World Health Organization – Research Report I

Exploring the Pros and Cons of AI in Healthcare and Its Potential to Transform the Future of Medicine

Introduction to the Topic:

Recently, a technological revolution commonly referred to as "The AI Boom" has resulted in a never-seen-before investment in Artificial Intelligence (AI) and Machine Learning (ML) systems. These have already resulted in a wide range of implementations in human day-to-day lives, such as Siri and Galaxy AI, the assistants on many people's mobile phones, or ChatGPT, a massive language model trained to talk with its users, amongst many others.

This new revolution has resulted in people all over the world rushing to find new applications for AI and ML systems in all sorts of fields, such as Engineering, Retail, Finance, Agriculture, etc. In this debate, however, the World Health Organization (WHO) will be focusing on the potential impacts of the development of AI, beneficial or harmful, on the healthcare sector. This is an issue that affects not only the richest and most developed countries in the world, but also the middle and low-income countries, where a lack of proper investment and accurate knowledge can result in misunderstanding, misuse, and, eventually, conflict.

Positive Aspects

There are many undeniable advantages of the implementation of Artificial Intelligence in the Healthcare sector. Firstly, its ability to rapidly process data can be of great use in medical centres, especially in those with many clients, as it allows these centres to cope with increasing stress from a large number of requests. Additionally, AI systems can be programmed to find more efficient schedules, as well as to suggest ways to reduce costs, which can then be approved and put into practice. This would allow medical centres to work more efficiently, potentially saving many more lives, especially in less-developed countries, where waiting times and treatment costs are still relatively high.

Disease Diagnostics is also an area where AI can contribute significantly. For example, AI can find patterns in medical results that may have been overlooked by human doctors, allowing for a more consistent and premature diagnosis. AI systems can thus help reduce the likelihood of errors caused by human fatigue, stress, or oversight. AI also has the ability to analyse large volumes of data and combine all the information it has about a patient into a report, resulting in an accurate prediction of possible future complications, allowing for more prophylactical, effective and targeted therapies.

Optimization is an area where AI gains a huge lead on humans. The automatization of administrative tasks like scheduling, billing, and medical records, in combination with human supervision, may leave healthcare providers to have more time to spend with their patients, ultimately reducing operational costs. With AI, many processes can be sped up¸ as well as 24/7 assistance which can be provided at a more consistent schedule. Additionally, AI-powered chatbots and virtual assistants can give the patients reminders, quick answers to common medical doubts, or mental support at any time. This would improve patient experience significantly.

As mentioned before, AI can also help healthcare systems worldwide cope with increasing stress and reduce inefficiencies in healthcare, allowing for significant cost reduction and a more flexible use of the hospital budget.

Faster Drug Development: AI models can analyse vast datasets to identify potential drug candidates faster, reducing the time and cost associated with developing new medications. For example, AI is being used to accelerate the discovery of treatments for complex diseases like Alzheimer's and cancer, and has already had some success. Another example is Google Deepmind's Alphafold 3, an AI that was trained to predict the shape of an amino acid molecule and has nailed many molecules with a previously unknown shape with an astounding accuracy of above 90%. These examples and many more have had many revolutionary effects on modern day medicine.

Despite the challenges that AI still faces in healthcare, the scope of advantages it can potentially bring are nearly limitless and are definitely a factor that should not be ignored when considering its implementation and development.

Negative Aspects and Possible Consequences

As promising as this AI revolution may seem to be, there are also significant drawbacks to take into consideration.

The first thing that comes to many people's minds is **unemployment**. Since the AI Boom, the medical sector has been constantly increasing its reliability on Artificial Intelligence systems, as more and more implementations and optimizations are found. This is expected to, at some point, begin replacing doctors in their jobs. There are already many systems in place that help, such as Predictive Analytics, which can diagnose diseases and predict future symptoms with growing accuracy. Additionally, AI-enabled chatbots can act as a replacement for human call centre attendees' basic tasks. This is feared to soon begin replacing doctors' and medics' jobs. Nurses face a similar threat, as projects where surgery robots which can perform their tasks at a cheaper cost are also gaining traction. Adding to this, the time and money required to retrain a big majority

of these doctors so they can work alongside AI will likely amount to a very large number, implying, potentially, a very large investment, which may not even pay off.

