



Short Communication

Copyright© Samir Aloulou

Personalizing Medicine in Oncology in Developing Countries: Barriers and Challenges

Samir Aloulou^{1,2*}, Najet Mahjoub³, Sourour Fallah¹, Hadil Chaari¹, Asma Yaich¹ and Amine Hamdaoui¹

¹Department of Medical Oncology, Gabes Hospital, University of Sfax, Tunisia

²Tunisian Society of Medical Oncology, Tunisia

³Department of Medical Oncology, Jendouba Hospital, University of Tunis El Manar, Tunisia

*Corresponding author: Samir Aloulou, Department of Medical Oncology, Gabes Hospital. 6029 Ibn Khaldoun Street Gabes. University of Sfax, Tunisia.

To Cite This Article: Samir Aloulou*, Najet Mahjoub, Sourour Fallah, Hadil Chaari, Asma Yaich and Amine Hamdaoui. Personalizing Medicine in Oncology in Developing Countries: Barriers and Challenges. Am J Biomed Sci & Res. 2024 23(1) AJBSR.MS.ID.003035, DOI: [10.34297/AJBSR.2024.23.003035](https://doi.org/10.34297/AJBSR.2024.23.003035)

Received: 📅 June 19, 2024; Published: 📅 June 24, 2024

Abstract

Cancer is a leading cause of morbidity and mortality in Low-and Middle-Income Countries (LMICs). Compared to high-income countries LMICs had significantly higher total cancer-related mortality rates, which continue to rise as the rates in high income countries remain stable or decrease. Personalized medicine in oncology is a revolutionary form of medicine that uses individual's genetic, environmental and omic information in the diagnosis treatment and prevention of cancer. In this paper, we will summarize the relevant barriers and challenges in order to implement personalized medicine in LMICs successfully.

Keywords: Oncology, Cancer treatment, Personalized medicine, Low-to middle-income countries, Omics, Barriers, Challenges

Introduction

Cancer is a worldwide health problem that needs considerable resources for screening, diagnosis, multi-modality treatment and prevention. Last decades, cancer has become a leading cause of morbidity and mortality in Low- and Middle-Income Countries (LMICs). Recently, management of cancer has benefited from the new paradigm of personalized medicine. Unequal access to cancer care between high income countries and (LMICs) remains a real problem.

The aim of this short communication is to summarize the relevant barriers and challenges in order to implement personalized medicine in LMICs successfully.

Short Communication

Cancer is the second leading cause of death worldwide with about 70% of deaths from cancer occurring in LMICs. In 2020, there

were almost 18.1 million new cancer cases around the world. Early diagnosis, cancer prevention, management and treatment have improved over the last two decades in high-income countries with decreasing mortality and improved survival rates. However, the situation is worse in LMICs. With the rising population and exposure to risk factors, the number of new cancer incident cases has been increasing significantly in LMICs in recent years. The survival rate of different cancers is lower in LMICs as they lack early detection programs, cancer prevention strategies, cost-effective treatment, oncologic infrastructure and access to innovation [1,2].

The most prevalent cancers in LMICs are associated with infections from viruses such as the hepatitis B virus (liver cancer), Epstein Barr virus (nasopharyngeal carcinoma) and human papillomavirus (cancer of the cervix). Lifestyle changes with regard to diet and physical exercise are rapidly occurring in most devel-



oping countries as these countries develop and move towards urbanization and modernization. In addition, tobacco use is heavily increasing in these countries where protective legislation is weaker or inexistent. More than 75% of cancer patients in developing countries are locally advanced or metastatic cancers at the time of initial diagnosis [3].

In the past three decades, the discipline of oncology in high-income countries has evolved from hematoxylin and eosin (H&E) stains to advanced diagnostic platforms. These basic science-driven advances have led to the advent of the new concept of personalized medicine. Personalized medicine is a revolutionary form of medicine that uses an individual's genetic, proteomic, and environmental information in the prevention, diagnosis, monitoring and treatment of diseases [1,4].

Precision medicine was described as "providing the right treatment at the right time to the right person and taking into account patients' health history, genes, environments, and lifestyles. "The recent completion of the Human Genome Project, along with technological advances for characterizing patients using "omics" including genomics, proteomics, metabolomics, and transcriptomics provides a unique and exciting opportunity for personalized medicine to play an important role in clinical decision-making. In the era of personalized medicine remarkable biotechnological advances are transforming cancer care. Tumor and cell-free DNA profiling using Next-Generation Sequencing (NGS), as well as proteomic and RNA analysis, and a better understanding of immune mechanisms are optimizing cancer treatment management. Recently, the precision medicine paradigm has embraced immunotherapy and its interaction with genomics, as genomic characteristics, such as mismatch repair gene defects, are critical predictors of checkpoint blockade response [5,6].

As precision medicine in oncology expands to include big data, proteomics, genomics, metabolomics, transcriptomics, molecular imaging, artificial intelligence and more, there are serious challenges ahead to translate that ideal into meaningful and equitable health care for patients. Issues surrounding elevated costs, adequate clinical trial design and data, defining meaningful benefits to patients, accessibility to innovation and equity remain to be solved [7].

The accessibility of cancer treatment procedures and medicines is quite low in LMICs due to the high costs, low income, deficient health insurance regimen and low public health spending. On the African continent, LMICs are suffering from lack of basic infrastructure, rurality, conflicts, and political instability. These facts mean that many Africans have no access to cancer screening, early diagnosis, treatment, or palliative care. The incidence of cancer is increasing, but it remains a low public-health priority compared to other health issues such as tuberculosis, malaria and AIDS, [2,8,9].

