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Evaluating the accuracy of large language model (ChatGPT) in providing information on metastatic breast cancer

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Abstract

Background: Artificial intelligence (AI), particularly large language models like ChatGPT developed by OpenAI, has shown promise in transforming various domains, including medicine. ChatGPT's ability to generate human-like responses to a wide array of subjects has been leveraged in various fields, notably passing the rigorous United States Medical Licensing Examination (USMLE) Step 1. However, its proficiency in responding to inquiries related to breast cancer, a prevalent and complex disease spectrum, remains underexplored.

Objective: This study aims to evaluate the accuracy and comprehensiveness of ChatGPT's responses to commonly asked questions about breast cancer, filling a critical gap in the literature and understanding its potential in enhancing patient education and support within the realm of breast cancer management.

Methods: A list of 100 questions was curated from frequently asked questions on Cancer.net and the National Breast Cancer Foundation's website, combined with inquiries commonly received in clinical practice. These questions were entered into the ChatGPT (Version 4.0) user interface, and the responses were evaluated by two primary experts for accuracy, using a four-point scale. Discrepancies in scoring were resolved by additional expert reviews.

Results: Out of the 100 evaluated responses, 5 were entirely inaccurate, 22 partially accurate, 42 accurate but not comprehensive, and 31 highly accurate. The majority of responses across different categories were found to be at least accurate to a certain extent, demonstrating ChatGPT's potential in providing reliable information on breast cancer.

Conclusions: ChatGPT exhibits potential as a supplementary resource for patient education on breast cancer. While its responses were generally accurate, the presence of inaccuracies highlights the importance of professional oversight. The study advocates for the integration of AI tools like ChatGPT in healthcare settings, emphasizing their role in supporting patient-provider interactions and health education, with the caveat of periodic updates to incorporate the latest research and clinical guidelines.

Keywords: Artificial Intelligence, ChatGPT, Breast Cancer, Patient Education, Healthcare.

Introduction

Artificial Intelligence (AI) has rapidly emerged as a transformative force across various domains, particularly in the field of medicine.[1] Among these innovations, ChatGPT, a next-generation large language model developed by OpenAI, stands out for its proficiency in generating human-like responses to diverse user inquiries on a wide array of subjects. Since its launch in November 2022, ChatGPT has garnered immense popularity, amassing over 100 million users within a mere two months and generating a staggering 1.5 billion visits per month.[2]

ChatGPT's potential in revolutionizing medical practice is particularly noteworthy. It achieved a passing score on the United States Medical Licensing Examination (USMLE) Step 1, demonstrating its capability in medical knowledge.[3-4] Moreover, in comparative assessments of responses to patient queries, ChatGPT's answers were rated higher in quality and empathy than those provided by physicians.[5-6] These advancements highlight the growing interest in integrating ChatGPT into healthcare.

However, the integration of ChatGPT and similar LLMs into healthcare also brings certain challenges and potential negative effects. On the positive side, ChatGPT can enhance accessibility to medical information, provide timely responses, and support patient education.[7] It can serve as a valuable resource for preliminary information gathering and improve patient engagement. Conversely, there are concerns about the accuracy and reliability of the information provided by ChatGPT, as it may generate responses that are partially accurate or entirely inaccurate.[8] The static nature of its knowledge base means it cannot incorporate the

most recent research or clinical guidelines unless periodically updated. Furthermore, the use of AI in healthcare raises ethical considerations, such as patient privacy and the potential for over-reliance on AI tools at the expense of professional medical advice.[9]

Recent investigations have illuminated ChatGPT's accuracy and utility in addressing specialty-specific inquiries across various medical disciplines, including bariatric surgery, cirrhosis and hepatocellular carcinoma, and cardiovascular disease.[9-11] Despite these promising developments, there remains a critical gap in the literature concerning ChatGPT's proficiency in responding to inquiries related to breast cancer, a significant and prevalent oncological condition affecting millions worldwide.[12]

Breast cancer represents a complex disease spectrum characterized by diverse manifestations, ranging from prevention strategies to diagnosis, treatment modalities, and survivorship considerations.[13-14] Given the multifaceted nature of breast cancer and the profound impact it exerts on patients' lives, accurate and empathetic information dissemination is paramount.[15-17] Thus, evaluating ChatGPT's performance in generating responses to commonly asked questions about breast cancer holds immense clinical and research significance.

