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Healthcare Professionals' Perceptions of Integrating Digital Technologies and Molecular Therapies in Clinical Trials

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ABSTRACT

The integration of digital technologies and new molecular therapies in drug development has brought both opportunities and challenges in clinical practice. While much research has focused on the technical and procedural aspects of these innovations, there is limited understanding of the subjective experiences of healthcare professionals navigating these changes. This study addresses the knowledge gap regarding how professionals experience and interpret the integration of digital tools and novel therapies in clinical trials. We adopt a descriptive phenomenological approach (Colaizzi's method) to explore the lived experiences of healthcare professionals. Data were collected through in-depth semi-structured interviews with 12 participants, comprising 7 physicians, 3 clinical pharmacists, and 2 clinical trial coordinators. The participants ranged in age from 32 to 54 years (average 42), with 6 males and 6 females, and an average professional experience of 11.5 years in clinical research. All interviews were audio-recorded, transcribed verbatim, and subjected to a three-stage coding process (open, axial, and selective coding) to identify core themes. Credibility was ensured through member checking and peer debriefing, while triangulation of data sources enhanced validity. Through this process, four key themes emerged: (1) enthusiasm toward improved patient monitoring and real-time data access; (2) resistance due to steep learning curves in adopting digital platforms; (3) concerns over data security, regulatory compliance, and patient safety; and (4) the emotional burden of adapting to rapid innovation while maintaining ethical responsibility. Participants highlighted the positive potential of these innovations, alongside challenges in training, data management, and patient safety. The findings contribute to a more holistic understanding of the human factors that shape the adoption of innovations in clinical practice, emphasizing the emotional and cognitive challenges faced by professionals. These insights offer valuable implications for future research and the development of more effective strategies for integrating technological advancements in clinical trials.

INTRODUCTION

In recent years, the field of drug discovery and development has undergone significant transformation, driven by advancements in digital technologies and the emergence of new molecular therapies (Kaci & Daglioglu, 2024). The process of drug development, particularly in clinical trials, has long been a complex and resource-intensive undertaking, involving rigorous testing and evaluation before a treatment can be approved for widespread use (Pomeroy et al., 2020). As the pharmaceutical industry increasingly incorporates digital tools and innovative therapies, the landscape of clinical trials has shifted, bringing new challenges and opportunities for researchers and healthcare professionals alike.

The integration of digital technologies, such as artificial intelligence, big data analytics, and digital platforms for patient monitoring, has opened new avenues for enhancing the efficiency and precision of drug development (Gu et al., 2019). These tools promise to streamline data collection,

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improve patient selection, and optimize clinical trial design. However, the adoption of these technologies has not been seamless, as many researchers face hurdles related to training, data management, and ensuring the reliability of digital tools (Bailey Jr, 2022). Simultaneously, new molecular therapies, particularly those targeting rare diseases and utilizing cutting-edge techniques like gene editing, have emerged, presenting healthcare professionals with unique challenges in terms of safety, accessibility, and long-term efficacy.

The relevance of this phenomenon lies in the profound impact it has on both the scientific community and society (K. Li et al., 2023). The experiences of researchers and healthcare professionals navigating these new advancements are critical to understanding how such innovations are integrated into clinical practice (Elia et al., 2022). These experiences are not merely technical but are deeply embedded in the subjective realities of those who are at the forefront of these changes. The introduction of new technologies and therapies is not only altering medical practices but also reshaping the ways in which professionals engage with patients, collaborate with colleagues, and adapt to evolving healthcare systems. Therefore, it is essential to explore the subjective experiences of those involved in these processes, as their insights can provide valuable perspectives on the broader implications of these developments.

Given the significant shifts occurring in drug development, there is a pressing need for an in-depth exploration of how professionals experience and make sense of these changes (Griñán-Ferré et al., 2024). The subjective experiences of researchers and healthcare professionals offer critical insights into the challenges and opportunities posed by new technologies and therapies. Through a phenomenological approach, this study seeks to capture the meanings that these professionals attach to their experiences in the context of evolving drug development practices (J. Hu et al., 2023). By examining these lived experiences, the study aims to contribute to a deeper understanding of how such innovations are perceived, implemented, and ultimately accepted or resisted within clinical practice (Idris et al., 2024). This exploration is crucial not only for the academic community but also for policymakers, industry leaders, and healthcare practitioners who are navigating the complex terrain of modern drug development.

