Global synthesis of NHNAI societal discussions (2023-2025)

Global-Health analysis

In 2023 and 2024, discussions on what it means to be human in the time of neuroscience (NS) and AI have been facilitated by NHNAI partners in 9 different countries. In each country, 3 lines of discussions have been opened to explore this question in the **3 thematic fields of education, health, and democracy**. Each partner then produced 3 **local syntheses** reporting on the content of discussions in these 3 fields in the corresponding countries.[1] On this ground, the coordination team proposed 3 **global thematic syntheses** (one per field explored, education, health and democracy). Finally, ideas of these 3 global thematic syntheses have been grouped to generate one **global-transversal synthesis**, gathering ideas that were more general and have been expressed in different thematic fields.

This document presents the **ideas of the global-health synthesis**, together with nexuses in which some ideas emerging from discussions enter in conflict and tension, manifesting possible complexities and delicate points of questions related to the topic of health.

[1] For an exact total of 8*3 + 2 local syntheses. In Canada (Québec), Cégep Sainte-Foy organized discussions focused on Democracy and Education, but not on Health.

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Part 1: Global-health ideas

Being human in the time of NS and AI means …

Preserving human agency and autonomy (in healthcare)

Participants to the collective discussions highlight that patients, physicians, and other health professionals and healthcare providers should keep their agency and autonomy. With the support of technologies such as AI empowered precision medicine and through an excessive focus on what can be measured and quantified, medicine and healthcare may become overly prescriptive and coercive (imposing a certain vision of what health means). It may become difficult for physicians and health professionals to preserve independent decision-making, with the possibility to sometimes diverge from the machine recommendations (for instance based on their human-reflection with trained intuition). Health technologies should not lead to undermine the medical authority of health professionals and should not encourage self-medication. In the same vein, overdependence on such technologies may prove harmful on the long run (deskilling, loss of resilience in case of technologies unavailability). The risk also exists that technology facilitates illegitimate intrusion of outsiders (governments, administrators, insurers …).

Involvement in nexuses of complexity (see below Part 2: Global-health nexuses of complexities):

- Improving healthcare and medicine without losing sight of persons
- Improving healthcare and medicine without undermining professionals' agency and autonomy

Corresponding ideas from local thematic syntheses:

6 countries (BE, FR, CH, IT, TW, US) 11 ideas

1rst wave / 2nd wave

- (Belgium – Health) The patient's freedom and autonomy are threatened by ever more control
- (Belgium – Health) Desirable: it is important to safeguard the decision-making autonomy of the human doctor
- (France – Health) The debate about increasing human capacity through technology raises profound concerns
- (France – Health) Undesirable: Technological domination and algorithm normativity
- (France – Health) Why the AI development in health?
- (France – Health) Undesirable: Preventing aberrations and preserving human autonomy
- (Chile – Health) Risk of Self-Diagnosis and the Role of Medical Authority
- (Italy – Health) Risk of dependence in mental health
- (Taiwan – Health) Undesirable: AI replacing humans in healthcare
- (Taiwan – Health) Human decisions and interactions should not be delegated to AI
- (US – Health) AI puts at risk human agency, clarity and distribution of moral responsibility, and autonomy

Never believing we can delegate (moral) responsibility to machines

A consensus emerges from collective discussions on the fact that only humans can be (morally) responsible for medical decision-making and caregiving. Except in certain specific legal senses (corporate responsibility, legal personhood allowing for instance for monetary compensation),

moral responsibility (and criminal one) can never be attributed to machines. Dilution and obfuscation of chains of responsibility is highly problematic.

Involvement in nexuses of complexity (see below Part 2: Global-health nexuses of complexities):

- Improving healthcare and medicine without undermining professionals' agency and autonomy

Corresponding ideas from local thematic syntheses:

6 countries (BE, KE, IT, PT, TW, US) 10 ideas
1rst wave / 2nd wave

- (Belgium – Health) Artificial intelligence increases the efficiency and skills of doctors: responsibility can therefore be attributed to them
- (Belgium – Health) Doctors must not abandon their responsibility so that trust is preserved
- (Italia – Health) AI and Ethical Decision-Making
- (Kenya – Health) Moral judgement
- (Kenya – Health) Ethical risks in AI and Nanotechnology
- (Portugal – Health) Desirable: Humans should always be responsible for health decision-making and communication processes
- (Portugal – Health) Desirable: Humans should be responsible for all decisions, even if based on artificial intelligence
- (Taiwan – Health) Humans are ultimately responsible for healthcare decisions
- (Taiwan – Health) AI can only play a supporting role
- (US – Health) AI puts at risk human agency, clarity and distribution of moral responsibility, and autonomy

Acknowledging some of our limitations and vulnerabilities as inherent to our human nature

According to many participants to NHNAI discussions, meaning and value of life cannot reduce to efficiency and performance only. Systematically rejecting limits, attempting at overcoming and transgressing all limits by principles can deeply undermine our humanity. Some limits and vulnerabilities (such as being "affectible", and thus susceptible to experience suffering, or being mortal) also are core to what it means to be human. In the same vein, some participants claim that fatigue and weariness are sometimes the sign that something is wrong in one's life, rather than mere limits to overcome (e.g. by using some enhancement technologies). This type of limits deserves acknowledgement and great delicacy when dealt with in the healthcare context.

Involvement in nexuses of complexity (see below Part 2: Global-health nexuses of complexities):

- Distinguishing between care, legitimate improvement and dehumanizing practices

Corresponding ideas from local thematic syntheses:

2 countries (FR, PT) 3 ideas
1rst wave / 2nd wave

- (France – Health) Some participants explore the notion of human vulnerability and the implications of technological enhancement
- (France – Health) Undesirable: immortality
- (Portugal – Health) Humans have physical and mental limitations

Constantly seeking for self-improvement and progress

Participants to discussions in Portugal notice that humans tend to seek for self-improvement and progress, for maximizing their efficiency. Those are strong objective for most humans (which can lead to use cognitive enhancers or other enhancement technologies).

Involvement in nexuses of complexity (see below Part 2: Global-health nexuses of complexities):

- Distinguishing between care, legitimate improvement and dehumanizing practices
- Enhancement technologies: finding the right balance between innovation and safety

Corresponding ideas from local thematic syntheses:

1 country (PT) 1 idea
1rst wave / 2nd wave

- (Portugal – Health) Humans are highly motivated to improve and achieve more

Recognizing patients in their singularity and diversity (within a comprehensive approach)

Many participants emphasize that patients must be acknowledged as singular being, and treated accordingly, in a comprehensive way resisting any reduction (notably to measurable and quantifiable aspects or to what can be accounted for and addressed through technological means), doing justice to their diversity. The information about healthcare technologies that are provided to them should respect the needs, context and specificities of each person. Patients are not reducible to their medical condition. AI technologies should not lead to an excessive and exclusive focus on biological dimensions or dimensions covered by natural sciences (thereby excluding in principle traditional and alternative medicines).

Involvement in nexuses of complexity (see below Part 2: Global-health nexuses of complexities):

- Improving healthcare and medicine without losing sight of persons

Corresponding ideas from local thematic syntheses:

4 countries (BE, CH, FR, KE) 6 ideas
1rst wave / 2nd wave

- (Belgium – Health) The patient's freedom and autonomy are threatened by ever more control
- (Belgium – Health) Technology leads to discrimination between medical practices
- (Chile – Health) Adaptation to Patient Diversity
- (France – Health) Participants explore the complex relationship between artificial intelligence, neuroscience and human nature
- (France – Health) Undesirable: Technological domination and algorithm normativity
- (Kenya – Health) Human identity

Maintaining empathy and human relationship at the core of healthcare

NHNAI discussions largely converge on the idea that human contact and relationship are indispensable, especially for those that are ill (role of empathy, emotional support and counseling). The quality of doctor-patient relationship (with trust it allows establishing) is

central. More than a side dimension, it is a key factor in healthcare and caregiving. Participants worry that AI and automation can undermine this humane dimension of healthcare (notably by being task-oriented). Trust can be damaged by uses of health data perceived as illegitimate (such as by outsiders like company insurances or governments). The surrounding context can reinforce this risk of degrading the quality of human contact in healthcare, for instance in time of crisis (pandemics but also in ICU) or because of the exhaustion of healthcare systems. This importance of human relationships should also be preserved in medical training (especially when more and more digital tools are involved, e.g. virtual reality).