In light of the notable successes achieved by ChatGPT in other medical domains, it is imperative to investigate its efficacy in addressing inquiries specific to breast cancer. Such an evaluation not only holds the potential to enhance patient education and support but also provides valuable insights into the capabilities and limitations of AI-driven healthcare solutions. Therefore, this study aims to fill this critical gap by systematically assessing ChatGPT's proficiency in generating accurate and comprehensive responses to commonly asked questions pertaining to breast cancer. Through this work, we aim to contribute to the growing body of literature on AI applications in healthcare and inform future developments aimed at optimizing patient care in the realm of breast cancer management.[18]

Methodology

Questions curation and source of data

A list of 100 questions for entry into the ChatGPT (Verson 4.0) user interface were curated. from frequently asked questions listed on Cancer.net and the National Breast Cancer Foundation's website at https://www.nationalbreastcancer.org/breast-cancer-faqs, combined with inquiries commonly received in their clinical practice. These questions were carefully chosen to reflect the real-world concerns and informational needs of patients regarding breast cancer. [18]

ChatGPT

ChatGPT, developed by OpenAI, is a sophisticated language model trained on a vast array of data sources, including websites, books, and articles available up until early 2021. This extensive training dataset enables ChatGPT to generate articulate, conversational, and

comprehensible replies to a wide variety of queries. To enhance its performance and ensure it adheres to user instructions accurately, the model underwent fine-tuning through a process called Reinforcement Learning from Human Feedback (RLHF). In this process, human evaluators provided feedback that acted as a reward signal, allowing the model to learn and adapt to a broad range of commands and written instructions based on human preferences. Moreover, efforts were made to align the model's responses with user intentions while actively working to reduce biases and the likelihood of generating toxic or harmful content. The precise data sources utilized for ChatGPT's training are not publicly disclosed, ensuring a broad and diverse foundation for its knowledge and capabilities. [19-23]

Categories and scoring criteria for responses

The collected questions were organized into four thematic categories: diagnosis (17 questions), treatment (34 questions), survival (10 questions), and quality of life (49 questions), (Table S1-Table S4). The wording of these questions was deliberately conversational and framed in the first person, mirroring the typical manner in which a patient might pose their queries to the ChatGPT interface.

Subsequently, the responses generated by ChatGPT were compiled and forwarded to two experts (referred to as MS and EA) to evaluate the accuracy of the information provided. This evaluation process employed a rating system derived from a scoring method established in earlier studies involving ChatGPT.

1. Entirely inaccurate.
2. Partially accurate; includes both correct elements and inaccuracies.
3. Accurate yet non comprehensive; devoid of inaccuracies but lacking in detail that a specialized Gynecologic Oncologist would likely expand upon.
4. Highly accurate and comprehensive; devoid of inaccuracies, covering all essential aspects with no significant additions.

For each question, the initial pair of numeric scores were compared. In cases where these first two scores did not align, the response was forwarded to another expert (TE) for additional evaluation to settle the difference. Should the consensus not be reached on the numeric score by at least two of the experts following the input of the third reviewer, a fourth expert (FE) was consulted. The definitive numeric score for each question was determined by the agreement of at least two experts. It's important to note that all reviewers were unaware of each other's assigned scores during the process. [24-25]

The study analyzed the distribution of ChatGPT response scores both overall and within specific categories of questions. Additionally, it measured the frequency of instances where additional reviewers were necessary to reconcile scoring differences. In a separate analysis, responses were classified into "correct" (scores of 1 and 2) and "incorrect" (scores of 3 and 4). Responses that did not consistently fall into the same category (correct vs. incorrect) between the first two reviewers were removed, and the proportions of scores within the remaining groups were then recalculated. Graph Pad Prism (Version 8.0) was utilized for all statistical analyses. [24]