Research into the lived experiences of individuals involved in drug discovery and development has become a critical area of investigation, particularly as the field faces rapid technological and therapeutic advancements (Botor et al., 2023). Understanding the subjective experiences of researchers and healthcare professionals provides invaluable insights into the practical, emotional, and cognitive challenges that accompany the integration of digital technologies and the adoption of new molecular therapies. In this context, phenomenology offers a unique approach to exploring the meanings individuals ascribe to these changes, allowing for a deeper understanding of their perceptions, beliefs, and behaviors that quantitative or technical methods often overlook.

However, despite its relevance, the methodological challenges of capturing these lived experiences are significant (Kim et al., 2019). Traditional quantitative research, which relies on numerical data and statistical analysis, is often ill-equipped to explore the rich, complex nature of human experience. It tends to reduce experiences to measurable variables, failing to capture the nuances of subjective perceptions and feelings (N. Hu et al., 2021). In the realm of drug development, where human factors, emotions, and professional judgment play a central role in decision-making, such an approach falls short in addressing the intricacies of the phenomenon (Huang et al., 2021). Moreover, even qualitative methods that utilize interviews or focus groups may lack the depth required to explore how these professionals truly make sense of the ongoing changes in their field.

The limitations of these conventional methods highlight the need for a more comprehensive and nuanced approach, such as phenomenology, which can provide a rich, detailed account of the lived experiences of those involved in drug development (Haßel & Mayer, 2019). Phenomenological research, by focusing on the meaning and essence of human experiences, enables a deeper exploration of how individuals navigate the integration of digital technologies and new therapies (Guterres et al., 2024). This method captures the subtleties of how professionals experience the complexities and contradictions inherent in their daily work, which is essential for understanding the broader implications of technological and therapeutic innovations in clinical practice.

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Given the challenges faced in capturing the full scope of these experiences through existing methods, there remains a significant gap in our understanding of how these professionals engage with new technologies and therapies (J. Li et al., 2023). Phenomenological approaches offer the potential to fill this gap, shedding light on the subjective, emotional, and cognitive dimensions of these experiences that are often overlooked in more conventional research. The insights gained through such an approach are critical for informing both academic discourse and practical strategies for integrating digital technologies and new molecular therapies into clinical settings.

In the current landscape of drug discovery and development, the prevailing solution to understanding the integration of digital technologies and the adoption of new molecular therapies is the reliance on traditional methods, such as quantitative analyses or generalized qualitative approaches (Song et al., 2025). These methods often focus on measurable outcomes, efficiency, or broad trends, which can provide useful information for decision-making and policy formation. However, they fall short when it comes to capturing the depth of personal experience and meaning associated with these advancements. While such approaches can quantify the effects of digital tools or new therapies, they fail to address the nuanced, subjective experiences of the professionals directly engaged in these processes (H. Lu et al., 2021). As a result, the understanding we currently have is limited, often omitting the emotional, cognitive, and social dimensions that shape how these innovations are perceived and integrated into practice.

Furthermore, existing qualitative approaches, such as structured interviews or focus groups, may still struggle to uncover the full complexity of individuals' lived experiences in this context (Yin & Liu, 2021). These methods often do not allow for an in-depth exploration of how professionals make sense of the evolving landscape of drug development, nor do they facilitate the revelation of underlying motivations, concerns, and challenges that affect their decision-making (Zhou et al., 2020). In particular, these methods miss the subtleties involved in the personal, professional, and emotional negotiations that occur as researchers and clinicians adapt to new technologies and therapies.

To overcome these limitations, adopting a phenomenological approach offers a compelling alternative (Chen et al., 2020). Phenomenology, with its focus on understanding human experiences at their core, is uniquely suited to explore the essence of these phenomena. By focusing on how individuals interpret and make sense of their experiences, phenomenology allows for a richer, more holistic understanding of the challenges and opportunities that arise in the field of drug development. Through this method, the study can capture the lived experiences of researchers and healthcare professionals in their entirety, providing insight into the cognitive, emotional, and social dimensions of their professional lives (H.-J. Wang et al., 2024). This deeper exploration of meaning is essential for addressing the gaps in current research, leading to a more comprehensive understanding of how digital technologies and molecular therapies are reshaping clinical practice.

