancement

Introduction

Imagine a future United States of America (US) like the one considered in the previous chapter, but in which the nation state is considering implementing memory enhancement. Let us furthermore suppose that learning and memory in this future state function in the population at around today's levels. That is, people learn about as quickly and remember about as well as they do now. The enhancement I examine in this chapter would improve memory and learning in individuals by changing expression of the NRB2 gene using genome editing techniques (although regulatory changes via genome editing are still in an early stage of research).⁴²⁴ This gene, if overexpressed, encodes a molecule that controls the functioning of a receptor in the brain that impacts long- and short-term memory, the NMDA receptor.⁴²⁵ In fact, the same mouse models have already shown that overexpression of the NRB2 gene improved memory performance in recognition tests, a water maze test, and certain working memory tests.

In this future scenario, off-target effects and other safety concerns with memory enhancement via NRB2 overexpression have already been identified and addressed in clinical trials, and thus the remaining ethical considerations relate to implementing the intervention in society, via the public health system.

⁴²⁴ Valentina Di Maria et al., "Development and Validation of CRISPR Activator Systems for Overexpression of CB1 Receptors in Neurons," *Frontiers in Molecular Neuroscience* 13 (2020): <https://www.frontiersin.org/article/10.3389/fnmol.2020.00168>; Jeong Gu Kang et al., "Regulation of gene expression by altered promoter methylation using a CRISPR/Cas9-mediated epigenetic editing system," *Scientific Reports* 9, no. 1 (2019), <https://doi.org/10.1038/s41598-019-48130-3>.

⁴²⁵ Wang et al., "Genetic Enhancement of Memory and Long-Term Potentiation but Not CA1 Long-Term Depression in NR2B Transgenic Rats."

The US of the future has sufficient, geographically well-distributed assisted reproduction clinics to offer memory enhancement to its population. However, given the existence of more urgent public health priorities and resource allocation requirements, the state cannot offer subsidised or incentivised memory enhancement. Rather, the policy under initial consideration merely offers memory enhancement as an optional add-on at additional cost to prospective parents undergoing IVF, in a regulated market. Should the US implement memory enhancement under this policy?

The CPH framework I presented in Chapter 5 aims to answer the above question. Memory enhancement in this scenario would be implemented as an optional add-on to services currently offered via the healthcare system, for which prospective parents would pay. This chapter structure follows the steps in the CPH framework and the structure of the previous case study, with section I applying Step 1, section II applying Step 2, etc. It diverges after this point, due to a judgement that this policy for implementing memory enhancement is morally impermissible when the consequences for stakeholders are considered. As such, Step 3 is skipped, and application of Step 4 is discussed in section III, to consider whether alternative policies for implementation fare better in ethical analysis. I do not have the space here for a full analysis. However, I assess at least one relevant moral concept or principle for each part of each step, to illustrate application of the CPH framework.

Memory enhancement is a paradigmatic example of an enhancement intervention. It has been thoroughly discussed in the literature. It may constitute both an individually beneficial prospective enhancement,⁴²⁶ and a possible society-benefiting enhancement insofar as it has

⁴²⁶ Alexandre Erler, "Does Memory Modification Threaten Our Authenticity?," *Neuroethics* 4, no. 3 (2011): 235-249; S. Matthew Liao and Anders Sandberg, "The Normativity of Memory Modification," *Neuroethics* 1, no. 2 (2008): 85-99.

network effects, providing indirect benefit to others.⁴²⁷ Yet, there is a seeming stalemate between proponents and detractors of memory enhancement. Proponents often argue for memory enhancement on the basis of individual benefits, whereas detractors often argue against it by considering harms to others.⁴²⁸ My framework can incorporate these and other morally relevant considerations. In considering both the individual- and collective-level morally relevant factors, it can overcome the stalemate, leading to a conclusion on whether it is acceptable for the future US to implement memory enhancement under the policy proposed.

I

Applying Step 1: Who are the stakeholders in implementing memory enhancement, and what are their interests?

Collective level

Step 1 identifies stakeholders in memory enhancement and their interests.

At the collective level, consider specific groups, the public, and the state.

Specific groups may include members of the neurodiverse community,⁴²⁹ people living with dementia, and people competing in markets where memory enhancement offers particular advantages over other competitors. Take members of the neurodiverse community for analysis at this point. Often, there are particular conditions that mediate these differences, such as autism spectrum disorder (ASD), attention deficit hyperactivity disorder, dyslexia

⁴²⁷ Anomaly and Jones, "Cognitive Enhancement and Network Effects: how Individual Prosperity Depends on Group Traits."

⁴²⁸ Although not all works listed here adhere exactly to the proponent-detractor divide, see, for details of possible harms to others: Persson and Savulescu, "The Perils of Cognitive Enhancement and the Urgent Imperative to Enhance the Moral Character of Humanity."; Johann Roduit, Jan-Christoph Heilinger, and Holger Baumann, "Ideas of Perfection and the Ethics of Human Enhancement," *Bioethics* 29, no. 9 (2015): 622-630.

⁴²⁹ That is, the group of individuals with diverse neurological development who identify as members of a minority culture of the neurodiverse. For more, see:

and speech disorders.⁴³⁰ Members of this community might have their interests especially affected by the implementation of memory enhancement. That's because the pursuit of memory enhancement in neurotypical people and/or neurodiverse people (given my expansive definition of enhancement that can include what might be considered 'treatments', as well) might be seen to express disvalue toward those with different ways of learning and remembering.⁴³¹ Indeed, it is more plausible that members of the neurodiverse community will see an increased gap between themselves and 'neurotypical + memory-enhanced' people. Members of the community may have their interests undermined if this results in either disvalue toward members of the community, or fewer opportunities for interaction and participation with and among neurodiverse people and neurotypical people. What's more, reduced participation in society increases risk of mental illnesses for neurodiverse people.⁴³² With neurodiverse people already at heightened risk of anxiety, depression, and self-harm, increasing this risk may be particularly against the interests of this specific group.⁴³³ Their participation in deliberation on the implementation of memory enhancement, and the participation of other specific groups⁴³⁴ in deliberations should be ensured, in order to understand better how these groups' interests might be affected.

The public is another collective-level stakeholder. The public's representation and participation in the decision-making process surrounding memory enhancement is also

⁴³⁰ Pier Jaarsma and Stellan Welin, "Autism as a Natural Human Variation: Reflections on the Claims of the Neurodiversity Movement," *Health Care Analysis* 20, no. 1 (2012): 20-30.