Another major drawback is the **Black Box Algorithm nature**, which means that nobody, not even the designers of the AI themselves, can properly understand how variables are being combined to make predictions and decisions. This curtain between the human operator and the system creates a sense of uncertainty and unpredictability.

Additionally, **ethics** play a big role here as well. One big concern under this topic is the data that is used to train the system. If the data is biased (for example, to give priority to certain races or ages over others, etc...), then the resulting AI will likely also be biased, resulting in sudden, rash decisions, potentially causing trouble. One other issue here is that Artificial Intelligence systems are still looked at by many with scepticism and doubt. How would a desperate patient react upon finding out that their life lies in the hands of a machine, and not an experienced human doctor? Adding to this, rare diseases can be misdiagnosed, as AI, in contrast with experienced doctors, doesn't have much experience with these types of situations due to limited training data.

There are still many legal gaps and loopholes that can be exploited, and the large amount of bureaucracy and security measures that will have to come in place will slow the process down and make it more expensive

Furthermore, the sheer **amount of energy and power required** not only for training these systems, but to also run them for extended periods of time is also a controversial debate here, as a large sum of money is required to cover all these expenses, which could instead be spent on covering other costs with less difficulty and more efficiency. This goes without saying that this energy and power, which is currently not an unlimited good, could also go towards something else.

Moreover, **a massive investment in infrastructure** will likely be needed to implement these systems in many places which are currently incompatible with AI systems and add-ons. Where and how a government gets the funding for this can be a problem, especially in Least-Developed Countries, where investment and government budget and revenue are limited.

These are just a select sample from the many possible consequences of this issue, and a lot of these are becoming a reality, and must be addressed. [More details on the debate focus can be found in the "Focus of Debate" section].

Timeline of events

1950: In *Computers and Intelligence*, Alan Turing describes the "Turing test," designed to uncover whether computers are capable of human intelligence.

1956: John McCarthy coins the term "artificial intelligence" as the science and engineering of building intelligent machines.
1966: "Shakey," the first robot capable of interpreting instructions, is unveiled by Stanford Research Institute.
1971: Scientists create INTERNIST-1, which uses a powerful ranking algorithm to reach diagnoses.
1975: The National Institutes of Health, a US government agency, sponsors the first AI in Medicine workshop at Rutgers University.
1976: "Backward chaining" AI system MYCIN, still a rudimentary AI, delivers suggested antibiotic treatments for potential bacterial pathogens. The Present Illness Program is introduced to help evaluate Edema.
1978: Rutgers University develops the causal-associational network model, which couples statistical pattern recognition and AI for glaucoma consultations.
1986: University of Massachusetts releases DXplain, using inputted symptoms to generate diagnoses for 500 diseases—now expanded to more than 2,600 conditions.
1989: Cedars-Sinai cardiologists debut CorSage, a clinical tool that combines AI and statistical techniques to help physicians identify heart patients who are most likely to suffer another coronary event.
1991: The Pathology Expert Interpretative Reporting System generates pathology reports with nearly 95% diagnostic accuracy.
2003: The Human Genome Project provides a wealth of data on the genetic basis of disease.
2007: IBM creates the open-domain question-answering system Watson. In 2011, Watson wins first place on *Jeopardy* and, in 2017, neurologists use it to identify RNA-binding proteins altered in ALS.
2015: Pharmabot assists in medication education for paediatric patients and caregivers.
2016: AI autonomously performs a “soft-tissue surgery”, where it stitched together a pig's bowel “more successfully than a surgeon”.
2017: Arterys earns Food and Drug Administration (FDA) approval for a product that analyses heart MRIs in seconds.
2018: Deep-learning applications screen for diseases ranging from diabetic retinopathy to skin cancer with astonishing accuracy. The FDA approves the first AI-powered device for operating-room use.
2019: The FDA approves the first AI-powered device for cancer diagnosis as well as a deep-learning algorithm for interpretation of brain MRIs.
2020: Google DeepMind uses AI to predict a protein’s 3D structure from its amino-acid sequence, solving one of biology’s greatest challenges.
2022: The FDA authorizes 91 AI-powered devices. One, the EchoGo Heart Failure tool, detects heart failure from a single echocardiogram.

