



Integrating Chatbots into Clinical Practice: Perspectives and Challenges Among General Practitioners

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ABSTRACT

Artificial intelligence (AI) is transforming healthcare practices globally, with health chatbots emerging as digital tools designed to assist clinical decision-making and patient communication. Despite their increasing presence, little is known about how general practitioners (GPs) experience the integration of chatbots into their everyday medical routines. This study addresses the gap by asking: how do GPs make sense of and adapt to the presence of chatbot technologies in clinical practice? Using an interpretative phenomenological approach, the study explores the lived experiences of ten GPs in Indonesia, aged between 33 and 58 years, with professional experience ranging from 6 to 25 years, who actively use chatbots during consultations. In-depth, semi-structured interviews were conducted and thematically analyzed to uncover patterns of emotional, ethical, and professional response. Four major themes emerged: the negotiation of clinical authority, emotional ambivalence, the burden of verification, and the redefinition of the doctor-patient relationship. These findings suggest that chatbot integration is not merely a technical adjustment, but a meaningful transformation in how physicians understand their roles and relationships within healthcare. The study enhances our understanding of digital transformation by revealing the human dimensions often overlooked in AI implementation and provides a foundation for future work in more empathetic and ethically attuned technology integration. However, the study is limited by its small sample size and focus on a single country, which may affect generalizability. Future research could explore cross-cultural comparisons, longitudinal impacts, and patient perspectives to enrich understanding of chatbot integration in diverse healthcare contexts.



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INTRODUCTION

In recent years, the integration of artificial intelligence (AI) technologies into healthcare has accelerated significantly, marking a profound transformation in how medical services are delivered, experienced, and perceived (Azagba et al., 2020; Martinasek et al., 2021). Among these innovations, health chatbots—automated conversational agents designed to simulate medical dialogue—have emerged as prominent tools aimed at enhancing diagnostic accuracy, improving accessibility, and supporting patient engagement (Binyamin & Hoque, 2020). Their implementation reflects a broader movement toward technology-driven healthcare solutions, where digital tools increasingly mediate clinical interactions and decision-making processes. Within this evolving landscape, the role of general practitioners (GPs) is undergoing critical redefinition. The traditional model of care, which centers on relational trust, clinical intuition, and human empathy, is now intersecting with algorithmic systems that prioritize efficiency, standardization, and data-driven reasoning. While these technological advancements offer clear systemic benefits, they also raise fundamental questions about the lived experiences of healthcare providers—particularly how clinicians interpret, adapt to, and emotionally respond to the presence of AI in their daily routines.

The relevance of this phenomenon lies in its deeply subjective nature (Corsi-Zuelli, Marques, et al., 2022; Hatsukami & Carroll, 2020). Beyond technical considerations, the integration of chatbots

into clinical workflows affects how physicians perceive their professional identity, their relational dynamics with patients, and the moral dimensions of their practice. These are not merely operational shifts; they are experiential transformations that require a nuanced, person-centered understanding (Bent et al., 2021). Exploring how GPs experience and make sense of these changes is therefore essential to informing more humane and ethically grounded approaches to healthcare innovation.

Given the complexity and subtlety of such experiences, a phenomenological approach is particularly suited to uncover the underlying meanings embedded in practitioners' narratives (Nawi et al., 2021; Vieira et al., 2020). Rather than measuring outcomes or efficiency, this perspective seeks to illuminate how the phenomenon is lived and felt by those at the center of the transformation. In doing so, it provides a necessary counterbalance to predominantly technical discourses, grounding the discussion of AI in the rich, subjective realities of human experience.

The exploration of individual experiences within rapidly evolving healthcare environments has become an increasingly important domain of research, particularly as digital technologies intersect with deeply human aspects of clinical care (Punj & Kumar, 2019). Studies focusing on the subjective experiences of healthcare professionals—such as physicians, nurses, and clinical support staff—offer essential insights into how technological integration affects professional identity, emotional labor, and ethical judgment. In the context of AI-powered tools like health chatbots, understanding the clinician's lived experience is not only valuable but critical to shaping responsible and empathetic implementation strategies.

