



Artificial intelligence

Digital Transformation Toolkit

Policy overview

PAHO



Pan American
Health
Organization



World Health
Organization
REGIONAL OFFICE FOR THE
AMERICAS

ORGANIZATION, COORDINATION AND DEVELOPMENT

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Summary

Artificial intelligence (AI) is one of the eight guiding principles for the digital transformation of the health sector being promoted by the Pan American Health Organization (PAHO). This policy overview presents key concepts, recommended lines of action, and monitoring indicators to advance AI.

According to the PAHO definition, this guiding principle aims to **participate in global cooperation on AI and emerging technologies**. “Global cooperation on AI implies understanding the individual and social dimensions of the globalized and interconnected reality of the human condition. As well as working in multisectoral and interdisciplinary networks, such cooperation is vital when designing and adopting artificial intelligence solutions that promote equity, gender, and cultural diversity with safe, reliable, and open algorithms” (1).

AI is the science that develops machines able to do tasks that would require human intelligence, which includes many different areas of application. In the field of health there are successful examples of using AI in population health, research, care processes, solutions for patients, and the optimization of health operations. Moreover, AI has the potential to help overcome growing health challenges, including rising costs, demographic and epidemiological changes, unmet health needs related to the double burden of infectious and noncommunicable diseases, and a significant shortage of trained health professionals.

The development of AI strategies in health care poses major technical, ethical, political, regulatory, and human resource challenges. Particularly in the Region of the Americas, the development of sustained government policies and the creation of innovation ecosystems able to attract investment for developing these technologies can be difficult challenges to overcome.

This paper explores guiding principle number 6 – artificial intelligence – and its application within health systems, beginning with a conceptual definition of AI and its current state of play. Secondly, the obstacles to the implementation of AI and recommendations to overcome them are explored. Finally, indicators are proposed to monitor progress in implementation, along with some general recommendations.

Keywords: artificial intelligence, digital transformation, guiding principles of digital transformation.

Introduction

Artificial intelligence (AI) facilitates the transformation towards more proactive, predictive, and preventive health systems. Classically, AI has been defined as the science that develops machines to do tasks that would otherwise require human intelligence (2). This definition encompasses all the methods for enabling tasks for which human intelligence would be needed, both those that seek to represent human knowledge (symbolic AI) and those that use data to generate knowledge (AI based on machine learning). Moreover, the definition includes many different fields of application, such as natural language processing, computer vision, robotics, and speech processing. Given the many successful examples of using AI in such areas as population health, research, care processes, patient solutions, and the optimization of health operations, low- and middle-income countries are the most likely to gain or lose with the implementation of AI-based strategies. If these countries manage to align their health strategies with digital transformation processes and AI, they can achieve major improvements in care processes at the individual and population levels, in all the areas indicated above. However, if they fail to take advantage of these new tools, their digital gap with high-income countries will widen even further.

Global cooperation on AI and emerging technologies will enable different countries to realize their full potential in terms of the development of health information and communication technologies and information management, issues that have become priorities in the wake of the coronavirus disease (COVID-19) pandemic.

Such developments as the rise in computing capacity, the growing volume of data generated daily, and the great advances different AI algorithms in recent years are driving digital transformation measures, creating a positive feedback loop and promoting equal access to timely health care.

In the current context, with governments often prioritizing other investments, already existing health inequities are likely to worsen. Therefore, technical, political, regulatory, and human resource capacity building is crucial for countries to mature in their use of AI.

Finally, governments play a key role as promoters of strategic alliances and generators of policies and regulations that define minimum standards and good practices for the comprehensive, consistent, and sustained development of AI strategies in public health.

Current situation and identification of gaps

AI has the potential to help overcome growing health challenges, including rising costs, demographic and epidemiological changes, unmet health needs related to the double burden of infectious and noncommunicable diseases, and a significant shortage of trained health professionals. However, the development of AI strategies in health care poses major technical, ethical, political, regulatory, and human resource challenges.

There are numerous examples of biases in the development of AI applied to health, starting with failures in the algorithm building process, which can lead to discriminatory practices. In this regard, the World Health Organization (WHO) identifies three ways in which AI is associated with algorithmic bias and discrimination: **1) biases in data sets, 2) biases linked to those who develop a particular AI and the origin of the data sets on which the AI is trained, and 3) biases in AI production.**

Furthermore, **the most vulnerable countries face challenges in generating business models that can produce sustainable AI with a real impact on public health and that enable innovations to be integrated into the regulatory framework and the demands and priorities of the health system.** In low- and middle-income countries, scarce resources and the lack of an integrated financing ecosystem constitute barriers to the acquisition of AI tools, compounded by the complexity of the processes for governments to procure these tools.