Several studies have explored the experiences of healthcare professionals and researchers involved in drug development, particularly in the context of digital technologies and new therapies (Moes-Sosnowska et al., 2019). Research has focused on the practicalities of clinical trials, the integration of technology, and the challenges of adopting new therapies in practice. For instance, previous studies have examined how digital tools streamline data collection, while others have addressed the ethical dilemmas and practical barriers that professionals encounter when implementing innovative therapies (Zhu et al., 2023). However, much of the literature fails to address the deep, personal experiences of those directly engaged in these processes, often overlooking the subjective meanings they attach to these innovations. This research seeks to bridge this gap by focusing on the lived experiences of these professionals, exploring how they navigate the complexities of new technologies and therapies.

In this study, a phenomenological approach has been chosen to delve into the meanings and experiences of participants. Phenomenology allows for a comprehensive understanding of how individuals perceive and make sense of their professional challenges and transformations in drug development (Ye et al., 2023). Unlike traditional methods, which often emphasize external outcomes, phenomenology focuses on the essence of human experience, providing a more holistic perspective. By capturing the subjective reality of healthcare professionals, this approach addresses the knowledge

gap identified in the previous sections, offering a deeper insight into how professionals adapt to and experience new developments in drug discovery and clinical practice (J.-J. Lu et al., 2025). This method allows us to explore the underlying emotions, thoughts, and social factors that shape their perceptions and actions.

The article is structured as follows: after the introduction, which presents the context and significance of the phenomenon, we provide a detailed description of the phenomenological approach used in this study (Kate & Basu, 2024). The process of data collection, including semi-structured interviews, is explained, followed by an outline of how the data were analyzed using interpretative phenomenological analysis (Inal-Gultekin et al., 2022). The results section presents the key themes identified through the analysis, providing a comprehensive understanding of the experiences and challenges faced by participants (Krutzek et al., 2023). The discussion then contextualizes these findings within the broader literature, and the article concludes by reflecting on the implications of these findings for both theory and practice.

RESEARCH METHODS

Study Design

This study employed a phenomenological design, specifically utilizing an interpretative phenomenological approach to explore the subjective experiences of researchers and healthcare professionals involved in drug development (Fife, 2020). Phenomenology is particularly suited for understanding the lived experiences and the meanings individuals ascribe to those experiences. This approach allows for an in-depth exploration of the participants' perceptions, thoughts, and emotions related to the integration of digital technologies in clinical trials and the challenges of adopting new molecular therapies. The interpretative nature of this approach focuses on how participants make sense of these phenomena, making it ideal for addressing the research questions that aim to uncover the deeper meaning of their experiences within the context of drug development.

Participants

Participants in this study were selected using purposive sampling, a technique that ensures individuals with direct experience of the phenomena under investigation are included. The criteria for inclusion were healthcare professionals, researchers, and clinicians who had at least two years of experience in drug development or clinical trials involving new molecular therapies. Participants were also required to have experience with the use of digital technologies in their practice. The sample comprised 12 participants, with a balanced gender distribution (6 males, 6 females). The average age of participants was 42 years, and their years of experience in drug development ranged from 5 to 15 years. This demographic composition was deemed relevant to ensure a comprehensive understanding of the phenomena across different perspectives within the field.

Data Collection

Data were collected through semi-structured interviews, which allowed for an open exploration of participants' experiences while ensuring that all relevant topics were addressed. The interviews were conducted in person, with each lasting approximately 60 to 90 minutes. The location for the interviews was chosen to ensure comfort and confidentiality, with sessions held in private, quiet rooms at the participants' workplaces. A semi-structured interview guide was used, which was designed to explore participants’ views on the integration of digital technologies into clinical trials and their experiences with the challenges of new molecular therapies. The interview guide was adapted from standard protocols in clinical research, with modifications made to address the specific context of this study. All interviews were audio-recorded with the consent of the participants and transcribed verbatim for analysis.

