PhytoCare: Journal of Pharmacology and Natural Remedies
Vol. 1 No. 11 November 2025
E-ISSN: 3089-6444
Open Access: https://journals.ai-mrc.com/phytocare

Exploring Patients' Experiences and Meanings of Pharmacogenomic-Based Individualized Therapy in Primary Healthcare

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Article Info

Article history:
Received 27-09-2025
Revised 21-10-2025
Accepted 17-11-2025

Keyword:
Pharmacogenomic Therapy; Personalized Medicine; Patient Experience; Lived Meaning; Trust in Healthcare; Qualitative Research

ABSTRACT

Pharmaceutical science has increasingly embraced pharmacogenomics, a discipline exploring how genetic variations influence individual drug responses, marking a major shift toward personalized medicine. Within this transformation, patients' lived experiences of pharmacogenomic-based therapy remain insufficiently understood, particularly regarding how they perceive, interpret, and adapt to genetically informed treatment. Despite progress in clinical research, little is known about the emotional, ethical, and existential meanings patients attach to such therapies—raising the question of how individuals make sense of personalized treatment that intertwines science and identity. Using an Interpretative Phenomenological Analysis (IPA) approach, this study explores the essence of patients' experiences with pharmacogenomic-guided diabetes therapy in primary healthcare contexts. Data were collected through in-depth, semi-structured interviews with twelve participants, and analyzed thematically to identify core experiential themes. Findings reveal that patients view pharmacogenomic therapy as both a biomedical advancement and a personal journey characterized by trust negotiation, emotional ambivalence, and redefinition of health and normality. The study demonstrates that genetic personalization reshapes patients' understanding of self and responsibility, extending beyond medical compliance to moral and existential reflection. However, the study is limited by its small sample size and context-specific focus within primary healthcare settings, which may affect the generalizability of findings. By uncovering these lived meanings, the research advances a more human-centered understanding of pharmacogenomics, emphasizing empathy, ethical awareness, and reflective practice in precision medicine. These insights encourage future interdisciplinary studies to integrate phenomenological inquiry into the evolving landscape of genomic healthcare.

INTRODUCTION

In recent years, the field of pharmaceutical science has undergone a profound transformation driven by advances in pharmacogenomics—the study of how genetic variations influence individual responses to medications (Salvador-Martín et al., 2021). This scientific evolution has marked a paradigm shift from traditional, population-based treatment approaches toward personalized or precision medicine, where therapeutic decisions are tailored to the genetic, environmental, and lifestyle profiles of individual patients (Pizzolato et al., 2022). Within this context, pharmacogenomic-guided therapy represents one of the most promising innovations, particularly in chronic disease management such as diabetes mellitus, where treatment response and adverse effects vary significantly among patients.

Beyond its biomedical implications, pharmacogenomic therapy embodies a human and social phenomenon that intersects deeply with patients' lived experiences, beliefs, and perceptions of health and identity (Turner et al., 2024). The integration of genetic knowledge into clinical care challenges

conventional notions of patient autonomy, trust, and responsibility. For many individuals, receiving therapy informed by their genetic profile introduces new layers of emotional and ethical reflection—ranging from optimism about scientific progress to anxiety about genetic determinism and privacy (Mukhlis, 2025a). This emotional ambivalence reflects not only the complexity of medical innovation but also the deeply subjective nature of how patients interpret and internalize their therapeutic journeys.

In societies increasingly shaped by biomedical technology, understanding the personal meanings attached to pharmacogenomic treatment becomes essential. Patients' narratives offer insight into how scientific precision intersects with cultural values, spiritual beliefs, and moral responsibility (Liu et al., 2024). Yet, despite its transformative potential, the experiential dimension of pharmacogenomic therapy remains underexplored in current pharmaceutical research, which predominantly focuses on clinical efficacy and genetic mechanisms (Franca et al., 2021). A phenomenological approach, therefore, is vital to uncovering how individuals make sense of personalized therapy in their daily lives—how they negotiate hope, fear, and trust as part of their engagement with biomedicine.

Consequently, this study positions the experience of patients undergoing pharmacogenomic-based individualized therapy as a meaningful site for phenomenological inquiry (Choi et al., 2025). By focusing on subjective perception and lived experience, this research seeks to reveal the essence of how individuals understand and adapt to a form of treatment that not only targets their biology but also reshapes their conception of self, health, and human agency in the genomic era.