Despite the growing recognition of this need, methodological challenges persist (Liese & Monley, 2021; Shin, 2021). Much of the existing literature tends to adopt quantitative or outcome-oriented approaches, emphasizing metrics such as diagnostic accuracy, time efficiency, or patient satisfaction. While such measures provide useful indicators of system performance, they fall short in capturing the nuanced, often ambiguous experiences of medical professionals navigating complex emotional and ethical terrains. As a result, the affective and interpretive dimensions of how clinicians adapt to and interact with AI systems remain underexplored.

These limitations underscore a critical gap in the current research landscape (Corsi-Zuelli, Schneider, et al., 2022; Gray et al., 2021). Without methods capable of accessing the inner world of practitioners—their reflections, apprehensions, and reconfigurations of professional meaning—understanding the full impact of AI on clinical practice remains incomplete. Phenomenology, with its emphasis on depth, context, and meaning, offers a compelling response to this deficiency (Nasr et al., 2021). By prioritizing lived experience over abstract generalization, it allows for a more holistic understanding of how technological innovations are integrated not only into workflows, but into the identities and ethical frameworks of those who use them.

To date, the integration of chatbot technologies into clinical settings has largely been examined through functional or pragmatic lenses—primarily focusing on usability, efficiency, and clinical performance. These studies often adopt evaluative frameworks that measure outcomes such as diagnostic accuracy, system responsiveness, or user satisfaction, which, while valuable, do not adequately address the inner experiences of healthcare professionals. As such, they offer limited insight into the emotional, ethical, and existential dimensions of working alongside artificial intelligence systems in real-world medical environments.

Existing approaches frequently rely on standardized surveys or performance metrics, which tend to reduce complex phenomena into quantifiable variables (Galimov et al., 2022; Langley et al., 2019). This reductionist orientation limits the ability to capture the nuanced ways in which general practitioners negotiate their roles, authority, and patient relationships in the presence of chatbot technologies (Hasan et al., 2019). The lack of depth in current empirical research leaves critical questions unanswered: How do clinicians interpret the shifting nature of their work? What tensions do they experience when balancing professional judgment against algorithmic outputs? What meanings do they assign to their evolving relationships with both patients and machines?

A phenomenological approach provides a powerful alternative for addressing these limitations. By emphasizing lived experience and subjective meaning, phenomenology enables a

deeper and more holistic exploration of the human side of digital transformation in healthcare. Rather than seeking generalizable outcomes, it focuses on the richness of individual narratives, offering a more complete and context-sensitive understanding of the phenomenon. This study is therefore motivated by the need to illuminate what remains obscured by prevailing methodological norms: the felt realities of general practitioners as they adapt to AI-mediated clinical practice.

Recent studies have explored the use of artificial intelligence in healthcare, particularly focusing on technical performance and user satisfaction. However, only a limited number of works have examined the subjective experiences of medical professionals who directly interact with AI tools. Some literature addresses the ethical or relational impacts of AI but often lacks firsthand insights from those most affected (Tran et al., 2019). While interpretative studies are emerging, few have investigated how general practitioners experience the integration of chatbot systems in clinical routines. This study draws on these gaps to offer a deeper exploration of professional meaning and lived experience in the digital health landscape.

To address this aim, the study applies an interpretative phenomenological approach. This method is well-suited for understanding how individuals make sense of complex, shifting realities in their work and social environments (Strong et al., 2021; Zong et al., 2023). It allows for an in-depth analysis of doctors' narratives as they adapt to digital tools that influence clinical judgment and communication. Through this lens, the study responds directly to the limitations of prior research, emphasizing meaning over metrics. The phenomenological approach reveals emotional, ethical, and professional tensions that remain hidden in quantitative evaluations.

The structure of this article follows a clear and logical progression. It begins with an introduction to the research context and the significance of studying healthcare professionals' experiences with chatbot systems. The methods section outlines the phenomenological framework, participant selection, and data collection process (Kalasin et al., 2022). The results are organized thematically, based on the interpretative analysis of interview data. Finally, the discussion highlights the broader implications of the findings, followed by a conclusion that synthesizes the key insights from the study.

