AI in Society: Revolutionizing Healthcare

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The Possible Impact of AI in Healthcare and Medicine

The current situation in healthcare presents both opportunities and challenges. Healthcare systems worldwide face staff shortages, increasing patient loads, and inefficiencies. Diagnoses and treatments often rely on traditional methods. These methods can be slow and prone to human error. Another issue is the bias in healthcare data. Medical research often focuses on what works for the "average" white male. This leaves women and minority groups underrepresented [1]. As a result, diseases or conditions that appear differently in these groups can be misdiagnosed, mistreated, or completely missed.

Furthermore, drug discovery is an important aspect of the healthcare and medicine domain. It involves finding targets, testing compounds, and improving these to develop drugs. The process is slow, expensive, and often fails. On top of that, it often gets tested on animals while animal tests don't always match human responses. Patients react differently to treatments, and there aren't enough tools to measure drug success accurately [2].

Fortunately, Artificial Intelligence (AI) is bringing significant changes to healthcare. The first way in which AI benefits healthcare is by improving early diagnosis and enhancing patient care through assigning more precise treatments and assigning treatments faster. For example, AI tools like Chartwatch appear to correctly predict patient deterioration, helping healthcare providers act earlier with the most appropriate treatments. This can potentially help in reducing the number of hospital deaths [3]. AI is also able to detect hidden heart attack risks [4] and to support cancer diagnostics, which potentially improves survival rates [5]. Additionally, AI in routine health scans, like MRI, has the potential to help identify early-stage diseases that may not yet be visible to radiologists [6].

Another way in which AI benefits healthcare is by transforming drug discovery. AI analyzes large datasets to predict which chemical compounds might be effective against specific diseases. This significantly speeds up the research process compared to traditional methods [7]. Major companies like Pfizer, and AstraZeneca have started using AI tools to make drug discovery faster and more efficient [8][9].

Concerns and Critique aimed at AI in Healthcare and Medicine

While AI has brought and will continue to bring changes to healthcare, there are still many concerns about how it works and who it benefits. The main critiques focus on data bias, corporate control, and the lack of transparency and ethics in current AI systems. These issues challenge the idea that AI will automatically make healthcare better for everyone.

As mentioned earlier, healthcare data is often very biased [1]. AI tools rely on existing data to train their models. However, this data often leaves out certain groups, like women and minorities. Therefore, it is important to keep the quality of the data and its representativeness

in mind. Data biases can arise from datasets where certain demographics are underrepresented. The data also often leaves out the intersectionality of different groups. Medical research has historically focused on white men, and not necessarily on black women. Diseases that appear differently in the underrepresented groups will most likely not be recognized by AI systems trained on biased data. For example, heart disease symptoms are different in women compared to men, but AI might miss these differences because the training data isn't diverse enough. Similarly, medicines work differently in different people. Using data that doesn't include the entire population, can result in drugs discovered by AI not working for everyone. These issues are not unique to AI. It is also present in traditional healthcare [1]. Since AI is trained on existing data, any gaps or biases in that data will likely be reflected in its output [10]. This only makes the problem worse instead of solving it.

Another big concern is the corporate control of AI tools in drug discovery. Large pharmaceutical companies, like Pfizer and AstraZeneca, use AI to speed up research and development [8][9]. While this is a positive change, it also raises questions about who controls the technology and who actually benefits from it. Many companies keep their AI models and data private. This makes it harder for researchers, smaller companies, or public organizations to collaborate [11][12]. It also means that these corporations decide what types of drugs are developed. While it is also the case for drug discovery without the use of AI, there's a risk that profit motives could overshadow public health needs. Companies might prioritize developing treatments for more profitable conditions [13]. They can be more likely to focus on treatments for common or profitable diseases, while rare or less profitable conditions are ignored. Part of this became clear during the COVID-19 pandemic. Pharmaceutical companies prioritized patents and profits over sharing vaccine technology. As a result, poorer countries struggled to get access to vaccines while wealthier countries were prioritized [14][15]. A similar issue could happen with AI-driven drug discovery if corporate interests come before public health needs.

Developers play a huge role in shaping AI systems through the choices they make. This leads to another critique. AI tools are not neutral because they are influenced by human decisions. Developers determine which data to include, how to train the model, and what goals the system should achieve. These decisions often prioritize efficiency, speed, and cost savings over fairness [16][17]. Without careful thought, AI could reinforce existing inequalities in healthcare instead of solving them. This is why an intersectional approach is so important. Intersectionality in this case considers how overlapping identities like race, sex, and age affect health outcomes [18]. For instance, datasets might include women and people of color but still fail to include black women, leaving them unrepresented.

The current socio-technical system of AI in healthcare involves many workers and artifacts. Hospitals use AI tools like diagnostic software to save time and reduce costs [19]. Predictive analytics tools assist doctors in determining how specific medications will work for individual patients. This personalizes treatment plans to maximize effectiveness [20]. Developers of the AI models, decide which data to use and how to train AI models. These choices can be focused on efficiency and profits instead of fairness. Pharmaceutical companies use AI for drug discovery [8][9]. However, they keep their data and tools private. Keeping information like that private limits data sharing and collaboration [11][12]. This is in conflict with the principles of FAIR data. FAIR data is Findable, Accessible (with authorization), Interoperable,

and Reusable data [21]. It helps researchers share and reuse data. A group of scientists came up with these principles in Leiden in 2014. They wanted to make research data easier to manage and more reliable. Following FAIR principles promotes transparency and collaboration in the scientific community [21].

