Opportunities, Barriers, and Strategies for Pharmacogenomics Implementation in Mauritius

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Abstract

Pharmacogenomics (PGx) applies genetic insights to optimize drug therapy, offering a powerful tool to enhance medication safety and efficacy. Mauritius's multiethnic population—comprising African, Indian, Chinese, and European ancestries—presents significant interindividual variability in drug response, underscoring the need for PGx integration. This paper explores current opportunities, barriers, and strategies for PGx implementation in Mauritius. Although PGx could improve management of conditions such as diabetes and reduce adverse drug reactions, progress is hindered by limited infrastructure, insufficient professional education, underrepresentation in global genomic databases, and sociocultural and ethical concerns. Lessons from comparable African settings highlight knowledge gaps, technological constraints, and economic limitations as key obstacles. To address these challenges, the manuscript proposes a phased clinical integration beginning with high-risk patients, investment in molecular diagnostic capacity, incorporation of PGx training into healthcare curricula, and the development of robust policy and ethical frameworks. Establishing a national PGx biobank and registry, leveraging existing pharmacovigilance systems, and fostering international research partnerships are also recommended. Proactive engagement of pharmacists—through patient counseling, adverse drug

reaction monitoring, and clinical decision support—emerges as critical to advancing precision medicine. Strategic investment in these areas can enable Mauritius to harness the full potential of PGx, ensuring safer and more effective individualized healthcare.

Keywords: Mauritius, Pharmacogenomics, Knowledge, Drug response

Introduction

Pharmacogenomics (PGx)—the intersection of pharmaceuticals and genetics—examines how genetic variation influences individual drug responses and plays a pivotal role in personalized medicine. By enabling tailored drug therapy based on genetic profiles, PGx enhances both the safety and effectiveness of treatment [1]. However, Mauritius currently faces significant limitations in this area, including the absence of genetic testing facilities, limited access to genomic data, and inadequate clinical integration, all of which hinder the country's ability to realize the full potential of PGx. PGx is especially valuable for managing adverse drug reactions (ADRs), many of which stem from genetic mutations. Identifying gene–drug interactions can help prevent harmful events and optimize therapy by accounting for individual pharmacokinetic and pharmacodynamic differences [2]. Despite these benefits, PGx adoption in Mauritius is constrained by a lack of regulatory guidance, limited scientific infrastructure, insufficient research capacity, and gaps in professional education and public awareness. Addressing these barriers will require targeted solutions such as enhanced education and training, investment in infrastructure and research, the development of clear policies and guidelines, and broader international collaboration and advocacy. Pharmacists, as key members of the healthcare team, have a professional responsibility to champion PGx, raise awareness, and collaborate with other healthcare professionals to introduce this innovation into clinical practice across Mauritius [3].

Current Situation of PGx Implementation in Mauritius

Due to limited published data on adverse drug reactions (ADRs) and inadequate information resources, Mauritius must often look to comparable countries for insights on implementing pharmacogenomics (PGx) [4]. In many low- and middle-income countries, there is generally a positive attitude among primary healthcare professionals toward ADR reporting. However, actual

reporting remains poor, mirroring gaps observed in India, Pakistan, and South Africa [5]. Studies indicate that under-reporting is primarily due to lack of knowledge about how, where, and when to report, with only a small proportion of healthcare providers ever having submitted an ADR report. This highlights an urgent need for stronger pharmacovigilance education and training. These knowledge gaps create an important opportunity for pharmacists, who are often the most accessible medication experts. Pharmacists can lead targeted educational programs, support healthcare teams, and champion improved ADR detection while integrating PGx information into patient care. All healthcare professionals should be encouraged to report suspected ADRs regardless of severity, and integrating pharmacovigilance into healthcare curricula—supported by tools such as mobile reporting apps—can help increase reporting rates.

Many healthcare providers remain unaware of existing ADR reporting systems, a situation likely to be similar in Mauritius. Although most professionals acknowledge their obligation to report ADRs, many only do so when reactions are severe or involve new or unusual drugs. Misconceptions persist that a single unreported case will not affect safety databases, and concerns about confidentiality, lack of interest, and limited knowledge further discourage reporting. Addressing these attitudes and knowledge gaps is critical to improving pharmacovigilance. Another challenge is the widespread use of herbal and traditional remedies, particularly among older adults with diabetes. Many patients believe such remedies are free of side effects, yet when combined with prescribed treatments they can produce complex or hidden ADRs [6]. Educating healthcare providers and the public about the potential risks of herbal medicine and the importance of reporting related ADRs is essential. Mauritius could also benefit from mobile technologies or apps for ADR reporting, following examples from South Africa where electronic platforms have successfully streamlined data collection. Empowering pharmacists with digital tools would make ADR documentation easier and reinforce their role as frontline guardians of medication safety. Other African nations offer encouraging examples for PGx integration. South Africa has pioneered PGx-guided dosing in HIV treatment, showing reduced side effects and better adherence. Mozambique has applied PGx research to improve HIV therapy, while the continent-wide H3Africa initiative has advanced biorepositories and genomics research capacity [7]. These developments demonstrate the feasibility of PGx in resource-limited settings and provide valuable lessons for Mauritius. To further strengthen pharmacovigilance, Mauritius should develop specific

