

BETWEEN TUMOR BIOLOGY AND THE COMPLEXITY OF LIFE: INTERDISCIPLINARITY, TECHNOLOGY, SUBJECTIVITY, AND EQUITY IN THE CONSTRUCTION OF ONCOLOGICAL CARE

 <https://doi.org/10.63330/aurumpub.070-012>

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Abstract

Cancer is a complex phenomenon that extends beyond the strictly biological dimension and encompasses systemic processes, subjective experiences, interdisciplinary relationships, emerging technologies, and inequalities in access to care. This study aimed to analyze the interconnections among tumor biology, interdisciplinarity, technology, subjectivity, and equity in the construction of contemporary oncology care. The study is justified by the need to understand how scientific and technological advances can be integrated into person-centered care practices without disregarding social differences and individual needs. This integrative literature review was conducted in PubMed, Scopus, Latindex, the CAPES Journals Portal, and the Virtual Health Library and considered publications from 2021 to 2026 in Portuguese and English. Oncology studies addressing interdisciplinarity, technologies, artificial intelligence, subjectivity, humanization, or equity were included. The findings demonstrated a transition from predominantly biologicist models toward systemic and integrative perspectives. Artificial intelligence showed potential to support diagnosis, prognosis, treatment personalization, and decision-making, although challenges persist regarding data quality, bias, validation, safety, and governance. It is concluded that oncology care requires the integration of technological innovation, interdisciplinary collaboration, recognition of subjectivity, and a commitment to equity, while preserving the centrality of the person in the care process.

Keywords: Equity, Interdisciplinarity, Oncology, Subjectivity, Technology.

INTRODUCTION

Cancer is one of the main contemporary challenges facing health systems, not only because of the diversity of biological alterations that characterize tumors, but also because of the complexity of the individual and social experiences associated with illness. Differences in cancer occurrence, progression, and treatment response are related to biological, environmental, and social factors, demonstrating that

cancer disparities cannot be understood exclusively from a biomedical perspective (Freedman et al., 2021).

Against this backdrop, understanding cancer requires an approach capable of integrating different dimensions of care. Interdisciplinarity broadens the possibilities for coordinating knowledge, practices, and professionals, thereby fostering more comprehensive responses to patients' needs. This perspective recognizes care as an experience involving not only treatment of the tumor, but also the person, their relationships, their life course, and the concrete conditions of their existence (Nascimento et al., 2026).

At the same time, technological advances have been transforming different stages of oncology care. Artificial intelligence has been incorporated into prevention, diagnosis, risk stratification, treatment selection, monitoring, and patient follow-up, expanding the capacity to analyze large volumes of clinical and biological data (Riaz et al., 2025). This transformation is contributing to the development of increasingly data-driven models of care.

Among these innovations, the convergence of artificial intelligence and oncology stands out for creating new possibilities to support clinical decisions and personalize interventions. So-called intelligent oncology combines clinical, molecular, and imaging data to enable more accurate interpretations and individualized therapeutic strategies (Lin et al., 2022). Nevertheless, incorporating these technologies also poses challenges related to validation, transparency, safety, and integration into care workflows.

From another perspective, the use of artificial intelligence does not, in itself, guarantee greater equity in care. Algorithmic models may reproduce inequalities embedded in the data used to develop them, resulting in differences in the quality of recommendations and access to therapeutic options. Building fairer systems therefore requires attention to data representativeness, the inclusion of different population groups, and the identification of potential biases throughout the care process (Cobanaj et al., 2023).

Beyond technological considerations, the cancer experience remains deeply connected to subjectivity and the individual life course. Cancer survivorship extends beyond the clinical dimension,

encompassing changes in identity, family life, work, and social relationships that may persist after treatment ends. An integrated life-course perspective makes it possible to understand survivorship as a longitudinal process in which different events and contexts shape the experience of illness and recovery (Tieu, 2025).

The incorporation of technologies must also consider how patients perceive and experience the innovations available to them. Access to technological and therapeutic resources is not uniform, but is influenced by economic, organizational, territorial, and informational conditions. Qualitative evidence indicates that patients' perspectives are essential to understanding the barriers and facilitators associated with access to innovation in oncology (Julliot-Delval et al., 2026).