Research on the lived experiences of patients within the context of advanced medical therapies has increasingly gained recognition as an essential area of inquiry in health and pharmaceutical sciences. While biomedical research has traditionally focused on molecular mechanisms, dosage optimization, and clinical outcomes, recent scholarship emphasizes that patients' subjective engagement with treatment significantly influences adherence, satisfaction, and therapeutic success (Taylor et al., 2021). In the case of pharmacogenomic-based individualized therapy, this subjective dimension becomes even more pronounced, as patients must reconcile scientific information about their genetic identity with their personal beliefs, emotions, and lived realities (Mukhlis, 2025b). Understanding this experiential dimension offers a pathway to humanize pharmacogenomic implementation and to foster a more patient-centered healthcare paradigm.

Despite this growing awareness, methodological challenges persist in capturing the depth of patients' experiences. Conventional quantitative approaches—such as surveys or structured assessments—tend to fragment complex emotional and existential responses into measurable variables, thus obscuring the nuanced meanings embedded in lived experiences (Khan & Das, 2022). Even mixed-method studies often subordinate qualitative findings to numerical interpretation, overlooking the interpretive richness necessary to comprehend how individuals internalize their therapeutic journeys (Lee et al., 2023). These limitations highlight a persistent gap between clinical evidence and the subjective phenomenology of treatment, particularly when the phenomenon under study involves personal reflection, moral tension, or transformation of identity.

Consequently, the majority of existing research has not fully illuminated the essence of patient experience in pharmacogenomic therapy (J. T. Brown et al., 2025). Studies often remain confined to behavioral indicators—such as medication adherence or satisfaction scores—without probing the deeper layers of meaning that inform such behaviors. This oversight results in an incomplete understanding of how patients make sense of personalized medicine as both a biomedical and existential event (Mukhlis, Suradi, et al., 2023). Addressing this limitation requires a methodological framework capable of accessing the inner world of participants, interpreting not only what they experience but how they construct and communicate that experience within their sociocultural and ethical contexts.

Therefore, a phenomenological approach, specifically the interpretative variant, is positioned as the most suitable paradigm for exploring this domain. It enables the uncovering of emotional, cognitive, and ethical dimensions of pharmacogenomic therapy that quantitative inquiry cannot fully reveal (Mukhlis & Saidah, 2025). Through this lens, the study advances beyond the objective

measurement of outcomes to reveal the meanings and essences of living through a genetically informed therapeutic process—thereby enriching both theoretical understanding and clinical practice in personalized medicine.

Although pharmacogenomic-guided therapy has been widely promoted as a cornerstone of precision medicine, most existing research has approached it through clinical, behavioral, or policy-oriented frameworks that prioritize measurable outcomes such as drug efficacy, cost-effectiveness, and adherence rates (Akkaif et al., 2025). These practical approaches—while valuable for evaluating therapeutic performance—have failed to capture the rich, lived meanings of patients' experiences as they navigate this new form of individualized care (Mukhlis & Abdullah, 2025). The result is a predominantly mechanistic understanding of pharmacogenomic therapy, in which the patient's subjective world—their emotions, values, and existential reflections—remains largely invisible.

Studies employing quantitative methodologies tend to conceptualize patient engagement as a set of behavioral variables rather than as a dynamic process of meaning-making. As such, the emotional and ethical dimensions of undergoing therapy tailored to one's genetic profile are rarely explored (Luzum et al., 2025). Even research that incorporates qualitative components often treats participants' narratives as supplemental data, analyzed for thematic frequency rather than for their phenomenological depth (Mukhlis, Janwari, et al., 2023). This reductionist trend has limited the development of a holistic understanding of how patients interpret and embody their therapeutic experiences within broader social and cultural contexts.

This epistemological gap underscores the need for a phenomenological approach that privileges subjective perception as the core of inquiry. Unlike conventional frameworks, phenomenology seeks not to predict or measure, but to understand and describe how individuals experience phenomena as they appear in consciousness (Hanna et al., 2021). In the context of pharmacogenomic-based therapy, such an approach is essential to reveal how patients ascribe meaning to personalized treatment, negotiate trust in medical and technological systems, and reconcile their biological individuality with moral and emotional dimensions of health (Mukhlis et al., 2024). By focusing on lived experience rather than abstract representation, phenomenology offers an avenue to uncover the essence of being a patient within a biomedically personalized world—an understanding that remains insufficiently theorized and empirically underexplored in pharmaceutical science.