The system mainly seems to benefit large companies, AI developers, and hospitals. Represented groups like white males also seem to benefit from the incorporation of AI in healthcare and medicine. This group benefits because the system is designed around their needs, even though making it work for others would not disadvantage them. At the same time, people from underrepresented groups are often harmed. This can then also harm the represented groups by having other people in their lives being greatly disadvantaged.

The critique of corporate control in drug discovery is primarily championed by advocacy groups, like the Roosevelt Institute, and public health organizations such as the Drug Pricing Lab [13][22]. These groups argue that pharmaceutical companies sometimes prioritize profit. By retaining exclusive control over data and algorithms they restrict transparency and limit collaboration [23]. FAIR data was originally promoted by bioinformatics researchers. This group of researchers did not specifically mention using AI in science. However, FAIR data encourages transparency and collaboration which also advocates for sharing healthcare data in the context of AI. Large companies, AI developers, and some hospitals might resist these changes because it could cost them money or reduce their control.

For AI to help in the healthcare field, these problems need to be addressed. Sharing data and training AI models on unbiased and inclusive datasets for everyone can help reduce healthcare inequalities.

A New Hope for Medicine Testing

It is clear now that AI in healthcare has many potentials but it also contains serious flaws and concerns. Things like bias in training data, underrepresentation of certain groups in the data, and corporate control, are important to consider and limit. This needs to be done for beneficial incorporation of AI in healthcare and medicine. A subcategory of this field in which AI can play a major role is drug development. Earlier in this report, in the first section, animal testing in drug discovery was briefly mentioned. The current healthcare system relies heavily on animal testing for drug discovery and development, despite its limited accuracy. Additionally, testing on animals also raises ethical concerns about their welfare. Animal testing for medicine causes animals to experience pain, stress, and suffering during experiments. It often leads to their harm or their death.

Therefore, my proposed intervention envisions an AI system that replaces animal testing. On top of this, this system incorporates intersectionality, and promotes open data sharing among researchers, doctors, and institutions. This system addresses the challenges of biased data, corporate control, and ethical concerns in current AI applications, as well as ethical concerns in regards to animal testing. This AI system solves the limitations of animal testing by simulating diverse biological processes using advanced models. Animal testing often fails to predict human outcomes. Medicines that pass animal trials sometimes fail

during human testing. Moreover, this system will greatly decrease the number of animals that endure pain and suffering due to animal testing.

In theory, natural computing and AI can work together to replace animal testing by simulating biological processes [24][25]. Natural computing uses ideas from nature, such as evolution or brain-like networks, to solve problems. AI can build on this by learning patterns and making predictions from large datasets. Together, they can create virtual models of organs or systems to test drugs safely and ethically. With more development, they could become reliable tools for testing medicine and understanding how drugs work in humans.

Intersectionality is an important part of the training data of this AI. Traditional datasets often underrepresent certain groups, which in this case would lead to medication not working for every population. It is already often the case that medicines work differently in males than in females [1]. By including data from diverse and intersectional groups, this AI system ensures medicines are tested and tailored for all groups. The people working on this system should also incorporate FAIR data principles to make collaboration and data sharing easier. This will allow developers, researchers, and healthcare professionals to work together to continuously improve the model. In turn, it also reduces corporate dominance. Another benefit of making the data more public is that transparency will potentially increase people's trust in AI models [26], as some people may be reluctant to rely on them. However, people's privacy should also be considered and taken into account [27].

This proposed AI system directly addresses the main critiques discussed earlier on current AI in healthcare. By replacing animal testing, it also eliminates the ethical concerns about animal testing and animal suffering, and it improves medicine accuracy. Incorporating intersectionality ensures medicines work for everyone, reducing inequalities. Promoting FAIR data principles allows for collaboration and transparency. This challenges corporate control and increases trust in AI.

Reflection on Speculative Interventions

Working on this project made me realize how much data gaps in healthcare affect people. I always knew that medicine is often designed for the "average" male, and how females are often excluded from the research. However, due to my privilege of being white, I hadn't really stopped to think about how in healthcare and medicine the data is not just biased in regards to peoples' sex. It is also biased towards certain populations. For example, the Human Genome Project generated the first sequence of the human genome [28]. This genome is often still used as the reference genome in bioinformatics research linked to studying diseases. It is predominantly based on European ancestry, which leads to an underrepresentation of other populations. This is a clear example of how healthcare related data is also biased towards certain demographics.

Additionally, I hadn't thought about how AI could make this data gap problem in healthcare even worse. If AI is trained on biased datasets, it can deepen existing inequalities. This showed me even more how important it is to address these gaps. All of this goes beyond "just" healthcare and is present in every single field AI is used in. I have always been aware of the fact that AI is trained on very biased data which can result in racist or discriminatory

outputs. This is a whole problem in itself and absolutely horrendous, but that it is also the case in AI for healthcare really frightens me.

Imagining an AI system that replaces animal testing and includes intersectionality taught me more than I initially expected. It made me think about who benefits from current AI systems and who gets left behind. Adding ideas like FAIR data sharing and diverse training datasets seem like simple solutions, but this project made me see how rare it is for these practices to actually be used in certain cases.

Speculative projects like this show that AI can improve what already exists. It can help rebuild systems to be fairer and more ethical. On the other hand, it showed me how easily AI can repeat the same mistakes as people if it isn't designed carefully. This made me realize how much AI needs critical considerations and monitoring to make sure it is safe and inclusive.

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