From a care perspective, humanization remains indispensable amid the increasing technologization of care. Relational technologies associated with communication, bonding, attentive listening, and accountability make it possible to preserve the relational dimension of care even in settings characterized by sophisticated technological resources. In oncology care, this articulation helps ensure that innovation is incorporated without reducing patients to information generated by equipment and digital systems (Travaglini, 2024).

Despite the advances observed, challenges remain regarding the responsible implementation of artificial intelligence in oncology. Issues such as privacy, explainability, reliability, professional preparedness, system integration, and unequal access require strategies capable of reconciling technological innovation with clinical responsibility. Cheng and Shi (2025) emphasize that the development of artificial intelligence in oncology should be accompanied by a critical analysis of its limitations, risks, and prospects for application.

In this context, this study aims to analyze the relationship among tumor biology, interdisciplinarity, emerging technologies, subjectivity, and equity in the construction of oncology care. It seeks to understand how these elements can be coordinated to support care that combines innovation, comprehensiveness, humanization, and justice in access to care.

METHODOLOGY

This is an integrative literature review with a qualitative approach, descriptive character, and analytical purpose, conducted to gather, systematize, and interpret scientific evidence concerning interdisciplinarity, technologies, subjectivity, and equity in oncology care. The choice of this method made it possible to integrate different perspectives found in the scientific literature, allowing for a broader understanding of the phenomenon under investigation and its relationship with the organization of oncology care.

The review was guided by the following research question: How have interdisciplinarity, technologies, subjectivity, and equity been integrated into the construction of oncology care? This question guided the selection of descriptors, search strategies, eligibility criteria, and categories subsequently used to organize and interpret the findings.

The literature search was conducted in PubMed, Scopus, Latindex, the CAPES Journals Portal, and the Virtual Health Library (Biblioteca Virtual em Saúde - BVS), selected because of their coverage of scientific literature in health, oncology, technology, and interdisciplinary sciences. Studies published between 2021 and 2026 were considered, making it possible to include recent research on the technological and care-related transformation of oncology. To ensure greater methodological transparency, information concerning the sources consulted, search strategy, and study-selection process was considered in accordance with recommendations for the systematic reporting of literature reviews.

The search strategies used descriptors and free-text terms related to the study topic, combined through the Boolean operators AND and OR. The principal terms included “*Neoplasms*,” “*Cancer*,” “*Oncology*,” “*Artificial Intelligence*,” “*Technology*,” “*Interdisciplinary Care*,” “*Patient-Centered Care*,” “*Health Equity*,” “*Subjectivity*,” and “*Humanization of Care*,” as well as their Portuguese equivalents. The combinations were adapted to the specific characteristics of each database to broaden the retrieval of relevant studies without sacrificing thematic specificity.

The inclusion criteria were as follows: scientific articles published between 2021 and 2026; studies available in full text; publications in Portuguese or English; studies directly related to oncology care; and studies addressing at least one of the review's central dimensions, namely interdisciplinarity, technology, artificial intelligence, subjectivity, humanization, equity, or access to care.

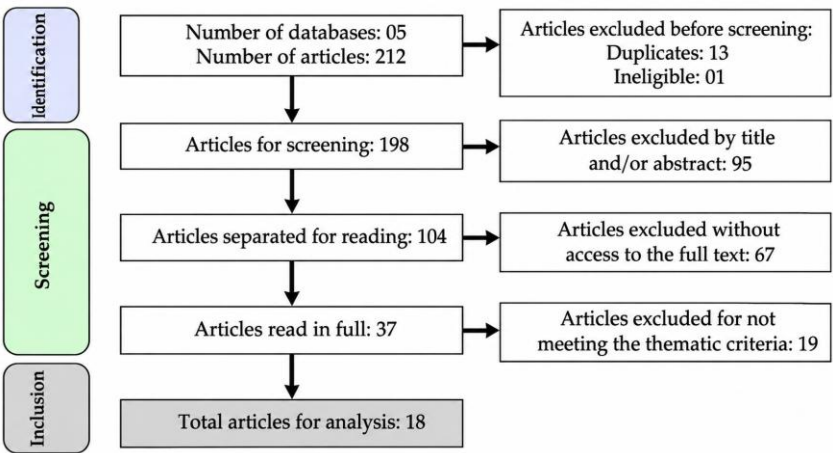
Studies duplicated across the databases consulted, publications outside the established time frame, works in languages other than those specified, documents without access to the full text, and publications with no substantive relationship to the topic under investigation were excluded. Editorials, letters to the editor, simple abstracts, opinion pieces, news articles, academic works not published as scientific articles, and studies whose content did not make it possible to identify contributions related to the construction of oncology care were also excluded.

