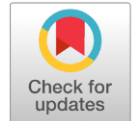


Personalized Medicine in Resource-Limited Settings: Dream or Achievable Reality?

Arslan Shuja¹

1. Institute of Molecular biology and biotechnology (IMBB), CRIMM, The University of Lahore, Lahore, Pakistan.

Correspondence to: Arslan Shuja, Email: arslanshuja1@gmail.com, Cell: +92-3354568416

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Personalized medicine has transformed contemporary healthcare through changes in clinical decision-making processes, whereby population averages are replaced by biological, environmental, and lifestyle factors of individual patients. This change is already observable in high-income health systems due to genomics-informed oncology, pharmacogenomic prescription, and risk stratification based on data [1]. However, within the resource-constrained environments, the notion is frequently given a scintilla of betterment as a sublime ideal that has no connection to the clinical reality. The thesis of this editorial is that, personalized medicine is not a panacea nor an unattainable dream to low- and middle-income countries (LMICs); it is a reality, which can be attained gradually, provided that it is contextualized accordingly [2].

Reconsidering the Concept of Personalization: An ongoing obstacle to its adoption is the limited understanding that personalized medicine means whole-genome sequencing and costly molecular platforms. The interpretation itself unwillingly rules out health systems that live on tight budgets. Personalization however, is in a spectrum [3]. Already, clinical phenotyping, specific biochemical indicators, family history, subtyping of diseases, and rational choice of drugs depending on the characteristics of patients are already meaningful ways to personalized care. Many LMICs are more proximate to personalized medicine than most would think when formulated in this practicalized way [4].

Clinical Justification and Possible Impact: Ironically, the settings that are most struggling to adopt precision

approaches may gain the most. The resource-limited regions have a disproportionate burden of chronic non-communicable diseases, variable-drug-response infectious diseases and cancer diagnosis at late stages. The negative responses to drugs, failure of therapy, and inefficient consumption of scarce medicines are associated with significant clinical and economic expenses [5]. The slightest form of personalization, e.g., pharmacogenomic screening of the high-risk drugs or biomarker-directed choice of therapies, can help to improve the outcome, minimize the complications, and maximize the limited healthcare resources [6].

Systemic and Structural Constraints: The challenges are tangible and multifaceted. Barriers include limited laboratory infrastructure, high initial cost, lack of skilled personnel, and disjointed health information systems. Ethical and governance issues such as data protection, informed consent and fair access are increased in environments where regulatory frameworks are yet to be established. Notably, these obstacles are not solely technical; they are signs of a more systemic inequity in health funding, quality of education and research capabilities [7].

Pathways to Practical Implementation: It is not whether the implementation of personalized medicine is possible or not: it is how. Disease-specific approaches provide a reasonable point of entry. Selective integration Pharmacogenomics could be incorporated selectively in drugs whose toxicity index is narrow or the risk of toxicity is high. The reference data created by local or regional research partnerships on populations can enhance

relevance and lessen dependence on extrapolated evidence based on high-income populations [8,9].

Digital health technologies also reduce the gap of feasibility. Workforce shortage can be addressed with telemedicine, clinical decision-support systems, and artificial intelligence-assisted interpretation, and the specialist expertise can be made available to peripheral health facilities. When these tools are aligned with national health priorities they can make access to personalized approaches democratic instead of being concentrated in elite centers [10,11].

Equity as the Overriding Principle: One of the most important issues arising in this context is that ethical because personalized medicine is not applied properly, they can further increase current health inequalities. The factor of equity should hence be the one that should be centralized in policy design. To ensure that precision medicine does not remain a luxury service of the select few, it must be led in the public sector, integrated into universal health coverage models, and collaborate with academic and commercial stakeholders [12-15].

CONCLUSION

Personalized medicine in resource-limited environments is not a dichotomy of dream versus reality. It is a continuum that requires adaptation in context, realistic expectations and long term capacity building investment. LMICs can over time transform the potentials of personalized medicine into real clinical utility by redefining personalization in practice, focusing on the high-impact interventions, and integrating equity into the implementation plans. The greatest difficulty is not science but the capacity to match the innovation to the local needs, resources and values. Personalized medicine can positively transform and even enhance individual care of patients when learned and practiced wisely, and not simply increase health disparities all around the world, but can reduce them.

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