WHO

CHAIR: OHONA ISLAM
DIRECTORS: EMILY ZONG &
SOPHIE ZHANG

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Land Acknowledgement

The staff at HCMUN XII acknowledges that we are situated on the traditional territories of many nations, including the Mississaugas of the Credit, the Anishnabeg, the Chippewa, the Haudenosaunee, and the Wendat peoples, and are now home to many diverse First Nations, Inuit, and Métis peoples. Toronto is covered by Treaty 13, signed with the Mississaugas of the Credit, and the Williams Treaties, signed with multiple Mississaugas and Chippewa bands.

As we prepare to attend and direct conferences such as HCMUN, we would like to take this opportunity to reflect on the continuous injustice that affects Indigenous and Inuit peoples. As we gather together, it is important to reflect on the discrimination and the lasting impact our government has had on Indigenous communities across Canada. We take this time to recognize those who continue to share their culture and push back against discrimination, for the good of future generations.

Equity Disclaimers

Dear delegates,

Throughout this committee, delegates may be challenged to engage in complex and heavy discussion on a broad range of important world issues. At Havergal College Model UN, our top priority is to ensure that every delegate feels respected, included, and able to participate fully. In the meantime, they also feel comfortable in the committee they are in. We would like to ask participating delegates to approach all discussions on sensitive topics with a great deal of professionalism, empathy and respect.

The staff here at HCMUN are here to support you, so if you experience or observe behaviour that makes you uncomfortable, or have concerns related to diversity, equity, or inclusion involving a delegate, chair, or staff member, please contact the equity team. You may submit an anonymous report or reach out to a team member directly, whichever you prefer. All reports are taken seriously and will be reviewed promptly. Delegates who engage in inappropriate behaviour may become ineligible for awards and may face further action if necessary. We hope you feel supported throughout the conference and wish you a positive experience!

Sincerely,
Belle Guo and Mia Liu

Tech Policy

At HCMUNXII, we are committed to creating a fair, focused, and academically honest environment for all delegates. To uphold these standards, delegates are expected to follow the conference's technology guidelines throughout their committee experience.
During committee sessions, technology may only be used during unmoderated caucuses. At these times, delegates are not permitted to access online research, external sources, or any materials beyond what they prepared before the conference. Technology is allowed strictly for the purpose of drafting resolutions and collaborating on written documents. To maintain transparency, all draft resolutions, working papers, and collaborative files must be shared in real time with the Dais. Any document not shared with the Dais may be considered invalid for committee use.

Outside of formal committee time, delegates are free to access technology and conduct research during lunch and scheduled breaks. However, the conference maintains a firm commitment to academic integrity. The use of any AI tools — including generative AI, automated writing tools, or AI-based research systems — is strictly prohibited throughout any point before or during the conference. Plagiarism of any kind is not tolerated, and all work presented in committee must be original and reflect the delegate's own preparation and analysis. Any violations of these expectations will be handled in accordance with HCMUNXII's academic policies.

These guidelines are designed to ensure that committee work remains equitable, that debate is grounded in authentic understanding, and that HCMUNXII upholds the highest standards of integrity and professionalism. Let this policy help guide delegates toward productive collaboration, meaningful diplomacy, and an enriching Model UN experience.

WHO as a TOC Qualifier

The WHO committee is thrilled to announce that we are a **Tournament of Championships (TOC) qualifier** at HCMUNXII this year! The first Tournament of Champions in Toronto will be taking place from May 28th - May 30th, 2026. This is a competition hosted by HarvardMUN where delegates will engage in extremely competitive debate to earn the 2026 Canadian Championship Titles. As a TOC qualifier, the Best Delegate from our committee will automatically qualify to participate in the TOC! We highly encourage all delegates who are interested in this opportunity to learn more information about the TOC by referring to the following link: https://www.hmuncanada.org/tournament-of-champions. This is an extremely exciting chance for delegates to prove their skills in debating, innovation, and international policy. The WHO committee could not be more honoured to host this opportunity.

Letter From the Secretary General

Dear Delegates and Advisors,

It is our honour and privilege to invite you to the twelfth annual Havergal College Model United Nations Conference. Each year, HCMUN brings together passionate, curious, and globally minded students from across the region, delegates who are eager to question, collaborate, and imagine solutions to the world's most pressing challenges.

At its core, HCMUN is more than a one-day event. It is a space where young people can test ideas, challenge assumptions, and discover the power of diplomacy. Whether you are stepping into your very first committee or returning as an experienced delegate, we hope this conference offers you a chance to push your thinking, embrace unfamiliar perspectives, and develop the confidence to advocate for meaningful change.

Our team has worked hard to create engaging, dynamic committees that encourage creative problem-solving and meaningful dialogue. We invite you to participate with curiosity, empathy, and confidence — your voice will shape the experience of everyone in the room.

Thank you for joining us. We can't wait to see the diplomacy and passion you bring to HCMUN XII!

Sincerely,
Aurelia He and Marlowe Herman
Secretary Generals, HCMUNXII

Letter form the Dais

Dear Delegates,

Welcome to the WHO committee of HCMUNXII! We are so honoured to be your dais for this committee. The World Health Organization (WHO) focuses on addressing global health concerns and establishing international health policies. As international tensions continue to accelerate, global health must be improved and adapted to ensure a stronger, more equitable future.

This year, the WHO committee will be addressing the following topics: **Access to Healthcare in Fragile, Conflict-Affected, and Vulnerable States** and the **Ethics of Technology Use in Healthcare.** This committee will tackle topics such as barriers in providing healthcare, gaps in healthcare systems, use of biotechnology, and the implementation of Artificial and Organoid Intelligence. Delegates will engage in respectful, constructive debate and collaborate with each other to create innovative solutions for the aforementioned topics.

