

Case Report

AI-Supported Psycho-Oncology Care for Breast Cancer: A Case Report on Digital Biomarkers and Post-Mastectomy Distress

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Abstract

Psychosocial distress has been demonstrated to have a significant impact on the quality of life and treatment adherence of patients diagnosed with breast cancer. The integration of digital biomarkers with artificial intelligence (AI) has emerged as a novel approach for the timely detection and management of distress. This case report describes a 42-year-old female breast cancer patient who experienced severe psychosocial distress following the commencement of chemotherapy and subsequent mastectomy. The utilisation of artificial intelligence (AI)-driven digital biomarkers, derived from smartphone applications, in conjunction with the analysis of digital communications and virtual conversational assistance (e.g. ChatGPT), enabled clinicians to expeditiously identify early indications of distress and promptly implement bespoke psychosocial interventions. The early identification of psychological distress in patients receiving cancer treatment has been demonstrated to result in significant improvements in their psychological health, treatment adherence, and overall quality of life. This underscores the potential of artificial intelligence-supported psycho-oncology interventions. The study observed improvements in the following areas: increased regularity of sleep, increased physical activity levels, and normalised heart-rate variability patterns, as detected via Google Fit. These improvements were accompanied by reduced anxiety and improved emotional stability during the follow-up period.

Keywords: Artificial Intelligence; Breast Cancer; Digital Biomarkers; Mastectomy; Psycho-Oncology

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Introduction

Psychological distress is a prevalent yet frequently under-recognised consequence of a diagnosis of breast cancer and its subsequent treatment, with anxiety and depressive symptoms reported in up to 50% of patients during active therapy (Aitken & Hossan, 2022). As posited by Park, Chun, et al., 2024; Park, Jung, et al., 2024, such profound psychological distress has the potential to have a detrimental effect on the quality of life of the individual concerned. Moreover, it may also have an adverse impact on the patient's adherence to their treatment regime, with the consequence that the clinical outcomes in the long term may be compromised. Advancements in digital health technologies, particularly those underpinned by artificial intelligence (AI), present promising avenues for real-time monitoring and early identification of emotional and behavioural health challenges (Haddou et al., 2024; Maass et al., 2019). Digital biomarkers, defined as objective, quantifiable physiological and behavioural data collected through digital devices, have demonstrated value in capturing changes in mood, activity, and sleep patterns that may indicate emerging psychological distress (Haddou et al., 2024; Maass et al., 2019; Park, Jung, et al., 2024). Concurrently, AI-powered conversational agents are being recognised more and more for their potential to provide accessible, stigma-free psychosocial support, particularly in settings where mental health remains under-discussed. In the context of oncology, psychological distress frequently goes unidentified, a phenomenon that is especially pronounced in conservative cultural settings where patients may be inclined to downplay or altogether refrain from discussing emotional issues. The utilisation of AI-driven digital biomarkers has emerged as a promising avenue for the identification of early behavioural changes that often precede verbal disclosure. This characteristic renders them particularly well-suited for the provision of proactive psycho-oncology support. This provides a robust rationale for the presentation of a case in which such tools have been integrated into routine care. Despite these advancements, the implementation of AI-driven digital biomarkers and conversational AI within oncology care, particularly in more traditional cultural contexts, remains restricted and under-explored. This case report presents the integration of these technologies into psycho-oncological management, illustrating their role in the supportive care of a breast cancer patient (Haddou et al., 2024; Maass et al., 2019).

Case Presentation

A 42-year-old woman diagnosed with stage II HER2-positive breast cancer was scheduled to

commence systemic therapy with trastuzumab and docetaxel. During the initial consultation, substantial anxiety and reluctance regarding chemotherapy were reported, primarily associated with concerns about treatment-related toxicity, alopecia, and the possibility of death. The patient expressed a preference for considering alternative remedies before initiating conventional treatment, reflecting concerns about the anticipated adverse effects of chemotherapy and uncertainty regarding its tolerability.

The oncologist addressed these concerns through empathetic, evidence-based counselling that acknowledged the patient's fears while explaining the expected benefits of treatment and the availability of supportive care measures. The consultation also explored existential and spiritual concerns, including feelings of injustice and the possibility that the illness represented divine punishment. The physician emphasised that cancer should not be interpreted as a personal failing or punishment and discussed faith as a potential source of psychological resilience. Following this discussion, the patient agreed to proceed with the proposed chemotherapy regimen.

As treatment progressed, sleep disturbances, increased anxiety, and persistent feelings of social isolation were reported. To supplement routine clinical follow-up, a digital monitoring approach was introduced using data from Google Fit, including physical activity, sleep patterns, and heart rate variability. AI-generated behavioural alerts were reviewed during follow-up appointments and informed decisions regarding psychosocial referrals and additional emotional support. The patient's use of ChatGPT was also discussed during counselling sessions, with attention to its potential supportive role and the importance of safe and appropriate engagement. In addition, AI-assisted analyses of the collected parameters and sentiment and tone analyses of smartphone communications were described as components of the monitoring approach. These processes were intended to facilitate the early identification of escalating psychological distress and support timely, individually tailored psychosocial interventions.