laws and policies that extend beyond current clinical trial and reporting guidelines. Clear definitions of ADR reporting requirements, alignment with international safety-reporting standards, and robust risk-management measures will be essential to support timely detection and response to emerging drug safety concerns [8].

Barriers to Pharmacogenomics (PGx) Implementation in Africa and Comparable Settings

Pharmacogenomics (PGx) offers significant potential to improve drug efficacy and reduce adverse drug reactions (ADRs) by tailoring therapy to individual genetic profiles. Despite this promise, the integration of PGx into clinical practice remains challenging across Africa and in low-resource countries with similar socioeconomic contexts, including Mauritius. Barriers include limited education among healthcare professionals and the public, inadequate infrastructure, sociocultural resistance, financial constraints, and ethical concerns. Because data on PGx in Mauritius are scarce, lessons are drawn from other African and comparable nations to illustrate the obstacles likely to be encountered.

Knowledge and Educational Gaps

A major barrier to PGx adoption is the lack of formal education and awareness among healthcare professionals. PGx content is often absent from undergraduate and postgraduate curricula, leaving physicians, pharmacists, nurses, and laboratory staff unprepared to integrate genetic information into routine care. Limited access to learning resources, low retention of prior knowledge, and lack of confidence in applying PGx further compound the problem. Community pharmacists, despite their frontline role in medication management, frequently possess insufficient knowledge and may hold ambivalent attitudes toward genetic testing, undermining public acceptance. Patients also contribute to the challenge: many are unsure which healthcare professional should provide genetic testing information, and misconceptions about the pharmacist's clinical role persist. In Mauritius, as elsewhere, pharmacists are sometimes perceived primarily as dispensers or business owners, reducing patient engagement in services such as ADR reporting and genetic counseling [9].

Infrastructural and Technological Constraints

Implementation of PGx requires advanced genomic laboratories, high-throughput sequencing platforms, secure biobanking, and robust computing capacity for data analysis—resources that remain scarce across Africa and in Mauritius. The absence of local manufacturing of testing kits drives up costs, while limited funding and restricted access to international genetic databases further impede progress. These shortcomings leave ADR monitoring reactive rather than predictive: without genetic confirmation of drug–gene interactions, therapy adjustments often rely on trial and error rather than evidence-based guidance [10].

Cultural, Social, and Ethical Challenges

Mauritius's multiethnic society brings diverse cultural norms that can influence public acceptance of genetic testing. In many African contexts, illness may be attributed to fate or spiritual causes, discouraging interest in genetic screening, especially when results could affect marriage prospects or social standing. Similar sensitivities are likely to exist in Mauritius. Ethical issues also present formidable obstacles. Informed consent procedures are often insufficient for the complexities of genomic research, and many patients who provide blood or tissue samples for diagnostic purposes have not consented to their use in genetic studies. Concerns about privacy, data ownership, and potential discrimination in employment or insurance deter participation and complicate the development of clear legal frameworks. Ongoing debates over the ownership and commercialization of genetic information add further uncertainty and may limit innovation [11].

Economic and Health-System Limitations

The high cost of genotyping and sequencing technologies places PGx out of reach for most patients and health systems in low- and middle-income countries. Mauritius, like many African nations, faces competing health priorities and limited resources, leaving little funding for genomics. Even in more developed settings, many healthcare providers report inadequate understanding of genomics, a problem amplified in resource-limited environments [12]. These factors force reliance on empirical prescribing, prolonging the time to find effective treatments and increasing the risk of ADRs. Underfunded pharmacovigilance systems also weaken national ADR databases, making it harder to identify gene-related drug toxicity patterns [13].

Genetic Diversity and Underrepresentation in Global Databases

Africa is home to the most genetically diverse populations in the world, yet African and multiethnic cohorts remain underrepresented in global genomic databases, which are dominated by individuals of European ancestry. For Mauritius—a population of African, Indian, Asian, and European heritage—this underrepresentation limits the accuracy of PGx tools and risk prediction models. Rare or population-specific variants may go undetected, leading to misinterpretation of genetic data and reduced clinical benefit. Limited capacity to generate, store, and analyze large-scale genomic data further restricts the development of population-specific reference genomes, while policy and technological barriers hinder data sharing and access to international resources.