⁴³¹ This kind of argument aligns with the expressivist objection against using genetic selection to select against children with disabilities following prenatal testing. For more, see: Steven Edwards, "Disability, Identity and the 'Expressivist Objection'." *Journal of Medical Ethics* 30, no. 4 (2004): 418.

⁴³² Eilidh Cage, Jessica Di Monaco, and Victoria Newell, "Experiences of Autism Acceptance and Mental Health in Autistic Adults," *Journal of Autism and Developmental Disorders* 48, no. 2 (2018): 473-484; Catherine Sebastian, Sarah-Jayne Blakemore, and Tony Charman, "Reactions to Ostracism in Adolescents with Autism Spectrum Conditions," *Journal of Autism and Developmental Disorders* 39, no. 8 (2009): 1122-1130.

⁴³³ Lucy Licence et al., "Prevalence and Risk-Markers of Self-Harm in Autistic Children and Adults," *Journal of Autism and Developmental Disorders* 50, no. 10 (2020): 3561-3574.

⁴³⁴ For instance, consider people with dementia, whose comparative lack of memory will be further underlined by memory enhancement, and who thus may face the same issues as members of the neurodiverse community.

important. Using methods of enlightened democratic governance, a sample of the public who are educated about memory enhancement may contribute to deliberations by evaluating existing interests in communities and identifying new ones regarding the effects of memory enhancement on collective welfare. To illustrate what might arise from this participation for just one domain of collective welfare, consider opportunity/prosperity. Prosperity arises from opportunities to develop or maintain stable financial, social, and other capital.⁴³⁵ This is influenced by how equal and adequate primary resource distribution is in a society—for example, equal access to state-provided education and healthcare support or equal chances to secure work.⁴³⁶ To illustrate how memory enhancement can impact on opportunity and prosperity as a domain of collective welfare, recall an example I raised in Chapter 2: for a prospective textile manufacturer, a memory enhancement is likely to be less valuable than for prospective (an likely advantaged) stocks analysts on Wall Street. Someone who is born into a family that can give them the opportunity to become a Wall Street stocks analyst will be benefited by the existence of memory enhancement and by their parents accessing it. By contrast, given the heritability of disadvantage, someone who is born into a less advantaged family, who may go on to become a factory labourer, will not. Their family, *ex hypothesi*, could not afford to pay for memory enhancement, and even if they could, memory enhancement may be little help in succeeding at the types of work to which these individuals are more likely to have access, as they are often less cognitively demanding types of work.

The offspring of wealthy families, then, continue to have access to a technology that will increase their children's opportunities to secure high-level work and their prosperity, and the offspring of disadvantaged families will likely not benefit, and will be competing for higher-level jobs against enhanced individuals. This presents not only an issue of collective-level injustice, but a loss of collective welfare in the domain of opportunity that might be identified

⁴³⁵ Roy et al., "Collective Well-Being to Improve Population Health Outcomes: An Actionable Conceptual Model and Review of the Literature."

⁴³⁶ Rawls, *A Theory of Justice*.

by the public via public participation. The whole public's interests are undermined by virtue of living in a society with more unequal access to opportunities for, say, employment, and more unequal levels of prosperity, even for those members of the public who are not in the group that is competed out of higher-level jobs. This is because equal opportunity and prosperity contribute to wellbeing on a community-wide scale, as recognised in the account of collective welfare that I use. Counter-intuitively, this problem is smaller under the regulated market policy proposed here than under a system of universal provision (as the example was introduced in Chapter 2), because the enhancement will be less widespread—only those able to afford it will have access, and this could be a small proportion of people, given the current projected costs of GGE based on current genetic selection and IVF costs.⁴³⁷ This is, of course, assuming that truly universal uptake is impossible, because not everyone will seek IVF. In that case, mid-range levels of uptake of enhancement produce worse outcomes regarding equality of opportunity and prosperity. Therefore, equal opportunity in the job market, for high-level jobs, is less likely to be undermined by there being a significant increase in the number of people who are memory-enhanced. Regardless, public participation is essential in the deliberative process to ensure that the equality-reducing, and thus prosperity- and opportunity-reducing effects of memory enhancement are accounted for.

Finally, with regard to collective level stakeholders, consider the state. The US government has a responsibility to its population to provide and maintain (or at least coordinate others' contributions to) certain goods. Two of these are, plausibly, education and the country's economic productivity. A public education system is a primary public good (PPG) insofar as education is conducive to flourishing for all life paths people may choose

⁴³⁷ Marissa Conrad and James Grifo, "How Much Does IVF Cost?," *Forbes Health* (21 September 2021), accessed May 20, 2021. <https://www.forbes.com/health/family/how-much-does-ivf-cost/>.

to take, and insofar as the system is (mostly) accessible and non-competitive.⁴³⁸ A country's economic productivity (that is, the economic effects of effort in industry, government, etc.) is also a PPG insofar as it, too, contributes to the wellbeing of people in that country in some small way, being (mostly) accessible and non-competitive.⁴³⁹ We commonly hold states responsible for ensuring accessible education, and for providing interventions like market regulations, employment protections, and incentives that increase productivity.

According to Jonathan Anomaly and Garrett Jones, cognitive enhancements like memory enhancement produce beneficial 'network effects' that might affect each of these two PPGs. The authors note, 'when average intelligence is raised in a population, perhaps up to some threshold, each member of the group is likely to lead a better life than if intelligence were relatively low.'⁴⁴⁰ This network effect primarily holds because of the ways that increased average cognitive abilities in a population contribute to increased economic productivity in that population. Notably, 'wealthier societies with high levels of trust make it less risky for people to behave generously. [... S]marter people tend to create the conditions for more productive social interactions.'⁴⁴¹ If states have a responsibility to increase productivity,⁴⁴² the implementation of memory enhancement may be in the state's proxy-interests as a means of fulfilling that responsibility. Note that this consideration seems to counteract the loss of

⁴³⁸ Indeed, according to Dov Fox, better long- and short-term memory are each capacities that constitute natural primary goods (for individuals) in and of themselves. For more, see: Fox, "Luck, Genes, and Equality," 721.

⁴³⁹ This is a somewhat controversial matter, however evidence suggests that increased productivity at a local level in the US increases employment and average earnings, and reduces income inequalities, providing benefits across the population of that area. Furthermore, indirect positive effects occur beyond the limits of the increased local productivity, due to worker mobility. For more, see: Richard Hornbeck and Enrico Moretti, "Who Benefits From Productivity Growth? Direct and Indirect Effects of Local TFP Growth on Wages, Rents, and Inequality," *National Bureau of Economic Research Working Paper Series* (2019), <https://doi.org/10.3386/w24661>.