Long standing patterns

Moore's Law: Moore's Law is a pattern identified by Intel Co-founder, Gordon Moore, in 1965, and, later, revised in 1975. It states that the number of transistors on a microchip doubles every two years, effectively doubling the processing capacity every two years. This would allow for increased computation power, allowing AI systems to handle much larger data sets and run complicated algorithms faster, encouraging its implementation in the healthcare sector.

Learning techniques: Another relevant trend is the shift in the philosophy of the techniques used by AIs to understand the world. In the very beginning, outcomes were programmed into the system, meaning it had a very limited set of choices to make. However, with the implementation of Deep Learning (DL) and Machine Learning (ML), the level of "understanding" of the situation has increased significantly, allowing it to accomplish more complicated tasks at or even above human level, such as processing the contents of images, making accurate diagnoses and applying concepts of predictive analytics.

Augmentation (of human skill): A commonly heard-of theme is the one of Human-AI collaboration. With the increasing skill level, convenience and accessibilities of Artificial Intelligence, combining this new revolutionary tool with human insight and experience allows for an enhanced evaluation, identification and treatment of a patient. Looking back, the first ever use of a robot in surgery was in 1984, where the robot would change the position of the patient's leg. In 1998, the first instance of Tele-surgery happened, where the surgeon was able to operate on the patient from a distance. The first all-robotic-assisted kidney transplant happened as early as January of 2009. In 2016, a fully autonomous AI robot performed surgery on soft tissue with human-like accuracy. Looking at the speed of evolution of AI in these past years strongly indicates that this trend will keep growing, which calls for strict frameworks to maintain this growth under control.

Long standing challenges

Data Privacy and Management: One common obstacle against the implementation of Artificial Intelligence in the healthcare field regards data and information. In fact, healthcare data is so highly sensitive to the point that it is heavily protected by laws such as HIPAA (Health Insurance Portability and Accountability Act), acting in the USA, or the GDPR (General Data Protection Regulation), which is enforced in Europe, amongst other laws. Speaking about data, the quality and format are also of great relevance. Since data is taken from various sources, it often comes incomplete or unstructured. This can result in inaccurate and inconsistent predictions and diagnosing. Taking all of these restrictions into consideration, it is very difficult to create an AI system that meets all the requirements, while still navigating private data efficiently, especially when considering the rapid development and diversification of available treatment methods nowadays.

Compatibility and validation: For AI systems to be widely used and accepted in clinics and hospitals, they must be vigorously tested in order to make sure that they are safe for commercial use. Testing and validation, however, require extensive and often costly trials. Without clear and robust verification, AI systems may face public scepticism, which would only slow down their adoption. To manage their data, many healthcare institutions use certain systems and software that may not be compatible with AI. Integrating AI into these systems without disrupting efficiency and cost can be very challenging and will likely be a costly task. Additionally, the integration of AI systems in hospitals adds a whole new layer of complexity to regulatory frameworks, further hindering efficiency.

Ethical and liability issues: In the case where an AI system makes an error, determining accountability for the decision made by the AI system has also historically been an issue. When an irrational/incorrect decision is made by the AI, which party will take the blame? Should it be the developer, the healthcare provider, or the system itself? Likewise, in the case of a new discovery, who would take the credit? There has been a big debate on this topic with many different parties suggesting different options, and this thus remains an open question towards the implementation of Artificial Intelligence in the healthcare industry.

Recent Developments:

The AI Race for Healthcare applications

After the recent AI boom, more companies and start-ups than ever are investing heavily to develop innovative solutions to fix the current problems in healthcare, optimize routines, enhance patient experience and accelerate new drug discoveries. Examples include:

Verily Life Sciences: a precision health company aims to aid healthcare companies by providing AI models and other AI-powered systems has big plans for 2025.