Our word of advice for all delegates of all levels is to try the things which you find the most intimidating! It can be nerve-wracking, but we encourage everyone to just speak that first word, try that crazy hook, and give their best effort — have the confidence and you will be surprised at what you can achieve. Never forget that the WHO committee is here to support all delegates in their Model UN journey!

Feel free to reach out to us about any and all inquiries you have about the conference or this committee. We look forward to having an amazing conference filled with topical motions, engaging debate, and effective resolutions at HCMUN this year!

Sincerely,
WHO Committee Dais
Chair Contact Info: ohona.islam.327@gmail.com

Topic 1: Access to Health Care in Fragile, Conflict-Affect, and Vulnerable States

Context

Fragile, conflict-affected, and vulnerable settings, often shortened to FCVs, encompass a wide range of situations including humanitarian crises, prolonged emergency states, as well as conflict zones.[1] The number of people living in FCV settings is growing, with almost a quarter of the global population, or 2 billion people, currently living in FCVs.[2,3] In these settings, medical services and distribution of medical supplies is often disrupted. FCVs are often severely vulnerable to diseases which become extremely difficult to treat in tense settings. Injury and death also increase strain on medical systems even after tensions and conflict have died down. When situations worsen, healthcare practitioners are forced to flee their work.[4] These factors result in people living in FCV settings to receive inadequate healthcare. This manifests itself in concerning amounts of casualties. The World Health Organization reports that FCVs are subject to more than 70% of epidemic prone diseases (e.g. cholera, measles, meningitis), 60% of preventable maternal deaths, 53% of deaths in children under 5, and 45% of infant deaths.[3]

People Affected

The nature of FCV settings result in altered and compromised healthcare delivery for all individuals involved. However, certain groups of people face more inequality within the system.

In FCV settings, minorities and vulnerable groups who are already disadvantaged are disproportionately excluded from quality health services.[5] This includes but is not limited to women, children, ethnic minorities, the elderly, the disabled, and the LGBTQ+ community.[6] The most vulnerable people in FCVs who do not receive adequate care are pregnant women and those with chronic diseases such as diabetes and HIV.[7] In addition to receiving poorer treatment,

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[1] https://www.who.int/teams/integrated-health-services/quality-of-care/quality-of-care-in-fragile-conflict-affected-and-vulnerable-settings
[2] https://pmc.ncbi.nlm.nih.gov/articles/PMC8876158/
[3] https://www.who.int/activities/accessing-essential-health-services-in-fragile-conflict-affected-and-vulnerable-settings
[4] https://www.doctorswithoutborders.ca/war-and-conflict/
[5] https://documents1.worldbank.org/curated/en/984761561616986756/pdf/World-Strengthening-Health-Service-Delivery-Resilience-in-FCV-Settings-Program-Summary.pdf
[6] https://blogs.worldbank.org/en/dev4peace/ensuring-healthcare-frontlines-conflict-and-crisis
[7] https://www.doctorswithoutborders.org/what-we-do/focus/care-in-conflict-zones

these groups are often subject to more violence and health issues. In FCV settings, there is an increase of sexual and gender based violence especially with the increased occurance of rape being used to overpower vulnerable communities.[8] Mental health issues are also more prevalent in FCVs with more than 1 in 5 adults having mental health needs. Patients, citizens, and medical staff alike experience depression, anxiety, and sleeping disorders amongst many other mental health issues.[9]

FCV situations also force many people to flee their homes and become displaced. In 2024, 123.2 million people were forcibly displayed due to violence, conflict, persecution, or violation of human rights.[10] For displaced persons and refugees, access to healthcare is uncertain and often compromised.[8]

Healthcare institutions and staff themselves are often attacked and mistreated. From 2018 to 2020, Doctors Without Borders/Médecins Sans Frontières recorded at least 40 attacks on Al-Thawra general hospital in Yemen, including shootings inside or near the hospital as well as direct attacks on patients and staff.[8] In 2022 alone, WHO reported 1328 attacks on healthcare facilities and workers in at least 16 different countries/territories. Heavy weapons attacks and capturing of health equipment were the most common offences. Notably, 232 healthcare workers were found dead and 451 were injured.[11]

Barriers in Providing Health Care

i. Increased Stress

FCV health systems are doubly stressed due to disruptions in the supply chain and the increase in injuries.[12] The most prevalent injuries which occur in FCV settings are traumatic injuries from gunshots, shelling, and land mines, which require intensive care to treat. Stress is also increased due to hospitals and medical facilities being damaged or destroyed. The few

[8] https://www.doctorswithoutborders.ca/war-and-conflict/
[9] https://www.doctorswithoutborders.org/what-we-do/focus/care-in-conflict-zones
[10] https://www.worldbank.org/en/topic/fragilityconflictviolence/overview
[11] https://www.who.int/about/accountability/results/who-results-report-2022-mtr/output/2022/essential-health-services-and-systems-maintained-and-strengthened-in-fragile--conflict-affected-and-vulnerable-settings
[12] \https://documents1.worldbank.org/curated/en/984761561616986756/pdf/World-Strengthening-Health-Service-Delivery-Resilience-in-FCV-Settings-Program-Summary.pdf

remaining facilities are then burdened with an influx of patients but a shortage of supplies. Even after conflict weakens, stress is still prevalent as more people feel comfortable leaving shelters in search of care.[13] Workers in FCVs often deal with staffing shortages, unsafe conditions, and pressure with time and resources, all resulting in compromised care.[14]