In addition to funding issues, **there are challenges in establishing comprehensive, stable, and consistent regulatory policies that enable the use of AI to be scaled to different jurisdictional environments.** Lack of transparency in the processes of data acquisition, transformation, and exploitation, and the need to establish regulations for patients, medical staff, and professionals from other disciplines to

use the information acquired in clinical and outpatient settings, are all complex challenges, which must be addressed to ensure that AI in health respects the rights of people.

Moreover, there is a need to forge closer ties between the private sector and undergraduate and postgraduate training initiatives. Although there are many experiences involving courses, conferences, and participation in program design, it is important to encourage contribution and cooperation between the private sector and training opportunities, as well as feedback on initiatives between the public and private sectors. Furthermore, **the lack of opportunities for academic and multidisciplinary training in AI and digital health has led to a series of limitations in formal education, training courses, development of skilled staff, and change management.** The Broadband Commission for Sustainable Development cites such problems as lack of prioritization of computer science and AI in formal education, absence of certified training in AI applied to health, an inflexible workforce, shortage of skilled staff, and resistance to technology-driven change.

Another issue to consider is that **the lack of evidence on the application of AI systems in the field of health poses an ethical dilemma and, furthermore, is one of the factors contributing to distrust of AI.** There is no definition of performance, accuracy, or outcome criteria against which to compare AI products. How they work can vary according to the objective of the AI: from more precise systems to others with a slightly wider margin of error. Although one of the principles may be the Hippocratic oath to “do no harm”, the lack of experience and lack of evidence in applying AI strategies to health care in less developed countries makes it difficult to differentiate potentially harmful products from those that are beneficial.

Lines of action

The following are the lines of action proposed by PAHO in its document “Eight guiding principles for digital transformation of the health sector: a call to action in the Americas” (1), which features a series of recommendations to implement this call to action, along with other lines of action that can complement the implementation of this principle. Recommendations provided by the experts consulted are also included.¹

1. WHEN DEPLOYING ARTIFICIAL INTELLIGENCE IN THE FIELD OF HEALTH, ENSURE THE DUAL ROLE OF THE STATE AS GUARANTOR OF HUMAN RIGHTS AND PROMOTER OF THE ENJOYMENT OF THOSE RIGHTS.

To this end, the most basic recommendation is to promote policies and regulations for the use and advancement of new information and communication technologies in health that guarantee people’s security and privacy. This is often a major limitation, especially in systems where enacting legislation and regulations takes a long time.

2. ESTABLISH FORMAL COORDINATION MECHANISMS THAT PROMOTE AND ENSURE COOPERATIVE AND CONSTRUCTIVE UNDERSTANDING AT THE REGIONAL AND GLOBAL LEVELS, INVOLVING THE PUBLIC AND PRIVATE SECTORS, GOVERNANCE MECHANISMS, ACADEMIA, INDUSTRY, AND CITIZENS

It is recommended that data access and governance be facilitated in order to implement AI strategies in the field of health. This depends to a large extent on the development of robust health information system (HIS) networks, as well as policies and regulations that facilitate data accessibility, ensuring data security and privacy. Along these lines, the Government of Singapore published a document in 2019, updated in 2020 (3), which offered a series of recommendations on the governance aspects involved, including roles and responsibilities, with a view to promoting collaboration between the public and private sectors.

3. PROMOTE MULTINATIONAL INVESTMENT FUNDS SO THAT THE MOST VULNERABLE COUNTRIES ARE NOT DEPRIVED OF THE BENEFITS OF EMERGING TECHNOLOGIES AND ARTIFICIAL INTELLIGENCE IN THE FIELD OF PUBLIC HEALTH.

The following actions are recommended:

- Stimulate and support the search for multinational financing based on collaborative proposals of interest to the Region of the Americas that are scalable to other Regions (4).
- Focus funding on sustainable strategies able to promote the development of human resources with the skills to replicate knowledge in developing the infrastructure, architecture, and implementation of AI-based public health strategies.
- Strengthen ties with institutions, organizations, and experts dedicated to AI in the Region that can support and engage in potentially financeable AI-based strategy projects.