This research was not considered to involve Human Subjects, thus it did not require approval from an Institutional Review Board. To ensure the study's novelty, PubMed searches were conducted before the study began and repeatedly afterwards, using the terms "ChatGPT" in combination with "breast cancer," "metastatic breast cancer," and "metastatic breast cancer."[24]

Results

A comprehensive analysis of 100 questions entered into the ChatGPT (Version 4.0) user interface was conducted across four distinct categories: diagnosis, treatment, survival, and quality of life of metastatic breast cancer. These questions were curated to reflect the inquiries commonly presented by patients on reputable cancer information websites and in clinical settings. Two primary experts were tasked with scoring the responses from ChatGPT, utilizing a four-point accuracy scale. In instances of scoring discrepancies, a third and, if necessary, a fourth expert provided additional assessments to reach a consensus. Out of the 100 questions evaluated, 5 responses were categorized as entirely inaccurate. There were 22 responses that were deemed partially accurate, containing some correct elements alongside inaccuracies. The largest number of responses, 42 in total, were considered accurate but not comprehensive, indicating that they contained the right information but lacked detail in certain areas. Finally, 31 responses received the highest accolade of being highly accurate, signifying that they were not only free of inaccuracies but also covered all essential aspects thoroughly. These figures underscore ChatGPT's capability to provide reliable information across a spectrum of patient inquiries related to breast cancer. Overall, the proportion of responses that were either accurate but not comprehensive or highly accurate was substantial across all categories, demonstrating a predominant trend towards reliable information provision by ChatGPT.

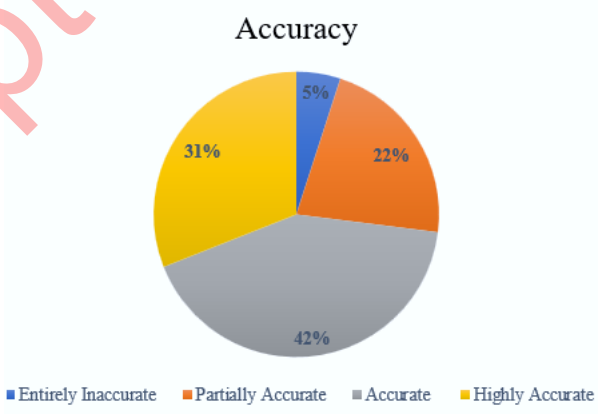

Figure 1. Percentage of different scores for all questions

In the diagnosis category, none of the 17 ChatGPT responses were categorized as entirely inaccurate. 2 (11.76%) responses were partially accurate, while 7 (41.18%) were accurate but not comprehensive. 8 (47.06%) were rated as highly accurate. The majority responses were rated as highly accurate.

Within the treatment category, of the 34 responses evaluated, only 1 (2.94%) was found to be entirely inaccurate. Partial accuracy was assigned to 11(32.35%) of responses, and 10 (29.41%) were considered accurate but not comprehensive. Notably, 12 (35.29%) achieved a rating of highly accurate.

In the survival category, for the 10 responses assessed, none were entirely inaccurate, 1 (10%) were partially accurate, 5 (50%) were accurate but not comprehensive, and 4 (40%) were rated as highly accurate.

For the quality-of-life category, among 49 responses, 4 (8.16%) were rated entirely inaccurate, 8 (16.33%) were partially accurate, 20 (40.82%) were accurate but not comprehensive, and 17 (34.69%) were deemed highly accurate.