ii. Pre-existing and Compounding Conflicts

Most FCV settings already have weakened healthcare systems before crises strike. This can make healthcare delivery during crises especially difficult and full recovery of the system after conflict can be near impossible. Food insecurity is another pre-existing condition in many FCV settings which worsen strain on the healthcare system. Out of all the people affected by food insecurity, a reported 75% of them live in FCVs. Economic insecurity and climate change also make it more difficult to deliver resources and healthcare services. 16 countries out of the top 25 countries vulnerable to climate change are FCVs.[15]

iii. Diseases and Epidemics

FCV situations are extremely vulnerable to diseases and epidemics that add extra demand on healthcare services. One third of the global disease burden is accounted for by FCVs and this includes diseases such as HIV, cholera, tuberculosis, and malaria.[16] Conflict and displacement can lead to overcrowding and poor living conditions which create environments for development of diseases such as cholera and measles.[17,13] Poor sanitation, education, and regulation, as well as a lack of clean water/food, governance, and stability are also drivers of epidemics in FCV settings.[16] When healthcare systems are already strained, delivering access to disease care and vaccination becomes increasingly difficult. For example, the Central African Republic's vaccination rate for measles went from 65% to 25% after the country entered a period of violence and instability in 2013.[17] Diseases and epidemics can fester long after conflict has ended due to the destroyed healthcare infrastructure. This was seen when the Sierra Leone and Liberia

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[13] https://www.doctorswithoutborders.org/what-we-do/focus/care-in-conflict-zones
[14] https://pmc.ncbi.nlm.nih.gov/articles/PMC8876158/
[15] https://www.worldbank.org/en/topic/fragilityconflictviolence/overview
[16] https://blogs.worldbank.org/en/dev4peace/ensuring-healthcare-frontlines-conflict-and-crisis
[17] https://www.doctorswithoutborders.ca/war-and-conflict/

civil wars in 1990 ended with thousands killed and healthcare systems destroyed, allowing for the development of Ebola.[18]

iv. Governance and Funding

In many FVC's, the fragility of the state makes the government incapable of providing and/or controlling healthcare services, specifically regarding its quality and allocation.[19] Conversely, certain FCV states have multiple bodies controlling healthcare service delivery which can result in confusions and inconsistency with the state directions.[20] Generally, many FCV countries have reduced funding which is often a result of political instability and the lack of governance in these states.[21,22] Inadequate funding is a large driver in why FCV settings also find themselves with a shortage of resources.[22]

v. Systemic Failures

Information systems in FCVs are often disrupted or limited.[20] This adds difficulty to the delivery of resources and services in urgent situations. Many people in FCVs also have major gaps in knowledge in effective health service delivery which decreases efficiency and could even create extra unnecessary issues.[23] The service delivery in FCVs is often limited due to poor infrastructure and technology implementation.[24] Quality assurance is also difficult to establish in FCVs due to a lack of consensus and governance on the matter.[20] Various social parties, schools of thought, and unique situational strains can lead to discourse over which sacrifices need to be made in the delivery of care, if any at all.

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[18] https://documents1.worldbank.org/curated/en/984761561616986756/pdf/World-Strengthening-Health-Service-Delivery-Resilience-in-FCV-Settings-Program-Summary.pdf
[19] https://blogs.worldbank.org/en/dev4peace/ensuring-healthcare-frontlines-conflict-and-crisis
[20] https://www.who.int/publications/i/item/9789240015203
[21] https://pmc.ncbi.nlm.nih.gov/articles/PMC8876158/
[22] https://www.who.int/about/accountability/results/who-results-report-2022-mtr/output/2022/essential-health-services-and-systems-maintained-and-strengthened-in-fragile--conflict-affected-and-vulnerable-settings
[23] https://documents1.worldbank.org/curated/en/984761561616986756/pdf/World-Strengthening-Health-Service-Delivery-Resilience-in-FCV-Settings-Program-Summary.pdf
[24] https://openknowledge.worldbank.org/server/api/core/bitstreams/59400dbc-4770-5c16-b9c1-72de61c69a56/content

Focus on Healthcare Systems

The current global healthcare system falls into 4 models: Beveridge, Bismarck, National Health Insurance, and Semashko model (Out of Pocket).[25] The Beveridge system is a nationalized healthcare system funded by taxes where most hospitals and clinics are considered government property. While there are small numbers of private clinics, doctors working under these clinics still receive salaries from the government, and not any individual or company.[26]

The Bismarck Model is a type of insurance system that is funded jointly by payroll deduction. Notably, this is different from yet commonly confused with the United States healthcare system as Bismarck covers everyone and is a non-profit system.[26]

The National Health Insurance Model is a combination of Beveridge and Bismark models. It has private healthcare workers, however they are paid by the government under this publicly funded insurance. The key differentiation from Beveridge model is the ownership of the infrastructure and the control for employment: where under NHI, it functions almost identical to a free market except the government will step in and pay the costs for the citizens when they receive care. Meaning that hiring, starting own clinics, are all within the freedom of the licensed professionals.[27]

Currently, the majority of the world doesn't have an established system for healthcare, especially FCV states where the creation of these systems adds on to the pressure of the country. This system, however, leads to only the rich getting medical care and the poor to suffer. As healthcare is hard to access and afford in FCV states, people turn towards traditional medicines and home-brew remedies, where it may not be effective against diseases and increases the difficulty of management in times of outbreaks. This healthcare system is essentially a free market, where there is no government support to help cover any healthcare, creating a free price range for private institutions to potentially exploit.[25]