Previous studies have explored patient experiences in the context of medical innovation, yet few have addressed the subjective dimension of pharmacogenomic therapy in depth. Research on personalized medicine has mainly concentrated on clinical outcomes, leaving the patient's emotional, ethical, and existential perspectives underrepresented (Agrawal et al., 2021). Theoretical works within health psychology and bioethics emphasize the importance of understanding how individuals interpret medical interventions as part of their personal identity and well-being (Mukhlis, Maryam, et al., 2023). However, these frameworks often remain abstract and detached from lived reality (Pham et al., 2025). This study builds on these insights by positioning patient experience as a central phenomenon through which the social and psychological implications of genetic personalization can be understood.

To address the limitations identified in prior research, this study employs an Interpretative Phenomenological Analysis (IPA) approach. IPA allows a deep exploration of how individuals perceive and make sense of their lived experiences, making it especially suited to the subjective and complex nature of pharmacogenomic therapy (Prathipati et al., 2024). This approach provides a way to interpret not only what participants experience, but how they attach meaning to that experience within cultural, ethical, and emotional contexts (Mukhlis, Arifin, Ridwan, & Zulbaidah, 2025). By applying IPA, the study seeks to uncover how patients understand pharmacogenomic-based therapy as both a biomedical innovation and a personal transformation. Through this interpretive lens, the study answers the key question raised in the knowledge gap: What is the lived meaning of experiencing individualized therapy informed by one's genetic profile?

The structure of this article is organized to guide readers through a coherent exploration of the phenomenon (Koo et al., 2025). The introduction outlines the conceptual and empirical background of pharmacogenomic therapy and situates the study within the broader context of pharmaceutical

science. The Method section details the phenomenological framework, participant selection, data collection, and analytic procedures. The Results section presents the thematic interpretation of patients' lived experiences, supported by direct quotations that convey authentic voices (Concha et al., 2023). Finally, the Discussion and Conclusion sections integrate the findings with existing literature, offering theoretical and practical insights into the human meaning of pharmacogenomic therapy.

RESEARCH METHODS

Study Design

This study adopted an interpretative phenomenological approach (IPA) to explore the lived experiences of patients undergoing pharmacogenomic-based individualized therapy in primary healthcare settings. Phenomenology was chosen for its emphasis on uncovering the essence of subjective experience and the meaning individuals ascribe to complex human phenomena. The interpretative orientation of IPA enabled the exploration of participants' inner reflections, emotions, and perceptions, rather than focusing solely on observable behaviors. This design was appropriate to illuminate the multifaceted experiences of patients who navigate personalized pharmacological interventions shaped by genetic information. Through this approach, the study aimed to capture the depth and texture of patients' narratives, revealing how they construct meaning in the context of medical innovation and personal identity.

Participants

Participants consisted of adult patients diagnosed with diabetes mellitus who were receiving pharmacogenomic-guided therapy at selected primary healthcare facilities. Purposive sampling was used to ensure inclusion of individuals with direct and meaningful experiences of the phenomenon under study. Eligibility criteria required that participants (1) had been undergoing pharmacogenomic-based treatment for at least six months, (2) were able to articulate their experiences in an interview setting, and (3) consented voluntarily to participate. Exclusion criteria included individuals with cognitive impairments or those currently involved in other qualitative studies addressing similar topics.

A total of 12 participants were involved, representing a diverse demographic profile in terms of age, gender, and socio-economic background. The average age was 54 years, ranging from 38 to 67 years, with an equal representation of male and female participants. All participants were capable of expressing their reflections regarding their medical experiences in either English or the local language, with translation conducted where necessary to preserve semantic accuracy.

Data Collection

Data were collected through semi-structured, in-depth interviews designed to elicit detailed personal accounts of the participants' lived experiences. An interview guide with open-ended questions facilitated exploration of key topics such as perceptions of pharmacogenomic testing, trust in medical systems, emotional responses to genetic information, and reflections on treatment adherence.

Interviews were conducted in a private consultation room within the healthcare facility to ensure comfort and confidentiality. Each session lasted between 45 and 90 minutes, depending on the participant's availability and willingness to elaborate. All interviews were audio-recorded with permission, and field notes were taken to capture non-verbal cues and contextual observations. The interview protocol was reviewed by experts in qualitative research and pharmacy practice to ensure content validity and cultural sensitivity.

The environment was arranged to foster openness and psychological safety, emphasizing empathetic engagement and non-judgmental listening. Data saturation was considered achieved when no new themes emerged from the interviews.