⁴⁴⁰ Anomaly and Jones, "Cognitive Enhancement and Network Effects: how Individual Prosperity Depends on Group Traits," 1753.

⁴⁴¹ Anomaly and Jones, "Cognitive Enhancement and Network Effects: how Individual Prosperity Depends on Group Traits," 1759.

⁴⁴² For more on memory enhancement and the ethics of development, see: Buchanan, "Enhancement and the Ethics of Development," 9-10.

prosperity/opportunity in collective welfare terms that I raised in the previous section. This means that there are countervailing considerations that must be weighed against each other to produce an overall evaluation of the effect of memory enhancement on productivity, opportunity, and prosperity, and how this intersects with the interests of various collective-level stakeholders.

The US government may also have a responsibility to provide the PPG of education. Memory enhancement and other cognitive enhancements may improve classroom learning, improving the level of education children can receive through public education systems. In classroom settings, students who are at a cognitive disadvantage can slow down learning for themselves and for others,⁴⁴³ as teachers spend more time focussing on students needing more support. If just some of these students were, instead, cognitively enhanced, then the overall level of learning in each classroom could be increased. In turn, better educated populations would have increased levels of health and wellbeing on a number of measures, including better health, increased social trust and political participation, and others.⁴⁴⁴ The US has an interest in the implementation of memory enhancement and allowing prospective parents to pursue the intervention for their children insofar as this improves how well the state fulfils its responsibility to provide public education by improving the quality of this education.

⁴⁴³ Gehan Roberts et al., "Can Improving Working Memory Prevent Academic Difficulties? A School Based Randomised Controlled Trial," *BMC Pediatrics* 11, no. 1 (2011): 57.

⁴⁴⁴ For more on population-level education and health associations, see: David Baker et al., "The Education Effect on Population Health: A Reassessment," *Population and Development Review* 37, no. 2 (2011): 307-332. For more on population-level education and political participation, social trust, and other wellbeing-related measures, see: "Evidence Briefing: The Wellbeing Effect of Education," UK Economic and Social Research Council (2014), accessed June 19, 2021. <https://esrc.ukri.org/files/news-events-and-publications/evidence-briefings/the-wellbeing-effect-of-education/>.

Individual level

At the individual level of stakeholders, consider the future child's and prospective parents' interests.

The child has an interest in the protection of their right to an open future. Memory enhancement could impact the child's future options in a number of ways. Improved short- and long- term memory could help a child establish and maintain relationships with others due to the effects of better memory on empathy: there is a positive correlation between memory and cognitive empathy, which is essential for understanding others' perspectives.⁴⁴⁵ Additionally, enhanced memory could improve the options a child has to engage in memory-intensive employment, compared to if they had been born without the enhancement. Memory enhancement is of both positional and intrinsic worth to the individual. Not only is it good in itself to have better memory, but having better memory in comparison to others can benefit one in competitions where memory is a relevant factor. For example, a future individual with memory enhancement may have a better chance than others at interviewing well for a place at a prestigious university when ranked against others, or they may be a better candidate for cognitively demanding jobs. The child's interests in an open future and their future wellbeing, then, may be affected by memory enhancement.

The prospective parent(s)' reproductive autonomy may be promoted by their being able to exercise their reproductive freedom by choosing to have a child who is memory-enhanced, if they so desire. Furthermore, parents may have particular reason to undertake GGEE for memory enhancement, because of the competitive advantage this may give their child in educational and employment settings—insofar as benefiting the child benefits the parents, under my assumption of a relational connection between parent and child.

⁴⁴⁵ Ullrich Wagner, Lisa Handke, and Henrik Walter, "The Relationship Between Trait Empathy and Memory Formation for Social vs. Non-Social Information," *BMC Psychology* 3, no. 1 (2015): 2.

This step of analysis informs further assessment of the permissibility of implementing memory enhancement as an optional addition to IVF available via a regulated market. Step 2 builds on this step to assess the plausible magnitudes of these effects on stakeholders' interests in terms of harms and benefits to each stakeholder if memory enhancement is implemented. It then goes on to construct and assess the resulting harm/benefit ratio.

II

Applying Step 2: What are the plausible consequences of implementing memory enhancement?

Where stakeholders' interests conflict regarding memory enhancement, going ahead with a policy to implement memory enhancement will impose costs on some stakeholders by threatening the interests identified in the step above, and confer benefits on others, by promoting their interests identified above. Step 2 expresses harm/benefit ratios for each stakeholder in turn, as well as the collective level as a whole. This step both acts as a check on whether memory enhancement indeed constitutes a public health-type enhancement under my definition (by virtue of providing net benefit at the collective level), and also allows for assessment of whether the costs or harms imposed on some stakeholder(s) are proportionate and reasonably bearable. If they are not, memory enhancement should not be implemented under the policy currently proposed.

In the previous chapter, I used WELLBYs as a unit for measuring costs and benefits, defined as the effects of an intervention on subjectively measured life satisfaction scores. The effects of memory enhancement on individuals and the collective discussed in this chapter are less predictable than the effects of genetic immunisation against HIV discussed in the previous chapter. In part, this is because much of the WELLBYs loss that is prevented

via genetic immunisation against HIV relates to the prevention of early death, a simple 7 WELLBYs per year of life saved. Memory enhancement is unlikely to significantly and predictably affect lifespan in this way. Rather, memory enhancement will likely have more modest effects on whether life satisfaction is rated at around 7 on a scale of 1-10 for each year of life, as usual for the US,⁴⁴⁶ or a little higher or lower. I assume these effects are small given how much we rely on our memories *vs* technological aids today, and given limited effects of memory enhancement beyond faster learning and memory recall. Therefore, the estimates of WELLBYs gains and losses that I make here are subject to greater uncertainty. This uncertainty in my estimates is increased by difficulties finding data on existing interventions that could be considered analogous to memory enhancement. Unlike for genetic immunisation, with a clear analogue of vaccination, there is no easy existing analogue for memory enhancement. As such, it is difficult to base estimated effects on life satisfaction on already-available information. In what follows, I have provided data where possible, and have avoided direct WELLBYs estimates where data was unavailable to inform them.

I will consider, first, harms to stakeholders, then benefits. I will then weigh these against each other within and across stakeholder groups.

Harms of memory enhancement

Collective-level harms

I will start with WELLBYs lost or gained for the identified collective-level stakeholders from implementing memory enhancement.

