## Ethical Challenges in Personalized Medicine

The Cancer Genomic Atlas (TCGA) powers AI-driven personalized medicine but raises ethical concerns. **Ethnic Underrepresentation**: TCGA includes <20% non-Caucasian patients, risking biased predictions for diverse groups like African or Asian populations. For example, genetic markers for breast cancer may differ across ethnicities, leading to misdiagnoses. **Socioeconomic Bias**: AI models may prioritize expensive treatments, excluding low-income patients who lack access to advanced therapies. **Data Quality Issues**: Incomplete data (e.g., missing lifestyle factors like diet or stress) can reduce model accuracy, affecting treatment efficacy.

**Mitigation Strategies**: - **Diverse Datasets**: Incorporate global genomic data (e.g., 1000 Genomes Project) to improve representation. - **Bias Auditing**: Apply fairness metrics like demographic parity to detect and correct biases. - **Explainability**: Use tools like SHAP to make AI predictions transparent to clinicians and patients. - **Policy Frameworks**: Enforce regulations for transparent dataset reporting and equitable access to AI-driven treatments.

Implementing these strategies ensures fair, accurate, and accessible personalized medicine, fostering trust and equity in healthcare. (Word count: ~150; expand to 300 in final draft.)