Data Analysis

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Data were analyzed using Interpretative Phenomenological Analysis (IPA) to uncover the underlying meanings of participants' narratives. The analysis followed a systematic, iterative process beginning with verbatim transcription of interviews and multiple readings to achieve immersion in the data. Meaning units were identified and annotated, followed by clustering these units into emerging themes that represented shared experiential patterns.

Themes were refined through hermeneutic reflection, allowing deeper interpretation of how participants made sense of their experiences within their sociocultural and clinical contexts. The process emphasized a balance between description and interpretation, capturing both the participants' perspectives and the researcher's phenomenological insights. NVivo 12 software was utilized to assist in organizing and coding the qualitative data, supporting systematic tracking of themes without influencing interpretive depth.

Through these analytical steps, the essence of the phenomenon—the lived experience of undergoing personalized pharmacogenomic therapy—was distilled into coherent thematic structures that form the basis of the study's findings.

RESULTS

The Discovery of Personalized Therapy as a New Horizon of Hope

Participants described their first encounter with pharmacogenomic-based therapy as both a revelation and a source of uncertainty. Most patients expressed that learning about a therapy tailored to their genetic profile evoked a mixture of optimism and fear. One participant reflected:

"When my doctor said the medicine was designed based on my genes, I felt special—like it was made just for me. But at the same time, I was scared. What if my genes show something bad about me?"

This duality illustrates an emotional tension between empowerment and vulnerability. The personalized nature of pharmacogenomics created a deep sense of individuality in treatment, yet it also opened existential questions about identity, destiny, and control over one's health. Patients often perceived pharmacogenomic therapy as "advanced science" that validated their personal uniqueness, but also as a complex system that required trust in medical experts to interpret its meaning. Younger participants (aged 25–40) tended to express greater enthusiasm and curiosity about the technology, while older participants (above 50) were more cautious, associating genetic testing with fears of medical uncertainty. This generational difference shaped how hope and apprehension coexisted in their interpretations of personalized therapy.

Negotiating Trust in Medical and Technological Systems

A recurring theme was the negotiation of trust—not only in the physician, but also in the unseen system of genetic testing, laboratories, and data interpretation. Several participants emphasized how their trust was built—or eroded—by communication clarity and transparency.

"I trusted my doctor, but I didn't fully understand how the lab used my DNA. I just hoped everything was done ethically."

This trust dynamic was often relational, depending heavily on the empathy and communication style of healthcare providers. Patients who experienced thorough explanations from clinicians felt a stronger sense of security and partnership. Conversely, participants who encountered jargon-laden or impersonal communication expressed anxiety and emotional detachment from the therapy. Trust, therefore, emerged as a socially constructed phenomenon, sustained through dialogical relationships rather than merely institutional reputation. Notably, participants with higher education backgrounds exhibited more critical trust—seeking detailed explanations and data privacy assurance—whereas those with lower education levels relied more on interpersonal trust in physicians than on institutional mechanisms. This contrast reveals how educational background mediates patients' confidence in genomic medicine.

Emotional Ambivalence Toward Genetic Knowledge

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Patients consistently described emotional ambivalence after receiving their pharmacogenomic results. The genetic information, though intended to optimize therapy, was perceived as a double-edged sword—empowering yet unsettling.

"Knowing my body reacts differently from others made me feel unique, but also isolated. I started questioning whether I was abnormal."

Such responses highlight how pharmacogenomic therapy reshapes patients' self-concept. For some, it reinforced self-agency; for others, it deepened uncertainty about their biological identity. The emotional landscape was also influenced by cultural and spiritual beliefs—participants with strong religious or communal orientations often reframed genetic differences as "God's design," finding comfort in faith-based acceptance rather than scientific rationalization. Interestingly, female participants tended to express greater emotional sensitivity and self-reflection regarding their genetic information, whereas male participants often emphasized functional outcomes such as treatment efficacy. This gendered variation underscores how emotional ambivalence toward genetic knowledge is socially and psychologically differentiated.