Financial Concerns

Poverty is growing in FCV's, and inadequate access healthcare in FCV settings is and will continue to disproportionately affect the poor. Currently, two-thirds of the low-income

[25] https://www.publichealth.columbia.edu/research/comparative-health-policy-library/types-health-systems
[26] https://www.pbs.org/wgbh/pages/frontline/sickaroundtheworld/countries/models.html
[27] https://www.pnhp.org/single_payer_resources/health_care_systems_four_basic_models.php

countries are also FCV settings. By 2030, 50% of the poor are predicted to live FCV, mainly due to the barriers in providing healthcare in FCVs such as increased conflict, political instability, damaged economies, climate change, and the lasting effect of epidemics such as COVID-19.[28] At that rate, 400 million people living in FCVs will be in extreme poverty in the next ten years.[29] Financing for resource pooling and allocation in FCVs is low and becoming more challenging, with some states spending less than $400 USD per capita on health financing in 2015. Additionally, citizens in FCV settings spend higher amounts paying for their healthcare out-of-pocket (OOP), with some spending more than 50% of their total healthcare expenditure OOP.[30]

Past and Current Policies

The health disparities present in FCV settings violate several of the United Nations Sustainable Development Goals targets. The targets which are most relevant include Universal Health Coverage, Health Workforce, Communicable diseases, Violence, and Mobilization of Resources amongst several others.[31]

In 2020, the World Health Organization published *Quality of care in fragile, conflict-affected and vulnerable settings: taking action*, a document detailing starting points FCV states can use to address this issue and improve their delivery and quality of healthcare. WHO highlights the following eight action plans for FCVs to implement:

1. Service Priorities: understanding the health priorities of the community and working with existing healthcare infrastructure to set goals addressing the priorities.
2. Quality Assurance: highlighting the importance of quality in services delivered.
3. Stakeholder Engagement: reaching out to stakeholders and engaging them in plans.
4. Situational Analysis: collecting data and stakeholder analysis to deliver better specialized-care tailored to the needs of the situation.

[28] https://pmc.ncbi.nlm.nih.gov/articles/PMC8876158/
[29] https://www.worldbank.org/en/topic/fragilityconflictviolence/overview
[30] https://documents1.worldbank.org/curated/en/844951563783610138/pdf/Health-Financing-in-Fragile-Conflict-and-Violence-FCV-Situations-Five-Key-Questions-To-Be-Answered.pdf
[31] https://www.who.int/data/gho/data/themes/sustainable-development-goals

5. Governance: establishing key roles and responsibilities to ensure collaborative and effective governance.
6. Interventions: organizing effective and realistic intervention related to reducing harm and improving access, infrastructure, environment, care, and patient/family relations.
7. Health Information Systems: reviewing previous data, collecting new data, and implementing relevant findings into practices.
8. Quality Measurement: carefully monitoring service to ensure no extra burden; improving practices which are effective.[32]

Additionally, the Word Bank highlights the importance of adapting care to each unique situation and how differentiating the terms "fragile", “conflict-afflicted”, and “vulnerable” is crucial for adequate resource allocation. They highlight four main questions which states much consider to improve their systems:

- What service should be provided?
- Who provides the services?
- Who receives the services?
- Who pays for services?[33]

They also highlight that investing in healthcare can lead to social harmony as health is a value shared by everyone in an FCV situation.[34] Health is an equitable force fostering the idea of peacekeeping, which is why all states are urged to support FCV settings in improving access to healthcare.

[32] https://www.who.int/publications/i/item/9789240015203
[33] https://openknowledge.worldbank.org/server/api/core/bitstreams/59400dbc-4770-5c16-b9c1-72de61c69a56/content
[34] https://documents1.worldbank.org/curated/en/984761561616986756/pdf/World-Strengthening-Health-Service-Delivery-Resilience-in-FCV-Settings-Program-Summary.pdf

Guiding Questions

1. What steps can FCV states take to successfully implement WHO's eight core action plans?
2. What improvements and/or additions to current policies can be implemented to address the various barriers to healthcare accessibility in FCV states before, during, and after crises?
3. How can healthcare delivery systems be reviewed to ensure minority/vulnerable groups and healthcare workers are protected in FCV settings?
4. What types of healthcare systems should be implemented in FCV states?
5. How can non-FCV states support FCV states in improving equitable access to healthcare?
6. As global tensions continue to increase, can the number and severity of FCV states be mitigated? Can preventative measures be taken to reduce strain on FCV healthcare systems in the future?

Topic 2: Ethical Use of Technology in Healthcare

Biotechnology

Biotechnology is the exploitation of biological processes for industrial and other purposes, especially the genetic manipulation of microorganisms for the production of antibiotics, hormones, etc.[35] Biotechnology is categorised based on their goals and applications, often represented by colours. Major categories include Red - healthcare, Green - Agriculture, White - Industry, Blue - Marine, Grey - Environment, Yellow - Food, Golden - Bioinformatics, Brown - Arid zones, Black - Biosafety, Violet - Ethics and Law.[36] Biotechnology, with its wide range of applications, proves to be a vital tool for tackling current challenges in health, the environment, industry, food production, and more.

