



Second Opinion in Medical Oncology in the Age of Artificial Intelligence and Telemedicine

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Abstract

The present review explores the role and impact of second opinions in medical oncology, particularly considering the recent advancements in artificial intelligence (AI) and telemedicine. A comprehensive literature search was conducted, and data from various studies were analyzed, highlighting why patients seek a second opinion, the rates of disagreement between the first and second opinions, and the potential barriers to obtaining a second opinion. The results showed that seeking a second opinion is common, with patients often seeking reassurance and a better understanding of their diagnosis and treatment options. However, there is limited evidence on the impact of second opinions on patient outcomes and the cost of care. Additionally, the introduction of Multidisciplinary Molecular Tumor Boards, AI, and telemedicine may improve decision-making and treatment strategies in the context of second opinions. Further research is needed to fully understand the role and implications of second opinions in medical oncology and how these recent technologies impact the second opinion process.

Keywords

- ▶ referral and consultation
- ▶ medical oncology
- ▶ artificial intelligence
- ▶ telemedicine
- ▶ interdisciplinary communication

Introduction

Upon receiving a cancer diagnosis, patients are confronted with a plethora of unfamiliar information about their condition, prognosis, and potential treatments. The ability of the first oncologist to effectively communicate with the patient is paramount, as it provides clarity and understanding amidst the emotional upheaval of receiving such grave news. In certain cases, even after the initial diagnosis, patients may still find themselves in need of a second opinion to alleviate any lingering uncertainties or confusion, particularly in the event of cancer recurrence or progression.

A second opinion is a process in which a patient or a physician seeks the professional judgment of a second health expert, who shares the same specialty as that of the first

professional, to validate an opinion that has already been given.^{1,2}

According to the projections of the American Cancer Society's Cancer Facts & Figures 2024, approximately 2 million new cancer cases will be diagnosed in the United States in 2024. Previous research^{3–8} indicates that 9.1% to 34% of cancer patients seek a second opinion. Even using a conservative estimate of 9%, it can be expected that there will be approximately 180 thousand instances of second opinion consultations in the United States in 2024, resulting in a significant additional cost. Therefore, there is a pressing need to determine the effects of second opinions on cancer patients' outcomes and costs of care. Furthermore, it is important to ascertain how this practice will adapt to and benefit from recent advances in the field of medicine, such as

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artificial intelligence (AI), Molecular Multidisciplinary Tumor Boards (MMTBs), and telemedicine.

Materials and Methods

Bibliographic Search Strategy

The present is a narrative review. Initially, we used the following search strategy for PubMed: (*Referral and Consultation* [Mesh]) AND *Medical Oncology* [Mesh]. The most relevant references retrieved were uploaded to the Research Rabbit program (<https://www.researchrabbit.ai/>) for semantic search of more pertinent articles. We also consulted the reference lists of the selected articles to find additional studies to include in the review. Moreover, we employed the SciSpace platform (SciSpace, Milpitas, CA, United States; <https://scispace.com/>) to search for articles addressing specific topics relevant to the present review review, such as telemedicine and AI in the context of second opinions in oncology.

Results

Articles Retrieved

Using the search strategy previously described, we found 638 articles in PubMed, from which we selected 26. After uploading these papers into ResearchRabbit, we found an additional 14 papers. We further identified studies related to specific topics of the review not covered by these 40 papers, either

through SciSpace or by reviewing the reference lists of the previously-selected papers. We then selected the 34 most relevant articles retrieved for the present review.

Reasons Why Cancer Patients Seek a Second Opinion and Benefits

Patients seek a second opinion for various reasons, most commonly for reassurance regarding the correctness of the diagnosis and treatment recommended by the first physician, and to better understand their diagnosis.^{2,3} Dissatisfaction with the first doctor, although among the minor causes cited, still holds some relevance.⁴ Some patients may also view a second opinion as an integral part of their care, particularly those who are highly educated and have conducted their research online, leading to many questions that need answering^{5,6} (→Table 1).