Involvement in nexuses of complexity (see below Part 2: Global-health nexuses of complexities):

- Improving healthcare and medicine without losing sight of persons
- Ensuring fairness and equity with AI and health technologies
- Using AI to prevent social isolation while preserving human interactions

Corresponding ideas from local thematic syntheses:

8 countries (BE, CH, FR, IT, KE, PT, TW, US) 24 ideas
1rst wave / 2nd wave

- (Belgium – Health) Technology should not decide the fate of a patient by replacing human relationships
- (Belgium – Health) Doctors must not abandon their responsibility so that trust is preserved
- (Belgium – Health) Human relationships risk being sacrificed for the benefit of AI techniques
- (Chile – Health) Empathy and Patient Respect
- (Chile – Health) Challenges of Humanization in Health Crises
- (Chile – Health) Workload and Health Crises
- (Chile – Health) Humanization in Intensive care
- (Chile – Health) Dehumanization of Medical Practice
- (Chile – Health) Technological Innovations in Medical Training
- (Chile – Health) Doctor-Patient Relationship
- (France – Health) Democratic issues are also shifting to health
- (France – Health) Preserving the human intervention in healthcare and care of patient
- (Italy – Human contact remains a fundamental component of healthcare and mental health
- (Kenya – Health) AI in the Health in the African context
- (Kenya – Health) Human disconnection in the health care
- (Kenya – Health) Culture conflict
- (Portugal – Health) Human contact and physical touch are basic human needs
- (Portugal – Health) Relationships with similar beings are crucial to humans
- (Portugal – Health) Desirable: Health should be promoted by stimulating social contact
- (Portugal – Health) Social needs being fulfilled by humans is the best route to health and well-being
- (Taiwan – Health) Undesirable: AI replacing humans in healthcare
- (Taiwan – Health) Human decisions and interactions should not be delegated to AI
- (Taiwan – Health) Undesirable: Overdependence on caregiving robots may lead to social isolation
- (US – Health) AI risk to the doctor-patient relationship

Using health technologies to better the conditions of life of the most vulnerable persons

In several countries, participants in discussions highlight the opportunities offered by AI and health technologies to facilitate access to healthcare (notably through telemedicine and) to the most vulnerable (poor persons, refugees). These technologies may also empower persons with disabilities, to help them becoming more independent. To work in that direction, access to these technologies should be reinforced and made easier (skills, access to efficient tools and

infrastructures) and trust and acceptance should be fostered among vulnerable communities (notably through their involvement in the development process).

Involvement in nexuses of complexity (see below Part 2: Global-health nexuses of complexities):

- Ensuring fairness and equity with AI and health technologies

Corresponding ideas from local thematic syntheses:

4 countries (FR, KE, PT, TW) 12 ideas
1rst wave / 2nd wave

- (France – Health) AI and neuroscience: just for therapeutic solutions
- (France – Health) Desirable: a certain human enhancement could be a positive potential
- (France – Health) Using AI as a tool for patient care
- (France – Health) Desirable: longer life expectancy / immortality
- (Kenya – Health) Improving access to quality healthcare service for refugees
- (Kenya – Health) Telemedicine
- (Kenya – Health) Empowerment of PWDs to become independent
- (Kenya – Health) Building trust for acceptance of AI and better health outcomes
- (Kenya – Health) Refuges and AI in healthy
- (Kenya – Health) Empowerment of PWDs
- (Portugal – Health) Desirable: Technological advances may help fulfil social needs
- (Taiwan – Health) Desirable: Caregiving robots

Ensuring fairness and equality in opportunities for living a good life

AI and health technologies may deeply transform healthcare practices and offer possibilities for human (cognitive) enhancement. This can create or reinforce inequalities. Many participants insist that it is necessary to ensure that benefits and difficulties raised by these transformations are fairly distributed (fairness in access to non-dehumanized healthcare and to positively contributing innovations, or in protection against dangers and unwanted effects). Inequalities can be in terms of access (skills and literacy, financial means, material infrastructures) as well as in terms of power or benefit-sharing asymmetries. Precision medicine (with individualized predictions on possible future diseases or health issues) can threaten healthcare systems articulated around the principle of solidarity. Inequalities can also occur when some groups (or cultural specificities) are underrepresented in datasets employed in machine learning processes or not accounted for when testing the new technologies.

Involvement in nexuses of complexity (see below Part 2: Global-health nexuses of complexities):

- Ensuring fairness and equity with AI and health technologies

Corresponding ideas from local thematic syntheses:

6 countries (BE, CH, FR, IT, KE, PT) 23 ideas

- (Belgium – Health) Technology is a source of economic exclusion
- (Belgium – Health) Technology causes discrimination due to its non-neutrality and the high skills it requires
- (Chile – Health) Democratization of Healthcare
- (Chile – Health) Technological Innovations in Medical Training
- (France – Health) Social inequalities arising from access to technological improvements on human beings through AIs and neurotechnologies
- (France – Health) Risks of AI development
- (France – Health) About some ethical issues

- (France – Health) Undesirable: ethical and social risks associated with AI and technology
- (France – Health) Preserving the value of solidarity in healthcare and society
- (France – Health) AI is potentially a new motor of inequalities
- (Italia – Health) Fair and non-biased AI
- (Kenya – Health) Improving infrastructure for better accessibility of healthcare service
- (Kenya – Health) Human history
- (Kenya – Health) AI - Vulnerable people
- (Kenya – Health) AI – Vulnerable people
- (Kenya – Health) Need to enhance infrastructure
- (Kenya – Health) AI-digital divide
- (Kenya – Health) Sustainable resources
- (Kenya – Health) AI – discrimination
- (Kenya – Health) Data Storage
- (Kenya – Health) Culture conflict
- (Portugal – Health) Undesirable: The demands regarding human performance and productivity may increase to unrealistic levels
- (Portugal – Health) Undesirable: There may be inequality regarding access to scientific and/or technological health innovations
- (Portugal – Health) Desirable: Universal access to scientific and/or technological health innovations should be fostered

Fostering literacy and critical thinking

Many participants in NHNAI discussions highlight the importance of technological literacy and critical thinking in the healthcare context. Concerned actors (patients, health professionals, caregivers, users of health technologies) should be aware of the nature, limits and risks of technologies they are using, or they are confronted with. AI should not be presented as infallible, or as by principle or nature superior to humans. More broadly, fostering awareness about health issues and ethical literacy is key. In addition, it is important to adapt information provided to contexts and specific needs of each person.

Involvement in nexuses of complexity (see below Part 2: Global-health nexuses of complexities):

- Improving healthcare and medicine without undermining professionals' agency and autonomy

Corresponding ideas from local thematic syntheses:

6 countries (BE, CH, IT, KE, PT, TW) 8 ideas
1rst wave / 2nd wave

- (Belgium – Health) AI and the issue of responsibility
- (Chile – Health) Importance of Health Education
- (Italia – Health) Ethical Literacy
- (Kenya – Health) Individual differences
- (Kenya – Health) AI training
- (Portugal – Health) Desirable: Increasing literacy is necessary to foster the best use of scientific and/or technological health innovations
- (Portugal – Health) Desirable: Social scientists should help families in preventing the harmful effects of technological advances
- (Taiwan – Health) Undesirable: Risks due to the unreliability of AI

Ensuring privacy protection (protection of sensitive health information and mind privacy)

For participants to collective discussions, health data collected by AI or digital tools should only serve medical and healthcare purposes. Digital solutions should not imply intrusion of outside organizations (like employers or insurance companies). With the convergence of NS and AI, mind privacy should be protected. However, participants wonder about the balance between benefiting from health data processing and protecting privacy is a complex issue. Should we have more or less right to opt out health data collection (pandemics, occupational medicine, health-related data platforms, …)?

