AI and Health Inequality Mapping

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Abstract

Health is like money in the crowded places of Dhaka, the hidden and untouched small ports of the Jamuna but it does not have the same value everywhere. A patient in Gulshan can meet a specialist within minutes and a woman living in a distant part of Sunamganj may suffer what public health scholars refer to as the distance of delay. In Bangladesh, healthcare disparity is not only about geography, but it is also about economics, digital, linguistic, and structural disparities.

Going deeper into 2026, the issue that policymakers will be faced with will not be the number of hospitals that we are constructing. Rather, it focuses on the level of smartness with which we utilize the information that we already have. Here, Artificial Intelligence (AI) and Machine Learning (ML) are not becoming a technological novelty, but are becoming a diagnostic reflection--they are becoming a reflection of the untold socioeconomic fractures inherent in our healthcare system.

Bangladesh has years of history of public health information, including datasets that represent the country, like the Bangladesh Demographic and Health Survey (BDHS). Conventionally, they were studied with classical statistical methods, which yield useful, but superficial, discoveries. Patterns that have never been visible before are being detected today by predictive analytics and sophisticated clustering methods. Training machine learning models on BDHS indicators maternal health utilization, immunization rates, sanitation access and nutritional status, researchers will be able to identify the patterns of disadvantage cutting across administrative lines. AI does not merely measure inequality, but it maps its anatomy.

Among the most interesting conclusions that can be drawn out of AI-driven analyses is what could be dubbed as the paradox of proximity. Geographic distance is one barrier to healthcare access that has been known long enough. The population is experiencing notable structural challenges to accessing formal medical care in rural Bangladesh with about two thirds of the population encountering these challenges. However, AI models prove that the physical proximity to hospitals does not necessarily mean quality care.

Researchers have found wealth to be the strongest predictor of high-quality maternal healthcare use with the help of Gradient Boosting Machines (GBM). Females in the wealthiest families have about twice the chances of obtaining comprehensive antenatal care than females in the lowest wealth tercile. The quality

difference is extreme even in metropolitan areas. High quality maternal services coverage is highest in divisions with Mymensingh and Dhaka, but greatly reduces in Rangpur and Sylhet. AI thus changes the topic of discussion: inequality is no longer about the lack of infrastructure but dissimilar access to quality in the common spaces.

In addition to supervised learning models which make prediction based on results, unsupervised learning methods, especially clustering algorithms, have offered a new perspective to the discovery of new hidden hotspots of neglect. Unlike the geographic adjacency grouping of districts, AI clusters districts based on the risk profile. A poor neighborhood in Chattogram might have more health vulnerabilities with a distant village in Barishal than with its own rich neighbor ward. The clusters include the multidimensional indicators: child stunting, maternal anemia, sanitation coverage, income distribution and educational attainment. The outcome is an administrative logic challenging map. Health inequality is impervious to district boundaries, it is socioeconomic in shape. This change is radical to policy makers. This is because instead of distributing the resources equally among districts, the interventions can be designed in clusters around shared risk to target more exclusively and evenly.

To make AI the most transformative potential, it should be developed into prescriptive decision-support as opposed to the descriptive analytics. The conceptualization of AI as a Decision-Support System (DSS) is becoming more and more dominant in the policy space of Bangladesh instead of a system that makes decisions independently. As an illustration, forecasting outbreaks of water-borne diseases and dengue fever with predictive surveillance models being trained with meteorological data, population density metrics and past cases trend are being incorporated. Having been reported to be found to be over 80 percent accurate, the systems facilitate health authorities to position medical supplies, allocate hospital bed space, and intensify the control of vectors before a surge. This form of anticipatory governance is a paradigm shift as compared to the reactive crisis management to a proactive planning of the public health.

Another prospective avenue is localized diagnostics. In the past, language has served as a digital health innovation barrier, with most medical AI systems having been trained against English-language data. The most recent attempts at narrowing this linguistic gap are incorporated in Bangla symptom-disease datasets. These models act as digital village doctors by allowing the community health workers to enter the symptoms in Bangla and be provided real-time triage instructions. Such tools may be used to further diagnostic service in underserved regions experiencing a shortage of specialist physicians with high reported classification accuracy. When used in a responsible manner, AI will be a multiplier of frontline capacity and not a replacement of human knowledge.

