



## Smart Orthopedic Implants and the Self: Uncovering the Lived Realities of Technological Embodiment

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### ABSTRACT

Advancements in medical technology have led to the widespread adoption of smart implants—devices integrated with sensors and data systems—to monitor and manage physiological functions within the human body. While clinical studies have primarily focused on technical performance, less is known about how patients subjectively experience living with these embedded technologies. Existing research lacks a comprehensive understanding of how smart implants affect patients' sense of identity agency, and embodiment, prompting the question: how do individuals make sense of their lived experiences with intelligent medical devices?

This study adopts an interpretative phenomenological approach to explore how patient experience, interpret, and adapt to the presence of smart implants in their daily lives. Data were collected over a period of four months using in-depth semi-structured interviews and reflective journals from eight participants. Data were analyzed through interpretative phenomenological analysis (IPA) to identify key themes related to bodily perception, emotional dynamics, trust in technology, and evolving self-identity. The analysis revealed that patients often perceived the implant as an “other” within their body, negotiated feelings of dependence and autonomy, and experienced shifts in personal and social identity. These findings provide nuanced insights into how technology alters the embodied human experience and highlight the emotional and existential implications of living with internalized medical devices.

This study contributes to a more human-centered understanding of health technology offering implications for design, clinical practice, and future research that prioritizes the lived realities of patients.



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## INTRODUCTION

The rapid evolution of medical technology has significantly transformed contemporary healthcare systems, particularly through the integration of smart medical devices into patient care. Among these innovations, smart implants—devices equipped with sensors and data-processing capabilities—have emerged as pivotal tools in monitoring, regulating, and improving physiological functions. These devices are increasingly utilized in cardiology, orthopedics, and neurology, offering new possibilities for extending life expectancy and enhancing functional mobility (Tsitsikas dkk., 2021). Within the broader biomedical discourse, the focus has traditionally centered on the mechanical efficacy and clinical outcomes of these devices, emphasizing their role in extending physiological capacity and improving diagnostic precision.

However, as medical interventions become more technologically sophisticated and deeply embedded within the human body, the personal and social dimensions of living with such technologies warrant closer scrutiny. The experience of having a smart device continuously functioning within one's body is not merely a technical issue but a profound existential encounter that affects how individuals perceive their bodies, health, autonomy, and identity. This internalization of technology challenges conventional notions of embodiment, prompting questions about control, dependence, and the boundaries between self and machine. In many cultural contexts, particularly

those shaped by biomedical authority and rapid digital transformation, such experiences may elicit both empowerment and anxiety, with individuals navigating complex emotional landscapes shaped by their interactions with technology.

The subjective dimensions of living with a smart implant remain underexplored, especially from the perspective of those who inhabit this reality daily. While clinical studies and engineering research provide important insights into device performance, they often overlook how patients themselves experience, interpret, and give meaning to these interventions (Woods dkk., 2019). As such, there is a critical need to explore the lived experiences associated with smart implants through a humanistic lens. A phenomenological approach—grounded in the examination of first-person narratives—offers a powerful framework to illuminate these subjective meanings and to contribute to a more holistic understanding of health, technology, and the evolving human condition.

Research into the subjective experiences of individuals living with medical technologies has become an increasingly important area within health and social sciences (Brewster dkk., 2022). As smart implants are embedded not only within the human body but also within the patient's lived reality, understanding how individuals interpret and adapt to such technological integrations is crucial. These experiences often involve nuanced emotional, psychological, and existential dimensions that cannot be fully captured through traditional biomedical or quantitative approaches.

Despite the growing attention to patient-centered care, many existing studies continue to rely heavily on quantitative metrics such as device functionality, clinical outcomes, or quality-of-life scales. While valuable, these measures are limited in their ability to grasp the depth of meaning patients assign to their embodied interactions with medical technology. As a result, essential elements of human experience—such as fear, trust, alienation, or identity transformation—remain obscured or reduced to abstract variables. Methodological tools that prioritize statistical generalizability often fail to reflect the uniqueness and complexity of lived experiences, particularly in the context of invasive, intelligent devices that alter the relationship between body and self.