Involvement in nexuses of complexity (see below Part 2: Global-health nexuses of complexities):

- Developing AI and Health technologies without undermining persons' privacy and integrity

Corresponding ideas from local thematic syntheses:

6 countries (BE, CH, FR, IT, KE, US) 12 ideas
1rst wave / 2nd wave

- (Belgium – Health) The issue of sharing personal data
- (Chile – Health) Patient Privacy
- (France – Health) Risks of AI development
- (France – Health) Health data protection: challenges and necessary regulations
- (France – Health) Health data management: between privacy protection and AI opportunities
- (France – Health) Artificial intelligence and employment: benefits and risks
- (Italy – Health) Ethical Boundaries in Neuroscience-AI Integration
- (Italy – Health) Ethical challenges of AI in healthcare
- (Kenya – Health) confidentiality/privacy when using AI
- (Kenya – Health) AI and data protection policy
- (US – Health) AI risk to the doctor-patient relationship
- (US – Health) AI puts at risk privacy and opens patients to harm from powerful organizations

Acknowledging the positive contribution of health technologies to healthcare

Participants to NHNAI discussion largely acknowledge opportunities and positive contributions offered by health technologies (including AI). The latter can support health professionals in medical decision making (they may even perform better in some tasks). Similarly, automating certain tasks may give more time for the human dimensions of caregiving and healthcare. AI and digital technologies can facilitate access to healthcare and health related information (especially in more isolated or poorer areas). They may also improve medical training, as well as preventive care and health prevention. It would be harmful to reject such positive contributions to healthcare. More broadly, AI and NS advancements may contribute to improving the understanding we have of ourselves and of others, to refine the understanding we have of ourselves as human being.

Involvement in nexuses of complexity (see below Part 2: Global-health nexuses of complexities):

- Improving healthcare and medicine without losing sight of persons
- Improving healthcare and medicine without undermining professionals' agency and autonomy

- Ensuring fairness and equity with AI and health technologies
- Developing AI and Health technologies without undermining persons' privacy and integrity

Corresponding ideas from local thematic syntheses:

8 countries (BE, CH, FR, IT, KE, PT, TW, US) 28 ideas
1rst wave / 2nd wave

- (Belgium – Health) New technologies are favorable to human relations by saving time and increasing efficiency
- (Belgium – Health) Artificial intelligence increases the efficiency and skills of doctors: responsibility can therefore be attributed to them
- (Belgium – Health) There is no reason to suspect technologies of coming into conflict with the "freedom" of patients
- (Belgium – Health) If a technology is medically beneficial, it should be used
- (Belgium – Health) Undesirable: Avoiding Bias Towards AI
- (Chile – Health) Prevention and Technologies
- (Chile – Health) Technological Innovations in Medical Training
- (Chile – Health) Artificial intelligence as a solution to an inefficient healthcare system
- (France – Health) Why the AI development in health?
- (France – Health) Desirable: Potential of AI to improve disease diagnosis and treatment
- (France – Health) Desirable: Using AI as a tool for patient care
- (Italy – Health) Benefits of using AI in healthcare
- (Kenya – Health) Automation of some tasks
- (Kenya – Health) AI Application in the Healthcare Sector
- (Kenya – Health) Application of AI in disease treatment
- (Kenya – Health) Application of AI in medical (early) diagnosis
- (Kenya – Health) Using AI to reduce medical errors
- (Kenya – Health) Desirable: Application of AI in disease detection
- (Kenya – Health) AI efficiency
- (Kenya – Health) Opportunities and benefits of AI in healthcare
- (Portugal – Health) Desirable: In health contexts, specific tasks may be delegated to machines
- (Portugal – Health) Desirable: Technology is an important resource for patients and informal caregivers
- (Portugal – Health) Desirable: Technology is an important resource for health professionals
- (Portugal – Health) Desirable: Artificial intelligence is beneficial in health contexts
- (Taiwan – Health) AI can improve the efficiency of healthcare workers
- (Taiwan – Health) Desirable: Human-AI cooperation in healthcare
- (Taiwan – Health) Desirable: Care-giving robots
- (US – Health) Health

Exploring the potential contributions of health technologies to humans' self-improvement

Some participants to collective discussions (in France and in Portugal) underline the potential of health technologies for increasing physical and mental abilities. These technologies could also prevent their decrease when aging. As we already have health practices with the same goal (e.g. knee or hip replacement), more recent options, such as brain technologies, may become acceptable.

Involvement in nexuses of complexity (see below Part 2: Global-health nexuses of complexities):

- Distinguishing between care, legitimate improvement and dehumanizing practices
- Enhancement technologies: finding the right balance between innovation and safety
- Ensuring fairness and equity with AI and health technologies

- Developing AI and Health technologies without undermining persons' privacy and integrity

Corresponding ideas from local thematic syntheses:

2 countries (FR, PT) 2 ideas
1rst wave / 2nd wave

- (France – Health) The debate on the integration of cyborgs into society raises ethical, legal and philosophical questions
- (Portugal – Health) PT-UCP: Desirable: Scientific and/or technological health innovations may increase physical and/or cognitive abilities

Privileging AI cooperation and support instead of human replacement

A large consensus emerges from NHNAI discussions on the claim that AI and health technology should contribute to a more humanized healthcare system. In general, machines should not replace humans. In particular, tasks pertaining to medical decision-making, communication and care giving should remain human. Although it is true that health professionals and caregivers often lack time and are exhausted, and that healthcare systems are under high pressure, AI technologies may not constitute the right or primary answer to these major issues.

Involvement in nexuses of complexity (see below Part 2: Global-health nexuses of complexities):

- Improving healthcare and medicine without losing sight of persons
- Improving healthcare and medicine without undermining professionals' agency and autonomy

Corresponding ideas from local thematic syntheses:

8 countries (BE, CH, FR, IT, KE, PT, TW, US) 22 ideas
1rst wave / 2nd wave

- (Belgium – Health) New technologies are not necessarily the solution to the lack of time in medicine
- (Belgium – Health) Human relationships risk being sacrificed for the benefit of AI techniques
- (Belgium – Health) Technology should not decide the fate of a patient by replacing human relationships
- (Chile – Health) Impact on the Doctor-Patient Relationship
- (Chile – Health) Ethical Limits in Care
- (France – Health) Democratic issues are also shifting to health
- (Italia – Health) Humanism and Human-Centric AI Development
- (Italia – Health) Ensuring Human Control
- (Kenya – Health) Human/non human collaboration for better health outcome
- (Kenya – Health) Human replacement by machines
- (Kenya – Health) Enhancement
- (Kenya – Health) Medication management
- (Kenya – Health) Human replacement by machines
- (Kenya – Health) AI and social interactions
- (Portugal – Health) Desirable: Humans should always be responsible for health decision-making and communication processes
- (Portugal – Health) Desirable: Humans have an essential role in caregiving tasks
- (Taiwan – Health) Undesirable: AI replacing humans in healthcare
- (Taiwan – Health) Human decisions and interactions should not be delegated to AI
- (Taiwan – Health) AI can only play a supporting role
- (US – Health) AI automating healthcare risks dehumanizing the healthcare system
- (US – Health) Undesirable: AI that replaces humanity in healthcare, rather than supporting humanity in healthcare
- (US – Health) Health

Withstanding the overvaluation of performance, efficiency or productivity

The idea emerges from collective discussions that overvaluing (or valuing only) human performance, efficiency and productivity may prevent accounting for other important human values (solidarity, meaning of life, happiness, …). It could lead to massive use of enhancement technologies, with issues of inequalities and of loss of meaning in one's life. It may also lead to focusing on measurable and quantifiable aspects alone, at the cost of acknowledging persons experiences and feelings.

Involvement in nexuses of complexity (see below Part 2: Global-health nexuses of complexities):

- Distinguishing between care, legitimate improvement and dehumanizing practices

Corresponding ideas from local thematic syntheses:

4 countries (CH, FR, PT, US) 5 ideas
1rst wave / 2nd wave

- (Chile – Health) Ethical Limits in Care
- (France – Health) The debate about increasing human capacity through technology raises profound concerns
- (France – Health) Enhancement: between benefits and inequality
- (Portugal – Health) Undesirable: The demands regarding human performance and productivity may increase to unrealistic levels
- (US – Health) AI puts at risk privacy and opens patients to harm from powerful organizations

Regulating AI and health technologies in healthcare

Many participants to societal discussion highlight the strong need for regulation and norms to ensure AI and health technologies deliver positive outcomes in healthcare. Norms and regulations are key to allow for trust building and for persons protection when deploying new technologies in healthcare (transparency, informed consent, privacy protection, …). Professionals mobilizing such technologies should be provided with guidelines and support. AI should comply with human values (fairness, non-bias, …) and should be human-centric (aiming at human flourishing). AI and health technologies should beneficiate to all (it is crucial to fight against the exclusion of poor and vulnerable persons). This need for regulation is even stronger as AI systems come with a lot of uncertainty, notably about their performance and the possibilities of progress in the future. Patients, healthcare professionals, caregivers, citizens and economic/industrial actors should be involved in regulation processes.