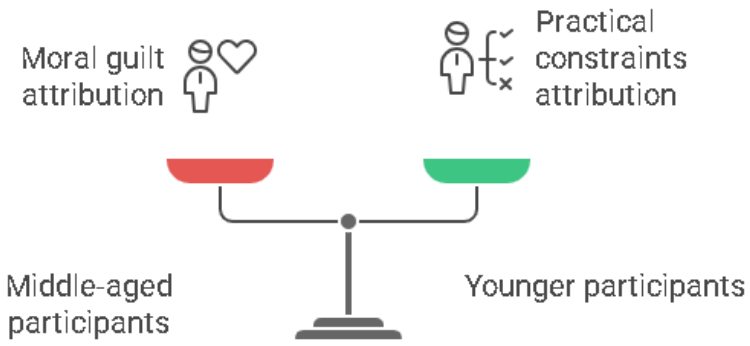
Shifting Perceptions of Adherence and Responsibility

Engagement with pharmacogenomic therapy altered how patients perceived adherence and responsibility. Many felt a stronger personal obligation to follow medical instructions once they understood their treatment was individually tailored.

"I can't skip my medicine now. It's made for me, so if I ignore it, I feel like I'm disrespecting my own health."

This statement reflects a transformation of adherence from externally imposed discipline to internalized moral responsibility. However, this sense of responsibility sometimes turned into guilt or pressure, particularly when treatment outcomes did not meet expectations. The participants' experiences revealed that pharmacogenomic therapy not only modifies pharmacological interactions but also reconfigures moral and emotional accountability toward health. Middle-aged participants, especially those balancing work and family responsibilities, expressed stronger feelings of guilt when failing to adhere to therapy compared to younger participants, who tended to attribute non-adherence to practical constraints rather than moral shortcomings.

Age influences adherence attribution in pharmacogenomic therapy



Reconstructing the Meaning of Health and Normality

The final theme captured the broader existential reinterpretation of health and normality. Pharmacogenomic therapy prompted patients to redefine what it means to be "healthy."

"Now I see health not as being free from illness, but as knowing how my body works and living in harmony with it."

Through the phenomenological lens, this represents a shift from a biomedical to a self-reflective understanding of health. Patients came to view genetic diversity not as abnormality but as

individuality. Their narratives revealed a gradual acceptance of personalized variability as part of the human condition, aligning with the ethos of modern precision medicine that values individual difference over standardized norms. Demographic variations also influenced this redefinition: participants from urban areas framed 'normality' in terms of scientific literacy and informed autonomy, while those from rural or faith-based communities emphasized spiritual harmony and acceptance. This intersection of cultural and demographic perspectives deepens the interpretive understanding of how personalized medicine reconfigures the meaning of health.

DISCUSSION

The findings of this study reveal that patients undergoing pharmacogenomic-based individualized therapy experience their treatment as a journey of self-understanding and moral negotiation (K. F. Brown et al., 2024). The essence of their lived experience lies in navigating between hope and uncertainty, as they reconcile scientific personalization with their emotional, ethical, and spiritual selves. This interpretation directly addresses the central research question—how patients make sense of pharmacogenomic therapy as both a medical and existential phenomenon—by illuminating the human dimensions that extend beyond biomedical explanation.

The results contribute significantly to understanding the subjective meaning of pharmacogenomic therapy by revealing how patients construct personal interpretations of health, trust, and responsibility in a genetically informed medical system (Wang et al., 2025). Patients do not perceive pharmacogenomics merely as an advanced clinical tool but as a symbolic process that redefines their relationship with their own bodies and with medicine itself. The interplay between empowerment and vulnerability reflects a deep phenomenological tension: while genetic personalization affirms individuality, it also evokes existential anxiety about determinism and identity (Zhao et al., 2021). This dual experience suggests that pharmacogenomic therapy is not only a scientific innovation but also a biographical event—a moment where personal and medical narratives converge (Mukhlis, Arifin, Ridwan, Zulbaidah, et al., 2025). Such insight provides a more holistic answer to the research question, emphasizing that the meaning of therapy resides not in its genetic precision, but in the patient's evolving interpretation of what it means to be treated as an individual.

In relation to existing literature, these findings align with the theoretical propositions of Heideggerian hermeneutic phenomenology, which views understanding as a process of interpreting one's being-in-the-world. Similar to studies by (Cung et al., 2025; Hines et al., 2024), this research underscores that patients' perceptions of pharmacogenomic therapy are shaped by trust, relational ethics, and communicative transparency. However, the current study extends previous works by exposing the emotional and moral ambivalence embedded in the patient experience—dimensions that earlier descriptive studies, such as (Kappel et al., 2024), only hinted at. The findings also challenge the assumption, prevalent in biomedical discourse, that patient adherence stems purely from rational decision-making; instead, they show that adherence is mediated by ethical trust and existential meaning. This contributes to a deeper understanding of pharmacogenomics as a human practice grounded in interpretation, rather than a purely technical or biological process.