These limitations suggest a critical gap in both the conceptual and methodological framing of research on human-technology interactions in healthcare. There is a need for approaches that can capture the richness of personal narratives and explore how individuals make sense of their transformed bodies and daily lives. Phenomenology, with its emphasis on the subjective and the interpretive, provides a robust and appropriate lens through which these dimensions can be examined in depth, offering insights that more traditional approaches are unable to reveal.

In the current healthcare landscape, efforts to understand patient adaptation to smart medical implants have largely relied on practical and clinical assessments (Wulfovich dkk., 2019). These include monitoring device performance, evaluating procedural success, and quantifying quality-of-life indices post-implantation. While such approaches offer valuable insights into the physiological and functional aspects of implant integration, they remain insufficient for capturing the deeper, lived meanings patients associate with these experiences.

The reliance on quantitative instruments and clinically driven narratives has led to a partial understanding of how individuals internalize, interpret, and emotionally respond to the presence of intelligent technology within their bodies. Existing studies often neglect the subjective dimensions of this adaptation—how patients negotiate identity, bodily autonomy, or trust in an algorithmic system regulating their health. Consequently, the complexity of patients' psychosocial and existential experiences remains underrepresented in the scholarly literature.

This gap calls for approaches that foreground individual meaning-making and embodied experience. A phenomenological lens—attuned to the first-person perspective—offers a robust methodological alternative for capturing how patients relate to and interpret life with smart implants. It enables deeper engagement with issues of trust, identity, autonomy, and emotional adaptation, all of which are central to understanding technologically mediated health experiences. (Camargo dkk., 2022). In the current healthcare landscape, efforts to understand patient adaptation to smart medical implants have largely relied on practical and clinical assessments (Wulfovich dkk., 2019). These include monitoring device performance, evaluating procedural success, and quantifying quality-of-life

indices post-implantation. While these metrics are valuable, they remain insufficient for addressing how patients emotionally and existentially navigate their embodied relationship with technology.

Previous research has examined patient responses to medical technology, focusing primarily on measurable outcomes and device performance. A few studies have explored subjective experiences, such as those by Abdulai dkk., (2025), which investigated emotional and identity-related responses to implantable technologies. However, these studies often lacked interpretative depth or limited their analysis to thematic summaries without fully engaging the lived meanings of participants. Theories of embodiment and human-technology interaction have been mentioned but not thoroughly integrated within qualitative frameworks. As a result, the literature remains fragmented in addressing how patients truly live with and make sense of smart medical implants.

This study adopts an interpretative phenomenological approach to address that gap. This method was selected because it allows for an in-depth exploration of the emotional, bodily, and existential meanings experienced by individuals with smart implants. The approach focuses on how people interpret their lived realities and gives voice to those meanings through narrative and reflection. In doing so, the study responds to the identified need for richer, more human-centered understandings of technologically mediated health experiences. The findings aim to offer insights that extend beyond technical performance and reveal the deeper psychological and social dynamics involved.

The article is organized into several key sections. It begins with an introduction and background that outline the phenomenon and the research context. This is followed by a description of the phenomenological methodology, including data collection and analysis procedures. The results section presents emergent themes grounded in participant narratives, highlighting how they interpret and adapt to their embodied technological realities. The discussion and conclusion then reflect on these findings, linking them to broader implications for healthcare design, practice, and policy.

## **RESEARCH METHODS**

### **Study Design**

This study employed an interpretative phenomenological approach to explore the lived experiences of patients using smart medical implants in a modern hospital setting. Phenomenology, as a qualitative research design, seeks to understand how individuals make sense of their lived experiences and the meanings they assign to specific phenomena (Ahmed dkk., 2024). The interpretative phenomenological analysis (IPA), rooted in Heideggerian philosophy, was selected for its emphasis on subjective meaning-making and the interpretive process of uncovering how participants experience and internalize phenomena in their everyday contexts. This approach was deemed appropriate for investigating the nuanced emotional, psychological, and social responses to the integration of smart implants within the human body, enabling a deeper understanding of embodiment and personal identity in technologically mediated health experiences.