Corresponding ideas from local thematic syntheses:

6 countries (CH, IT, KE, FR, PT, US) 11 ideas
1rst wave / 2nd wave

- (Chile – Health) Ethical Reflections on Technological Integration
- (France – Health) Risks of AI development
- (France – Health) Strict, ethical regulation of Artificial intelligence: issues of responsibility and transparency
- (France – Health) Undesirable: preventing aberrations and preserving human autonomy
- (Italia – Health) Humanism, Human values, Human Rights and Ethical Standards
- (Italia – Health) Call to Action
- (Kenya – Health) Ethical risks in AI and nanotechnology
- (Kenya – Health) Regulatory framework

- (Portugal – Health) Desirable: It is necessary to establish limits regarding the use of scientific and/or technological health innovations
- (Portugal – Health) Undesirable: Scientific and/or technological health innovations may pose physical risks
- (US – Health) AI needs regulation to protect health care norms such as consent, and by extension trust in healthcare

Limiting the use of health-enhancement technologies

For many participants, some health technologies may have consequences difficult to forecast (like brain technologies) and may pose physical or mental risks. While the use of health technologies in a medical context to overcome disabilities and cure seems possible, enhancement practices raise strong ethical concerns (overdependence, deskilling, cyborg social status, …). Patients, healthcare professionals, caregivers, citizens and economic/industrial actors should be involved in regulation processes.

Involvement in nexuses of complexity (see below Part 2: Global-health nexuses of complexities):

- Distinguishing between care, legitimate improvement and dehumanizing practices

Corresponding ideas from local thematic syntheses:

4 countries (CH, FR, IT, PT) 11 ideas
1rst wave / 2nd wave

- (Chile – Health) Ethical Limits in Care
- (France – Health) The subject of human enhancement raises complex ethical considerations
- (France – Health) The debate on the integration of cyborgs into society raises ethical, legal and philosophical questions
- (France – Health) The debate about increasing human capacity through technology raises profound concerns
- (France – Health) Undesirable: Some enhancement abilities are desirable
- (France – Health) AI and neuroscience: just for therapeutic solutions
- (France – Health) Desirable: A certain human enhancement could be a positive potential
- (Italia – Health) Ethical Boundaries in Neuroscience-AI Integration
- (Italia – Health) Call to Action
- (Portugal – Health) Desirable: It is necessary to establish limits regarding the use of scientific and/or technological health innovations
- (Portugal – Health) Undesirable: Scientific and/or technological health innovations may pose physical risks

Being aware of challenges regulation raises

Some participants in collective discussions stress acute challenges linked to (health-) technology regulation. Some technologies may have consequences difficult to forecast (like brain technologies). The pace of technological development may render new regulations rapidly obsolete. Risks as well as patterns of responsibility may prove difficult to assess. It may be difficult to delineate cure from enhancement in some cases. It may be difficult to judge whether a pathology requires / justifies the use of a given health technology.

Corresponding ideas from local thematic syntheses:

3 countries (FR, PT, TW) 4 ideas
1rst wave / 2nd wave

- (France – Health) Risks of AI development
- (France – Health) AI complexity: transparency and accountability
- (Portugal – Health) Undesirable: It is difficult to establish limits regarding the use of scientific and/or technological health innovations

- (Taiwan – Health) Undesirable: Uncertainty over the future of AI

Part 2: Global-health nexuses of complexities

Being human in the time of NS and AI implies carefully exploring nexuses of complexities where valid ideas are nonetheless in tension, manifesting subtleties and challenges one should not overlook. Here are below some examples of **nexuses of complexities** in the field of **health**, identified in NHNAI discussions based on **local and global syntheses**.

Distinguishing between care, legitimate improvement and dehumanizing practices

Some participants in the discussions point out that it is in the nature of humans to constantly seek to progress and improve. Advances in AI and neuroscience in the healthcare field may enable us to increase our physical and mental capacities (notably with neurological prostheses or implanted brain-machine interfaces). These technologies could also prevent the loss of capacity associated with aging. Similar practices (with hip or articular prostheses) are already widely accepted in society. We can therefore imagine that more recent possibilities linked to AI and neuroscience (such as brain implants) could also eventually become acceptable.

Nevertheless, the discussions also reveal a concern about the motivations and significance of such augmentation practices. While it seems acceptable to many participants to use health technologies in a curative context (to combat disabilities or degenerative diseases), practices aimed at unlimited increases in longevity or brain capacity, or even military applications, are viewed with more caution, and are even often criticized.

Emphasis is also placed on the risk of overvaluing performance, efficiency and productivity, with an excessive focus on measurable and quantifiable aspects alone, to the detriment of taking into account questions of meaning and values, people's feelings and life experiences.

So, for example, it's not clear that the right response to severe fatigue or a feeling of weariness is to increase resistance through health technologies (such as drugs or brain implants). We need to consider the possibility that such fatigue or weariness may also signal deeper problems in a person's life. Similarly, the discussions lead us to question the very idea of augmentation by technology, which could in some cases degenerate into dependence on technology and loss of competence (do I really become more “powerful” if a brain implant makes me capable of greater cognitive performance? What happens if I no longer have access to this technology, or if it malfunctions?)

On a more global level, some contributions criticize the idea of a systematic desire to surpass and reject all forms of limit, a desire that could go so far as to threaten our very humanity. Certain limits and vulnerabilities (such as being affectable and therefore susceptible to suffering and death) are at the heart of what it means to be human.

Ideas from local and global synthesis mobilized in this nexus of complexity:

- Potential positive outcomes of enhancement technologies:
  - (Global – Health) Constantly seeking for self-improvement and progress
  - (Global – Health) Exploring the potential contributions of health technologies to humans' self-improvement
- Concerns about overvaluing performance and about systematic rejection of any limits
  - (Global – Health) Withstanding the overvaluation of performance, efficiency or productivity
  - (Global – Health) Acknowledging some of our limitations and vulnerabilities as inherent to our human nature
- Risks of overdependence and deskilling, worries about augmentation practices:
  - (Global – Health) Limiting the use of health-enhancement technologies

Expertise input:

A. On human enhancement

Fernand Doridot[2]

Unprecedented means of human enhancement (cognitive amplifiers, neuroprosthetics, emotional regulation technologies, etc.) seem to be on the horizon. Their potential for improving quality of life and extending human capabilities beyond natural limits has long been highlighted.[3] Nevertheless, the development of these technologies is accompanied by legitimate concerns. In particular, their widespread availability could create unrealistic expectations, or foster a culture in which individuals are under constant "pressure to improve" to keep up with societal norms. In the long term, this could exacerbate inequalities between those who can afford these technologies and those who do not, paving the way for a new form of "biological elitism."[4] (Sandel, 2007). It is also to be feared that important societal values, such as the acceptance of human vulnerability and imperfection, which are often seen as important aspects of our common humanity, could be undermined by the constant quest for technological improvements. It is therefore imperative that demanding ethical frameworks are put in place to encourage the responsible use of technologies, and to ensure that the potential enhancement of individuals remains strictly a matter of choice, offered sometimes as a reasonable opportunity, but never becomes an obligation.