Microsoft: in collaboration with the Knight Cancer Institute, is developing its Hanover project, which will analyse medical research and predict effective cancer treatments, along with other types of diagnosing.

Google Deepmind's AI, in collaboration with UK's National Health Service, will aim at analysing medical imaging to identify cancerous tissues and improve diagnostics accuracy, speed and capacity.

Worldwide policy shifts and roles of significant parties

Fuelling and funding the AI Race are many countries around the world, such as:

- **The United States of America**: USA leads global AI investment with over $10 billion invested into AI--driven healthcare solutions.
- **China:** by the beginning of 2025, the equivalent of $61 billion were invested in AI, and a significant portion of this is going towards healthcare innovations
- **European Union:** Through programs such as Horizon Europe and Digital Europe, the EU allocates €2 billion per year towards AI initiatives. A significant portion of these funds is directed towards healthcare innovations and start-ups.
- **Developing countries:** With less funding and investment going towards AI applications, developing nations are not investing as much into AI, however, some funding is still being used to leverage AI to enhance diagnostics and optimize efficiency in hospitals and clinics, which would improve medical conditions around the country by a significant amount.
- **Global Scope:** The global AI healthcare market is expected to grow from $27 billion in 2024 to nearly $500 billion in 2032, reflecting on the significance of this revolution (see image below).