Study selection occurred in successive stages. First, the records retrieved from the databases were identified and duplicates were removed. Titles and abstracts were then screened, and records that did not meet the previously established criteria were excluded. Potentially eligible studies were subsequently read in full, at which stage their definitive relevance to the review corpus was assessed. This procedure makes it possible to describe the progression from identification and screening to eligibility and inclusion.

The study identification and selection process was organized into a methodological flowchart covering the number of records identified, duplicates removed, studies excluded during screening, full-text studies assessed, and the final set included in the analysis. Figure 1 presents this process schematically, allowing the stages through which the review sample was assembled to be visualized.

Figure 1

Flowchart of the identification, selection, eligibility, and inclusion of studies in the integrative review



Source: Prepared by the authors (2026).

A data-extraction instrument was developed containing information on the author and year of publication, study objective, methodological design, population or context investigated, dimension of oncology care addressed, technologies or strategies analyzed, and principal findings and contributions. The selected studies were subsequently organized into thematic categories, allowing similarities, differences, gaps, and trends in the scientific literature to be identified. Systematizing the characteristics of the studies enhanced the traceability of the information and the integrated interpretation of the results.

The data were analyzed qualitatively through exploratory, selective, and analytical reading of the included studies. The findings were grouped into thematic axes related to interdisciplinarity in care, technological incorporation and artificial intelligence, subjectivity and humanization, and equity and access to oncology innovation. The interpretive synthesis sought to establish relationships among these dimensions, considering both the advances identified and the challenges associated with implementing technologically mediated, person-centered models of care.

Because this integrative literature review was conducted exclusively with secondary data from previously published studies, it did not involve the direct participation of human subjects and therefore did not require review by a Research Ethics Committee, in accordance with Resolution No. 510 of April 7, 2016, issued by the National Health Council.

RESULTS AND DISCUSSION

Applying the search strategies and eligibility criteria enabled the selection of the studies comprising the corpus of this integrative review. The publications analyzed encompassed different perspectives on contemporary oncology care, including aspects related to the incorporation of technologies and artificial intelligence, interdisciplinary practice, patients' subjective experiences, and inequalities in access to and use of available resources. To systematize the characteristics and contributions of the publications included, the author and year, objective, thematic axis, method employed, and principal findings of each study were considered, as presented in Table 1.

Table 1

Characteristics of the studies included in the integrative review

No.	Author/year	Study objective	Study axis	Principal findings
1	Ha and Chow-White (2021)	To analyze how large volumes of genomic data are produced, interpreted, and incorporated into oncology care.	Genomic data and technological transformation	Demonstrated that the expansion of genomic data changes research and care practices but requires new forms of knowledge translation, infrastructure, and integration among different actors and scientific fields.
2	Horlait et al. (2021)	To understand the complexity, processes, and factors influencing the work of multidisciplinary teams in hospital-based oncology.	Interdisciplinarity and teamwork	Identified communication, coordination, role definition, trust, and organizational conditions as determinants of the effective functioning of multidisciplinary teams in oncology care.
3	Dankwa-Mullan and Weeraratne (2022)	To discuss the use of artificial intelligence and machine learning in cancer care, with an emphasis on inequalities, bias, and data diversity.	Artificial intelligence, equity, and bias	Demonstrated that AI systems may reproduce or exacerbate inequalities when developed using insufficiently representative datasets, reinforcing the need for diversity, transparency, and equity assessment.
4	Kelly-Brown et al. (2022)	To review the scientific literature on intersectionality in oncology care and identify gaps for future research.	Equity, subjectivity, and intersectionality	Demonstrated that social and identity-related characteristics interact within the cancer experience and access to care, indicating the need for approaches capable of