B. Additional insights on Vulnerability and Humanness

Better understanding vulnerability with David Doat, associate professor of philosophy at the Catholic University of Lille, holder of the ETH+ Chair in Ethics, Technology and Humanities:[5]

> *Vulnerability is not weakness or poverty. Nor can it be reduced to old age, disability or illness. The origin of the word comes from the Latin vulnus, meaning "wound". But here again, we need to distinguish between "vulnerability" and "vulneration". The former refers to the possibility of being affected in one's physical or psychological structure; the latter refers to the state following an injury. It's important to make the difference. During a romantic encounter, for example, the lovers are in a state of vulnerability as they expose themselves to each other, each allowing themselves to be affected by the beloved, but both are not injured. Vulnerability can be an opportunity.*

[2] Associate professor in ethics, philosophy of sciences and technologies (ICAM – Catholic University of Lille, ETHICS EA7440, France)
[3] Bostrom, N., & Roache, R. (2007). Ethical Issues in Human Enhancement. In J. Ryberg, T. Petersen, & C. Wolf (Eds.), *New Waves in Applied Ethics*, Palgrave Macmillan, pp. 120-152.
[4] Sandel, M. J. (2007). *The Case Against Perfection: Ethics in the Age of Genetic Engineering*. Cambridge, Harvard University Press.
[5] Extract from David Doat, 2021, « La vulnérabilité peut être une chance. Mais on l'oublie », Interview by Brigitte Bègue in *Actualités sociales hebdomadaires* (N.3199 5 mars 2021), pp. 38-39 (our translation), https://www.ash.tm.fr/hebdo/3199/entretien/la-vulnerabilite-peut-etre-une-chance-mais-on-loublie-634607.php

But we forget this. Very often, vulnerable people are associated with the elderly, the dependent, the disabled... From an anthropological point of view, we are all vulnerable and exposed to more or less significant risks, but there are singular vulnerabilities of a social, economic, cultural or health nature. An elderly person in a retirement home is more vulnerable to Covid-19 than a young person. This does not mean, however, that they will catch it and die of it. The challenge of education and support is not just to look at the disaster pole. We also need to consider the situations in which some people find themselves, and which can be positively converted. We have something to do with and within our vulnerabilities.

Deconstructing the modern ideal of an all-powerful, completely autonomous human, with Chiara Pesaresi, associate professor of philosophy at the Catholic University of Lyon, scientific director of the Vulnerabilities University Chair:[6]

It's true that the semantic field of vulnerability traditionally refers to devaluing representations, evoking ideas of lesser resistance and failure. Recognizing oneself as vulnerable means challenging modern and post-modern social imaginations centered on the ideas of progress, mastery and performance, and rethinking our individual and collective logic of action in light of the fragility of our lives, our institutions and even our environment.

Basically, it's a question of deconstructing the modern ideal of a completely autonomous human being, freed from limits and also from dependence on others. This vision of man as capable of absolute self-determination has led to a reduction of vulnerability and its manifestations to contingent defects, which must be corrected, repaired or overcome at all costs (the expression "design yourself", motto of the cyborg movement, illustrates this principle well)."

"However, this is not to glorify vulnerability or deny its testing, critical and even tragic nature: on the contrary, recognizing our own vulnerability is always part of a dialectic of consent and resistance, of acceptance and creative adaptation. It also reveals that we are never isolated beings, perfectly independent and autonomous. Emmanuel Levinas was convinced that subjectivity can grow only in the encounter with the other, where vulnerability presents itself as our common trait: for it is in his face that I recognize both his nakedness, his extreme vulnerability, and my own.

You can also find this complexity on the NHNAI website: https://nhnai.org/focus-on-nexuses-of-complexity-health/

[6] Extract from the opinion piece "Il est urgent de reconnaître la vulnérabilité dans nos vies", from Chiara Pesaresi, published in *La Vie* on May 10, 2022 (our translation), https://www.lavie.fr/ma-vie/sante-bien-etre/il-est-urgent-de-reconnaitre-la-vulnerabilite-dans-nos-vies-82292.php

Improving healthcare and medicine without losing sight of persons

Participants largely acknowledge that health technologies (including AI) can support health professionals in medical decision making (they may even perform better in some tasks). Similarly, they highlight that automating certain tasks may give more time for the human dimensions of caregiving and healthcare (for instance with care-giving robots). Some participants also point out that AI and digital technologies can facilitate access to healthcare and health related information, notably for preventive care and health prevention (especially in more isolated or poorer areas). The idea also emerges that digital technologies can improve medical training (e.g. with virtual or augmented reality).

It is however also largely consensual in the discussions that AI and health technology should contribute to a more humanized healthcare system. They should not lead to lose sight of the fact that patients are persons that should be treated with a comprehensive approach, making room to all relevant dimensions and firmly rooted in empathy and human relationships. The latter are key for the healing process and the doctor-patient relationship. In general, machines should not replace humans. In particular, tasks pertaining to medical decision-making, communication and caregiving should remain human. Although it is true that health professionals and caregivers often lack time and are exhausted, and that healthcare systems are under high pressure, AI technologies may not constitute the right or primary answer to these major issues.

In this perspective, many participants warn against the danger of overfocusing on what can be measured and quantified and of reducing patients to their data (with the risk of medicine and healthcare becoming overly prescriptive and coercive). Patients must be recognized in their singularity and diversity.

Ideas from local and global synthesis mobilized in this nexus of complexity:

- (Global – Health) Acknowledging the positive contribution of health technologies to healthcare
- AI and health technologies should not lead to dehumanization of healthcare and medicine:
    - (Global – Health) Privileging AI cooperation and support instead of human replacement
    - (Global – Health) Maintaining empathy and human relationship at the core of healthcare
    - (Global - Health) Preserving human agency and autonomy (in healthcare)
- (Global – Health) Recognizing patients in their singularity and diversity (within a comprehensive approach)

Expertise input:

A. The irreducible central place of humans in health and caregiving

Fernand Doridot

The risk of moving from the liberation of care - where technology supports caregiving - to the liberation of care, where the essential relational and emotional aspects of caregiving are diminished or lost, raises important ethical concerns. According to Joan Tronto's ethics of care,[7] caregiving cannot be seen as a simple set of tasks to be streamlined, but must rather be seen as a relational practice involving attention, responsibility and response to the unique needs of individuals. As such, the challenges and emotional labor inherent in caregiving, however

[7] Tronto, J. C. (2013). *Caring democracy: Markets, equality, and justice*. New York: New York University Press.

difficult, are at the heart of its meaning and cannot be entirely handled by machines. In a similar vein, Michel Foucault warns in *The Birth of the Clinic*[8] that medicine's emphasis on quantification and control can reduce patients to data and strip them of their individuality and humanity. An over-reliance on AI could, of course, reinforce this trend and transform healthcare into a more prescriptive and impersonal practice. According to Neumann et al. (2011)[9] , Halpern (2001)[10], and more recent analyses of AI-mediated clinical encounters (e.g. Ghafourifard et al., 2025)[11], empathy and communication are essential to patient satisfaction and outcomes. As Sherry Turkle and Noel Sharkey point out[12] (Turkle, 2011; Sharkey, 2008), these are qualities that AI and robot caregivers cannot replicate. So technologies, while useful for routine tasks, are unlikely to replace the deep emotional and relational dimensions required for meaningful care.

B. The limits of reducing health to data

Nathanaël Laurent[13] & Federico Giorgi[14]

The participants express their concern about the possibility that the automation of medical practice could become so extreme that even fundamental decisions concerning patients' lives might be delegated to a machine. Their opposition to a scenario that, fortunately, still seems distant today is entirely justified. In fact, a machine designed to prescribe the appropriate treatments for patients would inevitably have very limited effectiveness, since, as Giuseppe Longo (2021) emphasizes, alphanumeric language is based on a reduction of the continuous (the living organism) to the discrete (a series of letters and numbers), and the price to be paid in terms of scientific understanding for such a simplification is very high. A patient's state of health cannot be described through a set of numerical parameters (Amjahad, Vialars, and Kozlowski, 2021), because the meaning of each of these parameters must always be assessed within the overall functioning of the organism in question and in light of its ontogenesis. As a result, the same value for a given parameter may require very different treatments from one individual to another. Such a challenge cannot be addressed while remaining within the realm of the discrete, as an algorithm does, but necessarily requires the intervention of a human physician—someone capable of integrating their diagnostic models with their experience, their ability to listen, and their intuition.

C. The hard question of the balance between humanity and efficiency

Brian P. Green[15]

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[8] Foucault, M. (2003). *The birth of the clinic: An archaeology of medical perception*. London: Routledge.

[9] Neumann, M., Edelhäuser, F., Tauschel, D., Fischer, M. R., Wirtz, M., Woopen, C., ... & Scheffer, C. (2011). Empathy decline and its reasons: A systematic review of studies with medical students and residents. *Academic Medicine, 86*(8), 996–1009.

[10] Halpern, J. (2001). *From detached concern to empathy: humanizing medical practice*. Oxford University Press.

[11] Ghafourifard M, Ghasempour M, Purabdollah M, Killam LA. The AI Fever: Can Artificial Intelligence Replace Compassionate Human Care? J Caring Sci. 2025 Jun 8;14(2):135-137. doi: 10.34172/jcs.025.35005. PMID: 40894977; PMCID: PMC12397513.