An interesting and potentially increasing reason for seeking a second opinion is illustrated in the paper by Kurian et al.,⁶ who observed a significantly higher proportion of patients with difficult-to-interpret genomic testing results (such as variants of uncertain significance in germline panels or intermediate-risk oncotype results). Therefore, the increasing rates of germline and tumor somatic genomic testing in this era of personalized medicine may increase the need for second opinions in the future.

Another reason second opinions may be increasingly sought in the future relates to enrollment in clinical trials

Table 1 Second opinion in oncology: patients. Surveys from the literature

First author and publication date	Study design	Number of patients	Rate of second opinion	Reasons for second opinion	Satisfaction with second opinion
Olver et al., ² 2020	Survey in Australia, 2013-2015	355 (out of 823 screened)	16.1%	Need for reassurance (49.1%); need to consider treatment options (41.8%)	Not explicitly stated
Fuchs et al., ³ 2017	Survey	106	34%	Checking treatment accuracy (81%); better understanding of diagnosis (49%)	79% felt assured
Loehberg et al., ⁴ 2020	Prospective study, 2014-2016	164	164 (only those who had a second opinion were included)	Various, including stress from diagnosis, hope for change in treatment, and dissatisfaction with initial physician	89.7% felt better informed and 91.8% were satisfied with doctor-patient communication after second opinion
Cecon et al., ⁸ 2019	Survey, 2017	419 (out of 4,626 surveyed)	9.1%	Mostly unrelated to the physician-patient relationship: higher level of schooling associated with seeking another physician's recommendation and doing everything possible	70.4% of the patients found the second opinion helpful regardless of the outcome
Philip et al., ⁵ 2010	Surveys in Australia	52, including responses from oncologists	33% (among surveyed patients)	Concerns around communication; the extreme nature of the medical condition; need for reassurance; urged by others	94% found the second opinion helpful, citing improved communication and reassurance
Kurian et al., ⁶ 2017	Population-based survey, Georgia and Los Angeles County, 2013-2014	1,901 (stages 0-II)	9.8%	College education; frequent use of internet-based support groups; uncertainty regarding genomic test results	Not explicitly stated

at different institutions. In these situations, the first consultation to assess for trial eligibility may also serve as a second opinion for patients.⁷

According to some studies,^{2-6,8} most patients (ranging from 70.4 to 94%) have reported that they have benefited from a second opinion in terms of assurance and better understanding of their disease (►Table 1). However, we found no formal quality of life assessment studies in cancer patients who sought a second opinion.

Rates of Disagreement between First and Second Opinions

The rates of disagreement between first and second opinions varied between 28% and 50%, while major disagreements leading to a change in management ranged from 16% to 34.6%, the areas of discrepancy mainly concentrated on diagnosis and treatment⁸⁻¹¹ (►Table 2). There are no studies showing improvement in outcomes for medical oncology patients seeking a second opinion, or that this practice decreases the costs of their care.

In a small study restricted to cancer patients undergoing colorectal surgery in Taiwan, Chang et al.¹² showed that patients who sought care at different hospitals presented lower rates of hospital complications, whereas those who sought the opinions of multiple doctors presented a higher rate of complications.

Prior awareness by the second physician of the suggestions made by the first one, especially when the primary doctor will be informed of the second specialist's suggestions, may create a bias in favor of agreement between both opinions. This raises the question of how independent second opinions are and whether the rate of disagreement might be underestimated.¹³

Relationship with the Primary Physician after a Second Opinion

In one study,⁸ most patients (79.5%) reported that their relationship with their primary physicians did not suffer after seeking a second opinion. Factors significantly correlated with a feeling of worsened relationship with the primary physician occurred when there was discordance between physicians regarding diagnosis or treatment.⁶ In another study,¹⁴ in which cases were submitted to a multidisciplinary team for a second opinion, most physicians (82%) and patients (74%) reported no significant change in their perception of the relationship between the patient and the primary physician.