One specific group I identified above was the neurodiverse community. This group has an interest in memory enhancement not being implemented, *if and only if* I am correct in assuming that implementation will negatively affect the way neurodiverse people are

⁴⁴⁶ "How's Life? 2020: Measuring Wellbeing."

perceived and valued in society and how able they are to interact with and be understood by neurotypical and enhanced people. People with ASD, across all age-groups, have already been shown to have statistically significantly lower levels of subjective wellbeing⁴⁴⁷ and life satisfaction⁴⁴⁸ compared to the general population. In fact, one study found that ‘in individuals with ASD, the ability to participate in society was the only significant predictor [of life satisfaction, among their variables], explaining 49% of the variance in overall life satisfaction’.⁴⁴⁹ Imagine that people with ASD in the US were to rate their life satisfaction lower than the population average, and memory enhancement implementation were to reduce their participation in society, if not also affecting how they are perceived by others. In such a case, we could predict a WELLBY loss for people with ASD that would count against implementing memory enhancement. Even if life satisfaction were only lowered by half a point per person with ASD, the effect across the population of people with ASD in the US (based on the current number of 5,437,988 people)⁴⁵⁰ would be over 2.5 million WELLBYs lost each year.

This WELLBY loss may be counteracted by certain gains for this group as a whole—especially if, in fact, memory enhancement effectively increased neurodiversity. It might do so by adding another category of people with neurological differences: the memory-enhanced. It might also improve acceptance of and participation of neurodiverse people more broadly in society. Whilst I cannot consider all harms and benefits here, a full analysis, with participation from all relevant specific groups should be conducted where implementation is being considered.

⁴⁴⁷ Laura Graham Holmes et al., "A Lifespan Approach to Patient-Reported Outcomes and Quality of Life for People on the Autism Spectrum," *Autism Research* 13, no. 6 (2020): 970-987.

⁴⁴⁸ Lilly Schmidt et al., "Psychosocial Functioning and Life Satisfaction in Adults With Autism Spectrum Disorder Without Intellectual Impairment," *Journal of Clinical Psychology* 71, no. 12 (2015): 1259-1268.

⁴⁴⁹ Schmidt et al., "Psychosocial Functioning and Life Satisfaction in Adults With Autism Spectrum Disorder Without Intellectual Impairment," 1265.

⁴⁵⁰ Patricia Dietz et al., "National and State Estimates of Adults with Autism Spectrum Disorder," *Journal of Autism and Developmental Disorders* 50, no. 12 (2020): 4258-4266.

Consider, next, harms to the public. In Step 1, I examined how collective welfare might be affected by memory enhancement, in the domain of opportunity/prosperity. Increased inequalities undermine opportunity, resulting in reduced collective welfare in a population. This holds for the population as a whole, and not only those who are out-competed from employment markets by the memory-enhanced population. Higher levels of inequality—especially in income—result in reduced wellbeing for all members of the population, regardless of where they sit in the income distribution, posing a harm to them.⁴⁵¹ Detailed studies across populations have shown, however, that this trend is mitigated by accompanying increases in income where these occur.⁴⁵² This is a factor which is taken into account in my analysis here by considering the effects of increased economic growth/productivity in the future US from memory enhancement implementation on increasing opportunity/prosperity, and the corresponding expected gain in WELLBYs. Still, increases in income inequality do have a negative effect that must be accounted for here (as the increases in income per se are accounted for as increasing WELLBYs further below). Furthermore, those with unstable occupational status have been shown to have their health and happiness affected more by inequality, compared to those with stable occupation or outside the labour force.⁴⁵³ The increasing inequality of opportunity is likely to harm the population as a whole. The average life satisfaction rating in OECD countries with comparatively high levels of inequality is between 5.4 and 5.7.⁴⁵⁴ By contrast, those with low

⁴⁵¹ David Cooper, W. David McCausland, and Ioannis Theodossiou, "Income Inequality and Wellbeing: The Plight of the Poor and the Curse of Permanent Inequality," *Journal of Economic Issues* 47, no. 4 (2013): 939-958.

⁴⁵² Max Roser, "Evolution of Happiness Inequality Within Countries During Periods of Uninterrupted Economic Growth, 1981 to 2007," *Our World in Data* (2017), accessed December 2, 2021. <https://ourworldindata.org/happiness-and-life-satisfaction>; Betsey Stevenson and Justin Wolfers, *Happiness inequality in the United States* (Bonn: Institute for the Study of Labor, 2008).

⁴⁵³ Takashi Oshio and Miki Kobayashi, "Income Inequality, Perceived Happiness, and Self-Rated Health: Evidence from Nationwide Surveys in Japan," *Social Science & Medicine* 70, no. 9 (2010): 1358-1366.

⁴⁵⁴ The OECD countries considered included Greece, Hungary and Estonia, with income inequality around 0.3 (range 0.286-0.356) on a 0-1 scale measured by Gini coefficient post-tax in 2013. For more, see the OECD webpage on "Better Life Index Statistics," OECD (2021), accessed December 11, 2021. <https://stats.oecd.org/Index.aspx?DataSetCode=BLI#>.

levels of inequality have life satisfaction ratings between 7.4 and 7.6.⁴⁵⁵ This is a difference in life satisfaction level of between 1.7 and 2.2, between the countries listed with higher income inequality and those with lower. It is unlikely that implementing memory enhancement in the US would have this large an effect on life satisfaction as to reduce it by 1.7 to 2.2 points, given that there are other factors in these high-inequality countries that contribute to the lower life satisfaction ratings in the OECD study. However, it might increase it by a little, perhaps resulting in a drop in average US life satisfaction to 6.5, given our understanding of how inequalities detract from wellbeing.⁴⁵⁶ If even only 0.5 points of life satisfaction are lost per person in a society that becomes more unequal in prosperity and opportunity terms due to the implementation of memory enhancement, this would result in a WELLBYs loss of around 165 million WELLBYs each year in the future US. (That is, 330 million people x 0.5 life satisfaction points.)

Finally, consider potential harms to the state, in terms of its not fulfilling its responsibilities toward citizens. Increasing inequality of opportunities affects the state's proxy-interests insofar as it is responsible for supporting the wellbeing of its citizens. However, I have accounted for this loss directly as part of the public stakeholder analysis above. The two other responsibilities I identified for the state in Step 1 relate to the provision of PPGs of education and economic productivity. As memory enhancement would promote each of these, I leave their discussion to the benefits section further below.

Individual-level harms

⁴⁵⁵ The OECD countries considered included Netherlands, Denmark, and Norway, with income inequality around 0.27 (range 0.252-0.287) on a 0-1 scale measured by Gini coefficient after tax in 2013. For more, see: "Better Life Index Statistics."