Nevertheless, the introduction of AI in health governance cannot be done with a sense of ethics. The philosophy of garbage in, garbage out is especially relevant in a situation where there is a structural inequity. AI will be as just as the data on which it was trained is. Health data collection in Bangladesh is

skewed and tends to favor those populations that have more access to digital media. Male population has a considerable greater probability of possessing smartphones and using internet as compared to females. This results in the fact that health information collected using mobile applications is biased towards men. When these distorted data are involved in predictive models, the algorithms created can end up undermining the health needs of women in an inherent manner.

It is a bigger issue than just gender. The most disadvantaged population groups, such as chars, hill tracts, and informal urban settlement residents, are not always visible in the official healthcare records. Patients who are unable to pay to go to hospitals are never shown in the hospital records. In case AI models are trained solely with institutional information, they may end up forgetting the very groups of individuals who will be targeted most by intervention. The consequences of this invisibility can be great. As an example, when a model is used to suggest the creation of new clinics that are based on the perceived demand, which is just an observed demand, based on the available usage of the services, it can focus efforts on already well-off neighborhoods where residents readily seek care. By so doing, inequality is not only ignored, it is actively checked by algorithm.

Skewed algorithms during the policy planning are not neutral- they automate inequality. In cases where predictive models are used in influencing budget funds, infrastructure development, or to deploy the workforce, inherent biases may evolve into systematic disadvantage. In this way, algorithmic accountability should be one of the key pillars of AI governance. The policymakers are to insist on regular auditing of training information, disclosure of model assumptions and impact analysis to determine whether AI recommendations favor some socioeconomic groups. Model assessment should include fairness measures to make sure that predictive efficiency does not conflict with equity.

The National Digital Health Strategy (2023-2028) of Bangladesh is a vision of a country named Smart Bangladesh where digital transformation is used to achieve inclusive development. To make AI implementation consistent with this vision, three pillars are needed. In the first place, specific datasets should be given priority. Bangla-first models, which are trained on local patterns of diseases, local sociocultural behaviors, and language contexts are essential towards contextual validity. Trained models imported on Western data are also likely to misclassify the symptoms or underestimate the frequency of region-specific disorders. Local data creation, which is combined with ethical data governance frameworks, is thus necessary.

Second, technological solutions should be able to consider infrastructural limitations. Large areas are connected to the internet rarely, and cloud-based AI systems are not feasible. Edge AI which models run offline on devices that can be carried with oneself is a possible alternative. Artificial intelligence-powered miniature ultrasounds and diagnostic kits that will be able to operate without constant connectivity will bring high-quality services to charters and hill tracts. The incorporation of intelligence into devices directly

eliminates the need to rely on the centralized digital infrastructure in healthcare delivery.

Third, there should be institutionalization of algorithmic accountability. The use of AI should be guided by transparency and explainability and be publicly controlled. This incorporates the formation of interdisciplinary review boards which will consist of technologists, experts in the field of the public health, ethicists and community representatives. These mechanisms make sure technological innovation does not go outside the track of human values and social justice goals.

After all, AI cannot be a silver bullet that would be able to offset poor infrastructure, staffing deficits, or systemic poverty. It is not able to replace political will and fair funding. But it also provides the most powerful thing of all, clarity. AI can enable policymakers to stop relying on assumptions and anecdotal data in place of disability, by charting inequality with a granular degree. It shows the distribution of maternal mortality risk, gaps in immunization, and where the disease outbreak is prone to occur. It converts fractured data to make understandable plots of vulnerability and strength.

In Bangladesh where resources are limited and it requires a strategic allocation, this emphasis is priceless. Instead of allocating scarce funds evenly or reacting to noticeable crises, the decision-makers are able to focus interventions, where they are most required as well as most likely to be effective. AI therefore is not a goal, but a means of equity- a critical guide to the path of inclusivity in public health.

The real test of the success of AI will not be its predictive accuracy, but its role in ensuring difference between Gulshan and the chars, between those who can get care easily and those who have to run the distance of delay. When used in a responsible way, where it is used with care, without falling into prejudice and adhering to justice, AI has the potential to reveal the hidden outlines of inequality and shape the policies that will cross them.

Now that Bangladesh is on the path to its digital future, it is not a question of whether we will apply AI in healthcare, but how. Will algorithms duplicate the hierarchies that exist or would they be capable of breaking structural barriers? The solution is in our decision on governing, our moral devotion and our readiness to make equity at the center of technological creativity. Artificial intelligence can not construct hospitals, but it could indicate to us where to put them most. When we accept it as an accuracy lens and not a panacea we are making the right move towards the healthcare system in which geography, wealth, and gender cease to be determining factors in the value of life..