PHARMACEUTICS

ACCESS TO PHARMACOGENETICS IN DIVERSE COMMUNITIES, BARRIERS AND FACILITATORS (MINI REVIEW)

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Abstract

Pharmacogenetics⁄Pharmacogenomics (PGx) is one of the most important aspects of personalised medicine, which aims to individualise drug therapy by using the knowledge of genetic polymorphism during drug prescription. Pharmaceutical companies are increasing their investment in research on precision medicine to improve the public health system by minimising fatal drug side effects. However, the accessibility of PGx to diverse communities is a point of concern. This review aims to highlight the barriers and facilitators to applying PGx knowledge in clinical practice. Although technological advancements in the field make it possible to achieve PGx, the application of these techniques requires not only selecting the right method for the right purpose, but also engaging knowledgeable specialists. The lack of trained staff to implement PGx in practice has been confirmed by numerous review studies. Hence, training healthcare teams, and consumer awareness of genomic testing and its benefits in improving the process of disease treatment is crucial. The expense of genomic testing limits its accessibility for patients, especially in low- and middle-income countries. Moreover, there is a lack of knowledge about genetic variation in the vast majority of the world's population. Specifying reliable strategies to advance PGx implementation by health care system authorities seems necessary.

Keywords: Pharmacogenetics, Pharmacogenomics, Genetic testing, Barriers, Facilitators, Knowledge, Attitude

Introduction

Pharmacogenetics⁄Pharmacogenomics (PGx) is one of the most important aspects of personalised medicine, which aims to individualise drug therapy by using the knowledge of genetic polymorphism during drug prescription. Variations in population genetics may lead to heterogeneity in drug responses among individuals, highlighting the importance of PGx in diagnostic accuracy, as well as, medication safety and efficacy [1, p. 1538]. As a matter of fact, Single-Nucleotide Polymorphisms (SNPs), known as the most common variation in human DNA, may occur in genes associated with the pharmacokinetics (PK) and pharmacodynamics (PD) of drugs, altering the level of gene expression or its activity, thereby affecting drug response [2, p. 2 of 14]. Adverse drug reactions (ADRs) are recognized as one of the leading causes of death and a significant source of costs for pharmaceutical industries [3, p. 1680; 4, p. 2 of 20]. Meanwhile, worldwide medication errors impose a high cost on governments [1, p. 1545]. Therefore, pharmaceutical companies are increasing their investment in research on precision medicine to improve the public health system by minimising fatal drug side effects [5, p. 15 of 28]. However, the accessibility of PGx to diverse communities is a point of concern. This review aims to highlight the barriers and facilitators to applying PGx knowledge in clinical practice, and helping propose solutions to these barriers, while emphasising the factors that support its use in health care context.

Review and Discussion

Technological advancement: Currently multiple genotyping technologies such as single nucleotide variant (SNV) panel testing and next generation sequencing (NGS), which includes whole exome sequencing (WES), whole genome sequencing (WGS), and tar-

geted sequencing are applying in clinical PGx, diagnostics and research [6, p. 2-6 of 16]. Although technological advancements in the field make it possible to achieve PGx, the application of these techniques requires not only selecting the right method for the right purpose, but also engaging knowledgeable specialists. Moreover, a suitable digital infrastructure is essential for data processing and interpretation, as well as for effective genomic preservation. Interestingly, this challenge is particularly significant not only in low- and middle-income countries (LMICs) but also in rural populations within high-income countries [7, p. 4865; 8, p. 2477].

Education: The lack of trained staff to implement PGx in practice has been confirmed by numerous review studies [8, p. 2477; 9, p. 18]. Training healthcare teams, including general practitioners, specialists, nurses, and pharmacists through various methods, appears essential for incorporating PGx knowledge into medical treatment. Integrating PGx as a new course in pharmacy and medical curricula, along with continuous educational conferences, training programs, and online courses, may help bridge the knowledge gap among healthcare providers and enable them to interpret genomic testing [10, p. 7 of 10]. Moreover, patients are one the main stakeholders involved in PGx implementation in clinic settings. Hence consumer awareness of genomic testing and its benefits in improving the process of disease treatment is crucial [9, p.03 of 23].

Financial issues: In spite of the high cost, countries around the world are focusing on implementing PGx. However, the high cost of genomic testing limits its accessibility, particularly for patients in LMICs [11, p. 97]. It is important to highlight that the aforementioned items, including access to PGx technology, genetic testing, analysing data, conducting research in this field, and training healthcare professionals, are associated with significant costs. This presents a considerable challenge for developing countries with fragile and underdeveloped economies [7, p. 4865]. Hence, the population is more likely to pursue PGx testing if the cost is covered by their insurance [12, p. 04 of 08]

Insurer involvement: Recently, insurance companies have become aware of the advantages of PGx testing and how it helps patients receive the right medicine and dosage. Some of them now offer a platform that allows patients to access PGx testing for approximately 70 percent of the most commonly prescribed drugs [13]. However, assessing private health insurance companies in the United States has revealed that their coverage of PGx testing was not sufficient [14]. Evidence of the effectiveness of utilising PGx testing drives public and private health insurance toward greater coverage and reimbursement of individualised treatment [9, p. 04 of 23].

Positive Attitude of healthcare staff and patients to adopt PGx: The attitudes and knowledge of healthcare providers and patients toward the implementation of PGx have been studied by several authors worldwide. For instance, Jia et al. [15, p. 18 of 23] have examined knowledge and attitude of physicians towards PGx testing in China. They found that, although the physicians showed poor knowledge of PGx testing, they had a positive attitude towards its use in routine medical practice.

A similar result was obtained when reviewing [16, P. 4-16] or evaluationg [17, P. 7 of 15] knowledge of and attitudes toward PGx among pharmacists and pharmacy students. Clearly, a positive attitude plays an important role in encouraging health care providers to improve their knowledge of PGx content and in recommending it to patients. Additionally, educating the population about the benefits of personalised medicine may enhance their attitude toward adopting PGx within the healthcare system. This issue is particularly acute in LMICs [7, p. 4871]. However, cultural or religious beliefs have been reported as significant barrier to adopting PGx in some regions [8, p. 2479].

Research and evidences: Although numerous studies have been conducted based on the genomes of large communities, the majority were carried out on European populations, limiting the ability to obtain validated and reliable data interpretations. This highlights the lack of knowledge about genetic variation in the vast majority of the world's population. Moreover, a lack of evidence about genetic variations of Black people in databases has been reported by AAMCNEWS [10,p. 7 of 10; 18]. Although guidelines such as those from the Dutch Pharmacogenetics Working Group (DPWG), the Clinical Pharmacogenetics Implementation Consortium (CPIC), and the Canadian Pharmacogenomics Network for Drug Safety (CPNDS) provide clinicians with recommendations for prescribing medicines based on genotypes and predicted phenotypes, the number of drugs included in their lists remains limited [19, p. 2 of 12]. Designing additional clinical trials will advance research on more biomarkers, leading to improvements in the guidelines [5, p. 13 of 28].

Conclusion

It is time to move from a one-size-fits-all approach in medicine to targeted therapy. The barriers to applying PGx in clinical settings in each community need to be identified. Specifying reliable strategies to advance PGx implementation by health care system authorities seems necessary. The incorporation and expansion of insurance coverage in this field may help patients select safer, more targeted treatments, potentially preventing death.

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