¹ On 23 November 2021, in collaboration with PAHO, an asynchronous policy dialogue was convened to advance implementation of the roadmap for the digital transformation of the health sector in the Region of the Americas. To achieve this, references were identified on the topics addressed by the guiding principles.

4. BUILD AN OPEN AND COOPERATIVE ARTIFICIAL INTELLIGENCE INNOVATION SYSTEM, PROMOTING THE DEVELOPMENT OF OPEN ACCESS CODE FOR ALGORITHMS AND APPLICATIONS.

To this end, the following actions are recommended:

- Guarantee the privacy and security of information. This is another of the major challenges when handling and using sensitive personal data, which must be developed in tandem with clear policies and regulations.
- Creation of open data sets that lower the access barrier to information, which tends to be one of the main difficulties when launching a project. In recent years, the consolidation of data sets has led to milestones in the development of AI-based tools, such as ImageNet, the MS COCO data set, and Google Open Images data set. Specifically, during the COVID-19 pandemic, data sets were created that enabled decision-makers to conduct real-time monitoring of cases, such as Our World in Data (5), and of the emergence of new variants, which led to such scientific advances as the GISAID initiative (6). In the field of health, the creation of these open data sets tends to face reluctance to opening them, owing to data privacy issues. However, there are also success stories, such as the MIMIC-III clinical database, whose contributions have been enormous and are being used as a basis for the development of different AI projects, such as predictive models, image classification, and natural language processing tasks.
- Stimulate the development of infrastructure and architecture for data management and analysis. These are priority investment areas for health systems that are prioritizing AI strategies.

5. PREVENT ALGORITHMIC BIASES AND GUARANTEE SOCIAL INCLUSION IN THE DESIGN OF ARTIFICIAL INTELLIGENCE SYSTEMS AND IN THEIR POTENTIAL APPLICATION AT ALL ECONOMIC, SOCIAL, AND GEOPOLITICAL LEVELS IN THE COUNTRIES OF THE REGION.

The digitalization of health system information is not the only important issue to be addressed. The different information systems must also be interoperable in

order to ensure both the quantity and quality of the data to be used in AI design. The design of information systems must focus on the data, in order to quickly identify errors or inconsistencies and correct them, while also being user-friendly so that data collection is as clean as possible with the least amount of noise.

In this regard, the following is recommended:

- Stimulate the development of integrated HIS through policies and regulations that facilitate the implementation of high-quality HIS in national health networks. For regions with incipient and heterogeneous implementations of HIS, the experiences of other countries with years of development, as well as the creation of robust interoperability standards and terminology, will make it possible to move forward with implementation on more solid foundations.
- Strengthen data quality because this will influence the accuracy of AI products. Factors determining data quality include accuracy, completeness, consistency, integrity, timeliness, and uniqueness. The quality of health data depends to a large extent on the development and maturity of HIS.

6. ACCELERATE THE DEVELOPMENT OF ETHICAL AND LEGAL FRAMEWORKS, TRAINING, AND THE SEARCH FOR HIGH-LEVEL TALENT IN ARTIFICIAL INTELLIGENCE. BUILD AI AS AN ACADEMIC DISCIPLINE BY FORMING MULTIDISCIPLINARY TEAMS

The following is recommended:

- Promote research into the ethical issues involved in implementing AI-based strategies, which raise new questions regarding the use of personal data, its costs to the health system, equity with respect to potential beneficiaries, and the replication of biases present in the data.
- Strengthen the education and training of human resources specialized in AI in health. The development of technical skills, thematic knowledge, and interdisciplinary work teams for implementing AI strategies in the field of health is a very important challenge in a very competitive labor market. There is great demand for specialists and it is necessary to develop training strategies.

7. GENERATE EVIDENCE ON THE APPLICATION OF ARTIFICIAL INTELLIGENCE SYSTEMS

The following is recommended:

- Promote the development of standard methodologies for evaluating (7) and reporting (8) the operation of AI-based tools.
- Foster evaluation and monitoring of the impact of

these tools on the health value chain in the areas in which they are implemented.

- Promote research into the impact of implementing AI-based strategies. This is another vital aspect that must be considered, since AI is a relatively recent field of science, with limited evidence and experience of implementation for health decision-making at different levels. Furthermore, each new AI development must be able to show its effectiveness and benefits compared to other strategies.

Monitoring indicators

To advance the development and implementation of AI in health, the following indicators are proposed. It is important to clarify that this is not an exhaustive list; rather, that each country or region can incorporate other indicators, define the necessary level of disaggregation, and the frequency of measurement.

