
WHO Expert Advisory Committee on
Developing Global Standards for Governance
and Oversight of Human Genome Editing

HUMAN GENOME EDITING:
POSITION PAPER



World Health
Organization

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WHO Expert Advisory Committee on Developing Global Standards for Governance and Oversight of Human Genome Editing

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Executive summary

The recent application of tools, such as CRISPR-Cas9 (clustered regularly interspaced short palindromic repeats; Cas9 nuclease), to edit the human genome with the intention of treating or preventing disease and the gaps in our scientific understanding, in addition to some of the proposed applications of human genome editing, raise ethical issues that have highlighted the need for robust oversight in this area. The COVID-19 pandemic has clearly demonstrated the importance of using new tools and methods to combat serious diseases and highlighted the potential benefits of human genome editing research. It also reminds us of the need to develop technology carefully, with robust testing and quality assurance measures in place to maximize benefit and minimize harm. The balance between benefit and harm, safety and speed, and innovation and access is relevant to all of human genome editing.

In December 2018, the World Health Organization (WHO) established a global, multidisciplinary expert advisory committee (the Expert Advisory Committee on Developing Global Standards for Governance and Oversight of Human Genome Editing, hereafter called the Committee) to examine the scientific, ethical, social and legal challenges associated with human genome editing (somatic, germline and heritable). The Committee was tasked to advise and make recommendations on appropriate institutional, national, regional and global governance mechanisms for human genome editing. Its remit did not include a review of matters to do with safety and efficacy. Committee members were drawn from each of the WHO regions – Africa, the Americas, South-East Asia, Europe, Eastern Mediterranean and Western Pacific.

The 18 members of the Committee worked for two years and developed several products and new initiatives. The governance framework on human genome editing, along with the recommendations of the Committee, form a set of two publications that provide advice and recommendations on appropriate institutional, national, regional and global governance mechanisms for human genome editing. A position paper on human genome editing provides a summary of these two publications.

During its work, the Committee reviewed the current literature on human genome editing research and its applications, considered existing proposals for governance and relevant ongoing initiatives, and gathered information on a range of topics relating to the different uses of this technology. The Committee consulted widely with individuals and representatives of organizations including, but not limited to, United Nations (UN) and other international agencies; academies of science and medicine as well as other national or professional bodies; patient groups and civil society organizations.

The governance framework and the recommendations on human genome editing form a pair of reports that have been developed by the WHO Expert Advisory Committee on Developing Global Standards for Governance and Oversight of Human Genome Editing. This position paper provides a summary of these two publications.

Background information

The World Health Organization (WHO) Expert Advisory Committee on Developing Global Standards for Governance and Oversight of Human Genome Editing (hereafter called the Committee) was charged with reviewing the literature on current human genome editing research and its applications, considering existing proposals for governance and relevant ongoing initiatives, and soliciting information about societal attitudes towards the different uses of this technology.

To better understand the scope of activities relevant to its charge, the Committee mapped current, potential and speculative human genome editing research (governance framework, Box 3).

To update previous efforts to map the current scientific and technical capabilities, the Committee commissioned a report on important developments, including in the understanding of relevant basic science, different types of human genome editing, the tools being used for genome editing and the targets being exploited.

To improve gathering of data on what research is underway or planned for human genome editing, the Committee, early on in its work, recommended that a registry be set up using the International Clinical Trials Registry Platform,¹ which WHO subsequently established.

To understand what policies governed research and development and clinical use of human genome editing in different countries, the Committee made use of a 2020 survey of documents relevant to policy (legislation, regulations, guidelines, codes and international treaties) for germline human genome editing (not for reproduction) and heritable germline human genome editing (for reproduction).²

To ensure a participatory process in the course of its work, the Committee consulted widely and solicited information about societal attitudes towards a number of areas of research and clinical use of human genome editing technology. The Committee consulted with international organizations, regional organizations, national health ministries, national regulatory authorities, national research institutes, national boards of technology, patient groups and patient advocates, civil society organizations, indigenous groups, campaign groups, industry associations, private companies, national academies, bioethics committees, professional societies, universities, medical schools and academic research institutions, as well as other relevant experts and interested parties. Participants from 29 distinct groups contributed to the Committee's meetings. The Committee also held two in-person and 15 online topic-specific meetings drawing on contributions from 71 distinct groups. The Committee has also developed a glossary of key terms intended for a non-specialist audience.