				considering multiple dimensions of inequality.
5	Mäurer et al. (2023)	To investigate the importance of interdisciplinarity in contemporary oncology from the perspective of young professionals in the field.	Interdisciplinarity and organization of care	The results reinforced the relevance of interdisciplinary structures to oncology practice, emphasizing the need for communication, collaboration, and integration among different specialties.
6	Pradeu et al. (2023)	To explore opportunities for closer ties between philosophy and science to broaden the understanding and development of cancer research.	Philosophy, science, and cancer complexity	Proposed moving beyond excessively fragmented approaches by recognizing philosophical and scientific concepts capable of broadening the understanding of cancer's complexity, heterogeneity, and dynamics.
7	Cobanaj et al. (2023)	To examine artificial intelligence applications aimed at constructing personalized, equitable, and inclusive oncology care.	AI, personalization, and equity	Highlighted AI's potential to support different stages of care but emphasized the need to address algorithmic bias, data inequalities, and barriers to inclusion to ensure fairer applications.
8	Casotti et al. (2024)	To integrate systemic, evolutionary, and multidisciplinary perspectives to broaden the understanding of cancer-related mechanisms.	Systems biology, evolution, and interdisciplinarity	Advocated a holistic approach to cancer as a complex phenomenon, combining biology, evolution, systems, and multidisciplinary collaboration in the search for more comprehensive strategies.
9	Hwang et al. (2024)	To identify priorities at the interface between cancer and neuroscience and encourage the integration of these fields of research.	Oncology, neuroscience, and interdisciplinarity	Demonstrated the need to bring oncology and neuroscience closer together to understand relationships among tumors, the nervous system, the microenvironment, and cancer-related experiences, thereby expanding opportunities for research and care.
10	Lotter et al. (2024)	To analyze the contemporary landscape, challenges, and future prospects of artificial intelligence applied to oncology.	Artificial intelligence and oncology innovation	Identified applications of AI in diagnosis, prognosis, and decision support, while also identifying challenges related to validation, generalizability, clinical integration, explainability, and safety.
11	Macheke et al. (2024)	To systematize evidence on artificial intelligence applications at different stages of cancer care	AI and the care pathway	Demonstrated the growing use of AI at different stages of oncology care but identified methodological heterogeneity and the need for greater

		pathways following diagnosis.		prospective validation before widespread clinical implementation.
12	Swanton et al. (2024)	To broaden the understanding of cancer based on its systemic characteristics and interaction with different biological processes in the body.	Tumor biology and systemic complexity	Proposed viewing cancer as a systemic and dynamic disease, incorporating interactions among the tumor, organism, microenvironment, metabolism, immunity, and evolutionary processes beyond an exclusively tumor-centered perspective.
13	Cheng and Shi (2025)	To review the applications, challenges, and future prospects of artificial intelligence in cancer research and care.	AI, diagnosis, and treatment	Demonstrated applications of AI in diagnosis, classification, prognosis, drug discovery, and personalized medicine, while emphasizing limitations involving data, interpretability, safety, and clinical implementation.
14	Riaz et al. (2025)	To examine the application of artificial intelligence across different stages of the oncology care continuum.	AI and the continuum of care	Demonstrated that AI has potential applications ranging from prevention and detection to diagnosis, treatment, monitoring, and follow-up, although its integration requires validation, governance, infrastructure, and professional involvement.
15	Wang et al. (2025)	To assess the role of artificial intelligence in multidisciplinary tumor boards as a clinical decision-support resource.	AI and multidisciplinary teams	Indicated that AI can improve the integration and interpretation of clinical information and support decisions by multidisciplinary teams, although its effectiveness depends on proper integration into workflows and professional oversight.
16	Cohen and Ben-Arye (2026)	To present the evolution, foundations, and future prospects of integrative oncology.	Integrative oncology and person-centered care	Characterized integrative oncology as an approach that combines conventional treatments with complementary strategies and person-related dimensions, emphasizing comprehensive care, quality of life, and patient participation.
17	Lastra et al. (2026)	To discuss an oncology approach that moves beyond exclusively biologist and pharmacological models.	Complexity, comprehensiveness, and humanization	Advocated a broader understanding of cancer that incorporates biological, clinical, psychosocial, and contextual dimensions to overcome reductionist models and foster individualized strategies.

18	Robatjazi et al. (2026)	To discuss the potential, limitations, and requirements for the responsible implementation of artificial intelligence in cancer management.	AI, oncology management, and implementation	Emphasized that AI’s transformative potential depends on institutional preparedness, data quality, clinical validation, professional training, governance, and responsible integration into care practices.
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Source: Prepared by the authors (2026).

The complexity of cancer is a point of convergence among different contemporary perspectives in oncology, particularly when the disease is understood beyond its anatomical location and molecular characteristics. Swanton et al. (2024) propose a systemic understanding in which cancer interacts dynamically with metabolic, immunological, evolutionary, and environmental processes. Consistently with this view, Pradeu et al. (2023) advocate closer ties between science and philosophy as a strategy for broadening the frameworks used in cancer research, indicating that complex phenomena require interpretations extending beyond exclusively reductionist explanations.