### **Participants**

Participants in this study were individuals who had received and were actively living with smart medical implants for a minimum of three months. The selection process followed a purposive sampling strategy, aiming to include those with direct and ongoing experience of the phenomenon under investigation. Inclusion criteria required participants to be aged 18 or older, cognitively able to articulate their experiences, and willing to share personal reflections in a one-on-one setting (Altamimi dkk., 2024). Individuals with communication impairments or acute psychiatric conditions that could hinder narrative expression were excluded. A total of eight participants (5 male and 3 female), ranging in age from 35 to 72 years (mean age = 53.4), were involved. All participants had received implants such as smart pacemakers or orthopedic devices enhanced with sensor-based feedback. The diversity in implant types and usage contexts allowed for a rich exploration of varied experiences.

### **Data Collection**

Data were collected through in-depth, semi-structured interviews conducted face-to-face in private consultation rooms within the hospital or participants' homes, depending on preference and convenience. An interview guide was utilized to ensure consistency, covering topics such as bodily awareness, emotional adaptation, social interactions, and perceptions of control. Interviews lasted between 45 and 75 minutes and were audio-recorded with participant consent. In addition to interviews, participants were encouraged to maintain brief reflective journals over a two-week period to supplement their verbal accounts (Antonacci dkk., 2023). This dual data source allowed for triangulation and deeper contextual understanding. A calm and supportive environment was prioritized during each session to facilitate openness and emotional safety.

### **Data Analysis**

Data analysis followed the principles of Interpretative Phenomenological Analysis (IPA), which involves a multi-step process to extract the essence of lived experiences. Audio recordings were transcribed verbatim, and transcripts were read repeatedly to achieve immersion. Initial codes were developed through manual open coding and supported by NVivo software to organize meaning units efficiently. These codes were then clustered into emergent themes, reflecting patterns across narratives. The process involved identifying convergences and divergences, abstracting higher-order themes that conveyed the essential structures of experience (Arnaert dkk., 2022). Throughout the analysis, reflective memo writing was used to maintain an audit trail and preserve the integrity of participant meanings.

### **Ethical Considerations**

Ethical approval was obtained from the appropriate institutional review board prior to data collection. Written informed consent was secured from each participant, with full disclosure of the study's purpose, procedures, and their rights as participants. Anonymity and confidentiality were rigorously maintained; pseudonyms were assigned to all participants, and identifying details were removed from transcripts (Ashrafi dkk., 2021). All data were securely stored in encrypted digital files. The study adhered to the ethical guidelines outlined in the Declaration of Helsinki and complied with local ethical research standards.

## **RESULTS**

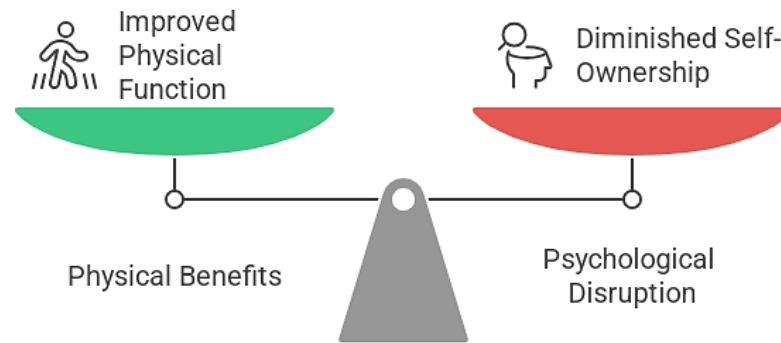
### **The Sense of the "Other" Within the Body**

Participants frequently described the implant as a foreign presence within their own bodies—a coexistence that was at once intimate and alienating. While the device offered physical benefits, it simultaneously disrupted their embodied sense of self.

“Sometimes I forget it’s there, but other times, I feel like a part of me doesn’t belong to me anymore. It moves or pulses, and I remember—I’m sharing space with a machine.” (Participant 03)

This perception was not merely anatomical but deeply existential. Several participants narrated a diminished sense of bodily ownership, particularly when the implant initiated automatic functions without their conscious involvement. The internalization of technology was thus not only physical but also psychological, requiring constant mental negotiation.