Psychological vulnerability became more pronounced as the patient approached mastectomy. Concerns regarding femininity, body image, and marital acceptance were reported, particularly in relation to the perceived implications of breast loss for personal identity and the marital relationship. Despite psychosocial support, the postoperative period was characterised by hopelessness and a profound sense of loss. The patient described feeling as though a part of her identity had been lost. In response, the oncologist acknowledged the emotional significance of these concerns and discussed reconstructive surgery as a

potential option, providing some reassurance regarding possible approaches to post-mastectomy recovery.

During recovery, the patient reportedly began using ChatGPT independently after learning about it through a health-related television programme. The interactions were described as an accessible and non-judgemental source of support that helped alleviate feelings of isolation and develop coping strategies incorporating emotional guidance and spiritual resources.

Patient Perspective

The patient's retrospective account indicated substantial emotional distress following diagnosis, including feelings of shame, fear, psychological disruption, and uncertainty. Chemotherapy and mastectomy were described as experiences that intensified this distress and contributed to a sense of losing control over everyday life and personal identity. Nevertheless, faith, support from the healthcare team, and the perceived assistance provided by a virtual conversational tool were identified as factors that helped restore a sense of self and foster hope. ChatGPT was described as an unexpected source of support during a particularly difficult period, although its perceived benefits did not eliminate the emotional pain associated with the diagnosis and treatment.

Discussion

This case underscores the expanding role of artificial intelligence (AI) and digital health tools in strengthening psychosocial care for patients with cancer. The integration of behavioural analytics and sentiment analysis facilitated the early identification of psychological distress, potentially before the patient explicitly communicated her difficulties. In this case, reductions in physical activity and disruptions in sleep patterns were identified as potential indicators of increasing emotional distress, prompting timely interventions that might otherwise have been delayed (Abdelaziz et al., 2022; Singer et al., 2015).

The patient's independent use of a virtual conversational agent provided an additional source of psychosocial support. A key potential advantage of AI-based monitoring is its capacity to identify behavioural changes, such as sleep disturbances and reduced physical activity, that may precede more pronounced psychological symptoms. However, these tools also present challenges, including the risk of inaccurate interpretations, dependence on user engagement, and the need for robust data privacy safeguards. Digital tools may be particularly valuable in cultural settings where mental health stigma can discourage patients from expressing emotional distress or accessing formal counselling services. By providing an accessible and non-judgemental environment for emotional reflection,

conversational AI may serve as an adjunct to standard psycho-oncology care. Importantly, in this case, the digital tool complemented rather than replaced clinical care, illustrating the potential value of a hybrid approach that combines technological innovation with human empathy (Garzón-Partida et al., 2025; Olawade et al., 2024; Rudroff, 2025).

This case also illustrates the multifaceted nature of psychosocial distress in breast cancer, encompassing treatment-related concerns, body image, marital relationships, and spiritual well-being. The patient's concerns regarding femininity, personal identity, and potential marital rejection following mastectomy reflect challenges that may affect women undergoing similar treatment. Addressing these concerns through empathetic dialogue, timely psychosocial counselling, and clear communication about reconstructive options may help preserve patients' dignity and strengthen their sense of control (Fakhari et al., 2018; Heidari et al., 2015; Roy et al., 2024).

Nevertheless, the integration of AI into psycho-oncology requires careful ethical consideration. Protecting patient privacy, safeguarding sensitive health data, and minimizing the risk of inaccurate or overly generalized AI-generated responses remain essential. In this case, implementation was reported to involve informed consent and ongoing clinical oversight, with the aim of preserving the central role of the patient–clinician relationship while using digital tools as supportive resources (Fouladi et al., 2013; Goumas et al., 2024; Neha et al., 2024; Xu et al., 2021).

Ultimately, this case highlights the potential of personalized and culturally sensitive psycho-oncological care supported by digital technologies. Further clinical research, robust ethical frameworks, and interdisciplinary collaboration are needed to guide the safe, effective, and equitable use of AI in supporting emotional resilience among patients with cancer.

Conclusion

The integration of digital biomarkers, conversational AI, and AI-based analytics demonstrates potential for strengthening psycho-oncology care by supporting the early identification and individualised management of psychosocial distress in patients with breast cancer. This case illustrates how these technologies may complement conventional clinical practice and support patient well-being and treatment adherence. However, further research involving larger patient cohorts is required to establish their effectiveness, reliability, and safety, while robust ethical frameworks are needed to guide

their responsible, equitable, and culturally sensitive implementation in oncology practice.

Declarations

Ethics Approval And Consent To Participate

The study protocol was reviewed and approved by the Institutional Review Board of the participating tertiary oncology centre. All patient information was de-identified before analysis to protect confidentiality. All procedures were conducted in accordance with the ethical standards of the institutional and national research committees, the Declaration of Helsinki, and applicable local regulations.

Consent For Publication

Not applicable.

Availability Of Data And Material

The data that supports the findings of this study are available from the corresponding author upon reasonable request.

Conflicts Of Interest / Competing Interests

The authors declare that there are no conflicts of interest.

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Authors' Contributions

M.L.: Conceptualization, Methodology, Investigation, Writing – original draft.

Y.T.: Conceptualization, Methodology, Investigation, Writing – original draft.

T.K.: Investigation, Methodology.

L.A.: Validation, Writing – review & editing, Supervision.

L.B.: Conceptualization, Writing – review & editing.

C.D.: Validation, Writing – review & editing, Supervision.

I.F.: Validation, Writing – review & editing, Supervision.

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Use Of Generative AI And AI-Assisted Technologies

Not applicable

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