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Letter to Editor

Pharmacogenomics: The Dawn of Truly Personalized Medicine

Abdolhassan Kazemi[1], Sana Kazemi[2], Mehmet Tatli[3], Ehsan Sarbazi[4*]

[1]Medical Philosophy and History Research Center, Tabriz University of Medical Sciences, Tabriz, Iran
[2]Student Research Center, Uremia University of Medical sciences
[3]Emergency Medicine Department, Van Training and Research Hospital, Health Science University, Van, Turkey
[4]Road Traffic Injury Research Center, Tabriz University of Medical Sciences, Tabriz, Iran

***Corresponding Author:** Ehsan Sarbazi, Email: ehsansarbazi20@gmail.com

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Dear Editor,

Imagine a house where your medicine cabinet in your home does not hold a one-size-fits-all family member's painkiller, but a prescription uniquely calibrated to your own DNA. Even, not only a house but also a world where debilitating side effects are rare, and treatments work the first time. This is the promise of pharmacogenomics, which is a revolutionary field poised to transform how we prescribe and take medication.[1-4]

At its core, pharmacogenomics is the study of how our unique genetic makeup influences our body's response to drugs. The name itself is a blend of "pharmacology" (the study of drugs) and "genomics" (the study of genes and their functions). While we frequently focus on genetic diseases, our genes also hold the blueprints for the enzymes, transporters, and receptors that process every pill we swallow.[5-7]

The principle is elegantly simple yet profound: individual genetic variations can make a drug effective, ineffective, or even dangerously toxic for a particular person.[8]

Consider a common example: the blood thinner warfarin. For decades, doctors have prescribed it with extreme caution, starting with a low dose and requiring frequent blood tests to adjust it. This is because a patient's required dose can vary tenfold based on variations in two key genes (*CYP2C9* and *VKORC1*). One person's therapeutic dose can be another's life-threatening overdose. Pharmacogenomics testing now enables clinicians to predict a safer and more effective starting dose from the outset.[9-11]

The benefits of this genetic tailoring are immense. First and foremost is improved safety. Severe adverse drug reactions are a leading cause of hospitalizations. By screening for high-risk genetic markers, it is possible to avoid prescribing drugs like the antidepressant fluvoxamine or the chemotherapy 5-fluorouracil to patients whose genetics predict a high probability of severe side effects.[12-15]

Secondly, pharmacogenomics enhances efficacy and efficiency. The traditional "trial-and-error" approach to finding the right medication for depression or hypertension conditions can take months, leaving patients to suffer unnecessarily. A genetic test can help a psychiatrist determine whether a patient is a "poor metabolizer" of a common selective serotonin reuptake inhibitor antidepressant, guiding them toward a different, more likely-to-work option from the start. This saves time, reduces suffering, and lowers healthcare costs.[16-18]

Finally, it represents the ultimate shift toward personalized, or precision medicine. It moves us away from population-based averages and toward care designed for the individual sitting in front of the doctor.[18-19]

However, the field is not without challenges. Widespread adoption of pharmacogenomics, personalized, or precision medicine by societies, people, and health systems with different cultures, policies, goals, and programs requires overcoming hurdles (e.g., the cost and accessibility of genetic testing), ensuring clinician education, and integrating complex genetic data into everyday clinical workflows. Ethical considerations around genetic privacy and potential discrimination need careful management.[14]

Despite these challenges, the momentum is undeniable.

Major medical centers are increasingly implementing pharmacogenomics programs, especially in fields like diabetes, inflammatory bowel disease, oncology, psychiatry, and cardiology. As testing becomes faster and more affordable, and as the evidence base grows, what is now a specialized tool is destined to become a routine part of the prescription pad.[20-23]

Conclusion

Pharmacogenomics is more than a scientific advancement; it is a paradigm shift. More precisely, it acknowledges our biological individuality and leverages that knowledge to make medicine safer, smarter, and profoundly more personal. We are moving from guessing to knowing, and we are opening a new chapter in human health accordingly.

Ethics statement

Not applicable.

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Conflict of interests declaration

The author declares no competing interests concerning authorship and/or publication of this article.

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Data Availability Statement

The authors confirm that the data underpinning the results of this study can be found within the article.

Author contributions

Conceptualization: Abdolhassan Kazemi, Sana Kazemi
Data Curation: Abdolhassan Kazemi
Formal Analysis: Abdolhassan Kazemi, Sana Kazemi
Investigation: Abdolhassan Kazemi
Methodology: Abdolhassan Kazemi
Project Administration: Abdolhassan Kazemi
Resources: Abdolhassan Kazemi
Supervision: Abdolhassan Kazemi
Validation: Abdolhassan Kazemi
Visualization: Abdolhassan Kazemi
Writing–Original Draft: Abdolhassan Kazemi, Sana Kazemi
Writing–Review & Editing: Abdolhassan Kazemi, Sana Kazemi, Mehmet Tatli, Ehsan Sarbazi

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