RESEARCH METHODS

Study Design

This study employed an interpretative phenomenological approach to explore the lived experiences of general practitioners (GPs) integrating chatbot technologies into their clinical practices (Mueller et al., 2024; Perry, 2023). Phenomenology, as a qualitative methodology, seeks to uncover the essence of participants' experiences by focusing on how they perceive and make sense of specific phenomena in their lifeworld. The interpretative variant, grounded in the Heideggerian tradition, emphasizes the contextual and meaning-making processes through which individuals interpret their realities. This design was particularly appropriate for addressing the research question, which seeks to understand how medical professionals construct meaning in response to the adoption of artificial intelligence tools in healthcare (Xie et al., 2021). By prioritizing the subjective perspective of GPs, the design facilitated an in-depth understanding of emotional, ethical, and relational dynamics that quantitative approaches may overlook.

Participants

Participants consisted of licensed general practitioners currently working in clinical settings where chatbot technologies were actively implemented as diagnostic support tools (Hammersley, 2003; McMahon & McGannon, 2024). Selection was conducted using purposive sampling, ensuring that each participant had direct, sustained experience with chatbot-assisted consultations. Inclusion criteria required that participants had used chatbot systems for at least three months and were actively involved in patient diagnosis and communication. Exclusion criteria included physicians who had no prior exposure to such technologies or those serving solely in administrative roles. A total of ten participants (six males and four females), ranging in age from 31 to 55 years (mean age = 42.3), were

included (Albahri et al., 2019). All participants practiced in urban healthcare facilities with access to digital infrastructure. Their experience levels in general practice ranged from 5 to 20 years.

Data Collection

Data were collected through in-depth, semi-structured interviews conducted in-person at the participants' workplaces or via secured video conferencing platforms when in-person meetings were not feasible (Bednarek-Gilland, 2015; Gibton, 2015). An interview guide was developed to elicit detailed narratives about participants' experiences with chatbot integration, including prompts related to clinical decision-making, patient interactions, emotional responses, and ethical concerns. Each interview lasted between 45 to 75 minutes and was audio-recorded with participants' consent. Interviews were conducted in private settings to ensure comfort and confidentiality (T. He & Lee, 2021). Field notes were taken to capture contextual observations and non-verbal cues. To support consistency, all interviews followed a standardized protocol, adapted as needed to suit the flow of conversation and allow participants to express their perspectives freely.

Data Analysis

Data were analyzed using Interpretative Phenomenological Analysis (IPA), a method that enables researchers to examine how individuals make sense of their experiences through a double hermeneutic process—interpreting participants' interpretations (Borcsa & Rober, 2015; McNabb, 2015). Transcribed interviews were read multiple times to ensure familiarity, followed by initial noting and identification of emergent themes. These themes were then clustered into superordinate categories based on conceptual similarities. NVivo software was utilized to support coding and organization of qualitative data but was not central to the interpretative process (Chong et al., 2019). The analytic procedure emphasized iterative reflection and thematic refinement to distill the essential meanings embedded in participants' narratives. Through this process, four primary themes emerged that captured the multifaceted nature of the phenomenon under investigation.

Ethical Considerations

Ethical approval for the study was obtained from the institutional review board affiliated with the research institution (Hillman & Radel, 2018; Lutz & Knox, 2014). Participants provided written informed consent prior to data collection. Confidentiality was maintained by anonymizing all participant identifiers, and data were stored securely in encrypted digital formats (Zhang et al., 2020). The research was conducted in accordance with the Declaration of Helsinki and adhered to relevant national and institutional guidelines for ethical research involving human subjects.

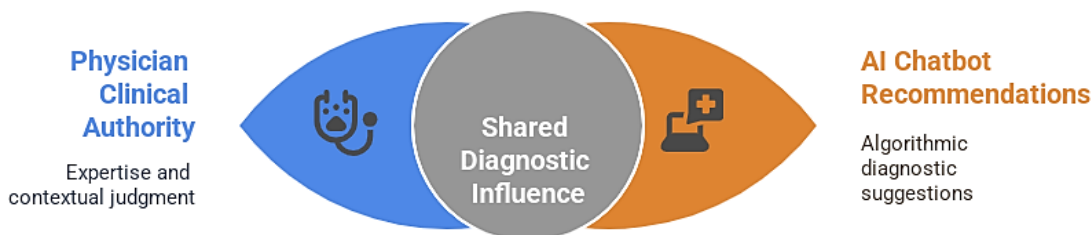
RESULTS

Negotiating Clinical Authority in the Age of AI

One of the most salient themes that emerged from the data is the perceived tension between clinical authority and the algorithmic suggestions provided by chatbots. Many GPs described a sense of diminished control over diagnostic processes, leading to professional discomfort and ethical ambivalence.