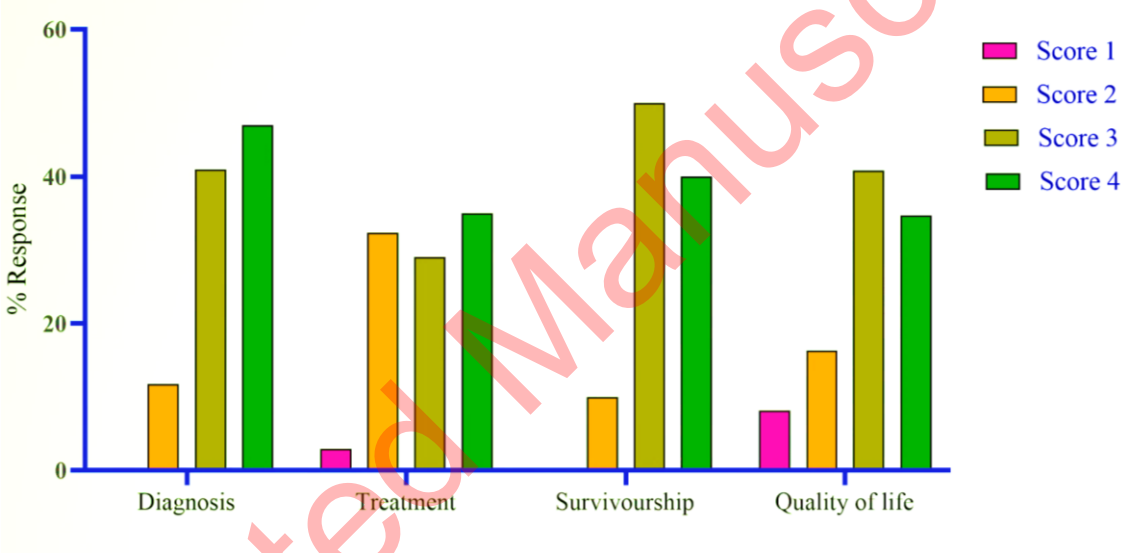

Figure 2. Percentage of scores in each category of questions.

Discussion

The analysis of ChatGPT's responses to breast cancer-related questions reveals a high degree of accuracy, suggesting its potential as a supplementary resource for patient information. Notably, none of the responses in the survival category were entirely inaccurate, and the majority across all categories were at least accurate to some extent. These findings indicate that ChatGPT can generate responses aligned with expert oncological knowledge. However, the presence of responses rated as partially accurate or entirely inaccurate, though a minority, highlights the need for professional oversight when using ChatGPT in a medical context. The study also underscores the complexity of evaluating responses in a nuanced field like oncology. The need for additional expert review in some cases reflects the subjective nature of medical information and the varying levels of detail expected by experts. While ChatGPT can provide immediate responses, which is advantageous in terms of accessibility and time compared to traditional patient-doctor interactions, it cannot replace the personalized advice of healthcare professionals. Moreover, its static knowledge base limits its ability to incorporate the most recent research or clinical guidelines unless periodically updated.

Conclusion

In conclusion, ChatGPT demonstrates significant potential as a supplementary tool for patient education and initial information gathering in breast cancer. Its responses generally align with expert knowledge, making it a useful resource when guided and interpreted by healthcare professionals. However, the presence of inaccuracies underscores the need for cautious application without professional oversight. Further research should explore how such AI tools can be integrated into healthcare settings to support patient-provider interactions and enhance health education initiatives. This study contributes to the growing body of literature on AI applications in healthcare and highlights the importance of continuous evaluation and improvement of AI technologies in medical practice.

Conflict of interest: None to declare.

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Supplimentary Information

Table 1: Questions related to diagnosis (n=17)

S.No.	Question	Answer	R1	R2	R3	R4	Score
1.	Can physical activity reduce the risk of breast cancer?	Yes, engaging in regular physical activity is associated with a lower risk of breast cancer. The American Cancer Society recommends at least 150 minutes of moderate-intensity or 75 minutes of high-intensity exercise each week to help lower cancer risk.	3	2			3
2.	Can a healthy diet help to prevent breast cancer?	While no specific diet can prevent breast cancer, a healthy diet rich in vegetables, fruit, poultry, fish, and low-fat dairy products can help to reduce the risk of breast cancer. Obesity is a known risk factor, and maintaining a healthy weight may help lower risk.	2	1			2
3.	Does smoking cause breast cancer?	Smoking is linked to an increased risk of breast cancer, especially in premenopausal women. The risk increases with the number of years and the amount of tobacco smoked.	2	4			4
4.	Can drinking alcohol increase the risk of breast cancer?	Yes, alcohol consumption is associated with an increased risk of breast cancer. The risk increases with the amount of alcohol consumed. Women who drink one alcoholic drink a day have a small increase in risk, and those who consume two to five drinks daily have about 1.5 times the risk of	4	2			4