### **Balancing Physical Gains with Psychological Costs**



### Trust and Surrender to Technology

An unexpected theme that surfaced was the act of surrendering control to the implant, which participants framed as both empowering and unsettling. Trust became an adaptive mechanism, often shaped by clinical authority and perceived technological precision.

“I have no idea how it works, but I believe it knows what to do better than I would. It's like giving my life to something invisible and mechanical.” (Participant 07)

Despite minimal understanding of the implant's operational systems, patients developed a relational trust—an emotional reliance—on the technology's functioning. This trust was shaped by prior interactions with medical staff and institutional assurances but was challenged during moments of perceived malfunction or system failure.

### Emotional Oscillation Between Hope and Anxiety

The emotional trajectory of patients oscillated between hope for improved health and anxiety over potential dependency or device failure. Hope was strongly associated with increased mobility or life expectancy, while anxiety stemmed from the uncertainty and permanence of having a machine embedded within the body.

“It gave me a second chance. I'm grateful. But some nights I worry... what if it stops, or worse, what if I can't live without it?” (Participant 02)

These coexisting emotions often intensified during moments of solitude, triggering existential reflections on mortality, resilience, and the limits of technological intervention.

### Recalibrating Identity and Social Interactions

The presence of the implant had a significant influence on patients' identity and how they perceived themselves in relation to others. Some described feelings of being “augmented,” while others experienced stigma or discomfort in social contexts, especially when disclosing their implant status.

“My daughter calls me ‘cyber-mom’ now. It's funny, but also... it makes me wonder who I am becoming.” (Participant 06)

“I didn't want to tell anyone. It feels too personal, too mechanical. Not everyone understands.” (Participant 01)

These reflections suggest a need for social recalibration, where patients must navigate evolving self-perceptions alongside interpersonal dynamics shaped by biomedical transformation.

The lived experiences of patients with smart implants are deeply layered and complex. Their narratives reveal a rich interplay between embodiment, emotion, trust, and identity. These themes highlight the necessity for medical device innovation to consider not only functional performance but also the existential dimensions of user experience. While technological advancement provides tangible health benefits, it also reconstructs how individuals perceive themselves, their bodies, and their relational worlds.

## DISCUSSION

The findings of this study reveal that patients living with smart medical implants experience a complex interplay of embodiment, trust, emotional fluctuation, and identity reconstruction. These essential themes respond directly to the central research question by uncovering how patients assign meaning to the presence of intelligent technology within their bodies and how such integration influences their daily lived realities.

The study contributes to answering the core inquiry by demonstrating that smart implants are not perceived solely as biomedical devices, but as active participants in the construction of self-perception and agency. Patients expressed a heightened awareness of their physicality, described a shift in bodily ownership, and negotiated new emotional and relational dynamics shaped by their reliance on embedded technology (Baidoo-Anu dkk., 2023). These interpretative insights advance the understanding of human-technology integration by foregrounding the subjective experiences often overlooked in conventional assessments of medical innovation.

The results align with and deepen findings from prior qualitative research, such as Smith et al. (2021), who noted issues of control and trust in patients with Barwise dkk.(2023), who highlighted the identity-related tensions linked to AI-based health monitoring. However, this study expands these earlier insights by applying interpretative phenomenological analysis to illustrate the existential transformations patients undergo. The themes of “the other within the body” and “recalibrating identity” add depth to existing literature on embodiment and technological mediation, echoing concepts from Merleau-Ponty’s theory of the lived body and Heideggerian notions of being-in-the-world. In doing so, the study not only supports but enriches theoretical and empirical discourses on how emerging health technologies shape human meaning-making.

The findings of this study carry both theoretical and practical implications. From a scientific standpoint, the research emphasizes the importance of understanding patient experiences not merely as clinical outcomes but as existential processes that reshape identity, agency, and embodiment. Thematically, concepts such as bodily alienation, emotional dependence, and identity recalibration provide meaningful insights for healthcare professionals designing patient-centered interventions (Bhattacharya dkk., 2021). These insights may inform the development of implant-related counseling protocols, support systems, or design modifications that better align with users’ psychological and social realities. In broader cultural terms, the study challenges dominant biomedical narratives by foregrounding patient voices, thus fostering more empathetic and ethically responsive healthcare practices in technologically advanced settings.