“Sometimes, I feel like I’m just validating what the chatbot already told the patient. It used to be that patients came to me for answers. Now, they come after they’ve been pre-diagnosed by an app.” (Participant 3)

This shift in clinical dynamics was perceived not merely as a technological adjustment but as a redefinition of the doctor-patient relationship. GPs expressed concern that chatbot recommendations, though often useful, were being perceived by patients as definitive diagnoses, thereby challenging the physician's interpretive and contextual expertise.



Navigating Clinical Authority in the AI Era

Emotional Ambivalence and Professional Identity

The integration of chatbots also triggered complex emotional responses related to the physicians' sense of professional identity. While some participants acknowledged the practical benefits of chatbot-assisted consultations, such as time efficiency and quick triage, they simultaneously reported feelings of emotional detachment and depersonalization.

“It’s like having a silent partner that never rests... but also never cares. There's no empathy, and that makes me question what kind of medicine we’re practicing now.” (Participant 7)

This emotional ambivalence reflects a broader concern about the erosion of humanistic elements in clinical care. Several GPs felt that reliance on chatbot technology subtly reduced their role from being compassionate caregivers to data interpreters or decision validators.

Trust, Accuracy, and the Hidden Burden of Verification

A recurring concern among participants was the need to constantly verify chatbot-generated information, especially when the chatbot’s conclusions diverged from clinical intuition or contextual patient knowledge.

“The chatbot sometimes misses nuances, like when a symptom is related to a mental health condition rather than a physical one. So I double-check everything. In the end, it’s more work than help.” (Participant 1)

This hidden burden of verification not only added to the physicians' workload but also introduced a layer of cognitive dissonance. Some participants noted that while the system was designed to assist, it inadvertently demanded more vigilance, which conflicted with the intended goal of efficiency.

Reconstructing the Doctor-Patient Relationship

Despite concerns, some GPs acknowledged that the presence of chatbots influenced the way they engaged in communication with patients. The technology, in some cases, served as a springboard for deeper discussions or clarified the patient's understanding before the consultation.

“Interestingly, patients come in more informed, which saves time. But I have to be careful not to just say ‘yes’ to the bot’s output. My role has shifted—now I guide interpretation rather than just deliver information.” (Participant 5)

This redefined interaction highlights an emerging model where the physician operates as a mediator between digital tools and human narratives. While this shift requires adaptation, it also presents an opportunity for physicians to refine their communication and patient engagement strategies.

The lived experiences of general practitioners integrating health chatbots into their clinical workflows reveal a multifaceted transformation in clinical authority, emotional labor, and doctor-patient relationships. These findings underscore the paradoxes of digital innovation: while chatbots offer practical advantages, they simultaneously reshape the cognitive, ethical, and emotional dimensions of medical practice. The themes identified here provide foundational insights into the

human experiences behind technological integration in healthcare—insights that quantitative evaluations alone cannot capture.

DISCUSSION

The findings of this study reveal the complex and often conflicting experiences of general practitioners as they integrate chatbot technologies into their clinical practice (Chung & Park, 2019). At the core of these experiences lies a negotiation of professional identity, emotional response, and relational dynamics—all shaped by the shifting boundaries between human and algorithmic authority in healthcare. These insights address the central research question: how do GPs experience the presence of chatbots in their daily routines, and how does this affect their interaction with patients and their clinical decision-making?

This study contributes to a richer understanding of the phenomenon by illuminating the emotional and ethical implications that accompany digital transformation in clinical settings. It demonstrates that chatbot integration is not merely a technical upgrade, but a deeply experiential shift that alters how physicians perceive their roles and relationships. Rather than simplifying clinical work, the technology introduces new forms of ambiguity—forcing physicians to reinterpret their responsibilities and navigate tensions between personal intuition and algorithmic recommendations. The interpretative phenomenological approach enabled the surfacing of these subtleties, providing a textured and meaningful account of professional adaptation.