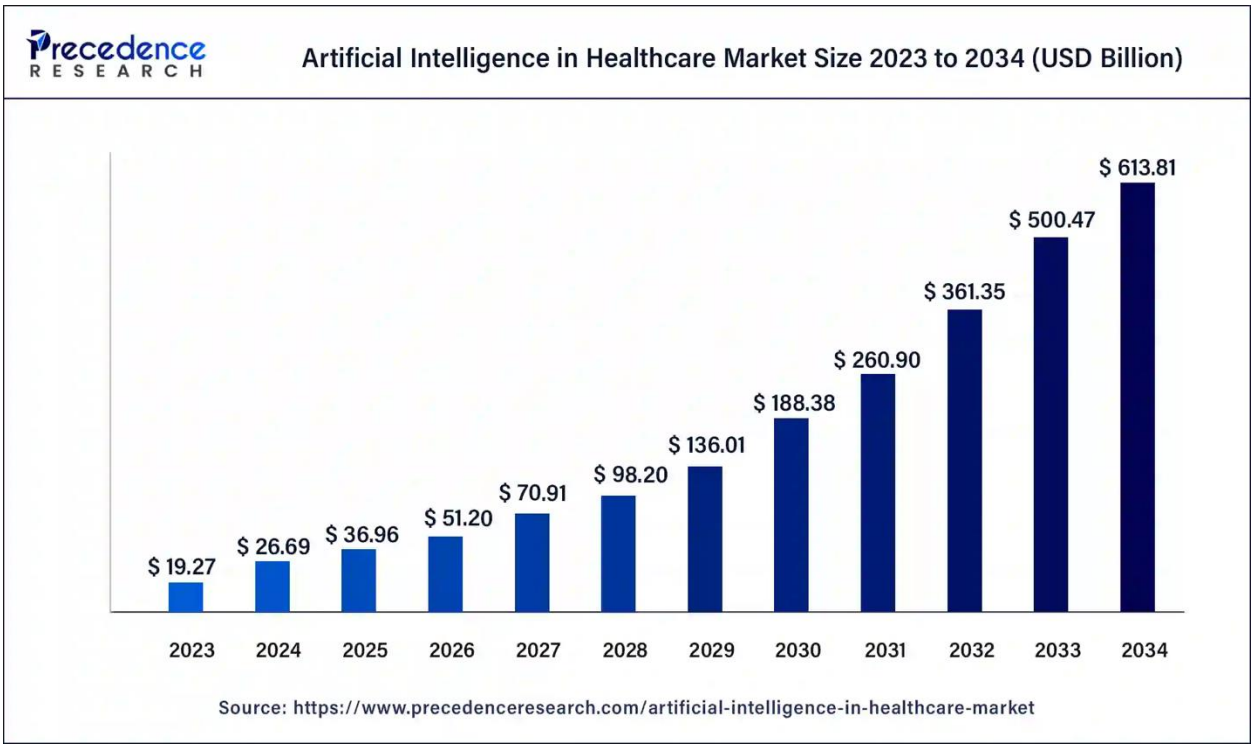

Figure no. 1 - Market Cap, in billion dollars, for AI in the Healthcare sector (*Precedence Research*). Retrieved from: **https://www.precedenceresearch.com/artificial-intelligence-in-healthcare-market?**

Summarising, investment in AI, especially in healthcare, although already large, is projected to increase exponentially in the near future (at over 40% yearly, according to Fortune Business Insights), further highlighting the need for effective measures to ensure that the situation is under control.

Changes in political tensions arising from the development of AI in healthcare

- **USA and China:** USA and China have seen the tension between them rise, as both nations race to achieve AI dominance in many fields, including the one of healthcare. Additionally, US's measures to restrict China's access to advanced AI chips has further increased tensions, as these chips are crucial for further developing AI systems.
- **USA and Middle Eastern Countries**: The UAE has sought partnerships with US companies to develop and Research AI, especially in fields such as healthcare. However, there are many concerns about transferring advanced AI tech to autocratic regimes.
- **EU to Global partners:** After the implementation of strict regulations, such as the AI Act, challenges related with international collaboration may arise, making it difficult to progress with the foreign and domestic funded development of AI in European boundaries.

Focus of the Debate:

Delegates should discuss worldwide health priorities, how they coincide with the varied number of resources available from country to country and their respective connections with medical/technological developments. To ensure a fruitful debate and an adequate range of viewpoints, the following focus areas can be put forward:

Ethical and Legal Implications

Delegates ought to consider potential ways in which AI in healthcare may honour universal principles such as patient privacy, data privacy and ethical medical practice, bearing in mind the cultural, legal and infrastructural contexts of nations.

Country Specific Roles: Developed nations may explore means of transferring their knowledge without compromising ethical practices across borders. Less developed nations and resource-poor countries could point out issues faced as well as solutions in the event of searches for ethical standards.

Key Questions for Debate: How can the WHO assist member states in building ethical AI governance frameworks? What steps must be taken to address the liability of AI errors in accuracy efficiency healthcare?

Economic Impact on Healthcare Systems

Delegates are encouraged to address the costs regarding the use of AI, particularly the cost of health are, human resources and investment requirements of different countries.

Country-Specific Roles: Wealthier countries may push for funding for AI technology. Under-developed countries can investigate and suggest reasonably priced technology for AI use.

Key Questions for Debate: How can the WHO contribute to the financing of AI for developing countries? What is the impact of AI on the employment in the health sector across countries that are members?

Revenue Forecast for AI in Healthcare by 2030:

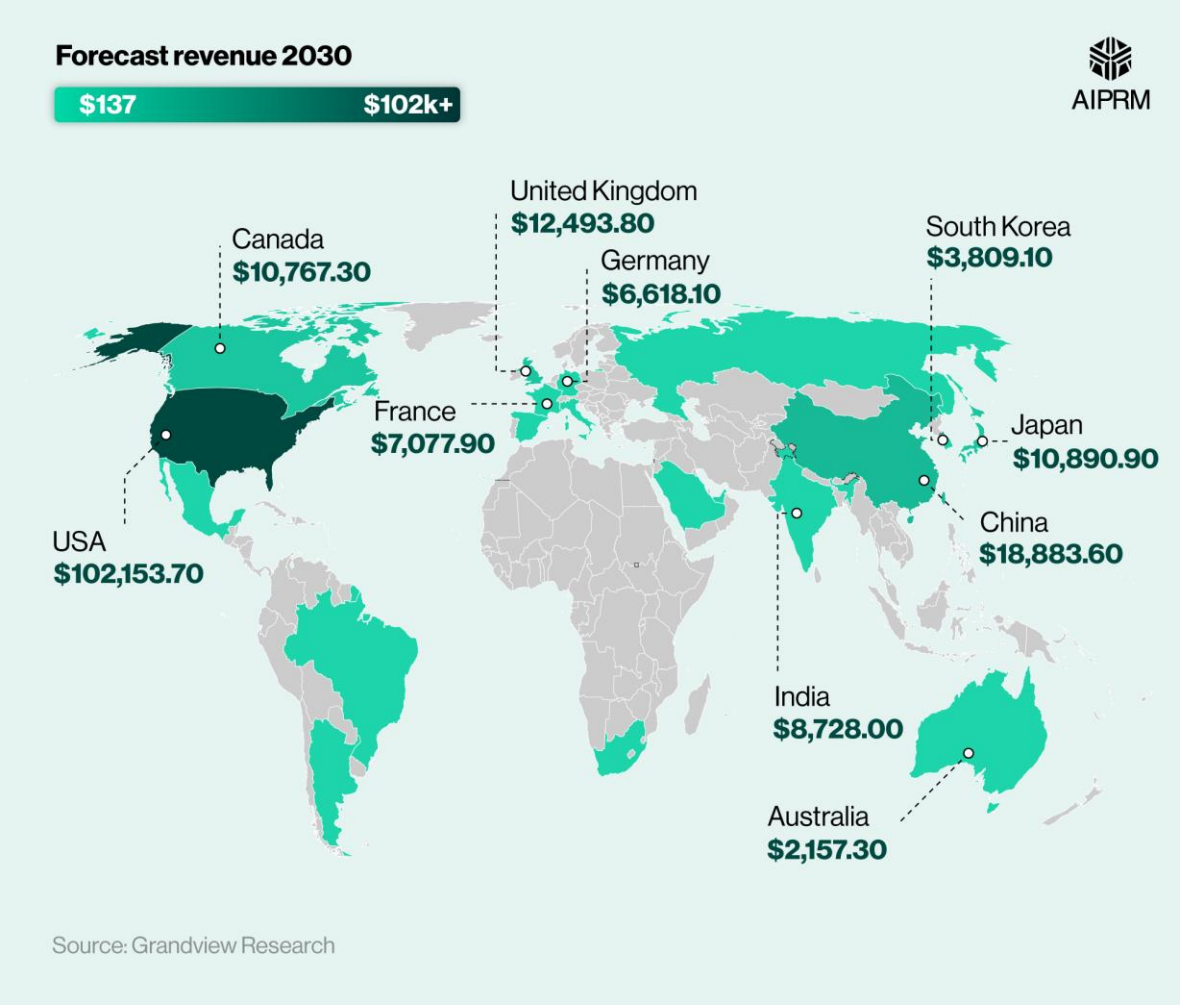

Figure no. 2 - A breakdown of the forecast revenue for AI in healthcare in 2030. *(Grandview Research)*. Retrieved from: https://www.aiprm.com/ai-in-healthcare-statistics/AI-in-Healthcare-Stats-2_hu9771206b13816494f7e92a57fe744bc5_366357_1320x0_resize_q90_h2_box_3.webp

Global Health and Disease Control

Delegates should explore AI's role in pandemic preparedness, disease surveillance, and emergency response, ensuring that its benefits are shared globally.

Country-Specific Roles: Nations with established AI systems can discuss partnerships for real-time disease monitoring. Developing countries can highlight the importance of AI in managing health crises in resource-poor areas.
Key Questions for Debate: How can AI be made globally available for early disease detection and pandemic response? What role should the WHO play in facilitating cross-border collaboration for AI in public health?

