AGEISM IN ARTIFICIAL INTELLIGENCE FOR HEALTH

WHO POLICY BRIEF

Ageism in artificial intelligence for health: WHO policy brief

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GLOBAL CAMPAIGN TO COMBAT AGEISM

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INTRODUCTION

Ageism refers to stereotypes, prejudice and discrimination directed towards others or ourselves on the basis of age. As reflected in the Global report on ageism (1), this issue **affects people throughout their lives and pervades many institutions and sectors of society,** including health and social care. Tackling ageism is critical to human well- being and human rights. Specifically for older people, ageism is associated with a shorter lifespan, poorer physical and mental health and decreased quality of life. It also contributes to poverty and financial insecurity in older age and can limit the quality and quantity of health care provided to older people (1).

The world today is also increasingly impacted by the application of artificial intelligence (AI). “Artificial intelligence” generally refers to the performance by computer programs of tasks that are commonly done by intelligent beings (2). The basis of AI systems is algorithms, which are translated into computer code that carries instructions for rapid analysis and transformation of data into conclusions, information and other outputs (3). Enormous quantities of data and the capacity to analyse them rapidly characterize AI systems, which are designed to operate at various levels of autonomy (3). The types of AI technology include machine-learning applications such as pattern recognition, natural language processing, signal processing and expert systems. Machine learning, which is a subset of AI techniques, is based on use of statistical and mathematical modelling to define and analyse data. Such learned patterns are then applied to perform or guide certain tasks and make predictions (2), such as to predict illness or major health events before they occur. AI technology could help to assess the relative risk of disease, which could be useful for the prevention of noncommunicable diseases such as cardiovascular disease and diabetes, or to identify individuals with tuberculosis in low- to middle-income countries who are not reached by the health system and therefore do not know their status (2).

AI holds great promise for the practice of public health and medicine (2). Yet, to fully reap the benefits of AI, ethical challenges for health-care systems, practitioners and beneficiaries of medical and public health services must be addressed. **A pervasive ethical challenge for the use of AI for health is bias** (4–7). The implicit and explicit biases of society are often replicated by AI technologies, including those used in the criminal justice system, banking, human resources management and the provision of public services. The forms of bias that can affect a person or a group of people because of certain characteristics, such as age, gender, race and sexual orientation, must be considered and addressed to ensure that AI technologies are used appropriately, equitably and responsibly (2, 8). **This brief addresses the potential interplay between ageism and AI for health as it affects older people**, including the conditions in which AI for health can exacerbate forms of ageism and whether use of AI for health introduces new forms (or risks) of ageism. It then **presents legal, non-legal and technical measures that can be used to minimize the risk of ageism in AI** and to maximize its use for older people as these technologies become more commonly used.

This brief does not cover ethical challenges of the use of AI that are not related to ageism, although such additional ethical challenges must also be addressed, as they could directly or indirectly impact older people in health and other areas (e.g., employment). Some of these concerns are addressed in WHO Guidance on the ethics and governance of AI for health (2), and others merit additional study and consultation.

HOW AI TECHNOLOGIES FOR HEALTH ARE USED BY AND ON BEHALF OF OLDER PEOPLE

Technological software and devices that focus on the needs of older people are collectively known as "gerontechnology" (9). While many digital applications that are classified as gerontechnology do not include AI, AI has been identified as especially promising in at least two areas: remote monitoring to facilitate community care and long-term care and development of drugs related to ageing. This limited focus may in itself reflect age-based stereotypes about older people and the types of AI technologies that they may benefit from (9).

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COMMUNITY CARE AND LONG-TERM CARE VIA REMOTE MONITORING

One aspect of gerontechnology focuses on the use of health technologies for monitoring the health of older people at a distance and to facilitate community and long-term care (10). Many remote monitoring systems already in use do not require or involve AI and are used in some settings as a means for alerting caregivers of a change in location or behaviour of the patient and also to facilitate remote data exchange between the caregiver and the patient (11, 12). Yet, as human resources are lacking even for remote monitoring and in view of some concern about human error, there is now interest in using AI in remote monitoring systems (12).