Major barriers to personalizing medicine in oncology in LMICs are summarized below [1,9]:

a) Lack of relevant cancer data: Most cancer registries in LMICs do not function and screening programs are largely inexistent.

b) Lack of Health Financing: Limited resources make it difficult to purchase the costly high technology driven modern day equipment that are needed for implementing personalized medicine in oncology in LMICs.

c) Lack of Advanced Genetic Testing Facilities: The limitation to access to genetic testing may include problems of few genetic specialists, limited primary care genetics knowledge and unequal testing access.

d) Lack of Needed Expertise: Many physicians may struggle to accurately interpret test results without specialist's assistance. A major cause is significant "brain drain" in the health care systems of LMICs among its health care professionals and knowledge, as health workers migrate to wealthier countries.

e) Clinical trials/ Precision Medicine Barriers in drug development: Barriers to conducting clinical trials in developing countries were identified as lack of financial and

f) human capacity, ethical and regulatory system obstacles, lack of research environment.

g) Lack of Adequate Health Insurance Coverage: High cost of innovant anticancer therapies and molecular and genomic tests associated to lack of an effective insurance system and a proper health policy impact negatively access to personalized medicine in LMICs.

h) The Physicians Resistance and Patients Unawareness: In most LMICs physicians may not be aware of the new guidelines approved for the cancer care and some of those that know may find it difficult to adopt it immediately. Providing timely information to patients to fully inform them about their treatment and biomarker screening options will allow them to appreciate the value of personalized treatment options.

i) Lack of Immediate Availability of Novel Drugs in LMICs: Access to new cancer medicines is an essential part of the healthcare. LMICs will not likely have immediate access to new drugs until many years after the initial approval. For example, drugs like pembrolizumab, atezolizumab and pertuzumab that were approved between 2016 and 2017 are still not readily available in LMICs.

The transition from a traditional one-size-fits-all approach to healthcare to precision medicine comes with a lot of challenges. There are massive heterogeneous data including genetic, medical history, lifestyle, environmental information, the data science and computational challenges they represent. However, the successful integration of precision medicine into the global healthcare system also presents several conceptual, developmental, social and ethical challenges.

These are some challenges to implementing precision medicine in oncology in LMICs successfully:

a) To improve the quality of cancer registration data into national and departmental cancer registries.

b) To increase funding dedicated to healthcare specially to cancer care.

- c) To improve health insurance system and generalize social coverage for the entire population.
- d) To expand access to genetic counselling and genetic testing
- e) To address the lack of needed expertise, the knowledge gap among available health care professionals can be bridged by introducing, updating and training them regarding precision medicine. Incorporating the basics of precision medicine in medical student's curriculum
- f) To conduct clinical trials in the field of precision medicine in LMICs and promote the development of new drugs.
- g) To train healthcare professionals in the field of precision medicine and familiarize them with molecular and genomic tests and concepts.
- h) To initiate the holding of molecular multidisciplinary consultation meeting.
- i) To ensure the immediate availability of personalized tests and therapies.
- j) To define specific legislation for ethical and social aspects related to genomic testing

Conclusion

Personalized medicine is now the recommended standard of care in medical oncology. It demonstrates improvement in efficacy, safety, overall survival and quality of life of patients compared to conventional therapies. There are still many barriers to implement successfully precision medicine in LMICs. The implementation of personalized medicine in LMICs would require the capacity building of a diverse array of skilled personnel. These include re-

searchers, doctors, clinical geneticists, genetic counselors, nurses, pharmacists, technicians, biostatisticians, bioinformaticians, data scientists, and data security personnel. Collaborative and synergistic efforts are highly needed.

Acknowledgement

None.

Conflict of Interest

None.

References

1. Adeniji AA, Dulal S, Martin MG (2021) Personalized medicine in oncology in the developing world: Barriers and concepts to improve Status Quo. *World J Oncol* 12 (2-3): 50-60.
2. Huang J, Ssentongo P, Sharma R (2023) Editorial: Cancer burden, prevention and treatment in developing countries. *Front Public Health* 10: 1124473.
3. Reeler AV, Mellstedt H (2006) Cancer in developing countries: Challenges and solutions. *Ann Oncol* 17 Suppl 8: viii7-viii8.
4. Owolabi P, Adam Y, Adebisi E (2023) Personalizing medicine in Africa: current state, progress and challenges. *Front Genet* 14: 1233338.
5. Akhoun N (2021) Precision Medicine: A new paradigm in therapeutics. *Int J Prev Med* 12: 12.
6. Tsimberidou AM, Fountzilas E, Nikanjam M, Kurzrock R (2020) Review of precision cancer medicine; Evolution of the treatment paradigm. *Cancer Treat Rev* 86: 102019.
7. The Lancet (2021) Editorial: 20 years of precision medicine in oncology. *Lancet* 397 (10287): 1781.
8. (2011) Editorial: Cancer in developing countries: can the revolution begin?. *Lancet Oncol* 12 (3): 201.
9. Lajmi N, Alves Vasconcelos S, Tsiachristas A, Haworth A, Woods K, et al (2024) Challenges and solutions to system-wide use of precision oncology as the standard of care paradigm. *Camb Prism Precis Med* 2: e4.