[12] Sharkey, N. (2008). The ethical frontier of robotics. *Science, 322*(5909), 1800–1801. Turkle, S. (2011). *Alone together: Why we expect more from technology and less from each other*. New York: Basic Books.

[13] Associate professor in philosophy of biology (Université de Namur, ESPHIN, Belgium)

[14] Post-doctoral researcher in philosophy (Université de Namur, ESPHIN, Belgium)

[15] Professor in AI Ethics, Director of technology ethics at the Markkula Center for Applied Ethics (Santa Clara University, USA)

Medical AI might be better able to deal with humans as individual cases than any human can simply because it can truly absorb the volume of particular data specific to any particular individual.

AI can be vastly more patient and empathetic than any human can ever be: never growing tired, needing a break, getting bored, etc. AI bots for companionship and counseling are in some ways already superhuman (and that raises many problems opposite to the one suggested here). The key question then becomes what does a human in particular bring to the medical relationship and why is that important?

Similar to what is mentioned above, humans are vital to the medical system, but their exact role in relation to AI, especially when AI might be "more human" than humans can be, remains in question. If a fully automated hospital were possible and had superior medical outcomes than one staffed by humans, what use is there going to the human-staffed hospital? What benefit is there to the patients if the people working there are more gruff, less skilled, and slower? We can remind ourselves of the beneficial opportunities for grow that come along with adversity, but that seems like a difficult thing to assert when human health and lives are at stake.

This question of the balance between humanity and efficiency is perhaps the most central question regarding the use of AI in healthcare. What do humans bring to healthcare besides our expertise? And does that additional factor outweigh the efficiency, accuracy and other improvements that AI may bring? Surely the warmth and care that humans can bring will be appreciated, but the healthcare system currently does not focus on that - can it be re-emphasized?

Theologically-speaking, humans are made in the image of a God who is both love and logos (Divine "Word" but also logic & reason). If AI takes the Logos away from us, then we should "double down" on the "love" side of things, or we face being replaced entirely. This would require a completely revolutionary shift in understanding of human behavior and culture.

D. Human contact and self-care mechanisms

Juan R. Vidal[16]

In health care, there is an aspect that is partly overlooked, and that is the mechanisms of self-care that the brain-body relationship activates when a person feels cared for. These mechanisms, very often overlooked, are at stake in certain placebo effects that, though downplaying the importance and impact of pharmacological treatments, highlight the incredible capacity of human bodies to engage certain mechanisms of self-repair and pain reduction that increase human well-being. This placebo effect is often gated by the encounter between the person's beliefs and a certain clinical context or contact with a human practitioner and has been shown to engage brain systems in placebo-responsive individuals.

Because this effect uses the agency-recognition processes by patients towards caring and medical human practitioners ("it's a human like me that is helping me"), it is important to keep

[16] Associate professor in cognitive neuroscience (UCLy (Lyon Catholic University), UR CONFLUENCE : Sciences et Humanités (EA 1598), Lyon, France)

the human bond and interaction in health care (including human touch, as when the doctor auscultates the body through bodily contact, eye contact with the doctor, conversation with the health practitioner). Such bond and interaction are indispensable to keep these placebo mechanisms active in the more global process of fostering medical and psychological well-being.

You can also find this complexity on the NHNAI website: https://nhnai.org/focus-on-nexuses-of-complexity-health-2/

Improving healthcare and medicine without undermining professionals' agency and autonomy

Participants largely acknowledge that health technologies (including AI) can support health professionals in medical decision-making (they may even perform better in some tasks). Similarly, they highlight that automating certain tasks may give more time for the human dimensions of caregiving and healthcare (for instance with care-giving robots). Some participants also point out that AI and digital technologies can facilitate access to healthcare and health related information, notably for preventive care and health prevention (especially in more isolated or poorer areas). The idea also emerges that digital technologies can improve medical training (e.g. with virtual or augmented reality).

It is however also largely consensual in the discussions that AI and health technology should contribute to a more humanized healthcare system. In general, machines should not replace humans. In particular, tasks pertaining to medical decision-making, communication and caregiving should remain human. Although it is true that health professionals and caregivers often lack time and are exhausted, and that healthcare systems are under high pressure, AI technologies may not constitute the right or primary answer to these major issues.

Participants also insist upon the fact that we should preserve health professionals' and caregivers' independent decision-making, with the possibility to sometimes diverge from the machine recommendations (for instance based on their human-reflection with trained intuition). Health professionals and caregivers should remain in charge of decision making, their authority should not be undermined by technological solutions (especially, the latter should not encourage self-medication) and that overdependence on such technologies may prove harmful on the long run (deskilling, loss of resilience in case of technologies unavailability).

Importantly, (moral) responsibility of medical decision-making should remain in the hands of humans (and not only health professionals but also technological devices builders, as these devices can fail or be faulty).

Ideas from local and global synthesis mobilized in this nexus of complexity:

- AI and health technologies can improve medicine and health care: (Global – Health) Acknowledging the positive contribution of health technologies to healthcare

- AI and health technologies should not lead to dehumanization of healthcare and medicine: (Global – Health) Privileging AI cooperation and support instead of human replacement
- Risk of overdependence and of problems with responsibility:
    - (Global – Health) Preserving human agency and autonomy (in healthcare)
    - (Global – Health) Never believing we can delegate (moral) responsibility to machines
    - (Global – Health) Fostering literacy and critical thinking
    - (Belgium – Health) AI and the issue of responsibility

Expertise input:

A. Cooperation, independence and responsibility

Based on insights from Fernand Doridot and Brian P. Green

The dangers of automation bias and deskilling

Despite its advantages in healthcare, AI also carries risks, such as the "deskilling" of professionals. Too accustomed to rely on AI, doctors and nurses are at risk of losing important skills. Natali et al. (2025) highlight that clinicians may shift from independent clinical judgement to an oversight role of validating algorithmic outputs, leading to an erosion of technical and cognitive skills and diminishing their confidence and ability to challenge AI recommendations[17]. This overconfidence in the results produced by AI is embodied more generally in an "automation bias", whereby the recommendations issued by AI are considered more reliable, even in cases where human intervention would be more relevant.[18] This situation can lead caregivers to make serious errors, following misleading recommendations, or neglecting important elements due to a lack of guidance from the machine.[19] The overall resilience of the healthcare system could thus be weakened by the progressive inability of professionals to deal autonomously with complex or novel situations, such as rare pathologies, or AI system malfunctions.

Concerned actors and professionals should therefore know the limits of the tech they are using, and a healthy skepticism of that tech should be included (in their training).

Responsibility attribution

Despite the gains brought by AI in terms of data analysis and diagnostics, automation also comes with important ethical questions, such as the need for human professionals to continue to shoulder responsibility for medical decisions and weigh up their moral implications, especially in cases of direct impact on patients' lives.[20]

However, this importance of preserving human responsibility does not come without any difficulties. For instance, automated systems will make mistakes and the humans "responsible" for those machines could easily be made scapegoats to blame. "Operator error" is often the excuse of first resort when a machine fails, even if the real blame lies in extremely complex systems of interactions that no individual could reasonably be expected to understand or be responsible for. Moreover, opposing machines may become a risk that health professional

[17] Natali, C., Marconi, L., Dias Duran, L.D. *et al.* AI-induced Deskilling in Medicine: A Mixed-Method Review and Research Agenda for Healthcare and Beyond. *Artif Intell Rev* **58**, 356 (2025). https://doi.org/10.1007/s10462-025-11352-1

[18] Skitka, L. J., Mosier, K., & Burdick, M. (1999). Does automation bias decision-making?. *International Journal of Human-Computer Studies, 51*(5), 991–1006.

[19] Parasuraman, R., & Riley, V. (1997). Humans and automation: Use, misuse, disuse, abuse. *Human Factors, 39*(2), 230–253.

[20] Floridi, L., & Cowls, J. (2019). A unified framework of five principles for AI in society. *Harvard Data Science Review, 1*(1).

could prove more and more reluctant to take. Especially with the aforementioned automation bias likely to intrude and disempower healthcare providers, their patients, and others. These actors may be led to simply see a computer recommendation as something they are not able to dispute, and if they do oppose it and are wrong they will be held liable and possibly punished.