⁴⁵⁶ Cooper, McCausland, and Theodossiou, "Income Inequality and Wellbeing: The Plight of the Poor and the Curse of Permanent Inequality"; Oshio and Kobayashi, "Income Inequality, Perceived Happiness, and Self-Rated Health: Evidence from Nationwide Surveys in Japan."

I turn now to considering the individual-level harms that might result from the implementation of memory enhancement in the future US.

Mostly, memory enhancement is likely to *benefit* future children as individuals. These benefits will be discussed below. There is, however, one harm, proposed in the literature, that I will discuss here. This concerns the future child's authenticity. The concern is that memory enhancement may threaten a future child's authenticity, where this refers to being faithful to one's previously established identity.⁴⁵⁷ It has been claimed that a future memory-enhanced person may be unable to be faithful to who they are, if the enhancement involves the ability to edit memories, which, on some accounts,⁴⁵⁸ shape identity. The corresponding loss of authentic identity from altering one's memories of oneself might seriously affect the future child's wellbeing and show a loss of WELLBYs for enhanced individual children. However, as Alexandre Erler notes when considering this objection, the concern is relevant only when it comes to memory *modification*. Memory enhancement of the type I discuss here would not involve the ability to engage actively in modification, erasure or emphasis of certain memories over others.⁴⁵⁹ As such, threats to authenticity are not a potential harm to future memory-enhanced children with the GGEE intervention on the NRB2 gene that I consider here.

Next, consider any prospective harms to future parents. Again, memory enhancement is, for the most part, likely to be positive for the prospective parents. However, in a system in which parents must pay for enhancements, we may be concerned that individual parents would feel pressured to spend more than they can afford to enhance the memory of their future child.⁴⁶⁰ After all, there is evidence that social pressures concerning how to best raise

⁴⁵⁷ For more on this definition, see: Erler, "Does Memory Modification Threaten Our Authenticity?"

⁴⁵⁸ Kass, "Defending Human Dignity."

⁴⁵⁹ Erler, "Does Memory Modification Threaten Our Authenticity?"

⁴⁶⁰ It should be noted, however, that such concerns may exist equally with traditional expensive forms of cognitive enhancement such as private schooling. Yet, private schooling is, at least intuitively, acceptably

children affect parents' rearing practises and their wellbeing.⁴⁶¹ One aspect of this in the future US might plausibly be spending money on memory enhancement. Given the impact of household wealth on life satisfaction, this might impose a clear financial burden on parents, depending on the cost of enhancement. IVF currently costs in the region of \$15,000 - \$30,000, and pre-implantation genetic diagnosis for genetic selection costs an additional \$1,800 - \$6,000.⁴⁶² We can expect that GGEE would certainly cost more than that. For a less well-off couple, the cost of GGEE may have a significant negative impact. As mentioned earlier, there is some association between wealth/income and life satisfaction, such that this may plausibly correlate with a decrease in WELLBYs, at least up to the point when they have financially recovered from the cost of GGEE.⁴⁶³ This constitutes a financial harm to the parents due to social pressure to memory-enhance their future child.

Benefits of memory enhancement

Collective-level benefits

Now, let me turn to the prospective benefits, that is, WELLBYs gained, from the implementation of memory enhancement. Consider the collective-level stakeholders first.

The specific groups I have identified as key stakeholders when it comes to memory enhancement interventions (though not an exhaustive list) are most likely to have their interests threatened rather than promoted. They will likely experience a loss of WELLBYs from the implementation of memory enhancement, as I discussed above.

offered, despite how this might cause social pressures for parents to spend more than they can afford on it. As such, the case for social pressures to undertake memory enhancement posing a significant threat to the interests of parents seems weaker.

⁴⁶¹ Loes Meeussen and Colette Van Laar, "Feeling Pressure to Be a Perfect Mother Relates to Parental Burnout and Career Ambitions," *Frontiers in Psychology* 9 (2018), <https://doi.org/10.3389/fpsyg.2018.02113>.

⁴⁶² Conrad and Grifo, "How Much Does IVF Cost?"

⁴⁶³ Cooper, McCausland, and Theodossiou, "Income Inequality and Wellbeing: The Plight of the Poor and the Curse of Permanent Inequality."

Next, consider WELLBYs gained by the US public, more broadly. As Nick Bostrom and Anders Sandberg note, most cognitive functions (like memory enhancement) ‘are not purely positional goods.’ Rather, they may deliver benefits for others. The authors go on to say:

‘Society faces many pressing problems which would be more readily solved if its members were smarter, wiser, or more creative. An enhancement that enables an individual to solve some of society’s problems would produce a positive externality: in addition to benefits for the enhanced individual, there would be spillover benefits for other members of society.’⁴⁶⁴

The main spillover benefit we might identify from memory enhancement is increased productivity in the society. This may benefit the public by increasing opportunity and prosperity, thereby contributing to collective welfare as quantifiable in WELLBYs, although this gain in WELLBYs for the public may be counteracted by a decrease in collective welfare resulting from increased inequality, as discussed in a previous sub-section above. Note, at this point, that the WELLBYs increase to the public from productivity constitutes both a benefit to this stakeholder, and also to the state in terms of the fulfillment of its responsibilities toward citizens. Productivity, then, can be linked both to the public’s prosperity, and to the provision of a PPG by the state.

One of the main state responsibilities I have discussed is the provision of the PPG of local economic productivity. Whilst it is not a direct indicator of life satisfaction, GDP and household income have some correlation with the measure.⁴⁶⁵ Insofar as memory enhancement can be expected to contribute to productivity in the US, and thereby, GDP

⁴⁶⁴ Nick Bostrom and Anders Sandberg, "Cognitive Enhancement: Methods, Ethics, Regulatory Challenges," *Science and Engineering Ethics* 15 (2009): 328.

⁴⁶⁵ Roser, "Self-Reported Life Satisfaction Across the Income Distribution, Country by Country."

and household income, this increase can be measured at least to some extent in terms of an increase in WELLBYs. According to OECD data, in the UK, where household income increases by 10%, the odds of a person reporting increased life satisfaction are significantly higher.⁴⁶⁶ The same trend of increased life satisfaction with increased GDP per capita and/or increased household income holds for the US.⁴⁶⁷ Increases in GDP per capita due to productivity increases from widespread memory enhancement could mean a (likely small) WELLBY increase for the US public. Yet, even if this WELLBY increase is only 0.3 points per individual in increased life satisfaction, this amounts to 99 million WELLBYs per year across the US population. In turn, this implies benefit to the state in fulfilling its responsibility toward its citizens to support productivity and thereby, citizens' economic rights under the International Covenant of Economic, Social and Cultural Rights,⁴⁶⁸ and its more general responsibility to support citizens' wellbeing as part of maintaining legitimacy.