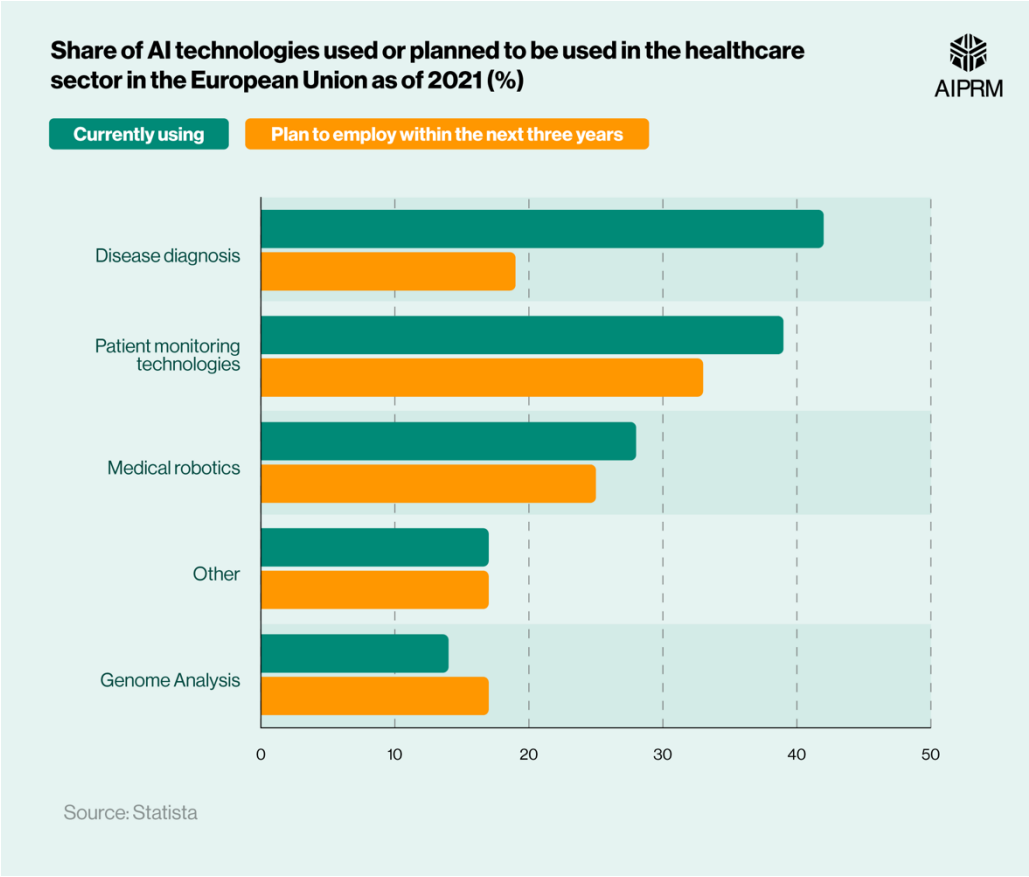

Figure no. 3 - A breakdown, in percentage, of the share of AI technologies used or planned to be used in the healthcare sector in the European Union as of 2021 *(Statista)*. Retrieved from:

ttps://www.aiprm.com/ai-in-healthcare-statistics/AI-in-Healthcare-Stats-2_hu9771206b13816494f7e92a57fe744bc5_366357_1320x0_resize_q90_h2_box_3.webp

Significant Parties:

United States
Why: Notable tech corporations such as Google, IBM and Microsoft have taken the lead in AI healthcare innovations, for instance Watson Health and DeepMind.
How: Significant private sector investment in AI-driven diagnostic tools, telemedicine platforms, and drug development.
When: The healthcare sector has had AI since the early part of the decade but on its full-scale adoption was particularly enhanced due to COVID- 19 as AI diagnostic and therapeutic tools were incorporated into use.

China:
Why: China plans to achieve global supremacy in AI by the year 2030, capitalizing on its massive population for AI health data training.
How: Expenditures on AI diagnosis tools augmenting through deep learning in medical imaging and national programs for digitizing the healthcare sector.
When: Ever since 2015, after the unveiling of the strategy “Made in China 2025” which focused the importance of AI in the health care systems.

India:
Why: Seeks to address healthcare disparities in its large population using AI-driven tools.
How: Initiatives like "Digital India" and partnerships with AI firms to implement low-cost diagnostics and predictive healthcare models.
When: Active involvement since the late 2010s, focusing on scalable AI healthcare solutions.