These findings resonate with and expand upon existing literature. While prior studies such as Azbeg dkk. (2022) have emphasized the potential of AI to reshape clinical decision-making, they often overlook the lived realities of practitioners who must reconcile their expertise with the authority of digital tools. The emotional ambivalence and role conflict observed in this study echo concerns raised by K. He dkk. (2020) regarding the socio-technical challenges of health IT implementation. Moreover, the findings align with K. He dkk. (2020), who highlighted the trust deficit in human-AI collaboration but lacked the depth provided by firsthand experiential accounts. This study, therefore, offers a necessary complement to these prior works by centering the clinician's voice and interpreting the nuanced meanings behind their adaptation.

The findings of this study carry important implications for both clinical practice and the broader discourse on technology adoption in healthcare. On a professional level, the results highlight a need to reframe how digital tools are introduced into medical environments—not simply as instruments of efficiency, but as agents that shape identity, ethics, and relational dynamics. Socially and culturally, the ambivalence expressed by general practitioners reflects a deeper tension between human-centered care and algorithm-driven systems, particularly in contexts where trust, empathy, and communication are essential to patient outcomes. These insights suggest that institutions implementing AI technologies must address not only technical training but also the emotional and ethical support needs of practitioners. The relevance of these findings extends to global healthcare settings undergoing digital transformation, where similar tensions between tradition and innovation are likely to emerge.

This study is not without limitations. As with many phenomenological inquiries, the sample size was relatively small and focused on a specific group of professionals within urban clinical environments. While this allowed for deep and focused analysis, it limits the generalizability of the results to broader populations, such as rural healthcare providers or specialists in other fields. Furthermore, the study relied on self-reported data collected through interviews, which may be influenced by memory, bias, or context-specific dynamics. These limitations are not shortcomings but reflections of the depth-oriented nature of phenomenological research. They also underscore the importance of situating interpretations within specific cultural and professional contexts.

Future research may benefit from expanding the participant pool to include other stakeholders in the digital health ecosystem, such as nurses, patients, or policy-makers. Longitudinal studies could further examine how perceptions and experiences evolve as chatbot technologies become more deeply embedded in practice (Sharma et al., 2021). Comparative research across healthcare systems with

differing levels of AI integration may also illuminate cross-cultural dynamics and inform more context-sensitive implementation strategies. Ultimately, this study opens new avenues for exploring how digital transformation is not only shaping healthcare delivery, but also reconfiguring what it means to care, to diagnose, and to be a medical professional in the digital age.

CONCLUSION

This study explored the lived experiences of general practitioners in integrating chatbot technologies into clinical practice, addressing the need to understand the human dimensions of digital transformation in healthcare. The findings revealed that chatbot adoption influences not only clinical efficiency but also emotional, ethical, and relational aspects of medical work. Physicians experienced shifts in professional identity, trust, and communication, highlighting tensions between traditional care models and emerging AI systems. These insights contribute a deeper understanding of the subjective realities behind AI implementation, filling a gap left by earlier studies focused mainly on performance metrics. The study demonstrates the value of phenomenological methods in capturing rich, contextual meaning that quantitative approaches often overlook. Future research can expand this inquiry across diverse healthcare settings and professions to inform more empathetic and responsible integration of AI technologies.

CONFLICT OF INTEREST

The authors declare no conflict of interest. This research was conducted independently, and no financial or personal relationships could have influenced the work reported in this article. All sources of funding and institutional support have been acknowledged appropriately.