1 WHO launches global registry on human genome editing (accessed 27 June 2021).

2 Baylis F, Darnovsky M, Hasson K, Krahn T. Human germline and heritable genome editing: the global policy landscape. *CRISPR J.* 2020;3(5):365–77. <https://doi.org/10.1089/crispr.2020.0082>

Preventing premature use of human genome editing

To help ensure heritable human genome editing does not proceed prematurely to clinical trials, the Committee recommended, and the WHO Director-General subsequently made, a policy statement in July 2019 clarifying that “it would be irresponsible at this time for anyone to proceed with clinical applications of human germline genome editing.”³

Governance framework

The Committee was tasked to advise and make recommendations on appropriate institutional, national, regional and global governance mechanisms for human genome editing. Its remit did not include a review of matters to do with safety and efficacy of human genome editing.

The Committee developed a governance framework that draws from good practices in the governance of emerging technologies and applied them specifically to human genome editing. The framework is intended to help those tasked with strengthening oversight measures, regardless of whether this is at the international, regional, national or institutional level. The Committee recognized some of the necessary governance structures and processes already exist; these may need to be reinforced or amended. Where such structures and processes are lacking, gaps must be filled. The governance framework provides tools to help.

To maximize the positive impact and minimize the potential harms of human genome editing, the Committee identified procedural and substantive values and principles to inform both how and what decisions are made (governance framework, Table 3).

To assist in tailoring oversight measures to human genome editing, the framework explores five specific challenges in: (i) postnatal somatic human genome editing; (ii) prenatal (in utero) somatic human genome editing; (iii) heritable human genome editing; (iv) human epigenetic editing; and (v) enhancement. For each, the Committee identified a series of questions that should be considered when reviewing or creating oversight measures.

3 Statement on governance and oversight of human genome editing (who.int) (accessed 27 June 2021).

To help take advantage of the full range of individuals and organizations able to influence or control the direction of research and possible future uses of human genome editing, the governance framework reviews 12 sets of tools, institutions and processes. These range from laws and regulations to professional self-regulation and the role of professional bodies, to public advocacy and activism. It is intended as an indicative list of options for those working to strengthen oversight measures and will need to be tailored to the specific circumstances of the user.

To demonstrate how the various components of the governance framework come together in practice, the Committee used seven scenarios: (i) somatic human genome editing clinical trials for sickle-cell disease; (ii) somatic human genome editing clinical trials for Huntington disease; (iii) somatic human genome editing and unscrupulous entrepreneurs and clinics; (iv) somatic human genome editing and epigenetic editing to enhance athletic ability; (v) heritable human genome editing (for reproduction); (vi) heritable human genome editing and unscrupulous entrepreneurs and clinics expanding assisted reproduction; and (vii) prenatal (in utero) somatic human genome editing clinical trials for cystic fibrosis. These scenarios illustrate the practical challenges that might be encountered in the future when implementing good governance for human genome editing research.

To ensure that the governance framework reflected broad input and would be suitably comprehensive, realistic and practical, the Committee shared draft copies of the text during its development. The Committee held two online consultations on the governance framework. The first consultation was held from 15 January to 7 February 2020 and resulted in 325 unique responses from individuals and organizations in 32 countries. The second consultation was held from 14 July 2020 to 19 August 2020 and resulted in 69 unique responses from individuals and organizations in 23 countries. Comments received were used by the Committee to refine and improve the governance framework.

Recommendations

Following careful reflection and deliberation, the Committee produced a series of recommendations in nine discrete areas. The Committee noted that its recommendations are subject to the limits of WHO's mandate and resources. In implementing these recommendations, the Committee wished to stress the importance of avoiding unfunded mandates.