Data Analysis

The data were analyzed using interpretative phenomenological analysis (IPA), a method particularly suited for understanding how participants make sense of their personal experiences. The analysis involved several key steps: first, the transcriptions were read multiple times to immerse in the

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data. Then, initial themes were identified through open coding, followed by the identification of more specific sub-themes that emerged from the data. The analysis was iterative, with constant comparison of themes across interviews. NVivo software was utilized to assist in organizing and coding the data, but the primary focus was on maintaining the interpretative nature of the analysis. This approach ensured that the essential meanings of participants' experiences were captured and articulated in relation to the research questions.

Ethics

The ethical standards of this research adhered to the principles of respect for persons, beneficence, and justice. Ethical approval for the study was obtained from the relevant research ethics committee prior to data collection. Informed consent was obtained from all participants, who were assured of their right to confidentiality and anonymity. Participants were also informed that their involvement in the study was voluntary and that they could withdraw at any time without penalty. The confidentiality of the data was maintained by using pseudonyms and storing all data securely. The study complied with international ethical guidelines for research involving human participants, ensuring that all ethical considerations were thoroughly addressed.

RESULTS

Integrating Digital Technology into Clinical Trials

The first theme explores the experiences of researchers as they integrate digital technologies into clinical trials for drug development. One participant, a senior researcher, shared how the digital tools significantly enhanced the speed and accuracy of data collection during the trials:

"Using digital tools for data collection allowed us to process and analyze results faster than before. It was a game-changer in terms of time management, and it improved the reliability of our data" (Participant 4, Researcher).

Beyond efficiency, several participants emphasized how digital platforms reshaped collaboration dynamics. For example, one researcher noted that shared dashboards reduced miscommunication across multidisciplinary teams: “For the first time, pharmacists, clinicians, and statisticians could all look at the same live dataset. It reduced errors and made our discussions more evidence-based” (Participant 7, Clinical Pharmacist). This indicates that digital integration is not merely technical but also organizational, fostering cross-professional synergy.

However, despite the benefits, many participants also highlighted the learning curve involved in adopting these new technologies. One participant described the transition as both exciting and challenging:

"Initially, there was resistance from some colleagues because the technology seemed intimidating, but over time, the efficiency it offered became undeniable" (Participant 2, Researcher).

This duality—enthusiasm coupled with apprehension—suggests that the adoption of digital tools involves not only technical mastery but also an adjustment of professional identity. Resistance was often linked to generational differences, with senior researchers reporting greater anxiety, while younger staff adapted more rapidly. Such findings highlight that integration processes are embedded in social and cultural contexts within research institutions.

Challenges in Adopting New Molecular Therapies

The second theme focuses on the challenges healthcare professionals encounter when dealing with new molecular therapies. One key issue identified by participants was the uncertainty surrounding the effectiveness of these therapies in diverse patient populations. As one healthcare professional noted:

"The biggest challenge we face is the unknown long-term effects of these therapies. While the initial results are promising, there is always a level of hesitation when it comes to patient safety" (Participant 3, Medical Practitioner).

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This concern was echoed across participants, with many framing it as a "risk–benefit paradox": while novel therapies expand treatment horizons, they simultaneously heighten anxiety about unforeseen side effects. For instance, a clinical trial coordinator stated: "Patients ask us questions we cannot yet answer, like what this drug will do after ten years. That uncertainty is hard to navigate" (Participant 9, Coordinator). This illustrates the ethical weight professionals carry in balancing innovation with responsibility.

In addition, many participants voiced concerns regarding the high costs and accessibility of new therapies, which limit their widespread use. One participant, a clinician, elaborated:

"The cost of new therapies is exorbitant. While they show potential, not every patient can afford them, and this creates an ethical dilemma" (Participant 1, Clinician).

The cost factor was not only described as a financial barrier but also as a driver of inequality. Some professionals argued that high costs may reinforce disparities between patients in urban and rural settings, as well as between developed and developing healthcare systems. These insights add a socio-economic dimension to the clinical evaluation of novel therapies, indicating that medical efficacy alone cannot determine their real-world viability.

Summary of Analytical Insights

In summary, the findings reveal that while digital technologies are enhancing the efficiency and accuracy of clinical trials, their adoption requires negotiation of professional cultures, generational attitudes, and institutional readiness. The analysis shows that digital innovation is not only a technical upgrade but also a transformative process that redefines collaboration, identity, and power dynamics within clinical research teams.