Barriers to Obtaining a Second Opinion

A Swiss qualitative study¹⁵ involving patients and health professionals identified four main barriers for cancer patients seeking a second opinion. First, patients are often shocked by a cancer diagnosis, and obtaining a second opinion in this bewildered state does not seem to be a priority. Second, there is time pressure to start treatment quickly, which undermines attempts to obtain a second opinion due to fear of delaying anticancer therapies. Third, there is a fear of information overload from a second encounter with another physician. Finally, the potential harm it could cause to the relationship with the first doctor is the fourth main barrier for cancer patients seeking a second opinion.

The same study¹⁵ made several suggestions to overcome these barriers, which include providing written information in an understandable and simple language, coupled with clearer face-to-face communication between doctors, supported by psycho-oncology professionals, and referrals to patient support groups. Additionally, doctors should enable patients to reach their conclusions regarding therapeutic choices, acting as coaches instead of unilaterally directing their care, thereby providing more patient empowerment.

How Should One Conduct a Second Opinion in Oncology?

A second opinion consultation in oncology may be lengthy, as it requires a complete evaluation of previous medical records, test results (including genomic data), patient anamnesis, and a physical examination, as well as time for explanations and to answer questions. Given that second opinion seekers often include highly-educated and internet-savvy patients, the number of questions is generally high.⁶ Therefore, the second physician should allocate adequate time for it. To save time, it is important for patients to bring all their clinical information organized chronologically, to facilitate the work of the second doctor.

After explaining the conclusions reached upon reviewing all clinical information, ideally, a written summary should be provided to the patient for later reading, and a copy addressed to the primary physician should be offered for the patient to deliver personally.¹⁶ Patients may not want their primary doctors to be aware of the second opinion, so delivering the physician letter will be at their discretion. It is also important to provide an email address or other contact information to answer questions related to the second opinion that may arise later.

Table 2 Rates of disagreement between second and first opinions

First author and publication date	Number of patients	Rate of total disagreements (major disagreements)	Area of disagreement
Mellink et al., ⁹ 2006	403	32% (16% Major)	Diagnosis and therapeutic advice
Schook et al., ¹⁰ 2014	188	50% (28% Major)	Diagnosis, stage, and therapeutic advice
Lipitz-Snyderman et al., ¹¹ 2023	120	37% (34.6% major)	Diagnosis and treatment recommendations
Cecon et al., ⁸ 2019	419	28% (25% major)	Treatment

Patients may be asked to record the consultation on tape or with their smartphones.^{17,18} However, providing a written summary may be a better practice than allowing the recording of the consultation, because the chances of misunderstanding are lower with written materials.¹⁸

The written summary should address whether the diagnosis was confirmed and provide management recommendations. Ideally, if the case was presented at a Multidisciplinary Tumor Board (MTB) meeting, the summary should reflect the recommendations made and note any controversy or lack of consensus regarding them.

Additionally, the written report should include a brief review of the genomic information provided and how it influenced any of the recommendations. Furthermore, suggesting enrollment in feasible clinical trials is highly-desired information for patients and their primary doctors, and it should be included in the written summary.

Second opinion providers should see themselves as counselors rather than potential primary caregivers.¹⁹ Patients should be referred to their primary physicians whenever possible. In rare instances in which there is a lack of trust, or if the patient-physician relationship with the first doctor is severely damaged, patients may choose to change their care provider.

New Advances: Multidisciplinary Tumor Boards, Artificial Intelligence, and Telemedicine

Multidisciplinary Tumor Boards (are specialized groups comprising experts from various fields, including oncologists, radiologists, geneticists, and pathologists.²⁰ Molecular Multidisciplinary Tumor Boards enhance these teams by adding specialists who can analyze comprehensive genomic data, integrating it with clinical information and the expertise of all other specialists to suggest targeted therapeutic approaches tailored to individual patients.²¹ The complexity of genomic data and the rapid evolution of oncological therapies pose significant challenges in clinical decision-making, making MTBs and MMTBs essential for modern oncology, including second opinions.^{21,22}