AI technologies are designed to mimic and replace human monitoring of older people by collecting data on individuals from health monitoring technologies and from additional sensors installed in the person's home to monitor and measure various activities and to detect unusual movements and activities that might signal cognitive or physical decline (11). Such continuous data collection has extended the possibility of predictive analysis of disease progression and health risks for older populations, personalization of care management and prevention of health risks through behavioural analysis (13). Common challenges for older people, such as falls or sudden emergencies, might therefore be predicted and prevented by algorithms based on the continuous collection of data on individuals at risk of injury or other health-related events (13). Other evidence indicates that AI-based systems could reduce the number of hospital admissions and overall health-care costs without reducing the quality of patient care (13).

DRUG DEVELOPMENT RELATED TO AGEING

Another use of AI for older people is in drug development. Generally, it is expected that AI will be used to both simplify and accelerate drug development, making the process less expensive and more effective (2). AI could change drug discovery from a labour-intensive to a capital- and data-intensive process with the use of robotics and models of genetic targets, drugs, organs, diseases and their progression, pharmacokinetics, safety and efficacy (2). Data on the ageing process are now applied to machine-learning to provide a pipeline of medicines and other interventions to increase longevity (14). For example, AI can be used to identify targets of interest by screening compound libraries to identify those that might increase longevity (14).

Beyond these two areas of focus, AI technologies for health have also been used in health activities for all age groups, from diagnosis (including predictive diagnosis) and clinical care (including precision medicine and automatic decision-making systems) to public health surveillance and outbreak response (2).

RISKS OF AGEISM IN THE DESIGN, DEPLOYMENT AND USE OF AI TECHNOLOGIES FOR HEALTH

Although AI technologies hold great promise for improving health care for older people, fulfillment of the promise depends partly on ensuring that the technologies do not exacerbate or introduce ageism. Encoding of stereotypes, prejudice, or discrimination in AI technology or their manifestation in its use could undermine, for example, the quality of health care for older people, reduce intergenerational engagement or limit the beneficial use of AI technologies for older people because of preconceived, often flawed assumptions of how older people wish to live or interact with technology in their daily lives. For example, AI is being considered for use in decisions about prioritization or allocation of scarce resources. Use of computerized decision-support programs – AI or not – to inform or guide resource allocation and prioritization for clinical care has long raised ethical issues. At population level, a decision-support program that encodes a system based on quality-adjusted life-years could be inherently ageist, as it attaches less value to saving the lives of older people and encourages use of resources for people who are expected to realize the greatest net benefit in terms of expected life span, i.e., younger individuals (2). This section explores a few of these potential risks in greater detail.

AGEISM MAY BE ENCODED IN DATA

Machine-learning approaches require large amounts of data, referred to as "big data", to give tangible results. During the past two decades, data that qualify as health data have expanded dramatically and are collectively known as "biomedical big data". They include massive quantities of personal data from many sources, including genomic data, radiological images, medical records and non-health data converted into health data, such as "digital exhaust", or data that individuals generate from use of online services (2).

Biomedical big data can be ethically (and scientifically) important, as AI technologies based on high-quality data can improve the speed and accuracy of diagnosis, improve the quality of care and reduce subjective decision-making. Yet, data sets used to train AI models often exclude older people, who are frequently within a "minority" data set (2) for AI technologies that are not explicitly classified as gerontechnology. They are excluded despite the fact that they are likely to be the single largest group that uses health-care services in many countries. Exclusion of older people from data sets could introduce biases, especially in AI technologies for health intended for use in many age groups.