The term biotechnology was used for the first time by Karl Erkey, a Hungarian Engineer, in 1919. However, biotechnology has existed in human society for over thousands of years. Biotechnology can be defined as "the use of living organism/s or their product/s to modify or improve human health and human environment".[37] Early civilization used fermentation to make bread and wine while also practicing selective breeding on livestock and crops. These methods represent the most ancient form of biotechnology, when humans learned to harness living organisms for benefits. During the 19th and early 20th centuries, safer food production, early vaccine development, and penicillin discovery accelerated the field. Modern biotechnology emerged in the 1970s with the development of recombinant DNA technology, which allowed scientists to cut and splice genes from different organisms. The first major commercial success of this era was the production of human insulin in genetically engineered bacteria in 1982. Scientists begin to see the potential of biotechnology to produce life-saving medicine at scale. The field advanced further with the Human Genome Project (1990–2003).[37,38] Today's biotechnology is defined by the development of precise genome editing tools, especially CRISPR-Cas9, introduced in 2012.[39] CRISPR's accuracy allows scientists to treat genetic disorders, modify crops, and open new biomedicine pathways. Genome editing and advances

[35] https://www.britannica.com/technology/biotechnology
[36] https://www.tecnic.eu/the-10-types-of-biotechnology-and-their-applications/
[37] https://pmc.ncbi.nlm.nih.gov/articles/PMC3178936/
[38] https://en.wikipedia.org/wiki/History_of_biotechnology
[39] https://www.labiotech.eu/in-depth/crispr-cas9-review-gene-editing-tool/

in personalized medicine—such as pharmacogenomics and targeted therapies— allow practitioners to apply genetic information to tailor treatments to individual patients. These modern tools shifted working with organisms to the level of molecules and genetics.[40]

Genome Editing

Genome editing, also known as gene editing or genome engineering, is a powerful technology that allows scientists to make precise changes (additions, removals, or altercations) to an organism's DNA, essentially acting like "molecular scissors" to edit genetic material.[41] Driven by rapid advances in technology, several approaches to genome editing have been developed. The most famous tool, CRISPR-Cas9, short for Clustered Regularly Interspaced Short Palindromic Repeats, and CRISPR-associated protein 9, was adapted from a naturally occurring genome editing system that bacteria use as an immune defense.[42] There are two main categories of genome editing — somatic genome editing and germline genome editing. Somatic cells refer to all cells excluding the egg and sperm cells. Somatic genome editing means that DNA editing occurs in non-reproductive cells, therefore the changes made only affect the individual and cannot be further on passed to the next generation. Somatic editing is seen as less controversial as the editing is rather therapeutic than heritable.[43] Generally, somatic cell editing is supported as long as safe regulations are followed. Germline genome editing, on the other hand, is the editing of egg and sperm cells, sometimes also including early embryos. These editing happens within reproductive cells, meaning changes are heritable and will be passed onto the next generation. This technology can be used to edit the genes of early embryos to remove a gene that causes a genetic disease. There are many ongoing debates around the ethics and risks of germline editing: lack of consent from the recipient of gene editing, permanent mistakes for all future generations, immature technology causing mosaicism, off-target editing, and finally, ethical concerns around equitable access.[44, 45]

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[40] https://www.labiotech.eu/in-depth/crispr-cas9-review-gene-editing-tool/
[41] https://www.genome.gov/about-genomics/policy-issues/what-is-Genome-Editing
[42] https://pmc.ncbi.nlm.nih.gov/articles/PMC4975809/
[43] https://www.ncbi.nlm.nih.gov/books/NBK447271/
[44] https://pmc.ncbi.nlm.nih.gov/articles/PMC7747319/
[45] https://www.genome.gov/about-genomics/policy-issues/Genome-Editing/ethical-concerns

Personalized Medicine

Personalized medicine is an emerging practice of medicine that uses an individual's genetic profile to guide decisions made in regard to the prevention, diagnosis, and treatment of disease. Doctors adjust the type, amount, side effects of medicine to provide the best treatment for the individual.[46]

Scientists believe that individuals differ at molecular, physiological, environmental exposure and behavioral levels, they may need to have interventions provided to them for diseases that are tailored to these nuanced and unique characteristics, instead of a one-size fit all approach. Emerging technologies such as DNA sequencing and proteomics provide therapists the ability to gather personal data and design treatments specific to the recipient's profile.[47] This approach allows less trial and error prescribing and has the potential for better patient outcomes. The data collected is also able to detect potential disease risks and inform preventative strategies rather than only reactive treatments. Furthermore, complex diseases, such as certain types of cancer, react differently in different patients. Personalised treatment can tackle such problems much more efficiently than traditional medicine. However, a major challenge of personalized medicine is the expense of therapy and technologies. Without long-term data and proof of the effectiveness of the medicine than standard treatments, it is almost impossible for insurance to cover the costly price. Since genetic data, diagnostics, and personalized therapies are expensive and often available only in high-income regions, there is a real risk of health disparities in lower-income communities.

Organoid and Artificial Intelligence

Organoid Intelligence (OI) is the technology of using brain organoids.[48] Organoids are 3D cellular models derived from stem cells that mimic the structural and functional properties of human organs.[49] They are essentially cells that are trained to become neurons, and thus creating a human brain with it inside a lab. Using the lab raised brain, called brain organoids, can aid with various research opportunities such as mimicking brain developments, testing treatments, and AI enhancement.[48] When combined with artificial intelligence (AI), these models are able to analyse