REFERENCES

- Albahri, O. S., Albahri, A. S., Zaidan, A. A., Zaidan, B. B., Alsalem, M. A., Mohsin, A. H., Mohammed, K. I., Alamoodi, A. H., Nidhal, S., Enaizan, O., Chyad, M. A., Abdulkareem, K. H., Almahdi, E. M., Al Shafeey, G. A., Baqer, M. J., Jasim, A. N., Jalood, N. S., & Shareef, A. H. (2019). Fault-Tolerant mHealth Framework in the Context of IoT-Based Real-Time Wearable Health Data Sensors. *IEEE Access*, 7, 50052–50080. Scopus. <https://doi.org/10.1109/ACCESS.2019.2910411>
- Azagba, S., Shan, L., Latham, K., & Qeadan, F. (2020). Trends in cigarette smoking among American Indians and Alaska Natives in the USA: 1992–2015. *Cancer Causes and Control*, 31(1), 73–82. Scopus. <https://doi.org/10.1007/s10552-019-01250-7>
- Azbeq, K., Ouchetto, O., & Jai Andaloussi, S. (2022). BlockMedCare: A healthcare system based on IoT, Blockchain and IPFS for data management security. *Egyptian Informatics Journal*, 23(2), 329–343. Scopus. <https://doi.org/10.1016/j.eij.2022.02.004>
- Bednarek-Gilland, A. (2015). *Researching values with qualitative methods: Empathy, moral boundaries and the politics of research* (p. 122). Ashgate Publishing Ltd; Scopus. <https://www.scopus.com/inward/record.uri?eid=2-s2.0-84938280606&partnerID=40&md5=9fe04cec3f08b662639e63bdf2de404d>
- Bent, B., Wang, K., Grzesiak, E., Jiang, C., Qi, Y., Jiang, Y., Cho, P., Zingler, K., Ogbeide, F. I., Zhao, A., Runge, R., Sim, I., & Dunn, J. (2021). The digital biomarker discovery pipeline: An open-source software platform for the development of digital biomarkers using mHealth and wearables data. *Journal of Clinical and Translational Science*, 5(1). Scopus. <https://doi.org/10.1017/cts.2020.511>
- Binyamin, S. S., & Hoque, M. R. (2020). Understanding the drivers of wearable health monitoring technology: An extension of the unified theory of acceptance and use of technology. *Sustainability (Switzerland)*, 12(22), 1–20. Scopus. <https://doi.org/10.3390/su12229605>

- Borcsa, M., & Rober, P. (2015). *Research perspectives in couple therapy: Discursive qualitative methods* (p. 176). Springer International Publishing; Scopus. <https://doi.org/10.1007/978-3-319-23306-2>
- Chong, Y.-W., Ismail, W., Ko, K., & Lee, C.-Y. (2019). Energy Harvesting for Wearable Devices: A Review. *IEEE Sensors Journal*, 19(20), 9047–9062. Scopus. <https://doi.org/10.1109/JSEN.2019.2925638>
- Chung, K., & Park, R. C. (2019). Chatbot-based healthcare service with a knowledge base for cloud computing. *Cluster Computing*, 22, 1925–1937. Scopus. <https://doi.org/10.1007/s10586-018-2334-5>
- Corsi-Zuelli, F., Marques, L., da Roza, D. L., Loureiro, C. M., Shuhama, R., Di Forti, M. D., Menezes, P. R., Louzada-Junior, P., & Del-Ben, C. M. (2022). The independent and combined effects of cannabis use and systemic inflammation during the early stages of psychosis: Exploring the two-hit hypothesis. *Psychological Medicine*, 52(16), 3874–3884. Scopus. <https://doi.org/10.1017/S0033291721000726>
