

Rewriting the Code of Care: Ethics and Bias in AI-Powered Personalized Medicine

The rise of Artificial Intelligence (AI) in personalized medicine represents a shift from reactive to precision healthcare, where decisions are guided by each patient's unique genomic blueprint. At the core of many of these breakthroughs is the Cancer Genomic Atlas (TCGA) - a vast repository of tumor genomics that serves as a training ground for AI models seeking to match individuals with targeted therapies. However, while these technologies promise equity and efficiency, they also carry the risk of repe...

A major concern lies in the demographic imbalance of datasets like TCGA. The majority of genomic samples originate from individuals of European descent, while other racial and ethnic groups - particularly Black, Indigenous, and Asian populations - remain statistically underrepresented. This disparity is not simply a numerical oversight; it creates blind spots in the algorithms, leading to recommendations that are less accurate or even harmful for those outside the data majority.

Beyond race, biases can also arise from uneven inclusion across gender identities, socio-economic backgrounds, and geographic regions. For instance, cancer types prevalent in low-income populations may be insufficiently studied, resulting in AI models that perform worse for patients who already face access barriers.

To course-correct, fairness must be engineered into the pipeline - from data collection to deployment. One foundational strategy is the intentional curation of diverse training datasets, including global genomic contributions and community-based biobanks. But data alone is not the solution. AI systems must also undergo algorithmic audits, applying fairness-aware machine learning techniques such as equalized odds, group reweighting, and intersectional subgroup testing.

Furthermore, AI in medicine should not be treated as a black box. There must be transparency in how recommendations are generated, especially when life-altering treatment options are at stake. This includes explainable AI (XAI) models that clinicians and patients can interrogate - a step toward restoring agency in an increasingly automated decision loop.

Ethical AI in personalized medicine is not just about avoiding bias - it's about rebuilding trust in the healthcare

Rewriting the Code of Care: Ethics and Bias in AI-Powered Personalized Medicine

system. As we train machines to interpret genomes, we must also train them to respect the full spectrum of human diversity. Only then can precision medicine truly be personal.