Defined as the simulation of human intelligence processes by machines, AI involves learning (acquiring information and the rules to use it), reasoning (using the rules to reach conclusions), and self-correction. Through advanced algorithms and large language models, AI systems offer substantial benefits in handling copious amounts of information typical of complex oncological cases with unique genetic profiles. Studies²¹ have demonstrated that AI can efficiently process and summarize vast datasets, compare patient information against existing oncological databases, and propose treatment strategies that align closely with the latest clinical guidelines and research. Furthermore, AI can accelerate clinical trials by identifying eligible patients and suggesting the most appropriate trials for them.²³

For instance, Sorin et al.²⁴ tested the efficacy of AI in a breast tumor board setting, finding that the AI's treatment recommendations aligned with the board's decisions in most of cases. This study²⁴ highlighted AI's capability to not only understand complex medical data but also generate

clinically-relevant recommendations that support the decision-making processes of tumor boards.

Moreover, the integration of AI extends the capabilities of MTBs and MMTBs by aiding in treatment recommendations, especially in situations in which clinical evidence is limited or evolving. According to Sunami et al.,²¹ AI systems showed higher concordance with centralized treatment recommendations than human experts, particularly after participants engaged in a learning program aimed at harmonizing treatment decision strategies across different institutions. This suggests that AI can significantly enhance the consistency and quality of care provided by MTBs and MMTBs across various healthcare settings.

Therefore, MTBs equipped with AI are poised to transform oncological care in the future by providing sophisticated second opinions that synthesize vast amounts of genetic and clinical data. This integration not only streamlines the treatment recommendation process but also enhances the adaptability and precision of oncological therapies, ensuring that patients receive the most appropriate and personalized care possible.

In recent years, especially after the coronavirus disease 2019 (COVID-19) pandemic, telemedicine has emerged as a transformative approach in oncology, providing substantial benefits for second opinion processes in complex cases.²⁵ This method of care delivery uses telecommunications technology to bridge geographical gaps between patients and specialists, which is crucial for those residing in remote areas or in regions lacking specialized medical resources. Telemedicine has facilitated more dynamic interactions between primary diagnoses and expert reviews, enhancing the depth and breadth of oncological evaluations. Shah et al.,²⁶ for example, demonstrated how telemedicine enabled substantial changes in treatment plans, validated through the comparison of original and second opinions, often leading to improvements in diagnosis accuracy and treatment choice.

Moreover, telemedicine interventions, by facilitating timely and convenient access to second opinions, help tailor treatment plans more closely aligned with the latest research and clinical guidelines. This is especially critical in oncology, in which treatment advancements are rapid and patient conditions can vary significantly. Studies such as the one by Mao et al.²⁷ show that telemedicine not only supports but also empowers patients from remote and underdeveloped areas by providing them with access to comprehensive care pathways that might otherwise be unavailable in their immediate locations.

The scalability of telemedicine enables it to be seamlessly integrated into existing healthcare frameworks, minimizing disruption and enhancing the efficacy of health services. Knudsen et al.,²⁸ for instance, noted the rapid integration of telehealth services during the COVID-19 pandemic, underscoring the adaptability and critical value of telemedicine in maintaining uninterrupted oncology care. This adaptability is crucial to implement robust telemedicine frameworks that can provide reliable second opinions by reputable cancer centers, ensuring that most oncology patients receive care that reflects the current standards and best practices, regardless of their physical location.

Table 3 Suggestions to optimize second opinions in oncology

Category	Suggestions
	<ul style="list-style-type: none"> Encourage patients to bring all available clinical, pathological, and genomic information in a chronologically-organized way to the second opinion consultation.
Initial approach	<ul style="list-style-type: none"> Clearly understand the reason for the second opinion.
	<ul style="list-style-type: none"> Ensure complete review of patient's medical records and previous tests.
Patient communication	<ul style="list-style-type: none"> Allocate adequate time for consultation to address all patient concerns.
	<ul style="list-style-type: none"> Provide clear, written summaries of the consultation for the patient and the primary physician.
Handling discrepancies	<ul style="list-style-type: none"> Be aware of and respect any differences in opinions to avoid biases.
	<ul style="list-style-type: none"> Multidisciplinary and Molecular Tumor Boards should be consulted whenever possible, but always for complex cases.
Technological integration	<ul style="list-style-type: none"> Use artificial intelligence and telemedicine to enhance decision-making and access to expertise.
Barriers and solutions	<ul style="list-style-type: none"> Address barriers such as emotional distress, time pressure, and information overload.
	<ul style="list-style-type: none"> Offer support through psycho-oncology professionals and patient support groups.
Ethical and personal considerations	<ul style="list-style-type: none"> Maintain independence and objectivity, avoiding conflicts driven by ego or competition among peers.
	<ul style="list-style-type: none"> Focus on patient-centered care rather than clinician-centered outcomes.
	<ul style="list-style-type: none"> Refer patients back to their primary physicians whenever possible.