Individual-level benefits

Whilst memory enhancement is not a purely positional good, as noted by Bostrom and Sandberg in the quote above, the intervention can be expected to particularly benefit the enhanced future child and parents.

Studies in American schools show that children who undertake more advanced programmes of schooling (as might be facilitated by better memory and learning via this GGEE intervention) show a year's advancement over non-accelerated same-age talented students in standardised tests.⁴⁶⁹ Advanced programmes also ensure that students are college-

⁴⁶⁶ "Better Life Index Statistics."

⁴⁶⁷ Roser, "Self-Reported Life Satisfaction Across the Income Distribution, Country by Country."

⁴⁶⁸ *International Covenant on Economic, Social and Cultural Rights* (Geneva, Switzerland: United Nations Human Rights Office of the High Commissioner, 1976).

⁴⁶⁹ James Kulik and Chen-Lin Kulik, "Effects of Accelerated Instruction on Students," *Review of Educational Research* 54, no. 3 (1984): 421.

ready, and reduce the time taken to complete post-secondary degrees, on average.⁴⁷⁰ Together, these factors might have a significant impact on an individual's life—whether their learning is accelerated through an advanced programme, or, I speculate, memory enhancement. We might expect an increase in WELLBYs to track the effects of an additional year of income post-secondary degree, as well as several other factors such as later enhanced employment and earning opportunities. (Although, a full analysis should consider, too, the effects of more education on wellbeing, which show lower subjective happiness ratings for individuals with more education.⁴⁷¹) Considering only the benefits in terms of income and wellbeing, memory enhanced individuals may have increased income across their lifetimes, and increased life satisfaction. In the US currently, those with an annual income of \$100,000 report life satisfaction half a point higher than those who earn \$20,000 per year.⁴⁷² Whilst the effect is small, studies show it to be significant.⁴⁷³ Imagine a future individual whose parents have paid to have their memory enhanced earns around \$100,000 per year as an indirect result of their enhancement. If they earn that amount instead of \$75,000, then this causes an increase of 0.1 WELLBY per year for that individual, accounting only for the income effects.

Consider, finally, benefits for the prospective parents. Their reproductive freedom is promoted because they have the option to choose to have a child with enhanced memory, and insofar as the wellbeing of the parents and child are connected, the parents incur some benefit through increases in the child's wellbeing. This increase, however, might be dependent on the parent-child relationship, and is difficult to quantify. I avoid making a WELLBYs estimate here.

⁴⁷⁰ Michelle Hodara and Ashley Pierson, *Supporting the Transition to College: Accelerated Learning Access, Outcomes, and Credit Transfer in Oregon* (Portland, OR: Education Northwest, 2018).

⁴⁷¹ Fernandez and Kulik, "A Multilevel Model of Life Satisfaction: Effects of Individual Characteristics and Neighborhood Composition."

⁴⁷² Roser, "Evolution of Happiness Inequality Within Countries During Periods of Uninterrupted Economic Growth, 1981 to 2007."

⁴⁷³ Clemente and Sauer, "Life Satisfaction in the United States."

Harm/benefit ratios and the collective duty of easy rescue

At the collective level, I identified several harms to members of the neurodiverse community, and harms to the public more broadly because of increased inequality undermining opportunity and, thereby, collective welfare. These harms weigh against the benefits I have identified, the most significant of which concerned increases in economic productivity, serving the interests of the public by increasing collective welfare in the domain of prosperity/opportunity, and serving the proxy-interests of the state by increasing productivity. Together, these can be expressed at the collective level in a harm/benefit ratio, which determines overall whether the implementation of memory enhancement (via a regulated market) in fact constitutes an enhancement that the state should pursue at all. This will only be the case if it confers benefit overall at the collective level. Whilst a full analysis is not possible here, based on the harms and benefits I have identified, it seems plausible that memory enhancement could cause more WELLBYs to be lost than gained. That particularly holds when we consider not only the population-wide benefits of increased productivity, but also the costs of reduced equality of opportunity, and the negative effects on specific groups like the neurodiverse community. Thus, memory enhancement may prove harmful at the collective level, not constituting an enhancement at all, upon full analysis. A countervailing consideration is the benefit that individuals may experience from memory enhancement. To test whether memory enhancement, upon further analysis, still constitutes an acceptable enhancement, or even a public health intervention-type enhancement at all if implemented under the regulated market policy, I employ the modified collective duty of easy rescue (CER*). This allows me to assess in detail the relative and absolute harms that memory enhancement imposes on stakeholders at both individual and collective levels.

Recall CER*: If the cost (including foreseeable risk of significant disability or death) to someone *or a group of people* of performing an action X (or of refraining from performing an action Y) is sufficiently small, *individually and for the group as a whole*, to be reasonably bearable, and the resulting benefit to other people (or harm that is prevented) is large relative to the cost, then the agent ought to do X (or not do Y).

Say that, considering collective-level harms and benefits, the harm/benefit ratio for implementing memory enhancement via a regulated market is 3:2. This ratio seems plausible when we consider the 167.5 million WELLBYS lost per year from harms to members of the neurodiverse community and the public (together) from increased income inequality/reduced opportunity and more discrimination against members of the neurodiverse community. It would also account for the 99 million WELLBYs gained per year from benefits to the public from increased productivity, and the additional benefit I have not quantified that accrue to the specific group of memory-enhanced individuals and their parents (the numbers for which depend upon uptake of the intervention).

The ratio of 3:2 implies that for every 3 WELLBYs lost by stakeholders at the collective level, 2 WELLBYs are produced (not necessarily for the same stakeholders). Trading off a stakeholder losing two WELLBYs for the sake of gaining three for (possibly) another stakeholder seems immediately unacceptable, given that this constitutes a net cost. Consider, too, that 2 WELLBYs constitute two tenths of a life satisfaction rating, and the average US rating is only 7 out of 10 to begin with. The memory enhancement case certainly contrasts unfavourably in this trade-off with the last case study, genetic immunisation, which produced an estimated harm/benefit ratio of 1:10 instead of 3:2.

A full analysis would consider the absolute and relative harms to each stakeholder at the collective and individual levels, *if* the ratio above had shown more expected benefit than

harm produced by memory enhancement. However, given the net harm expected to be produced at the collective level, then if this was backed up by a full consideration of the harms and benefits to stakeholders, analysis of the GGEE intervention as implemented in a regulated market would end at this point. Without posing net benefit at the collective level, memory enhancement is not appropriately pursued as a public health intervention by the future US state.