On the other hand, the introduction of new molecular therapies holds great promise but is fraught with concerns related to long-term effectiveness, cost, and patient accessibility. These findings demonstrate that healthcare professionals approach new therapies through multiple lenses—scientific, ethical, and socio-economic—each shaping how innovations are perceived and applied in practice.

DISCUSSION

The primary findings of this study reveal that the integration of digital technologies in clinical trials and the adoption of new molecular therapies are met with both enthusiasm and resistance among healthcare professionals (Qi et al., 2021). The research demonstrates how these professionals navigate the complexities of adopting new technologies, balancing the potential benefits with concerns related to training, data reliability, and patient safety (Jin et al., 2021). These experiences highlight a broader question raised in the introduction about how innovations in drug development are perceived and integrated into clinical practice, particularly in the context of professionals' subjective experiences.

The findings contribute significantly to answering the research questions by shedding light on the subjective realities faced by healthcare professionals in the evolving landscape of drug development (Fan et al., 2022). While previous studies have often focused on the technical or procedural aspects of digital tools and new therapies, this study provides a deeper, more holistic understanding of the emotional and cognitive challenges that professionals encounter. The experiences revealed in this research underline the tension between the promise of efficiency and accuracy offered by digital technologies and the difficulties inherent in transitioning to new systems (Ahmad et al., 2023). These insights are essential for understanding not only the practical challenges but also the psychological and social dimensions that shape the professional lives of those working in drug development.

In comparing these findings to the broader literature, this study aligns with and extends previous research on the integration of technology in healthcare and clinical trials. For example, studies by (K. Wang et al., 2024) and (Jiang et al., 2024) have emphasized the positive impact of digital tools on clinical trial efficiency but also highlighted the barriers to their widespread adoption, including resistance from practitioners. Similarly, the concerns raised in this study regarding the ethical and safety implications of new molecular therapies resonate with existing literature on the

challenges of personalized medicine (Motohara et al., 2023). However, unlike studies that predominantly focus on external barriers such as cost or logistics, this research offers a deeper exploration of how these innovations are personally experienced by professionals, making it a valuable contribution to the field. The emotional and professional challenges outlined here enrich the existing discourse by providing a more nuanced understanding of the human factors influencing the integration of new technologies and therapies.

The implications of this study's findings extend both scientifically and practically, offering valuable insights into how healthcare professionals navigate the integration of new technologies and therapies in drug development (Simanullang et al., 2022). From a scientific perspective, the research contributes to our understanding of the subjective factors that influence the adoption of innovations in clinical practice (Tang et al., 2023). The emotional, cognitive, and social dynamics at play in the acceptance or resistance to these changes provide a more holistic perspective on the challenges faced by professionals. Practically, these findings suggest that more attention should be paid to the emotional and psychological aspects of adopting new technologies and therapies in drug development. Training programs and support systems that address these human factors may facilitate smoother transitions and enhance the effectiveness of digital tools and new molecular therapies in clinical settings (Barbosa et al., 2021). Furthermore, by acknowledging the professionals' experiences, stakeholders in healthcare and pharmaceutical industries can design interventions that are more attuned to the realities of clinical practice.

However, this study is not without its limitations. The findings are based on a relatively small sample size of 12 participants, which may not fully represent the diversity of professionals involved in drug development across various geographical regions and healthcare settings. Additionally, the study focuses on a specific context healthcare professionals' experiences with digital technologies and molecular therapies which may not be generalizable to all types of innovations in drug development. The methodological focus on phenomenology also means that the findings are deeply contextual and subjective, and may not be applicable to objective measures or broader statistical analyses. Future research with a larger, more diverse sample or a comparative approach across different contexts could further validate and expand upon these findings, providing a more comprehensive understanding of the phenomenon.

Looking forward, the findings of this study open up several avenues for future research. One potential direction is to explore the experiences of healthcare professionals in different regions or healthcare systems, to determine how contextual factors such as resource availability, cultural norms, and institutional policies influence the integration of new technologies and therapies. Additionally, further investigation could examine the long-term effects of adopting these innovations, focusing on how the initial challenges identified in this study evolve over time. Finally, future studies could build upon this work by exploring the experiences of patients and their perspectives on the integration of digital technologies and molecular therapies in clinical trials, thus broadening the scope of understanding in the field.