[46] https://www.genome.gov/genetics-glossary/Personalized-Medicine
[47] https://pmc.ncbi.nlm.nih.gov/articles/PMC11981433/
[48] https://pmc.ncbi.nlm.nih.gov/articles/PMC12730694/
[49] https://link.springer.com/article/10.1186/s12929-021-00728-4

complex biological data. They can scan high-resolution images of organoid morphology, search for patterns that correlate with disease states, and make diagnosis more accurate and scalable. This technology, in the future, could help with early detection of cancerous changes by identifying subtle morphological cues in organoid models that mirror patient tissues. Moreover, organoids have the potential to be a highly effective tool for personalized medicine as it approximates human tissues more closely than 2D cultures or animal models. AI is also able to process large datasets efficiently, and its standardization of recognising patterns and eliminating subjective interpretation among clinicians can potentially aid in the interpretation of complex behaviors. [50,51,52]

Key Ethical Issues

A single dose of U.S. Food and Drug Administration approved gene therapy can cost up to 4 million USD.[53] The significant economic barrier makes it unrealistic for the population, excluding all but the wealthiest segments of society. Concerns include: patients not being able to afford the out-of-pocket share of a given treatment; insurers declining to add biotechnology to its formulary due to its acquisition cost; and patients on an expensive chronic therapy maxing out their lifetime insurance benefit. While high-income countries possess advanced laboratories and technology, low-income countries lack access to funding, infrastructure and trained personnel. This imbalance and discrepancy in biotechnology widens global inequality. Wealthier nations are able to gain a disproportionate amount of benefits while developing nations bear the disadvantages of delayed or out-of-reach treatments.[54]

It is a growing concern to protect patient's privacy while biotechnology heavily relies on genetic information. DNA contains extremely sensitive data that can reveal a person's health risks, ancestry, and even family relationships. Improper handling of gene information can lead to unauthorized access, discrimination, and misuse of surveillance by the government. This information could affect an individual's ability to obtain a job, insurance, and even a mortgage. Controversy arises as to whether such information should be available to insurers and others.

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[50] https://pmc.ncbi.nlm.nih.gov/articles/PMC12730694/
[51] https://www.sinobiological.com/resource/organoid-review/organoid-intelligence
[52] https://pmc.ncbi.nlm.nih.gov/articles/PMC10796793/
[53] https://www.drugdiscoverytrends.com/how-price-safety-and-efficacy-shape-the-cell-and-gene-therapy-landscape/
[54] https://www.genome.gov/about-genomics/policy-issues/Genome-Editing/ethical-concerns

Personalized medicine, for instance, owns large data banks such as 23andMe and hospital genomic repositories. These databases have already experienced data breaching where private health information is being available and exposed. Other concerns include the potential of designer babies, eugenics, and unregulated gene editing clinics rising at a more rapid pace.[55] Biotechnology companies could eventually monopolize life-saving treatments, making health a commodity and industry rather than a right.

Regarding OI, large datasets raise privacy concerns as they include patient-derived cells and associated clinical and genomic information. Genomic and health data is highly sensitive, and without strong legal and ethical safeguards, there is a risk that personal health data could be misused and shared without consent. Regulations such as HIPAA in the U.S. and GDPR in Europe attempt to protect health data, but AI systems often cross these legal boundaries as they pull and aggregate data from multiple sources.[56] OI is also argued to be unsuitable for therapeutic fields requiring human connections. AI cannot replace empathy, clinician judgement or patient-centered care in therapeutic fields such as mental health counselling or end-of-life care.[57]

Moreover, OI tools are not infallible. Like many other AI tools, using OI is only as good as the data it was fed.[58] Data training needs to be diverse, accurate and up to date in order to allow the OI system to perform well. Biased and incomplete datasets may misinterpret organoid features, leading to false negatives or positives. In addition, “black-box” AI/OI systems may make decisions without easily explainable reasoning, making it difficult for clinicians to interpret results or detect errors.[58,59]

AI models can also perpetuate and even amplify health disparities. AI-based OI offers the promise of personalized healthcare — tailoring diagnostics and treatments based on individual organoid responses. However, questions arise around how this technology can be monitored to ensure unbiased and objective predictions while maintaining personalised, human-centered care. While AI can reduce human error and recognize patterns at scale, it lacks capacity for empathy ethical judgments, and holistic understanding of the patient and social context.[57]

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[55] https://pmc.ncbi.nlm.nih.gov/articles/PMC6342697/
[56] https://pmc.ncbi.nlm.nih.gov/articles/PMC12244842/
[57] https://pmc.ncbi.nlm.nih.gov/articles/PMC10796793/
[58] https://www.sinobiological.com/resource/organoid-review/organoid-intelligence
[59] https://pmc.ncbi.nlm.nih.gov/articles/PMC12730694/

Current Situation and Policies

In 2025, several trials demonstrated rapid progress in editing somatic cells to treat rare inherited disorders, improved patient health outcomes and reduced symptoms in treated individuals.[60] Simultaneously, research has expanded into modifying immune cells to better recognize and attack cancer cells.[61] However, these technologies also raise significant ethical and safety concerns because of off-target effects and long-term unknowns, especially when germline cells are involved.

The legal and regulatory frameworks for biotechnology vary significantly by country and technology type. At the international level, WHO has created the government framework alongside the Expert Advisory Committee on Developing Global Standards for Governance and Oversight of Human Genome Editing.[62] The goal for the governance framework is to prevent unsafe and unethical genome editing and ensure equity so biotechnology does not only benefit wealthy nations.