Such data biases with respect to older people may emerge for several reasons. Health-care provision may already have biases that affect the quality or type of care received by older people (15). For example, the Global report on ageism (1) showed that age often determines who receives certain medical procedures or treatments. Any such systematic discrimination in the provision of health care can be reproduced in AI, which builds on historical data. In this way, AI algorithms can fix existing disparities in health care and systematically discriminate on a much larger scale than biased individuals. Health and medical data generated from other sources, including clinical trials, also tend to exclude or insufficiently represent older people in the data set (1, 16, 17). Thus, if the algorithm of an AI technology is trained with data on predominantly younger populations and then used for a population of older people for which the algorithm has not yet been trained, validated or assessed, it might be ineffective or, for example, provide an incorrect diagnosis or prediction (7).

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Even if adequate data on older people are available, they may not be appropriately disaggregated for use (1, 16). Lack of disaggregation of data for older people may be due partly to lack of recognition that older people differ significantly, as later life is stereotypically seen as a "homogeneous life-stage". The diverse skills and interests of older people may therefore not be reflected in AI technologies (1).

DIGITAL DIVIDE

The "digital divide" refers to the uneven distribution of access to, use of or effect of information and communication technologies among any number of distinct groups. Although the cost of digital technologies is falling, access has not become more equitable, and the digital divide persists geographically and by race, ethnicity, gender and age. In the USA, for example, older people have a lower rate of adoption of technology, with greater disparities for those who are older, less affluent or less educated (18).

The digital divide between younger and older people is due in part to ageism (19). The prevailing stereotype that older people cannot master technologies is often internalized by older adults (an example of self-directed ageism), who may therefore not even try to adopt new technologies, even when they are both available and affordable (1, 19) Older people may also have less "algorithmic awareness" than younger people or less knowledge about the proliferation and use of algorithms in many digital technologies. Less "algorithmic awareness" is a new, reinforced level of the digital divide, as it is a skill required for successful negotiation of digital technologies (20).

The digital divide results in lower rates of participation of older people in the digital economy or inadequate use of digital technologies. Without sufficient participation in use of AI, older people may not be fully represented in the data sets used to train and validate AI algorithms, thereby rendering the technologies less specific for individual characteristics and needs (21). Lack of sufficient participation may also mean that older people are viewed as less relevant to the private sector when they develop and deploy digital technologies, including AI (21).

Although some consider that the digital divide will narrow over time (defined more by generation than by age), it may in fact worsen, and older people may not accept such technologies (20).

EXCLUSIONARY DESIGN

The design of an AI technology, including how and who designs it, may also determine whether it encodes ageism. The design teams may not include older people or may not recognize ageist practices or biases that can be emulated and introduced in AI technology.

Biases can reflect who funds and designs an AI technology, with these technologies often excluding older people from market research, design and testing of user experience with the technology. Such exclusion is often due to ageism and particularly the stereotype that older people are "forgetful, more rigid in thought, less motivated, less dynamic than their younger counterparts; frail, ill, dependent and incompetent" (20). Thus, AI-based technologies, including those used for health, have tended to be designed and developed by one demographic group – specifically young white males, which increases the likelihood that ageism against older

people is not identified or avoided (2). For example, one stereotype is that older people are not interested in digital health technologies or are not sophisticated enough to use AI technologies. This may lead to unilateral exclusion of older people, disempowering them as a group and perpetuating the exclusionary stigmatization of older people in AI technology, which may be diffused widely and thus undermine gradual efforts to change social attitudes towards older people.

Bias can also arise from insufficient diversity of the people who label data or validate an algorithm. A diverse team that includes older people is necessary to recognize flaws in the design or functionality of AI when validating algorithms to ensure a lack of bias (2).

Even if designers intend to classify and program an AI technology with older people in mind, they may nevertheless design the technology with misconceptions about how older people live and engage with technology and specifically how they may wish to use AI technologies for their health. The tendency is to design on behalf of older people instead of with older people. This can lead to inflexible uses of AI technology, and, if such technologies are adopted as standards of care, could require older people to adapt to the prevailing approach and philosophy of the AI technology rather than use their lived experience.