- Corsi-Zuelli, F., Schneider, A. H., Santos-Silva, T., Loureiro, C. M., Shuhama, R., Menezes, P. R., Guimarães, F. S., Gomes, F. V., Cunha, F. Q., Louzada-Junior, P., & Del-Ben, C. M. (2022). Increased blood neutrophil extracellular traps (NETs) associated with early life stress: Translational findings in recent-onset schizophrenia and rodent model. *Translational Psychiatry*, 12(1). Scopus. <https://doi.org/10.1038/s41398-022-02291-4>
- Galimov, A., Vassej, J., Galstyan, E., Unger, J. B., Kirkpatrick, M. G., & Allem, J.-P. (2022). Ice Flavor-Related Discussions on Twitter: Content Analysis. *Journal of Medical Internet Research*, 24(11). Scopus. <https://doi.org/10.2196/41785>
- Gibton, D. (2015). *Researching education policy, public policy, and policymakers: Qualitative methods and ethical issues* (p. 226). Taylor and Francis; Scopus. <https://doi.org/10.4324/9781315775722>
- Gray, K. E., Hoerster, K. D., Taylor, L., Krieger, J., & Nelson, K. M. (2021). Improvements in physical activity and some dietary behaviors in a community health worker-led diabetes self-management intervention for adults with low incomes: Results from a randomized controlled trial. *Translational Behavioral Medicine*, 11(12), 2144–2154. Scopus. <https://doi.org/10.1093/tbm/ibab113>
- Hammersley, M. (2003). *The Dilemma Of Qualitative Method: Herbert Blumer and the Chicago Tradition* (p. 271). Taylor and Francis; Scopus. <https://doi.org/10.4324/9780203392904>
- Hasan, M. K., Shahjalal, M., Chowdhury, M. Z., & Jang, Y. M. (2019). Real-time healthcare data transmission for remote patient monitoring in patch-based hybrid OCC/BLE networks. *Sensors (Switzerland)*, 19(5). Scopus. <https://doi.org/10.3390/s19051208>
- Hatsukami, D. K., & Carroll, D. M. (2020). Tobacco harm reduction: Past history, current controversies and a proposed approach for the future. *Preventive Medicine*, 140. Scopus. <https://doi.org/10.1016/j.ypmed.2020.106099>
- He, K., Liu, Z., Wan, C., Jiang, Y., Wang, T., Wang, M., Zhang, F., Liu, Y., Pan, L., Xiao, M., Yang, H., & Chen, X. (2020). An On-Skin Electrode with Anti-Epidermal-Surface-Lipid Function Based on a Zwitterionic Polymer Brush. *Advanced Materials*, 32(24). Scopus. <https://doi.org/10.1002/adma.202001130>
- He, T., & Lee, C. (2021). Evolving Flexible Sensors, Wearable and Implantable Technologies towards BodyNET for Advanced Healthcare and Reinforced Life Quality. *IEEE Open Journal of Circuits and Systems*, 2, 702–720. Scopus. <https://doi.org/10.1109/OJCAS.2021.3123272>
- Hillman, W., & Radel, K. (2018). *Qualitative methods in tourism research: Theory and practice* (p. 294). Channel View Publications; Scopus. <https://www.scopus.com/inward/record.uri?eid=2-s2.0-85050434848&partnerID=40&md5=7ea1e3f0b2027993b53f6a795804ee51>
- Kalasin, S., Sangnuang, P., & Surareungchai, W. (2022). Intelligent Wearable Sensors Interconnected with Advanced Wound Dressing Bandages for Contactless Chronic Skin Monitoring: Artificial Intelligence for Predicting Tissue Regeneration. *Analytical Chemistry*, 94(18), 6842–6852. Scopus. <https://doi.org/10.1021/acs.analchem.2c00782>
- Langley, T., Bell-Williams, R., Pattinson, J., Britton, J., & Bains, M. (2019). ‘I felt welcomed in like they’re a little family in there, i felt like i was joining a team or something’: Vape shop