Many high-income countries have strict regulatory controls on genome editing. For example, in the United States and Canada, germline editing is effectively prohibited or tightly controlled, and gene therapies must undergo rigorous clinical review and approval by agencies such as the U.S. Food and Drug Administration (FDA).[63,64] In the European Union, the Oviedo Convention and related laws explicitly prohibit heritable genome editing, and regulatory systems require thorough scientific and ethical evaluation before clinical use.[65] In the United Kingdom, the Human Fertilisation and Embryology Authority oversees human genome editing research and permits some embryo work under strict guidelines, though strict limits on reproductive germline editing remain.[66]

By contrast, regulation in some countries remains lighter or under development. Nations

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[60] https://innovativegenomics.org/news/crispr-clinical-trials-2025/
[61] https://www.cancer.gov/about-cancer/treatment/research/car-t-cells
[62] https://www.who.int/publications/i/item/9789240030060
[63] https://crispr-gene-editing-regs-tracker.geneticliteracyproject.org/united-states-embryonic-germline-gene-editing/#:~:text=Federal%20law%20prohibits%20the%20use%20of%20federal,protocols%20or%20restrictions%20regarding%20human%20genetic%20engineering.
[64] https://crispr-gene-editing-regs-tracker.geneticliteracyproject.org/canada-germline-embryonic/#:~:text=Germline%20gene%20editing%20is%20strictly%20prohibited%20even,is%20no%20intention%20of%20implanting%20the%20embryo.
[65] https://pmc.ncbi.nlm.nih.gov/articles/PMC8366714/
[66] https://crispr-gene-editing-regs-tracker.geneticliteracyproject.org/united-kingdom-germline-embryonic/

like Japan and China have begun to establish regulatory pathways that distinguish between therapeutic somatic editing and germline manipulation, often allowing therapeutic applications while imposing tighter ethical review on heritable changes. China has also passed comprehensive biosafety and genetic resource laws that outline permissions and ethical limits for genetic research, partly in response to past controversial events.[67, 68]

In the end, there is no single global legal framework for technologies like CRISPR; rather, international guidance complements diverse national laws and regulatory standards. This diversity creates challenges for harmonizing safety requirements, ethical norms, and clinical practice internationally, especially as biotechnology crosses borders through research collaborations, global clinical trials, and commercial distribution.

Guiding Questions

1. To what extent can biotechnology and OI be considered ethical?
2. Which areas of healthcare can these technologies be used appropriately?
3. How can the global community ensure equitable access to these technologies across low income regions and vulnerable populations?
4. What strategies should be prioritized when expanding these technologies to consider barrier factors such as religion, affordability, safety, and adaptability to existing healthcare infrastructure?
5. What are the current policies in your state regarding biotechnology and OI?
6. What local and global policies should be implemented and improved to ensure safe, equitable, and ethical development of these technologies?

[67] https://pmc.ncbi.nlm.nih.gov/articles/PMC9614466/
[68] https://crispr-gene-editing-regs-tracker.geneticliteracyproject.org/

Work Cited

Balkhair, Omar, and Halima Albalushi. “Artificial Intelligence in Organoid-Based Disease Modeling: A New Frontier in Precision Medicine.” *Biomimetics* 10, no. 12 (December 17, 2025): 845. https://doi.org/10.3390/biomimetics10120845.

Columbia University. “Types of Health Systems.” Columbia University Mailman School of Public Health, June 30, 2020. https://www.publichealth.columbia.edu/research/comparative-health-policy-library/types-health-systems.

Conley, John, Alexandra Robinson, Rachel Wilson, Kristine Kuczynski, and Gail Henderson. “The Impact of the Three Major Human Genome Editing Reports on the Governance Landscape.” *Journal of Community Genetics*, June 16, 2025. https://doi.org/10.1007/s12687-025-00809-z.

ConsensusNLP. “Are There Global Regulatory Frameworks for CRISPR Gene Editing in Humans? - Consensus,” 2025. https://consensus.app/search/are-there-global-regulatory-frameworks-for-crispr-/AuVrmbkvRyKFtCeqANETeg/.

Doctors Without Borders. “Delivering Care in a Conflict Zone.” Doctors Without Borders - USA, 2024. https://www.doctorswithoutborders.org/what-we-do/focus/care-in-conflict-zones.

Dong, DI. “Health Financing in Fragile, Conflict and Violence (FCV) Situations.” World Bank Group, n.d. https://documents1.worldbank.org/curated/en/844951563783610138/pdf/Health-Financing-in-Fragile-Conflict-and-Violence-FCV-Situations-Five-Key-Questions-To-Be-Answered.pdf.

Goetz, Laura H., and Nicholas J. Schork. “Personalized Medicine: Motivation, Challenges, and Progress.” *Fertility and Sterility* 109, no. 6 (June 2018): 952–63. https://doi.org/10.1016/j.fertnstert.2018.05.006.

Hartung, Thomas, E Morales, and Lena Smirnova. “Brain Organoids and Organoid Intelligence from Ethical, Legal, and Social Points of View.” *Frontiers in Artificial Intelligence* 6 (January 5, 2024). https://doi.org/10.3389/frai.2023.1307613.

Hasumi, Takahiro. “Health Service Delivery in Fragile, Conflict, and Violence (FCV) Situations.” World Bank Group, n.d. https://openknowledge.worldbank.org/server/api/core/bitstreams/59400dbc-4770-5c16-b9c1-72de61c69a56/content.

Jangid, Pushpendra, Asha Meena, R Prerna, Zeeshan H Hashmi, Vinod Kumar, and Hemlata Bhagtani. “The Role of Artificial Intelligence in Safeguarding Patient Privacy in Healthcare Systems.” *Journal of Pharmacy & Bioallied Sciences* 17, no. Suppl 2 (June 2025): S1083–85. https://doi.org/10.4103/jpbs.jpbs_381_25.

Jeremy. “War and Conflict.” Doctors Without Borders / Médecins Sans Frontières (MSF ..., December 22, 2020. https://www.doctorswithoutborders.ca/war-and-conflict/.