The barriers to PGx implementation in Mauritius reflect a complex interplay of educational deficits, infrastructural and economic constraints, cultural sensitivities, and gaps in global genomic representation. Overcoming these challenges will require sustained investment in education and training, development of local genomic infrastructure, robust ethical and legal frameworks, and active participation in international data-sharing initiatives. Addressing these issues is critical for Mauritius to harness the full potential of pharmacogenomics and move toward precision medicine.

Discussion/Implementation Strategies for Pharmacogenomics (PGx) in Mauritius

Clinical Integration

A phased clinical integration can begin with high-risk patients in tertiary hospitals such as Dr. A.G. Jeetoo and Victoria Hospitals, which already manage large numbers of geriatric and diabetic patients [14]. Initial PGx panels could target commonly prescribed antidiabetic drugs. The development of clinical decision-support systems embedded within electronic health records would enable real-time application of PGx data. Pilot studies conducted in collaboration with private institutions like Wellkin Hospital could facilitate public–private knowledge exchange and provide valuable benchmarking. Adverse drug reaction (ADR) monitoring can be strengthened by adding genotype fields to ADR forms and linking these records to national pharmacovigilance databases to ensure structured, comprehensive reporting [19].

Capacity Building and Infrastructure

Developing PGx capacity in Mauritius will require investment in diagnostic infrastructure, training, and international collaboration. Establishing or upgrading molecular laboratories—such as those within the Central Health Laboratory—and linking them to biomedical research facilities would provide essential diagnostic capacity. PGx modules should be integrated into medical and pharmacy curricula, supported by continuing professional development workshops for clinicians, pharmacists, and nurses. Partnerships with regional genomics initiatives in South Africa or India could accelerate expertise through training exchanges and shared research projects. Mauritius's existing digital pharmacovigilance systems, strengthened during the COVID-19 response, can serve as a backbone for integrating genotype data, enriching ADR reports, and monitoring outcomes after PGx implementation. Expanding the roles of prescribers and pharmacists to include medication review, de-prescribing, and the use of internationally recognized guidance will enhance detection of CYP-related and PGx-associated risks in older adults. Clinical Pharmacogenetics Implementation Consortium (CPIC) resources can further support translation of genotypes into actionable dosing or therapy decisions at the point of care [16].

Policy and Ethical Considerations

Successful implementation requires a robust legal and ethical framework. Policies must ensure the secure, confidential use and storage of genetic data, particularly in relation to population-wide biobanking. Comprehensive patient consent procedures and education campaigns in English, French, Creole, and Hindi will promote transparency and foster public trust. Regulatory approval of PGx tests by the Ministry of Health and Wellness, alongside clear cost-sharing models, will support equitable access [17]. Incorporating PGx into national treatment guidelines for diabetes and geriatric care, coordinated by the Mauritius Institute of Health, will further embed PGx within routine clinical practice [18].

Research and Population Data

Local research is critical to identify prevalent genetic variants and develop prescribing guidelines tailored to Mauritius's multiethnic population. Establishing a national PGx biobank focused on diabetes and aging populations would provide a foundational resource [19]. Pilot association

studies on widely used drugs—such as metformin and sulfonylureas—could generate data to guide evidence-based dosing recommendations [20]. Creating a national PGx registry with standardized data collection, including patient case studies, will enable monitoring of implementation outcomes and measurement of ADR reduction across the Mauritian cohort [21].

Conclusion

Mauritius's genetically diverse population—spanning African, Indian, Chinese, and European ancestries—contributes to marked variability in drug response. Pharmacogenomics (PGx) offers a powerful means to optimize therapy by tailoring treatment to individual genetic profiles. Pharmacists, as frontline medication experts, are ideally positioned to drive PGx adoption through patient counseling, adverse drug reaction monitoring, and integration of genetic data into clinical decision-making. Their active involvement can enhance medication safety, prevent complications, and support personalized therapy for high-risk groups, particularly older adults with diabetes. Despite current challenges—including limited infrastructure, knowledge gaps, and underrepresentation in global genomic databases—strategic investment in pharmacist-led education, capacity building, and supportive policy frameworks can enable progressive implementation. Experiences from other African nations demonstrate that pilot studies, population-specific research, and systematic incorporation of PGx into routine care can improve therapeutic outcomes. Proactive pharmacist engagement is therefore essential to unlock the full potential of precision medicine, ensuring safer, more effective, and individualized healthcare for Mauritius's aging, multiethnic population.

Conflict of interest

The authors declare none.

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