- customers' experiences of E-cigarette use, vape shops and the vaping community. *International Journal of Environmental Research and Public Health*, 16(13). Scopus. <https://doi.org/10.3390/ijerph16132341>
- Liese, B. S., & Monley, C. M. (2021). Providing addiction services during a pandemic: Lessons learned from COVID-19. *Journal of Substance Abuse Treatment*, 120. Scopus. <https://doi.org/10.1016/j.jsat.2020.108156>
- Lutz, W., & Knox, S. (2014). *Quantitative and qualitative methods in psychotherapy research* (p. 448). Taylor and Francis; Scopus. <https://doi.org/10.4324/9780203386071>
- Martinasek, M. P., Wheldon, C. W., Parsons, C. A., Bell, L. A., & Lipski, B. K. (2021). Understanding Adverse Childhood Experiences as Predictors of Cigarette and E-Cigarette Use. *American Journal of Preventive Medicine*, 60(6), 737–746. Scopus. <https://doi.org/10.1016/j.amepre.2021.01.004>
- McMahon, J., & McGannon, K. R. (2024). *Trauma-informed research in sport, exercise, and health: Qualitative methods* (p. 268). Taylor and Francis; Scopus. <https://doi.org/10.4324/9781003332909>
- McNabb, D. E. (2015). *Research methods for political science: Quantitative and qualitative methods: Second edition* (p. 426). Taylor and Francis; Scopus. <https://doi.org/10.4324/9781315701141>
- Mueller, J. J., File, N., Stremmel, A. J., Iruka, I. U., & Whyte, K. L. (2024). *UNDERSTANDING RESEARCH IN EARLY CHILDHOOD EDUCATION: Quantitative and Qualitative Methods, Second edition* (p. 204). Taylor and Francis; Scopus. <https://doi.org/10.4324/9781003354499>
- Nasr, M., Islam, M. M., Shehata, S., Karray, F., & Quintana, Y. (2021). Smart Healthcare in the Age of AI: Recent Advances, Challenges, and Future Prospects. *IEEE Access*, 9, 145248–145270. Scopus. <https://doi.org/10.1109/ACCESS.2021.3118960>
- Nawi, A. M., Ismail, R., Ibrahim, F., Hassan, M. R., Manaf, M. R. A., Amit, N., Ibrahim, N., & Shafuridin, N. S. (2021). Risk and protective factors of drug abuse among adolescents: A systematic review. *BMC Public Health*, 21(1). Scopus. <https://doi.org/10.1186/s12889-021-11906-2>
- Perry, N. E. (2023). *Using qualitative methods to enrich understandings of self-regulated learning: A special issue of educational psychologist* (p. 64). Taylor and Francis Inc.; Scopus. <https://doi.org/10.4324/9781410608529>
- Punj, R., & Kumar, R. (2019). Technological aspects of WBANs for health monitoring: A comprehensive review. *Wireless Networks*, 25(3), 1125–1157. Scopus. <https://doi.org/10.1007/s11276-018-1694-3>
- Sharma, N., Mangla, M., Mohanty, S. N., Gupta, D., Tiwari, P., Shorfuzzaman, M., & Rawashdeh, M. (2021). A smart ontology-based IoT framework for remote patient monitoring. *Biomedical Signal Processing and Control*, 68. Scopus. <https://doi.org/10.1016/j.bspc.2021.102717>
- Shin, S. H. (2021). Preventing E-cigarette use among high-risk adolescents: A trauma-informed prevention approach. *Addictive Behaviors*, 115. Scopus. <https://doi.org/10.1016/j.addbeh.2020.106795>
- Strong, D. R., Pierce, J. P., Pulvers, K., Stone, M. D., Villaseñor, A., Pu, M., Dimofte, C. V., Leas, E. C., Oratowski, J., Brighton, E., Hurst, S., Kealey, S., Chen, R., & Messer, K. (2021). Effect of Graphic Warning Labels on Cigarette Packs on US Smokers' Cognitions and Smoking Behavior after 3 Months: A Randomized Clinical Trial. *JAMA Network Open*, 4(8). Scopus. <https://doi.org/10.1001/jamanetworkopen.2021.21387>
- Tran, V.-T., Riveros, C., & Ravaud, P. (2019). Patients' views of wearable devices and AI in healthcare: Findings from the ComPaRe e-cohort. *Npj Digital Medicine*, 2(1). Scopus. <https://doi.org/10.1038/s41746-019-0132-y>
- Vieira, I. S., Pedrotti Moreira, F., Mondin, T. C., Cardoso, T. D. A., Branco, J. C., Kapczinski, F., Jansen, K., Souza, L. D. D. M., & da Silva, R. A. (2020). Resilience as a mediator factor in the relationship between childhood trauma and mood disorder: A community sample of young adults. *Journal of Affective Disorders*, 274, 48–53. Scopus. <https://doi.org/10.1016/j.jad.2020.04.011>
- Xie, Y., Lu, L., Gao, F., He, S.-J., Zhao, H.-J., Fang, Y., Yang, J.-M., An, Y., Ye, Z.-W., & Dong, Z. (2021). Integration of Artificial Intelligence, Blockchain, and Wearable Technology for

- Chronic Disease Management: A New Paradigm in Smart Healthcare. *Current Medical Science*, 41(6), 1123–1133. Scopus. <https://doi.org/10.1007/s11596-021-2485-0>
- Zhang, H., Deng, K., Li, H., Albin, R. L., & Guan, Y. (2020). Deep Learning Identifies Digital Biomarkers for Self-Reported Parkinson's Disease. *Patterns*, 1(3). Scopus. <https://doi.org/10.1016/j.patter.2020.100042>
- Zong, P., Hu, W., Huang, Y., An, H., Zhang, Q., Chai, Z., Lei, Y. K., Wang, J., Li, D., & Cai, W. (2023). Effects of adding cocoa fermentation medium on cigar leaves in agricultural fermentation stage. *Frontiers in Bioengineering and Biotechnology*, 11. Scopus. <https://doi.org/10.3389/fbioe.2023.1251413>