Lyu, Gloria, and Matthew Spero. “Editing the Human Genome.” The Regulatory Review, June 1, 2024. https://www.theregreview.org/2024/06/01/editing-the-human-genome/.

MedlinePlus. “What Are Genome Editing and CRISPR-Cas9?” Medlineplus. National Library of Medicine, March 22, 2022. https://medlineplus.gov/genetics/understanding/genomicresearch/genomeediting/.

National Academies of Sciences, Engineering, National Academy of Medicine, National Academy of Sciences, and Medical Committee on Human Gene Editing: Scientific. *Somatic Genome Editing*. *Www.ncbi.nlm.nih.gov*. National Academies Press (US), 2017. https://www.ncbi.nlm.nih.gov/books/NBK447271/.

National Human Genome Research Institute. “Personalized Medicine.” Genome.gov, 2022. https://www.genome.gov/genetics-glossary/Personalized-Medicine.

———. “What Are the Ethical Concerns of Genome Editing?” National Human Genome Research Institute. National Institutes of Health, August 3, 2017. https://www.genome.gov/about-genomics/policy-issues/Genome-Editing/ethical-concerns.

O’Brien, Niki, Alexandra Shaw, Kelsey Flott, Sheila Leatherman, and Mike Durkin. “Safety in Fragile, Conflict-Affected, and Vulnerable Settings: An Evidence Scanning Approach for Identifying Patient Safety Interventions.” *Journal of Global Health* 12 (February 26, 2022). https://doi.org/10.7189/jogh.12.04018.

Pate, Muhammad A., and Franck Bousquet. “Ensuring Healthcare on the Frontlines of Conflict and Crisis.” World Bank Blogs, March 11, 2020.

https://blogs.worldbank.org/en/dev4peace/ensuring-healthcare-frontlines-conflict-and-crisis.

Physicians for a National Health Program. “Health Care Systems - Four Basic Models.” Pnhp.org. Physicians for a National Health Program, 2010. https://www.pnhp.org/single_payer_resources/health_care_systems_four_basic_models.php.

Reid, T.R. “Five Countries - Health Care Systems -- the Four Basic Models | Sick around the World | FRONTLINE | PBS.” Pbs.org, April 15, 2008. https://www.pbs.org/wgbh/pages/frontline/sickaroundtheworld/countries/models.html.

Rubeis, Giovanni, and Florian Steger. “Risks and Benefits of Human Germline Genome Editing: An Ethical Analysis.” *Asian Bioethics Review* 10, no. 2 (July 16, 2018): 133–41. https://doi.org/10.1007/s41649-018-0056-x.

SILVERMAN, ED. “The 5 Most Pressing Ethical Issues in Biotech Medicine.” *Biotechnology Healthcare* 1, no. 6 (December 2004): 41. https://pmc.ncbi.nlm.nih.gov/articles/PMC3570985/.

Sino Biological. “Organoid Intelligence (OI): A New Frontier in Bio-Inspired Computing | Sino Biological.” Sinobiological.com, 2025. https://www.sinobiological.com/resource/organoid-review/organoid-intelligence.

Sun, Nan, Xiangqi Meng, Yuxiang Liu, Dan Song, Chuanlu Jiang, and Jinquan Cai. “Applications of Brain Organoids in Neurodevelopment and Neurological Diseases.” *Journal of Biomedical Science* 28, no. 1 (April 22, 2021). https://doi.org/10.1186/s12929-021-00728-4.

TECNIC. “The 10 Types of Biotechnology and Their Applications.” TECNIC Bioprocess Solutions. TECNIC, April 23, 2025. https://www.tecnic.eu/the-10-types-of-biotechnology-and-their-applications/.

Verma, Ashish Swarup, Shruti Rastogi, Shishir Agrahari, and Anchal Singh. “Biotechnology in the Realm of History.” *Journal of Pharmacy and Bioallied Sciences* 3, no. 3 (July 2011): 321. https://doi.org/10.4103/0975-7406.84430.

WHO. “Accessing Essential Health Services in Fragile, Conflict-Affected and Vulnerable Settings.” www.who.int, n.d.

https://www.who.int/activities/accessing-essential-health-services-in-fragile-conflict-affected-and-vulnerable-settings.

———. “Decade of Action on Nutrition and Global Initiatives.” Who.int, 2021. https://www.who.int/teams/integrated-health-services/quality-of-care/quality-of-care-in-fragile-conflict-affected-and-vulnerable-settings.

———. “Essential Health Services and Systems Maintained and Strengthened in Fragile, Conflict-Affected and Vulnerable Settings.” Who.int, 2022. https://www.who.int/about/accountability/results/who-results-report-2022-mtr/output/2022/essential-health-services-and-systems-maintained-and-strengthened-in-fragile--conflict-affected-and-vulnerable-settings.

———. “Quality of Care in Fragile, Conflict-Affected and Vulnerable Settings: Taking Action.” www.who.int, December 16, 2020. https://www.who.int/publications/i/item/9789240015203.

———. “Sustainable Development Goals.” www.who.int, 2022. https://www.who.int/data/gho/data/themes/sustainable-development-goals.

World Bank. “Overview.” World Bank, 2010. https://www.worldbank.org/en/topic/fragilityconflictviolence/overview.

———. “Strengthening Health Service Delivery Resilience in FCV Settings.” World Bank Group, 2020. https://documents1.worldbank.org/curated/en/984761561616986756/pdf/World-Strengthening-Health-Service-Delivery-Resilience-in-FCV-Settings-Program-Summary.pdf.