It will thus be key to acknowledge the work that is genuinely performed by machines. It is problematic if health practitioners take all the blame when anything goes wrong. They would become "the fall guys" for complex systems that no individual can reasonably be held responsible for.

Independence of judgement and AI as a complement

It is only a matter of time before AI systems are standard practice in many areas of medicine. Using something less than the medical standard would be viewed as backwards or even grounds for malpractice. We should not think of AI as arriving as an alien imposition on the medical field. We should even less accept it is effectively integrated in that fashion. Instead, AI should arrive because there are certain problems that it can solve better. But this is to be judged from within healthcare practices, with practitioners themselves.

We must therefore stress the need for healthcare staff to be trained in independent judgment, and the ability to deviate from AI decisions if necessary. Globally speaking, integration of AI in practices, one should always ensure that the orientation of the interaction between practitioners and AI is in the sense that the human is assisted by machines in the tasks of care, and not the inverse, that humans assist the machines to provide the care. The integrity of healthcare can only be sustained if AI complements, but does not completely replace, human practices. Health professionals should keep their agency, notably their autonomy of judgment based on their expertise … but not only …

The previous discussion on the importance of human contact and self-care mechanisms is also relevant and interesting for this question.

You can also find this complexity on the NHNAI website: https://nhnai.org/focus-on-nexuses-of-complexity-health-3/

Ensuring fairness and equity with AI and health technologies

Participants largely acknowledge that health technologies (including AI) can support health professionals in medical decision making (they may even perform better in some tasks). Similarly, they highlight that automating certain tasks may give more time for the human dimensions of caregiving and healthcare (for instance with care-giving robots). Some participants also point that AI and digital technologies can facilitate access to healthcare and health related information, notably for preventive care and health prevention (especially in more isolated or poorer areas). The idea also emerges that digital technologies can improve medical training (e.g. with virtual or augmented reality).

Participants also recognize that advances in AI and neuroscience in the healthcare field may enable us to increase our physical and mental capacities (notably with neurological prostheses or implanted brain-machine interfaces). These technologies could also prevent the loss of capacity associated with aging.

However, participants also warn against the risk that the benefits and disadvantages of AI and health technologies may be unfairly distributed. While the potential to better the life of the most vulnerable is enormous, many participants worry about the risk of inequal adaptation of tools to groups and cultures specificities (for instance when some groups or cultural traits are underrepresented in datasets for machine learning or neglected in the testing of technologies) and the danger of access inequalities (because of lack of financial resources, but also of digital literacy or of reliable infrastructures). Notably, human contact and relationship in healthcare should not become a luxury, access to would be denied for the less favored. The same type of questions arises with respect to access to enhancement technologies.

Ideas from local and global synthesis mobilized in this nexus of complexity:

- AI and health technologies can improve medicine and health care: (Global – Health) Acknowledging the positive contribution of health technologies to healthcare
- Potential positive outcomes of enhancement technologies: (Global – Health) Exploring the potential contributions of health technologies to humans' self-improvement
- Need for fairness and equitable benefit sharing:
    - (Global – Health) Ensuring fairness and equality in opportunities for living a good life
    - (Global – Health) Using health technologies to better the conditions of life of the most vulnerable persons
    - (Global – Health) Maintaining empathy and human relationship at the core of healthcare

Expertise input:

Fernand Doridot

The use of sensitive data by AI devices in healthcare (such as electronic medical records or genomic data) raises ethical concerns, particularly for the protection and ownership of this data. Indeed, this information is often collected by private companies, with no possibility for patients to retain real control over its use.[21] The monetization of this data is playing a growing role in the economic model of healthcare innovation.[22] Companies use them to develop medical algorithms and personalized treatments, and also generate revenue from them via partnerships with health systems and insurers.[23] The benefits of AI therefore come to accrue primarily to companies rather than to patients or healthcare systems. This situation fuels fears of a confiscation of innovations for the benefit of wealthy populations and institutions, as well as an exacerbation of socioeconomic inequalities.[24] To remedy this, new regulatory frameworks are needed to ensure a fair distribution of benefits.

You can also find this complexity on the NHNAI website: https://nhnai.org/focus-on-nexuses-of-complexity-health-4/

[21] Rumbold, J. M., & Pierscionek, B. K. (2017). The ownership and use of human genomic data. *European Journal of Human Genetics, 25*(2), 200-207.
[22] Murdoch, T. B., & Detsky, A. S. (2013). The inevitable application of big data to health care. *JAMA, 309*(13), 1351-1352.
[23] Terry, N. P. (2012). Protecting patient privacy in the age of big data. *Journal of Law, Medicine & Ethics, 40*(1), 7-17.
[24] Powles, J., & Hodson, H. (2017). Google DeepMind and healthcare in an age of algorithms. *Health and Technology, 7*(4), 351-367.

Enhancement technologies: finding the right balance between innovation and safety

Some participants in the discussions point out that it is in the nature of humans to constantly seek to progress and improve. Participants also recognize that advances in AI and neuroscience in the healthcare field may enable us to increase our physical and mental capacities (notably with neurological prostheses or implanted brain-machine interfaces). These technologies could also prevent the loss of capacity associated with aging. Similar practices (with hip or articular prostheses) are already widely accepted in society. We can therefore imagine that more recent possibilities linked to AI and neuroscience (such as brain implants) could also eventually become acceptable.

Nevertheless, discussions also highlight risks of addiction, or other side effects such as changes in personality, or impaired decision-making abilities.

It is important to properly assess the benefits-risks balance.

Ideas from local and global synthesis mobilized in this nexus of complexity:

- Potential positive outcomes of enhancement technologies:
  - (Global – Health) Constantly seeking for self-improvement and progress
  - (Global – Health) Exploring the potential contributions of health technologies to humans' self-improvement
- Worries about risks and side effects:
  - (Portugal – Health) Desirable: It is necessary to establish limits regarding the use of scientific and/or technological health innovations
  - (Portugal – Health) Undesirable: Scientific and/or technological health innovations may pose physical risks.

Expertise input:

As Brian P. Green suggests, this nexus of complexity, with its tension between a possible drive for humans to improve themselves and the asserted need for limitations when it comes to medical or neurological enhancement, raises deep questions such as: How do we know when an enhancement is justified or not? When does an intervention make us more human and when does an intervention make us less human? What role does "naturalness" play in this determination, and what is "natural" to humans?

To help exploring them, we may draw upon insights from neuroscience first, to then deepen some ethical issues.

A. A clarification from neuroscience

Juan R. Vidal

Most medical implants aim at compensating a specific mechanism that has been damaged by neurogenerative disease (ex: Parkinson's) but have revealed to imply a dis-regulation on some other aspect of our behavior (addiction, impulsivity, identity-loss…). These interventions have been justified to compensate the loss of a capacity. Applying the same brain-implant devices for enhancing certain capacities is problematic, not only on an ethical perspective of equal access to these means, but also because it downplays the importance of effort in the achievement of learning for behavior. It shortcuts the rest of the body with whom our brain fully interacts and develops its functional specificities. The development of these implants for

motor-handicap like tetraplegic patients is very appealing and is no doubt fully justified. But considering that other cognitive capacities could be boosted through these implants by short-cutting the body is against the modus-operandi of the nervous system. Engaging in these efforts has the risk of leading the general public to believe that our mental/psychological capacities behave like independent modules in the brain, which is exactly what current neuroscience research is contradicting through its most recent findings. It is thus important to inform the public on how neurosciences show the intrinsic link between brain-body and that learning, and development of our mental and behavioral capacities require effort (and may entrain frustration in the process). The view of a brain with defined modules that manage independently certain high-level cognitive functions is false. And promoting neurotechnological artefacts with the false view of how the system works is equal to propagating fake scientific knowledge.

B. Ethical issues

Fernand Doridot

The development of enhancement technologies carries with it a real risk of dependency, both psychological and physiological. Continuous use of implanted cognitive enhancement devices can lead to dependencies similar to those already observed today with stimulants. The constant quest for perfection may also blur the distinction between need and desire.[25] Such dependence not only raises medical issues but also questions about its long-term impact on autonomy and mental health.