REDUCTION OF INTER-GENERATIONAL CONTACT

One of the purported benefits of AI technologies is that they could extend or augment the provision of health care, either because they enable outreach to patients in remote areas or to underserved populations that otherwise lack appropriate medical advice, or because they could automate many of the tasks of health-care providers. By entrusting repetitive or administrative tasks to AI-supported technologies, health-care workers have more time to attend to more urgent, complex or rare cases (13).

Use of automated AI technologies, including to monitor the well-being of individuals remotely, could, however, potentially reduce the number of contacts between caregivers and older people. For some individuals, this could eliminate periodic caregiving by individuals in other age groups (11), limiting opportunities to reduce or prevent ageism against older people through intergenerational contact, which has proven to be one of the most effective strategies for addressing this issue (1). This would occur if remote surveillance AI technologies were used in lieu of personal visits instead of as part of a mix of approaches to increase contact.

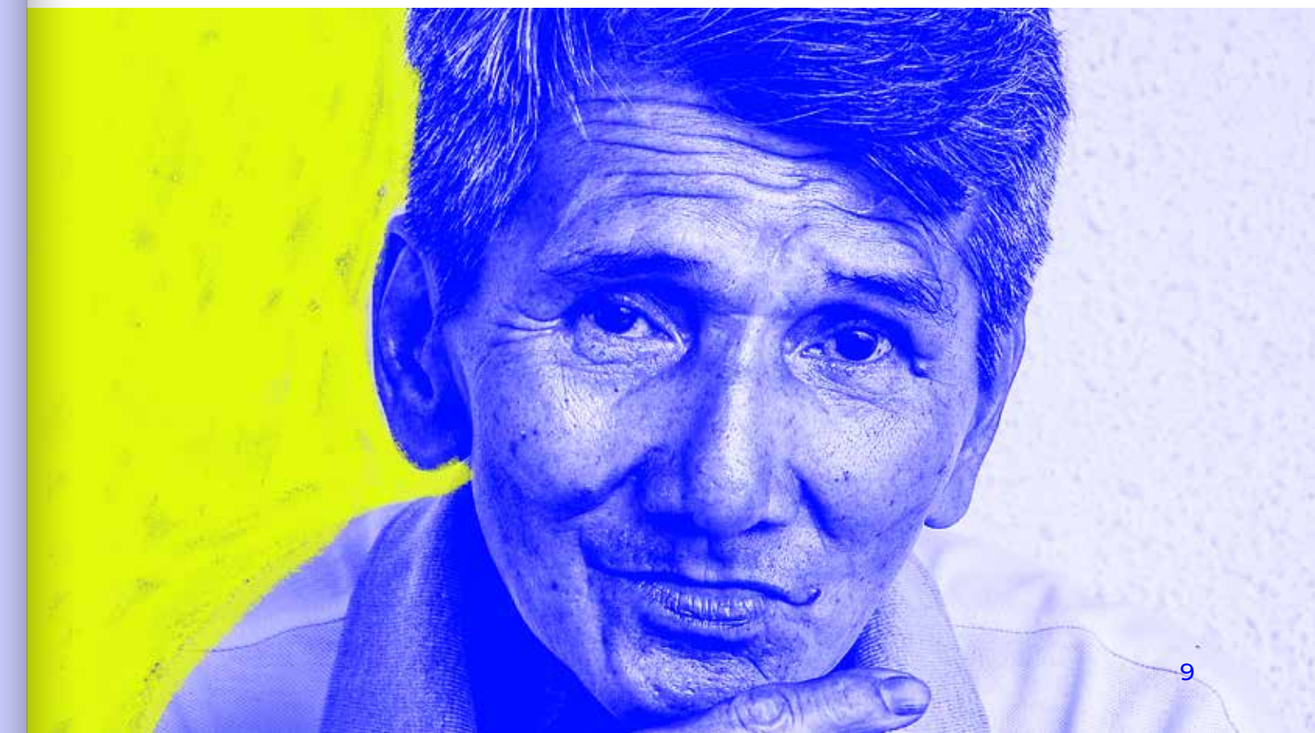
The tendency is to design on behalf of older people instead of with older people.