WHO (World Health Organization)
Why: Establishes international guidelines and standards for appropriate and ethical application of AI in medical care.
How: Produces reports and principles, for example, the document on the ethics of AI in health published in 2021 and acts as a facilitator for interaction among countries.
When: Engaged in AI initiatives since around the middle of the 2010s in conjunction with global health needs.

UNESCO (United Nations Educational, Scientific, and Cultural Organization):
Why: Supports the use of AI for the good of humanity and for the improvement of education and training in AI in the health area.

How: Issued the first universal directive on displacement of AI ethics regarding goals in health care, in the year 2021.
When: Became a substantial part of discussions in the AI ethical and governance space after the 2020s.

Bill Gates and the Bill & Melinda Gates Foundation: Invests in AI for global health initiatives, focusing on improving healthcare access in low-income countries.

Elon Musk (Neuralink): Exploring AI-driven brain-machine interfaces for supposed medical applications like neurological disorders.

Past UN Actions:

WHO Global Report on AI in Health (2021):
Operation: Released AI in health documentation covering six essential principles such as human control, transparency, accounting and inclusiveness, for the development and application of AI.
Result: Provided ethical considerations in the development and use of AI in health systems all over the world in a way that is just and fair.

UNESCO Recommendation on the Ethics of Artificial Intelligence (2021):
Operation: Approved world's first AI ethics instruments with rules on the use in healthcare, e.g. prevention of discrimination and the advancement of practices that respect human rights.
Result: Developed AI principles that render ethical use of AI technologies in health services while ensuring transparency and accountability in service delivery.

WHO's Global Initiative on AI for Health (GI-AI4H):
Operation: Developed a framework that guides the evaluation and introduction of AI in health considering equity, security and persons receiving care.
Result: Assisted countries in gaining access to AI technologies whilst eliminating barriers to equitable access to healthcare.

UN General Assembly Resolutions on Digital Health (2019-2023):
Operation: Advocated the use of digital technology including the use of AI for universal health coverage and other global health issues.
Result: Called on member states to pursue AI technologies with regard

Possible Solutions:

Global AI Regulation Framework:
Action: Suggest an international framework led by WHO for regulating healthcare AI.

Result: Guarantees that AI technologies are secure, efficient, and fair among all member nations, reducing risks such as algorithmic prejudice and data exploitation.

Initiatives for Capacity Development:
Action: Create UN-funded initiatives to assist low- and middle-income countries (LMICs) in integrating AI into healthcare.
Result: Minimizes healthcare inequalities and fosters fair access to AI-powered solutions worldwide.

Agreements for Data Sharing:
Action: Promote global accords on safe and responsible health data sharing for AI research and development.
Result: Expedites advancements in AI for healthcare while safeguarding patient privacy and data protection.

Programs for Training and Education in AI:
Action: Urge member nations to adopt training initiatives for healthcare workers and policymakers regarding the ethical and practical dimensions of AI in healthcare.
Result: Boosts confidence in AI technologies and guarantees well-informed choices in healthcare provision.

Glossary & Key Terms:

- **Artificial Intelligence (AI):** Artificial intelligence is programmable software/ technology that enables computers and machines to simulate human learning, comprehension, problem solving, decision making, creativity and autonomy.
- **Machine Learning:** A model made/refined by training an algorithm to make predictions or decisions based on data.
- **Deep learning:** One of the main topics of machine learning, where long neural networks, called deep neural networks, are used, more closely simulating the complex decision-making power of the human brain.
  NOTE: this allows for "unsupervised learning", where the system can learn on its own. On one hand, this results in efficiency, but on the other hand, can result in a black box algorithm, where it is near impossible to understand what is going on inside the system and thus predict what it will do next
- **AI ethics:** AI ethics is a multidisciplinary field that studies how to optimize AI's beneficial impact while reducing risks and adverse outcomes. Principles of AI ethics are applied through a system of AI governance consisted of guardrails that help ensure that AI tools and systems remain safe and ethical.

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