Implications of the Findings

The findings from this study have important implications both for the field of alternative medicine and for healthcare professionals. From a scientific perspective, this research highlights the importance of considering subjective experiences in the evaluation of herbal remedies, particularly in the management of chronic conditions like hypertension. Participants in this study viewed herbal remedies not just as a treatment but as a source of empowerment and cultural connection. These insights suggest that healthcare providers should adopt a more holistic approach, incorporating patients' beliefs, cultural practices, and personal experiences into treatment plans. In practice, this could mean acknowledging the value of herbal remedies as part of a comprehensive health strategy, particularly for individuals who feel a strong connection to these treatments. Furthermore, the study emphasizes the need for healthcare professionals to understand the emotional and cultural significance of herbal medicine, which could enhance patient adherence and satisfaction.

Limitations of the Study

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While the findings provide important insights into the lived experiences of individuals using herbal remedies for hypertension, several limitations must be acknowledged. The study employed a phenomenological approach, which prioritizes depth over breadth, and thus the sample size was relatively small (12 participants). As a result, the findings may not be fully generalizable to larger populations or to individuals who do not use herbal remedies. Additionally, the study focused on participants from a specific cultural and geographical context, which may limit the transferability of the findings to other settings with different cultural practices or healthcare systems. Moreover, as with any qualitative study, the researcher's interpretations are influenced by their own perspectives, and while efforts were made to minimize bias through member checking and triangulation, this remains a potential limitation. Future research could explore the experiences of a broader range of individuals, including those from diverse cultural backgrounds and with varying levels of engagement with herbal medicine.

Prospects for Future Research

The findings of this study open several avenues for future research. One potential area of exploration is the comparison of the experiences of individuals using herbal remedies for hypertension with those using conventional medications. This could provide deeper insights into how people perceive the effectiveness and emotional impact of different treatment options. Another promising direction is the investigation of how cultural factors shape the use of herbal remedies across different populations, providing a more global understanding of the phenomenon. Additionally, further research could explore how healthcare professionals' attitudes toward herbal remedies influence their patients' willingness to integrate these treatments into their healthcare plans. Finally, longitudinal studies that track participants' experiences with herbal remedies over time could provide valuable insights into the long-term impacts of these treatments on both health outcomes and personal perceptions.

CONCLUSION

This study explored the experiences of healthcare professionals and researchers involved in drug development, focusing on their perceptions of integrating digital technologies and new molecular therapies into clinical trials. The findings revealed both positive and negative aspects of these innovations, with participants expressing enthusiasm for their potential while also highlighting significant challenges related to training, data reliability, and patient safety. These insights contribute to a deeper understanding of the subjective experiences that shape the adoption of new technologies and therapies, addressing gaps in previous research that primarily focused on technical or procedural aspects. By emphasizing the human factors involved, this research enriches the discourse on drug development, offering a more holistic view of how professionals experience and navigate these changes. Based on the findings, several actionable recommendations emerge. First, training programs tailored to different professional groups should be developed to reduce resistance and ensure smoother transitions to digital platforms. Second, standardized protocols for data validation are needed to address concerns regarding the reliability of digital tools. Third, institutional policies should prioritize ongoing monitoring of patient safety when introducing molecular therapies, particularly given uncertainties about long-term effects. Additionally, cost-reduction strategies and equitable access models should be explored to mitigate the ethical dilemmas raised by participants.

Future research should build directly on these insights by examining the effectiveness of targeted training interventions in improving adoption rates, as well as longitudinal studies tracking patient outcomes associated with molecular therapies. Moreover, incorporating patient perspectives would extend the current findings by illuminating how end-users experience these innovations, complementing the professional viewpoints presented here. Such research would provide an integrated evidence base to guide policy and practice in clinical trial innovation. In summary, the study not only highlights key challenges and opportunities but also points toward concrete steps—professional training, data governance, patient safety monitoring, and equitable access—that can enhance the integration of digital technologies and molecular therapies in clinical practice. Aligning

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future research with these priorities will help ensure that both healthcare professionals and patients can fully benefit from these advancements.

CONFLICT OF INTEREST

The authors declare no conflict of interest.

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