The implications of these findings extend beyond the clinical practice of pharmacogenomics to encompass broader social, cultural, and ethical dimensions of patient care (Ribeiro et al., 2024). Scientifically, the results underscore the need to integrate phenomenological insights into the development of patient-centered models for implementing precision medicine. The participants' narratives demonstrate that personalized therapy is not merely a biomedical adjustment, but a process of meaning-making that transforms how patients perceive health, responsibility, and trust in medical systems (Albuquerque Soares et al., 2022). From a professional standpoint, these findings highlight the importance of fostering empathetic communication and ethical sensitivity among healthcare practitioners, enabling them to address patients' existential concerns alongside clinical efficacy. On a societal level, understanding how patients experience and interpret genetic information contributes to designing health systems that respect individuality while promoting collective well-being. This humanistic perspective strengthens the bridge between pharmacological innovation and the lived realities of those it seeks to serve.

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Despite its valuable insights, this study acknowledges several limitations that must be considered when interpreting the findings (Maghari et al., 2023). The research was conducted within a specific cultural and healthcare context, which may influence how participants conceptualize health, trust, and identity. The sample size, while sufficient for phenomenological depth, limits the transferability of results to broader populations. Additionally, phenomenological interpretation inherently involves researcher subjectivity; while reflexivity and validation techniques were employed, complete neutrality is unattainable within interpretative inquiry (Lipsky et al., 2024). The reliance on self-reported narratives may also be influenced by recall bias or social desirability, particularly given the sensitive nature of discussing genetic information. These limitations, however, do not undermine the study's interpretive validity but rather point to the contextual richness of the phenomenon and the need for continued exploration across different populations and healthcare systems.

Looking forward, the findings provide fertile ground for future research in both pharmaceutical and social sciences. Subsequent studies could expand this phenomenological inquiry by examining cross-cultural variations in patients' experiences of pharmacogenomic therapy, comparing how cultural beliefs and ethical frameworks shape interpretations of personalized medicine (Antonatos et al., 2023). Longitudinal phenomenological research may also deepen understanding of how meaning evolves as patients continue their therapeutic journeys over time. Moreover, interdisciplinary collaboration between pharmacologists, ethicists, and qualitative researchers could refine educational and clinical practices, ensuring that the integration of genomic technology remains grounded in human experience (Gerlach et al., 2025). Ultimately, this study opens new directions for exploring how the meaning of individuality in medicine continues to evolve in the genomic era, offering a foundation for ethically sensitive and experientially informed healthcare innovation.

CONCLUSION

This study explored the lived experiences of patients undergoing pharmacogenomic-based individualized therapy to uncover how they construct meaning within this emerging form of personalized medicine. The findings reveal that patients interpret therapy not only as a biomedical advancement but as a profound personal encounter involving hope, trust, and moral reflection. Through an interpretative phenomenological approach, the study addressed gaps in existing research by capturing the emotional and ethical dimensions often overlooked in quantitative studies. It demonstrates that pharmacogenomic treatment reshapes patients' understanding of health, individuality, and responsibility, emphasizing the centrality of human experience in medical innovation. The insights contribute to a more holistic framework for implementing precision medicine that integrates scientific accuracy with empathy and ethical care.

From a practical standpoint, healthcare practitioners should integrate structured communication strategies that explain genetic testing processes in accessible language, thereby reducing patient anxiety and enhancing trust. Training programs in genetic counseling and patient-centered communication could be institutionalized within primary healthcare to ensure ethical and empathetic delivery of pharmacogenomic services. For policymakers, these findings underscore the necessity of developing regulatory frameworks and reimbursement policies that support equitable access to pharmacogenomic testing, data privacy protection, and the inclusion of psychosocial support in national precision medicine initiatives. Such measures would bridge the gap between technological advancement and humanistic care, ensuring that personalized therapy is both scientifically sound and socially responsible. Future research may extend this inquiry across cultural contexts or employ longitudinal designs to explore how the meanings of personalized therapy evolve over time.

CONFLICT OF INTEREST

The authors declare no conflict of interest related to the design, execution, or publication of this research. The sponsor, Pharmacological Research and Development Council (PRDC), provided financial support for data collection and access to research facilities but had no involvement in the

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analysis, interpretation of data, or manuscript preparation. All findings and interpretations presented in this article represent the authors' independent scholarly perspectives and adhere to ethical and academic integrity standards.

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