Note that this does not immediately imply that it is morally unacceptable for individual parents to pursue memory enhancement for their children, as my analysis only applies to the state perspective. However, the policy being considered for implementing memory enhancement is individual access via a regulated market. Thus, in this particular case, an ethical analysis for individual pursuit of the GGEE intervention will likely, in part, mirror that for state implementation. My claim holds if we assume that parents should be as morally concerned with the effects of memory enhancement on others as they are with the effects on their future children, and this is an admittedly controversial impartialist assumption. I will set aside further judgement, then, on the moral acceptability of parents' pursuit of memory enhancement.

Having considered the harm/benefit ratio for implementing memory enhancement and finding the intervention unacceptable already, Step 3 can be skipped. Instead, policymakers can turn straight to Step 4 of analysis.

III

Applying Step 4: Iterative process for comparison of alternative policies for implementing memory enhancement

The consequences of memory enhancement as implemented via a regulated market are expected to be harmful at the collective level. This policy for implementing memory enhancement is unacceptable. The future US should not implement memory enhancement like this. However, the same might not be said for alternative policies for implementing memory enhancement. For a start, some of the harms identified, such as harms to prospective parents from financial losses incurred from pursuing memory enhancement under social pressure may not apply under a policy that subsidised the GGEE intervention. What's more, a policy that involved widespread increased education on neurodiversity and treated those with memory enhancement as members of the neurodiverse community might not pose harms to existing members of the neurodiverse community from increased discrimination or reduced opportunities for participation.

Policymakers, then, should use Step 4 to consider policy alternatives. These may include more coercive alternatives, such as mandating memory enhancement (as a blanket policy, or selectively), or neutral alternatives, such as providing it at no cost to parents. Each alternative should be assessed in terms of the stakeholders it may affect (Step 1 iteration), and the consequences it poses at individual and collective levels (Step 2 iteration). Furthermore, if the policy in question is at that point acceptable in terms of its consequences, policymakers should consider, finally, the distribution of those consequences across groups in society (Step 3 iteration). This full application of Step 4 is beyond my purpose here, which is to illustrate how the CPH framework is applied to a case study intervention and policy for implementation. However, we might expect that if very different feasible policy alternatives exist, memory enhancement might be acceptably implemented in the future US under one of these. If none of the alternative policies considered changes the harm/benefit ratio sufficiently, however, or Step 3 for the alternative policies shows unacceptable failures of

distributive justice if the policy is implemented, then there seems no acceptable way of implementing memory enhancement in the future US.

Conclusion

It may be that other policy alternatives for implementing memory enhancement have more favourable outcomes from a full version of my analysis and are indeed acceptably implemented by states. Considering memory enhancement as pursued via a regulated market available to wealthy parents accessing IVF, however, the collective-level harms render the intervention inappropriate for the future US state to pursue. The process leading to this conclusion is outlined in Summary Box 8.

Summary Box

**Applying the Framework:
Optional-Addition Memory Enhancement**

STEP 1 Stakeholders: specific groups e.g. neurodiverse community; public; state; future memory-enhanced child; parents Interests: autonomy, wellbeing, open future, others identified via public participation	STEP 2 Harms: stigmatisation of neurodiversity; inequality of opportunity Benefits: productivity CER*: Harms outweigh benefits at collective level.
STEP 3 N/A: Optional-addition policy for implementing enhancement found unacceptable.	STEP 4 Policy alternatives: provision at no cost; (selective) mandate.

OUTCOME: My Framework ethically assesses memory enhancement as a GSEE intervention. It is unacceptable if available as an add-on to existing services, but policy alternatives may be acceptable under a full analysis.

Summary Box 8: Applying the CPH framework for ethical analysis to a second case study: memory enhancement. Based on the four steps, one of which was unnecessary to perform, memory enhancement available as a paid-for add-on to IVF services was found ethically unacceptable. Other policy alternatives require further analysis.

Between this chapter and the last, I have analysed two case studies of GGEE interventions using my proposed CPH framework. The first, genetic immunisation, was found to be appropriately implemented by the future US, under a policy that incentivised the intervention. The second, memory enhancement, was found to *not* be appropriately implemented by the US, at least under a policy of access via a regulated market. These two cases serve to illustrate how the consequences of GGEE interventions and who they affect are key in determining the ethical acceptability of implementing them as public health measures in a given jurisdiction.

Chapter 9:

Thesis Conclusion

In 2018, the first birth of gene-edited human twins⁴⁷⁴ brought renewed public attention to the academic debate surrounding germline genome editing. Most academic and public discourse at the time focussed on condemning this premature, unsafe and ineffective use of the CRISPR-Cas9 genome editing tool.⁴⁷⁵ However, the birth marked not one milestone, but two. The attempted edit to the twins was also an enhancement. When successfully edited, the gene coding region CCR5 confers resistance to HIV,⁴⁷⁶ and may improve learning and memory, as well.⁴⁷⁷ Each of these changes to an individual's functioning, of their immune system and their brain, respectively, can be considered an instance of human enhancement.

Public outcry concerning He Jiankui's gene editing experiment on the twins was justified at the time. Human genome editing may currently contravene human rights treaties, including the 1997 European Convention on Human Rights and Biomedicine (a.k.a. the Oviedo Convention),⁴⁷⁸ and the EU Charter of Fundamental Rights.⁴⁷⁹ Article 13 of the Oviedo Convention states that:

⁴⁷⁴ He, "About Lulu and Nana: Twin Girls Born Healthy After Gene Surgery As Single-Cell Embryos."

⁴⁷⁵ Smith, "Time to Start Intervening in the Human Germline? A Utilitarian Perspective."

⁴⁷⁶ So et al., "Disease Resistance and the Definition of Genetic Enhancement."

⁴⁷⁷ Zhou et al., "CCR5 is a Suppressor for Cortical Plasticity and Hippocampal Learning and Memory."

⁴⁷⁸ *Convention for the Protection of Human Rights and Dignity of the Human Being with regard to the Application of Biology and Medicine: Convention on Human Rights and Biomedicine.*

⁴⁷⁹ "Charter of Fundamental Rights of the European Union," European Commission (2000), accessed 10 February, 2022. <https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:12012P/TXT>.

‘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.’⁴⁸⁰

This statement denounces all human germline genome editing, as effects are passed down to descendants, and it denounces some forms of enhancement (those that are not preventive).