Furthermore, telemedicine enables MTBs and MMTBs to discuss cases from institutions that may not be able to afford a full-time Tumor Board team. This is particularly important for smaller hospitals that may not have a full-time geneticist or a super-specialized oncologist for a particular tumor type. As the healthcare landscape evolves, the provision of second opinions through telemedicine will likely become a standard component of oncological care, reflecting a shift towards more patient-centered and technologically-integrated healthcare solutions.

► **Table 3** shows some recommendations to optimize the delivery of second opinions in oncology.^{19,29}

Potential Impact of Second Opinions on Cancer Care in Low- and Middle-Income Countries

In 2018, roughly a fifth of the global cancer cases and fatalities occurred in low- and middle-income countries (LMICs), where the burden of cancer-related mortality significantly outweighed that of high-income countries (HICs).³⁰ While cancer mortality rates in HICs have either stabilized or declined, LMICs continue to grapple with escalating rates.³¹ The disparities in cancer care stem from various factors, including political instability, insufficiently-trained healthcare professionals, and limited access to essential cancer treatments.³⁰

Research examining the adoption of oncology guidelines by clinicians in LMICs reveals a nuanced picture. Although clinicians are familiar with these guidelines, their effective implementation is hindered by inadequate facilities, guidelines not tailored to local contexts, and the complexity of the information provided.³² Second opinions are essential to ascertain if patients are receiving the minimal care they deserve within the limited resources typical of LMICs.

Furthermore, second opinions can indicate clinical trials suitable for patients, providing state-of-the-art care to cancer patients.

While ensuring access to vital cancer medications remains a top priority for LMICs, addressing broader aspects of cancer care is imperative to narrowing the care gap. This involves enhancing the quality of care through multidisciplinary management improvements and ensuring universal access to fundamental therapies. For instance, recent studies, such as the one conducted by Thiagarajan et al.³³ in 2023, highlight the potential of virtual tumor boards to facilitate multidisciplinary management, especially for rare cancers and complex cases in LMICs. Additionally, expanding access to palliative measures such as antiemetics, granulocyte colony-stimulating factor, and recombinant human erythropoietin is crucial in addressing disparities in cancer care.³⁴ Coupling multidisciplinary care with telemedicine initiatives holds promise in terms of extending the reach of adequate cancer care services in LMICs.

Conclusion

In summary, the practice of seeking a second opinion in medical oncology is still prevalent among cancer patients, with many reporting benefits such as reassurance and a better understanding of their disease. However, there are several barriers to obtaining a second opinion, including time constraints and fear of disrupting the doctor-patient relationship. Advances in the field of oncology, such as the use of MTBs, AI, and telemedicine, offer potential solutions to these barriers, enabling more efficient and comprehensive second opinions. Further research is needed to evaluate the impact of second opinions on the costs of care and outcomes for

cancer patients, including quality of life. Additionally, more data is needed to ascertain how these innovative technologies will impact the second opinion process and the overall care of cancer patients.

Authors' Contributions

AG: Collection and assembly of data, conception and design, data analysis and interpretation, final approval of the manuscript, manuscript writing, and provision of study materials or patients; SVS: collection and assembly of data, conception and design, final approval of the manuscript, and manuscript writing; and MUPC: data analysis and interpretation, final approval of the manuscript, and manuscript writing.

Clinical Trials

None.

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Conflict of Interests

The authors have no conflict of interests to declare.

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