Leadership by WHO and its Director-General

WHO and its Director-General should demonstrate both scientific and moral leadership, by: (i) being open about the opportunities and challenges inherent to human genome editing; (ii) clearly stating the ethical aspects of human genome editing (including a statement on somatic human genome editing to address equitable access to the benefits of research and priority setting and, for heritable human genome editing, at a minimum, reiteration of the Director-General's statement of July 2019); and (iii) outlining the consequences of failing to address the ethical issues before us if we develop and use technologies without prior careful reflection and intentional collaborative decision-making.

International collaboration for effective governance and oversight

WHO should work with others to develop and implement a shared vision for an ongoing international process to: (i) identify and develop points of agreement or convergence; (ii) establish a process for identifying key decision points; (iii) explore opportunities for collaborative engagement, standard-setting, investigation and oversight; and (iv) share information on relevant existing and planned policies (laws, regulations and guidelines).

In the interim, the Director-General should institute a cross-institutional approach, including to: (i) task the regulatory strengthening and capacity building teams within WHO's Department of Essential Medicines and Health Products to begin working on integrating human genome editing into their activities; (ii) convene a meeting of regulators from Member States on the feasibility of international agreements, capacity-building needs and possibilities for harmonization; and (iii) task the Science Division to convene meetings on human genome editing in each of the six WHO regional offices with regulators, medical and scientific leaders, patient groups, civil society organizations and other relevant bodies.

Human genome editing registries

WHO should: (i) ensure that clinical trials using somatic human genome editing technologies are reviewed and approved by the appropriate research ethics committee before inclusion in the Registry of human genome editing clinical trials; (ii) request that national and regional clinical trials registries make use of keywords to identify clinical trials using human genome editing technologies; (iii) develop an assessment mechanism to identify clinical trials using human genome editing technologies that may be of concern; (iv) establish a small expert committee to regularly monitor the clinical trials Registry and to develop and review a set of international standards for clinical trials involving human genome editing for the clinical trials Registry; and (v) support members of the scientific community to develop an additional basic and preclinical research registry.

International research and medical travel

The Director-General, in consultation with his new Science Council, should make a policy statement that somatic or germline human genome editing research should only take place in jurisdictions with domestic policy and oversight mechanisms. WHO, with guidance from the Science Council, should integrate into all of its relevant activities a focus on fostering responsible international research and medical travel.

Illegal, unregistered, unethical or unsafe research and other activities

WHO, with advice from its recently established Science Council, should charge the Science Division to lead an effort to create a multisector collaboration to develop an accessible mechanism for confidential reporting of concerns about possibly illegal, unregistered, unethical and unsafe human genome editing research and other activities.

Intellectual property

WHO should: (i) work with others to encourage relevant patent holders to help ensure equitable access to human genome editing interventions; (ii) encourage industry to work with resource-constrained countries to build capacity to take advantage of human genome editing inventions; and (iii) convene a meeting of those holding or applying for patents relevant to human genome editing, industry bodies, international organizations, such as the World Intellectual Property Organization and the World Trade Organization, and those involved in establishing or running relevant patent pools to explore the potential for the adoption of appropriate ethical licensing requirements.

Education, engagement, and empowerment

The Director-General should: (i) call upon the United Nations Secretary-General to establish a United Nations interagency working group on frontier technologies that facilitates global dialogue and produces a report outlining the implications of innovative technologies, including human genome editing, and the ethical frameworks to guide their application; and (ii) call for an inclusive dialogue on the future of human genome editing, including scientific, ethical and societal aspects.

WHO should: (i) develop models of best practice of inclusive multidirectional, multistakeholder dialogue, and supporting materials, that can be applied to human genome editing; and (ii) explore how best to include in decision-making under-represented groups that are interested in human genome editing.

Ethical values and principles for use by WHO

WHO should charge the health ethics and governance unit in the Science Division to lead an effort to create a set of officially endorsed and clearly defined ethical values and principles for use by its expert committees and in WHO deliberations. These values and principles should be built on public health goals and priorities. These should go beyond the WHO workforce, and provide an important road map for progress towards the Organization's goals.

Review of the recommendations

In no more than 3 years, WHO's Science Division should initiate an extensive review of these recommendations and the progress made to implement them. This review should not take longer than 18 months and should take into account scientific, technological, and societal changes, adequacy of implementation and assessment of impact, and potential future needs or concerns.



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