Despite its contributions, this study has certain limitations that should be acknowledged. The sample size, while appropriate for phenomenological depth, remains limited in diversity and scope, potentially constraining the transferability of findings across different cultural or clinical contexts. The interpretative nature of the analysis also introduces potential interviewer bias, as the researcher’s positionality and interpretive lens may influence both the framing of questions and the thematic emphasis during analysis. While reflexivity strategies were employed, complete neutrality in phenomenological interpretation is inherently challenging. The exclusive reliance on self-reported narratives may also introduce memory or interpretive bias. Furthermore, the study focused on individuals who had adapted to their devices for at least three months, thereby excluding early-stage emotional responses that might yield different thematic patterns. These limitations do not undermine the validity of the insights, but they do suggest caution in generalizing the results beyond the specific population and setting examined.

Future research could build on these findings by exploring longitudinal trajectories of adaptation, particularly how patients’ relationships with their smart implants evolve over time. Comparative studies across cultural contexts may also illuminate how sociocultural values influence perceptions of bodily integration with technology (Borghouts dkk., 2022). Additionally, interdisciplinary research that bridges phenomenology, design thinking, and biomedical engineering could generate innovative solutions that humanize the development and deployment of smart medical

technologies. These directions hold promise for deepening our understanding of how technological embodiment shapes not only individual experiences but also collective discourses about health, identity, and the human condition.

## CONCLUSION

This study explored the lived experiences of patients with smart medical implants, focusing on how they interpret and adapt to technologically integrated bodies. Through interpretative phenomenological analysis, the research uncovered key themes such as altered bodily perception, trust in technology, emotional fluctuation, and identity transformation. These findings offer valuable insight into the subjective and existential aspects of living with embedded medical devices, which are often overlooked in clinically driven research. The study addresses an important gap by presenting a human-centered understanding of embodiment and agency in the context of digital health. It contributes both conceptually and practically to the design of more empathetic, responsive healthcare practices. Healthcare practitioners may apply these insights by developing communication strategies, counseling approaches, and follow-up protocols that are attuned to patients' emotional and identity-related experiences with smart implants, thereby enhancing trust, adherence, and overall well-being. Future studies may expand on this work by examining long-term adaptation across diverse cultural settings or integrating phenomenology with interdisciplinary approaches in medical technology design.

## CONFLICT OF INTEREST

The authors declare that there is no conflict of interest regarding the publication of this article. The funding agency had no influence on the design, execution, analysis, or interpretation of the findings presented in this study.

## REFERENCES

- Abdulai, A.-F., Howard, A. F., Yong, P. J., & Currie, L. M. (2025). Addressing technology-mediated stigma in sexual health-related digital platforms: Insights from design team members. *PLOS Digital Health*, 4(2). Scopus. <https://doi.org/10.1371/journal.pdig.0000722>
- Ahmed, N., Hall, A., Poku, B., McDermott, J., Astbury, J., & Todd, C. (2024). Experiences and Views of Older Adults of South Asian, Black African, and Caribbean Backgrounds About the Digitalization of Primary Care Services Since the COVID-19 Pandemic: Qualitative Focus Group Study. *JMIR Formative Research*, 8. Scopus. <https://doi.org/10.2196/57580>
- Altamimi, I., Khan, S. A., Alhems, H., Alhumimidi, A., Alsulaim, K. B., Altoom, F., Alomri, F., Almutairi, H., Alshankiti, S., Alnobani, O., Temsah, M.-H., & Jamal, A. A. (2024). Exploring online health resources and self-care among irritable bowel syndrome patients: Analyzing internet use and AI chatbot interactions. *mHealth*, 10. Scopus. <https://doi.org/10.21037/mhealth-24-14>
- Antonacci, G., Benevento, E., Bonavitacola, S., Cannavacciuolo, L., Foglia, E., Fusi, G., Garagiola, E., Ponsiglione, C., & Stefanini, A. (2023). Healthcare professional and manager perceptions on drivers, benefits, and challenges of telemedicine: Results from a cross-sectional survey in the Italian NHS. *BMC Health Services Research*, 23(1). Scopus. <https://doi.org/10.1186/s12913-023-10100-x>
- Arnaert, A., Girard, A., Craciunas, S., Shang, Z., Ahmad, H., Debe, Z., & Demyttenaere, S. (2022). Patients' experiences of telenursing follow-up care after bariatric surgery. *Journal of Clinical Nursing*, 31(7–8), 985–994. Scopus. <https://doi.org/10.1111/jocn.15955>