CROSS-CUTTING INDICATORS FOR THE EIGHT GUIDING PRINCIPLES FOR DIGITAL TRANSFORMATION IN HEALTH

- Existence of a national digital health strategy established through a regulatory framework.
- Existence of a government organizational structure to lead the strategy for digital transformation in health.
- Existence of a budget for a digital agenda that includes human resources and the necessary technology.

SPECIFIC INDICATORS FOR ARTIFICIAL INTELLIGENCE

1. Ensure the dual role of the State as guarantor of human rights and promoter of the enjoyment of those rights when deploying artificial intelligence in the field of health.

- Promote and modernize regulations and policies for the use and advancement of new information and communication technologies in health that guarantee personal security and privacy.

2. Establish formal coordination mechanisms that promote cooperative understanding at the regional and global levels, involving the public and private sectors, governance mechanisms, academia, industry, and citizens.

- Include data science and AI in the curricula of national and subnational educational institutions.
- Create a public-private commission that meets regularly to define and monitor data access and governance to implement AI strategies in health.

3. Promote multinational investment funds for the most vulnerable countries.

- Define a national strategy and budget for the development of AI-based systems that can have an impact on population health.
- Implement national public-private agreements for implementing AI projects in health.
- Formalize collaboration agreements with institutions, organizations, and regional experts dedicated to AI.

4. Build an open and cooperative AI innovation system, promoting the development of open access codes for algorithms and applications.

- Create open data sets.
- Promote infrastructure and architecture for data management and analysis.

5. Prevent algorithmic biases and guarantee social inclusion.

- Design strategies to create inclusive data sets that incorporate population information from different governmental and non-governmental institutions.
- Accelerate ethical-legal frameworks, and the training and recruitment of high-level talent. Build an academic discipline by forming interdisciplinary teams.
- Ensure the participation of bioethics experts in work teams and committees related to AI and health.
- Establish exchange agreements between national teams and AI and health experts at the regional and global levels.

- Examine the number of training locations for the development of technical skills in AI and health.

6. Generate evidence on artificial intelligence.

- Examine the number of research projects that analyze the effectiveness and security of the implementation of AI-based strategies.
- Examine the number of publications on the results of the implementation of AI projects and programs in health.
- Examine the number of outreach events on experiences and impact of AI on health.

General recommendations

AI-based tools and processes should be considered like any other tool available to the health system and health workers. These tools must be developed, evaluated, implemented, and monitored following the same technological and ethical standards as for any other tool used by the health system. In particular, it is important to emphasize the following recommendations:

1. Ensure that these tools are a means to achieve greater accessibility and inclusion, avoiding the creation of new inequity gaps. Safeguard the privacy, confidentiality, and security of patient data and attempt to ensure that any social biases represented in the data fed into these tools, do not end up widening the current gaps and are not reflected in the algorithms.
2. Try to evaluate the effectiveness of these tools, using the same evaluation methods already available (e.g., randomized clinical trials, observational studies), both in experimental situations and in the real world, ensuring that they add value to health system processes, without losing sight of their impact on the first level of care.
3. Strengthen those HIS that serve as the basis for development of AI systems.
4. Promote the development of a sustainable ecosystem for open innovation in AI and its applications in health.
5. Adapt legal frameworks for a safe and responsible implementation of AI in the field of public health.
6. The use of AI in public health should be guided by technical and ethical considerations, mitigating ethical risk in public health and related policy interventions.

These considerations are reflected in the following principles:

People-centered. Actions and solutions should be people-centered and not considered an end in themselves. As one of many technologies able to facilitate work in the field of public health, AI must respect the rights of the individual.

Ethically-based. Discussions, development and implementation must be based on the universally agreed ethical principles of human dignity, beneficence, doing no harm, autonomy, and justice.

Transparent. Transparent approaches should always be used, which should be reported when developing AI algorithms.

Data protection. Privacy, confidentiality, and security in the use of data must be a crucial component of any AI that is developed.

Scientific integrity. AI interventions must adhere to the best scientific practices: they must be reliable, reproducible, fair and honest, and enable accountability.

Open and shareable. Everything should be as open and shareable as possible. The tools and underlying concept of openness must be both a feature and a crucial criterion for the success of any AI that is developed.

Non-discriminatory. Fairness, equality, and inclusion in impact and design must always be the foundation of any AI initiative in public health.

Human-controlled technology. Formal human control and review processes of automated decisions must be mandatory.

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