From this perspective, Lastra et al. (2026) question the adequacy of models centered predominantly on tumor biology and pharmacology, advocating an oncology capable of incorporating clinical, psychosocial, and contextual dimensions. This proposition aligns with Cohen and Ben-Arye (2026), for whom integrative oncology broadens the scope of care by considering patients’ different needs throughout the care process. Taken together, these studies support the understanding that the biological complexity of cancer must be accompanied by a corresponding expansion in the complexity of care.

Another relevant aspect concerns the need to overcome the fragmentation of specialized knowledge. Horlait et al. (2021) demonstrate that the effectiveness of multidisciplinary teams is associated with communication, coordination, and clarity regarding shared responsibilities. Similarly, Mäurer et al. (2023) demonstrate the importance of interdisciplinarity in modern oncology, reinforcing that different specialties must work in a coordinated manner when addressing cases involving multiple clinical and psychosocial needs.

Integration among fields of knowledge is also apparent in the convergence of oncology and disciplines traditionally less incorporated into oncology practice. Hwang et al. (2024) identify the interface between cancer and neuroscience as a strategic area for understanding relationships among tumor processes, the nervous system, and the human experience of illness. This perspective aligns with the proposal by Casotti et al. (2024), who recognize the value of systemic, evolutionary, and multidisciplinary models for interpreting cancer and indicate that knowledge production may benefit from interactions among different biological scales and scientific fields.

In the technological sphere, artificial intelligence represents a significant change in how information is produced, interpreted, and used in oncology. Lotter et al. (2024) identify applications at different stages of oncology practice, while Riaz et al. (2025) broaden this understanding by considering the continuum of care. The agreement between these authors demonstrates that technology should not be understood as an isolated resource, but rather as a component increasingly integrated into prevention, diagnosis, treatment planning, monitoring, and follow-up.

The incorporation of artificial intelligence into clinical decisions also changes the dynamics of professional relationships. Wang et al. (2025) note that intelligent systems can support multidisciplinary tumor boards by organizing and interpreting information relevant to decision-making. Nevertheless, Cheng and Shi (2025) emphasize that the expansion of these applications depends on overcoming limitations involving data quality, interpretability, safety, and implementation. Technology therefore tends to perform a complementary function, requiring the ongoing coordination of computational capabilities and clinical judgment.

From the perspective of data production and circulation, Ha and Chow-White (2021) demonstrate that the transformation of oncology is also related to the growing availability of genomic information and the need to convert it into clinically usable knowledge. This discussion becomes even more relevant in light of contemporary artificial intelligence applications, as the expansion of algorithmic resources depends on sufficiently extensive, high-quality, and representative information bases. Thus, the quality of

technology-mediated care remains linked to the epistemological and social quality of the data underpinning these systems.

Alongside technological benefits, equity emerges as an indispensable component of health innovation. Dankwa-Mullan and Weeraratne (2022) warn that artificial intelligence systems may reproduce existing inequalities when trained on insufficiently diverse data. Similarly, Cobanaj et al. (2023) argue that technological personalization must be associated with principles of justice and inclusion, demonstrating that algorithmic accuracy and equity are not necessarily equivalent phenomena.

The discussion of inequalities becomes even broader when the interaction among different social markers is considered. Kelly-Brown et al. (2022) demonstrate the relevance of intersectionality to understanding differentiated cancer experiences, indicating that social and identity-related factors may operate together in producing vulnerabilities. This contribution broadens the technological debate by demonstrating that apparently neutral systems can produce different outcomes across population groups when they fail to account for structural inequalities in the contexts in which they are used.

In addition, Macheka et al. (2024) demonstrate that the growing presence of artificial intelligence in oncology care pathways is still accompanied by heterogeneity in the available evidence. This finding is particularly relevant because incorporating a technology into clinical practice requires more than demonstrating technical performance. Validation processes, prospective assessments, analyses of applicability, and monitoring of effects across different populations are needed to prevent innovation from being implemented without an adequate understanding of its consequences.