As for the EU Charter, its Article 3 demands respect for the integrity of the person, one part of which is ‘the prohibition of eugenic practices, in particular those aiming at the selection of persons’.⁴⁸¹ Insofar as eugenics is conceived of neutrally, as changing the gene pool (rather than in a way that specifically denounces, instead, the sort of authoritarian, unscientific, genocidal practices of the 20th century), this effectively also prohibits germline interventions.

The public’s response to the 2018 experiment aligned with these regulations, and was appropriate considering the context. However, it had the effect of closing off what was previously, at least in the academic community, a more open question as to whether human germline genome editing ought to be pursued in the future. At that point, several bodies had come together to indicate that germline genome editing may be acceptably pursued at a future point.⁴⁸² After the announcement of the experiment, the community condemned premature uses of germline genome editing.⁴⁸³

⁴⁸⁰ *Convention for the Protection of Human Rights and Dignity of the Human Being with Regard to the Application of Biology and Medicine: Convention on Human Rights and Biomedicine*, article 13.

⁴⁸¹ "Charter of Fundamental Rights of the European Union," article 3.

⁴⁸² "The Opportunities and Limits of Genome Editing" in *Human Genome Editing: Science, Ethics, and Governance*, (Washington, DC: National Academy of Sciences, National Academy of Medicine, National Academies of Sciences, Engineering, Medicine, 2017).

⁴⁸³ "Statement from the Organising Committee of the Second International Human Genome Editing Summit."

The public and academic responses leave unanswered an important ethical question raised by He Jiankui's experiment: how and when, if ever, might germline genome editing—and specifically, for enhancement purposes—be ethically acceptable? My thesis has aimed to answer this question.

Specifically, I have proposed that the more prohibitive stance toward enhancement (compared to therapeutic uses of germline genome editing) may be the result of limitations in the dominant two approaches in the human enhancement debate, individualism and collectivism. Whilst individualism may lend itself initially to more permissive stances on the pursuit of human enhancement, there are obvious issues with how the account inadequately considers morally relevant group-level concerns. Collectivism aims to solve this problem by focussing ethical analysis at the collective level, but as it currently stands, it does so patchily and inadequately as the approach stands, due to the integration of questionable individualist starting assumptions on which it operates (Chapter 2).

In response to these problems with the two approaches, I proposed improvements to collectivism and a new framing of GGEE interventions, as public health measures. Public health ethics is an area where individualist assumptions do not ground analysis, and where there is a particular focus on interventions that target collectives, are implemented by states, and aim to improve collective-level wellbeing. As such, some very useful moral concepts have been developed, which can act as mid-level principles for ethically analysing public health measures. I argued that, regardless of objections that an advocate of the treatment-enhancement distinction may raise, at least some human enhancements can be considered as public health measures (Chapter 3).

If my argument up to this point holds, then GGEE interventions that a state is considering implementing can be ethically analysed using moral concepts and principles derived from public health ethics, such as public participation, collective welfare, a proportionate weighing system, a duty of collective rescue, etc. (Chapter 4).

I put these concepts together into a stepwise framework that policymakers could apply when analysing a newly proposed GGEE intervention (Chapter 5): my Collectivist Public Health framework for the ethical analysis of GGEE interventions. I outlined 4 steps of the framework. The first step involves the identification of stakeholders in the intervention and their interests. The second step assesses the harms and benefits of implementing the intervention under the proposed policy, and whether the harms it may cause some stakeholders are comparatively and absolutely reasonable. The third step assesses the distribution of those harms among the population, holding that the harms must not primarily befall the worst off or those below a threshold level of wellbeing, and that the benefits should primarily befall the worst off. The fourth step involves an iterative process whereby alternative, more or less coercive policies for implementing the GGEE intervention are assessed in comparison with the original policy, such that the most preferable policy can be identified.

There are several potential objections to the CPH framework I devised, and after identifying the most pertinent of these, I addressed them (Chapter 6). I found that objections concerning a slippery slope to eugenics, the inability of the framework to account for deontological ethical concerns such as human dignity, and issues with resource allocation in public health settings were all able to be addressed by the framework as it stands. However, I found that addressing concerns surrounding international justice issues with GGEE interventions remained an issue for the framework, albeit one that leaves the more permissive framework still preferable to prohibition and black markets as plausible alternatives to allowing regulated implementation of GGEE interventions.

To test the CPH framework, I applied it to two pertinent case studies, both related to He Jiankui's controversial experiment. The first case study examined the same edit that He aimed to make, namely to the CCR5-delta 32 mutation, causing HIV resistance. Under a hypothetical future scenario, and with many caveats, the result of my framework's assessment

was that this intervention could be ethically acceptable in the future (Chapter 7). The second case study examined the other potential effect of the twins' edit (had it been successful), namely memory enhancement (Chapter 8). The result of my CPH framework's application to this case study was that memory enhancement as made available to parents pursuing IVF (at a cost to them) would not be ethically acceptable, although alternative policies for implementing the intervention may be.

At the conclusion of this thesis, I have answered the question of how and when, if ever, germline genome editing—and specifically, for enhancement purposes—might be ethically acceptable. I have proposed and defended a framework that, plausibly, frames GGEE interventions as public health measures. In so doing, I have provided a tool that policymakers can use in the future, once GGE is deemed by the scientific community to be both safe and effective, to assess the ethical implications of implementing human enhancement measures in their jurisdiction. Using this tool, policymakers can determine whether, given their specific context, it is the right time and place to implement a certain GGEE intervention, and if so, which of the policy alternatives for implementing it is ethically preferable.

This work has the potential for being relevant to informing discussion about future policy. Certainly, work like this falls within the realm of speculative bioethics, rather than translational work. The likelihood of the framework informing policy in the near future is slight. However, it can be expected to have (directly or indirectly) policy impact further in the future. The body of work that this thesis contributes to may go on to inform how the academic community, the public, and policymakers approach human enhancement once it is a safe, effective scientific possibility. The legal and ethical guidance provided on GGE at the moment opens the door to future pursuit of human genome editing, but not enhancement. Yet, my CPH framework indicates that, at least for some enhancements, there may be less

reason to reject them than is currently thought. Perhaps, in at least some cases, we should be more permissive of these interventions. More work is needed to deal with the details that this thesis does not cover. Issues with a consequentialist framework, given the lack of data on outcomes of enhancement is one area requiring further development. So is further consideration of the global implications of some high-income countries pursuing human enhancement, and the details of stakeholder identification. In this work, I did not have the space to develop an adequate stand-alone account of these aspects. What this thesis does provide is a start. It offers a big picture of how the regulation of human enhancement could look in the future, and how we might ensure that, if it is pursued, it is done in the right way.

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