CHALLENGES OF GOVERNANCE

One means of mitigating or avoiding the risks of ageism in AI technologies for health is to establish mechanisms or frameworks of governance that ensure that older people are included in oversight. Older people may, however, struggle to contribute to effective governance and oversight of AI technologies for health. Like many other age groups, they may not be aware of the use of AI technologies for health care that are used to make decisions within or outside a doctor–patient encounter (2). If older people do not know that algorithms may be used increasingly to formulate health-care policies or individual health care-decisions, they may not recognize that such technologies and their oversight, design and use are a concern to be addressed collectively.

If governments, intergovernmental agencies, public–private partnerships and nongovernmental organizations do not exercise sufficient oversight of AI technologies for health, older people cannot ensure that such technologies are designed and deployed appropriately on their behalf. Older people must be involved in formulating new regulatory guidelines to test, approve and select AI technologies for use to ensure that their views are heard and that ageist policies and practices are identified and eliminated.

Even as governments exercise greater authority over AI technologies, technology companies will retain significant oversight and control of the technologies they design and market. Many companies may not exercise such power with the care it deserves and may therefore practise ageism or neglect older people in their policies and practices. Furthermore, their personnel may not adequately represent the needs and interests of older people in daily decision-making.



MAXIMIZING THE BENEFITS OF AI TECHNOLOGIES FOR OLDER PEOPLE AND AVOIDING AGEISM

AI technologies for health can strengthen health and social care for older people by helping to identify risks and enabling older people to meet their own needs individually or in collaboration with their health-care providers. **To ensure that AI technologies play a beneficial role, ageism must be identified and eliminated from their design, development, use and evaluations.**

The following **eight considerations** could ensure that AI technologies for health address ageism and that older people are fully involved in the processes, systems, technologies and services that affect them.

1

Participatory design of AI technologies by and with older people:

While older people may be involved in the design of some AI technologies for health, their participation in design and programming is unlikely to be systematic (9). Provision of training and educational opportunities for older people to participate in the design of AI technologies and ensuring that workforces maintain programmers and designers for several generations would rebalance the pool of programmers. Inclusion of older people also depends on how their input and participation is obtained, including the setting, the tools and methods and the stage of the design process at which older people are involved (19). Inclusion should also be intersectional, focusing not just on age but also on differences among older people, such as in gender, ethnicity, race and ability (2).

Furthermore, all AI programmers and designers, irrespective of age, should be trained in both recognizing and avoiding ageism in approaching their tasks and in their perception or recognition of older people (9). This must then be complemented by deliberate organization of design teams for all AI technologies to ensure that they are well balanced, not just according to age but also to other key demographics (2).

2

Age-diverse data science teams:

As data are critical in both the training and validation of AI technologies, data science teams responsible for selecting, validating and applying data must also be inclusive and well-balanced (2). Inclusion of older people in such teams and training other data scientists to both recognize and overcome forms of ageism can ensure that AI technologies are appropriate. Data science teams should also be diverse with respect to age and another demographics (2).

3

Age-inclusive data collection:

AI developers should ensure that AI data are accurate, complete and diverse, including according to age (2). If a particular group, such as older people, is underrepresented in a dataset, that group might be oversampled relative to its size to ensure that the AI technology provides the same quality of results for that population as for better-represented groups. Government-sponsored data hubs should ensure that the data collected are appropriately representative, including by age (2). In some countries, measures have been taken to allow discrete communities to oversee their data, such as in data cooperatives, which allow members to set common ethical standards, and some have developed their own tools and applications to ensure that the data are used beneficially (4). Such cooperatives could have two functions – first, they could ensure that adequate data are collected on older people so that the data can inform AI technologies, and, secondly, they could set standards for the data to be collected, how it is collected and how it should be used.