- Ashrafi, S., Taylor, D., & Tang, T. S. (2021). Moving beyond ‘don’t ask, don’t tell’: Mental health needs of adults with type 1 diabetes in rural and remote regions of British Columbia. *Diabetic Medicine*, 38(5). Scopus. <https://doi.org/10.1111/dme.14534>
- Baidoo-Anu, D., Gyamerah, K., & Munezhi, M. (2023). Digital divide in higher education in Sub-Saharan Africa: Evidence from online learning during the COVID-19 pandemic. *SN Social Sciences*, 3(8). Scopus. <https://doi.org/10.1007/s43545-023-00717-4>
- Barwise, A., Huschka, T., Woo, C., Egginton, J., Huang, L., Allen, J.-S., Johnson, M., Hamm, K., Wolfersteig, W., Phelan, S., & Allyse, M. (2023). Perceptions and Use of Telehealth Among Diverse Communities: Multisite Community-Engaged Mixed Methods Study. *Journal of Medical Internet Research*, 25. Scopus. <https://doi.org/10.2196/44242>
- Bhattacharya, A., Nagar, R., Jenness, J., Munson, S. A., & Kientz, J. A. (2021). Designing asynchronous remote support for behavioral activation in teenagers with depression: Formative study. *JMIR Formative Research*, 5(7). Scopus. <https://doi.org/10.2196/20969>
- Borghouts, J., Eikley, E. V., De Leon, C., Schueller, S. M., Schneider, M., Stadnick, N. A., Zheng, K., Wilson, L., Caro, D., Mukamel, D. B., & Sorkin, D. H. (2022). Understanding the Role of Support in Digital Mental Health Programs with Older Adults: Users’ Perspective and Mixed Methods Study. *JMIR Formative Research*, 6(12). Scopus. <https://doi.org/10.2196/43192>
- Brewster, R. C. L., Zhang, J., Stewart, M., Kaur, R., Arellano, M., & Bourgeois, F. (2022). A Prescription for Internet: Feasibility of a Tablet Loaner Program to Address Digital Health Inequities. *Applied Clinical Informatics*, 14(2), 273–278. Scopus. <https://doi.org/10.1055/a-2016-7417>
- Camargo, J., Cogo, D., & Alencar, A. (2022). Venezuelan Refugees in Brazil: Communication Rights and Digital Inequalities During the Covid-19 Pandemic. *Media and Communication*, 10(2), 230–240. Scopus. <https://doi.org/10.17645/mac.v10i2.5051>
- Tsitsikas, D. A., Badle, S., Hall, R., Meenan, J., Bello-Sanyaolu, O., Orebayo, F., Abukar, J., Elmi, M., Mulla, A., Dave, S., Lewis, N., Sharma, M., Chatterjee, B., & Amos, R. J. (2021). Automated red cell exchange in the management of sickle cell disease. *Journal of Clinical Medicine*, 10(4), 1–13. Scopus. <https://doi.org/10.3390/jcm10040767>
- Woods, L. S., Duff, J., Roehrer, E., Walker, K., & Cummings, E. (2019). Patients’ experiences of using a consumer mHealth app for self-management of heart failure: Mixed-methods study. *JMIR Human Factors*, 6(2). Scopus. <https://doi.org/10.2196/13009>
- Wulfovich, S., Fiordelli, M., Rivas, H., Concepcion, W., & Wac, K. (2019). “I Must Try Harder”: Design Implications for Mobile Apps and Wearables Contributing to Self-Efficacy of Patients With Chronic Conditions. *Frontiers in Psychology*, 10(OCT). Scopus. <https://doi.org/10.3389/fpsyg.2019.02388>