The human dimension remains central even amid increasing technological sophistication. In discussing integrative oncology, Cohen and Ben-Arye (2026) emphasize an approach that considers patients in their entirety rather than merely as carriers of a pathological alteration. This conception resonates with Lastra et al. (2026), who propose moving beyond exclusively biologicist models. The convergence of these perspectives reinforces the principle that technological innovation must preserve the uniqueness of the person as a constitutive element of care.

From an epistemological standpoint, integrating biology, technology, and subjectivity requires a transformation in the very manner in which knowledge in oncology is understood. Pradeu et al. (2023) demonstrate that bringing philosophy and science closer together can help problematize the assumptions and categories used in cancer research. In parallel, Swanton et al. (2024) present a systemic conception that reveals the multiplicity of processes involved in the disease. Together, these contributions support an understanding in which different levels of explanation do not compete with one another but may instead be integrated to interpret complex phenomena.

In care practice, interdisciplinarity assumes a strategic role in translating this knowledge into actual care practices. Horlait et al. (2021) and Mäurer et al. (2023) converge in demonstrating that collaboration among professionals depends on organizational structures capable of fostering communication, integration, and shared responsibility. When combined with digital technologies, this dynamic can enhance the circulation of information among specialties, provided that technological resources are incorporated into work processes without replacing the professional interaction needed to interpret individual needs.

In turn, integrating innovation and equity requires a conception of technology guided by social responsibility. Riaz et al. (2025) and Robatjazi et al. (2026) concur that the potential of artificial intelligence in oncology care is contingent upon adequate governance mechanisms, institutional preparedness, and professional training. This perspective shifts the discussion away from a view centered exclusively on the technical capabilities of systems toward an approach that also considers their implementation, oversight, and impact on different groups of patients.

Finally, the integration of the studies analyzed supports a conception of oncology care grounded in the combination of biological knowledge, interdisciplinary collaboration, technological innovation, recognition of subjectivity, and a commitment to equity. From different perspectives, Casotti et al. (2024), Cohen and Ben-Arye (2026), and Robatjazi et al. (2026) converge on the need for models capable of integrating multiple dimensions of cancer and its care. In this sense, the construction of contemporary

care depends not only on the capacity to understand the tumor, but also on the possibility of combining science, technology, and human relationships in strategies that recognize the complexity of life and the different conditions under which illness is experienced.

CONCLUSION

The synthesis of the literature analyzed demonstrates that contemporary oncology care is constructed through the integration of different dimensions extending beyond the treatment of disease in its exclusively biological expression. In this regard, interdisciplinarity, technology, subjectivity, and equity constitute interdependent components of care guided by the complexity of cancer and the unique needs of people experiencing illness.

The results made it possible to achieve the proposed objective by demonstrating that understandings of oncology have been incorporating systemic, integrative, and multidisciplinary perspectives. The literature analyzed points to a conceptual shift in which the tumor is no longer regarded as an isolated phenomenon, but is instead understood in interaction with biological mechanisms, individual characteristics, social conditions, life courses, and different contexts of care.

Regarding innovation, artificial intelligence was found to offer relevant possibilities for enhancing diagnostic capacity, supporting clinical decisions, fostering the personalization of interventions, and integrating information from different sources. Nevertheless, the findings also indicate that its responsible use depends on scientific validation, data quality and diversity, professional oversight, process transparency, and governance structures capable of mitigating risks and limiting the reproduction of inequalities.

The interdisciplinary dimension proved equally essential to transforming specialized knowledge into integrated care practices. Collaboration among different professionals promotes shared decision-making and makes it possible to address needs that cannot be adequately explained from the perspective of a single field. At the same time, recognizing subjectivity preserves the understanding of the patient as

the subject of their own life course, preventing the increasing use of technologies from reducing care to the interpretation of clinical data.

Another central element identified was the need to incorporate equity as a structuring principle of innovation in oncology. Socioeconomic, territorial, and cultural differences, as well as differences related to the characteristics of population groups, can affect access to technologies, services, and therapeutic options. Expanding oncology's technological capabilities therefore does not necessarily mean democratizing their benefits. It is essential to assess who has access to these innovations, under what conditions, and with what outcomes.

To advance this field of research, multicenter studies should be conducted to monitor the implementation of artificial intelligence-based technologies in oncology services, combining clinical indicators with dimensions related to patient experience, interdisciplinary practice, accessibility, and equity. Studies of this nature may contribute to establishing more consistent parameters for technology use and inform models of care in which scientific innovation, professional integration, and person-centeredness are developed in a coordinated manner.

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