4

Investments in digital infrastructure and digital literacy for older people and their health-care providers and caregivers:

Even if AI technologies for health are appropriately developed for older people, their use may be limited in the absence of appropriate digital infrastructure (1). Lack of digital infrastructure could also contribute to the prevailing ageist belief that older people do not use digital (or AI) technologies and therefore need not be accounted for. The developers and regulators of such technologies must ensure that older people understand how AI technologies could affect their lives and

also how to use and assess them (22). For example, when AI technologies are used in patient monitoring, older people must be informed what is being monitored and for what purpose, who will use the information and the possible implications for their daily lives (11). Health-care providers and caregivers might have to obtain new competence in using AI-supported technologies in their everyday practice, which may have to evolve rapidly as uptake of AI accelerates. Continuing education should be available and accessible to all providers and include training in the uses of AI technologies, the ethical challenges of AI and understanding and identifying how the technologies may encode and promulgate bias. AI curricula should therefore be integrated into existing programmes (2).

5

Rights of older people to consent and contest:

AI technologies should be maintained as a means of aiding human decision-making and assuring that humans ultimately make critical decisions (2). Older people should be able to exercise choice and provide consent for the AI technologies to be used, how the technologies should be used in addition to or instead of care and treatment provided by medical professionals and caregivers and to withdraw their consent from use of AI technologies for providing care and support. Older people should also have the right to contest recommendations provided by an AI technology for health (7), through mechanisms established by a ministry of health (2) or an appropriate legal proceeding.

6

Governance frameworks and regulations to empower and work with older people:

As new regulations are introduced to provide an appropriate framework to assess, fund, approve and use AI technologies for health, the governance and regulatory apparatus must not repeat exclusionary and ageist practices that could negatively affect the design of AI technologies for health. Mechanisms should be in place to ensure that governments, international agencies, nongovernmental organizations, the private sector and public–private partnerships can work with older people, discourage or identify ageism and ensure appropriate procedures to address ageism and its consequences. Older people must be involved in ethical committees, regulatory agencies and other intergovernmental or standard-setting

bodies that consider use of AI and set rules for its use. Government regulations should require that certain aspects of an AI technology be transparent, while respecting proprietary rights, to improve oversight and assure safety and efficacy for and by older people, their providers and relevant entities. The aspects may include the source code, data inputs and analytical approach of an AI technology (2). Government-mandated audits of AI technologies should be conducted to assure their safety and efficacy for older people and other groups that could be negatively affected by the technologies (23).

AI technologies should be maintained as a means of aiding human decision-making and assuring that humans ultimately make critical decisions.

7

Increased research:

In a fast-moving field such as use of AI for health, there are many unresolved technical and operational questions on how best to use AI (24) in general and, as discussed here, to avoid or not exacerbate ageism. Each new application or use of AI raises opportunities and challenges that should be addressed before widespread adoption. As AI technologies become more commonly used by and for older people, research and studies will be necessary to determine how ageism (and its intersection with other biases, such as racism and sexism) affects the design and use of AI and to identify the measures most likely to mitigate or avoid age bias.

8

Robust ethics processes:

A robust ethics process, especially in universities, not-for-profit organizations and companies that design AI technologies, is necessary to guide the development and application of AI systems for older people. Design processes that identify ethical challenges, including those related to ageism, will place those challenges at the forefront of design and quality assurance (2). Once an AI technology has been created, its beneficial and negative impacts on older people should be assessed (22). Impact assessments can provide technical information on possible consequences and risks (both positive and negative), improve decision-making, transparency and public participation in decision-making and inform a framework for appropriate follow-up and measurement (2).

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