The modification of brain function by external devices can also lead to disruptions in personality and behavior. Enhanced memory or decision-making *via* brain-machine interfaces (BMIs) could be accompanied by changes in self-perception, social interactions, personality traits, as well as identity in general.[26] These alterations could also concern critical thinking, judgment or emotional responses, with possible impacts on decision-making, thus opening up ethical questions regarding the maintenance of individuals' personal responsibility.[27]

It is therefore extremely important to make the development of enhancement technologies conditional on precautionary measures and rigorous testing, both medically and psychologically/socially. The challenge is to ensure that these technologies do not undermine the autonomy and identity they are designed to reinforce.

You can also find this complexity on the NHNAI website: https://nhnai.org/focus-on-nexuses-of-complexity-health-5/

Regulating technologies and preserving persons' privacy and integrity without stifling medical innovation

[25] Schermer, M. (2009). The mind and the machine: On the conceptual and moral implications of brain–machine interaction. *NanoEthics, 3*(3), 217-230.
[26] Ienca, M., & Andorno, R. (2017). Towards new human rights in the age of neuroscience and neurotechnology. *Life Sciences, Society and Policy, 13*(1).
[27] Fukushi, T., Sakura, O., & Koizumi, H. (Eds.). (2007). *The ethics of brain-computer interfaces and human enhancement.* Dordrecht: Springer.

Participants largely acknowledge the benefits one can get from developing AI and health technologies in healthcare and medicine as well as in the domain of human enhancement (improved medical decision making, automation of certain tasks, enhanced access to healthcare and health related information, enhancement of physical and mental capacities, …).

At the same time, participants also worry about the complexification of patterns of responsibility. While responsibility cannot be attributed to machines, their involvement modifies the actors involved and possibly concerned by responsibility issues.

In addition, many participants warn against the risk that sensitive health information is collected for non-medical uses. Health data collected by AI or digital tools should only serve medical and healthcare purposes. Digital solutions should not imply intrusion of outside organizations (like insurance companies).

Moreover, with the convergence of NS and AI, data could be used to enhance prediction power over persons behaviors and thoughts, as well as the possibilities for cognitive manipulation. Therefore, mind privacy should be protected.

This raises the hard question of regulation. As evoked in the discussions, innovation could be hampered by overly rigid regulation, and patient safety compromised by overly lax regulation. So how do we strike the right balance between encouraging innovation and protecting patients?

Ideas from local and global synthesis mobilized in this nexus of complexity:

- AI and health technologies can improve medicine and health care: (Global – Health) Acknowledging the positive contribution of health technologies to healthcare
- Potential positive outcomes of enhancement technologies: (Global – Health) Exploring the potential contributions of health technologies to humans' self-improvement
- Need for persons' protection and tech regulation (with recognition of the complexity of related issues):
    - Global – Health) Regulating AI and health technologies in healthcare
    - (Global – Health) Being aware of challenges regulation raises
    - (Global – Health) Ensuring privacy protection (protection of sensitive health information and mind privacy)
    - (Global – Health) Recognizing patients in their singularity and diversity (within a comprehensive approach)

Expertise input:

Fernand Doridot

The possibility of using healthcare data to contribute to the costly financing of healthcare innovation is a point of recurrent debate. This could prove to be an interesting avenue, provided that the protection of such data is convincing, and that it is used anonymized and with informed consent. However, a number of studies have documented cases where anonymization has failed, leading to a risk of re-identification.[28] It has also been highlighted that, under the effect of economic incentives, particularly vulnerable populations could be subject to various types of abuse.[29]

[28] Ohm, P. (2010). Broken promises of privacy: Responding to the surprising failure of anonymization. *UCLA Law Review, 57*(6), 1701-1777.

[29] Vayena, E., & Tasioulas, J. (2016). The ethics of personalized medicine: New challenges and opportunities. *Journal of Medical Ethics, 42*(8), 451-454.

It is generally recognized as very important that external actors such as insurance companies should not be able to access health data. Public trust could be seriously undermined by the use of health data by private organizations for commercial or discriminatory purposes. The use of health data for explicit medical purposes only is intended to be guaranteed by the EU GDPR regulation, which imposes clear restrictions on the access and use of personal data to this end.[30]

The convergence of AI and neurotechnology opens the door to the prediction or manipulation of cognitive behavior, and thus poses new threats to cognitive privacy and mental freedom. Several authors thus insist on the importance of protecting the "privacy of the mind," notably through regulations.[31]

Faced with all these challenges, tools such as blockchain are sometimes mentioned as likely to enable individuals to control access to their health data as well as its eventual availability for innovation purposes, on condition of the parallel development of voluntary and rigorous regulation.

Because of the stakes involved in terms of safety, efficacy and ethical use, it is imperative that innovation in AI and healthcare technologies is accompanied by sound regulatory frameworks. The healthcare sector is therefore expected to be able to bridge the gap between innovation and regulation. Excessive regulation, however, could have the effect of stifling innovation, discouraging investment in new technologies, and slowing the development of life-saving advances. Faced with a rapidly changing healthcare technology landscape, it is thus crucial to develop a balanced regulatory approach that is both flexible and adaptable. Some adaptive regulatory models have been proposed by researchers, in which technological development and oversight evolve simultaneously, allowing room for innovation without affecting accountability. In this way, we can hope to avoid the twin pitfalls of impeding progress, or under-protecting patients in the face of certain potential harms.[32]

You can also find this complexity on the NHNAI website: https://nhnai.org/focus-on-nexuses-of-complexity-health-6/

Using AI to prevent social isolation while preserving human interactions

[30] Floridi, L., & Taddeo, M. (2016). What is data ethics? *Philosophical Transactions of the Royal Society A: Mathematical, Physical and Engineering Sciences, 374*(2083), 20160360.

[31] Ienca, M., & Andorno, R. (2017). Towards new human rights in the age of neuroscience and neurotechnology. *Life Sciences, Society and Policy, 13*(1), 5.

[32] Bouderhem, R. (2024). Shaping the future of AI in healthcare through ethics and governance. *Humanities and Social Sciences Communications, 11*(416). Zhou, K., & Gattinger, G. (2024). The Evolving Regulatory Paradigm of AI in MedTech: A Review of Perspectives and Where We Are Today. *Therapeutic Innovation & Regulatory Science, 58*(456–464).

Participants to the NHNAI discussions acknowledge that some AI tools (such as robot companions, chatbots…) can alleviate and prevent social isolation as it can interact with people by imitating the human interaction. Those tools can bring a feeling of contact and affection to people who are lonely. Moreover, artificial companions can be really helpful for healthcare professionals who don't have the time to talk with every patient, or places where there are not enough healthcare professionals. Finally, robots are used as mediators to help better communicate with others, as is the case for autistic children.

However, participants raise the importance of preserving human interactions which seem to be at the core of healthcare. Participants highlight that human contact cannot be replaced by any AI tool. On top of that, participants emphasize the risk of developing overdependence on those tools, which can lead to trigger or increase social isolation.

Ideas from local and global synthesis mobilized in this nexus of complexity:

- (Global – Health) : Maintaining empathy and human relationship at the core of healthcare
- (Portugal – Health) Desirable: Technological advances may help fulfil social needs
- (Taiwan – Health) Desirable: Caregiving robots
- (Canada - Education): Overcoming loneliness with AI technologies

Expertise input:

Federico Giorgi & Nathanaël Laurent

The issue analyzed within this complex framework is today absolutely central, as in contemporary society it is somewhat more difficult than in the past to form lasting relationships. Many people, especially younger individuals, feel a sense of disorientation in the face of these changes that are reshaping the way we socialize.

Of the two opposing ideas considered by the participants in the debate—on the one hand, that AI could help overcome feelings of isolation, and on the other, that these feelings risk being intensified by excessive use of new technologies—psychological studies conducted so far tend to support the latter: the view that it is impossible to obtain the same emotional benefits from an interaction with a machine as from a human relationship (Pacilli, Giovannelli & Spaccatini, 2021).[33]

This does not mean, however, that there are no specific cases in which it may be worthwhile to rely on machines rather than on other human beings—for example, in the case of individuals who are blind or deaf, who could become more independent through the use of highly advanced technological devices and thus feel freer.

Nevertheless, even in the case of people with disabilities, the valuable contribution provided by machines does not replace a human relationship, but rather a form of practical assistance that would otherwise require the person to depend on others. In moments when a blind or deaf person wishes to confide in someone, it is only natural that they turn to a loved one rather than to a computer.

[33] M. Pacilli, I. Giovannelli & F. Spaccatini, *Psicologia sociale dei media digitali*, Maggioli, 2021.