		women who do not drink alcohol.					
5.	Is there a link between oral contraceptives and breast cancer?	Some studies have found a slight increase in breast cancer risk among current and recent users of oral contraceptives, but the risk appears to return to normal after stopping the pills for 10 years or more.	2	3			3
6.	Is there a link between hormone replacement therapy (HRT) and breast cancer?	Yes, there is evidence that hormone replacement therapy, especially combined estrogen-progestin therapies, is associated with an increased risk of breast cancer when used over extended periods.	4	3			4
7.	How often should I do a breast self-exam (BSE)?	Recommendations on BSE vary. Some organizations no longer recommend routine BSE as a screening tool for breast cancer due to a lack of evidence that it reduces mortality. However, being familiar with how your breasts normally look and feel can help you notice symptoms such as lumps, pain, or changes in size that may be of concern.	2	3			3
8.	Does a family history of breast cancer put someone at a higher risk?	Yes, having a family history of breast cancer, especially a mother, sister, or daughter who has been diagnosed with the disease, can increase an individual's risk. The risk is higher if the relative was diagnosed before the age of 50.	3	4			4
9.	Are mammograms painful?	Mammograms can be uncomfortable for some women, as the breast is compressed between two plates to get a clear image. However, the discomfort is usually brief. Pain levels vary among individuals.	3	3	2		2
10	How does menstrual and reproductive history affect breast cancer risks?	Women who began their menstrual periods before age 12, experienced menopause after age 55, or had their first child after age 30 may have a slightly higher breast cancer risk. Having many pregnancies	3	2			3

		and breastfeeding for longer periods may lower risk.					
11	How often should I go to my doctor for a check-up?	The frequency of doctor visits for check-ups can vary based on age, health history, and risk factors for diseases. Generally, annual wellness visits are recommended for adults to discuss preventative measures and screenings, including those for breast cancer.	3	3	3	3	3
12	What kind of impact does stress have on breast cancer?	The direct link between stress and breast cancer risk is unclear. However, high levels of stress can lead to unhealthy behaviors (e.g., smoking, overeating) that may increase cancer risk.	3	4			4
13	What celebrities have or have had breast cancer?	Many celebrities have been diagnosed with and treated for breast cancer, using their platform to raise awareness. Examples include Shannen Doherty, Julia Louis-Dreyfus, and Olivia Newton-John.	2	2	3		3
14	Where can I find a breast cancer support group?	Breast cancer support groups can be found through hospitals, cancer organizations (like the American Cancer Society), and online platforms. They offer a community for sharing experiences and support.	3	2			3
15	Can breastfeeding reduce the risk of breast cancer?	Yes, breastfeeding can lower the risk of breast cancer, especially if continued for 1.5 to 2 years. However, breastfeeding for any period can be beneficial.	2	4			4
16	Is dairy (milk) linked to a higher risk of breast cancer?	Research on dairy products and breast cancer risk has produced mixed results. Some studies suggest a potential link, especially with high-fat dairy, while others do not find a significant association.	4	4	4	4	4
17	Is hair dye linked to a higher risk of breast cancer?	Some studies have suggested	4	2			4

Table S2: Questions related to treatment (n=34)

S.No.	Question	Answer	R1	R2	R3	R4	Score
1	Where in my body has the cancer spread?	The spread of cancer depends on individual cases. Metastatic breast cancer commonly spreads to bones, liver, lungs, or brain. Imaging tests like CT scans, MRIs, or bone scans are used to determine the spread.	3	2			3
2	Are you experienced in treating metastatic breast cancer?	Most oncologists have experience in treating metastatic breast cancer, given its prevalence. It's important to have a specialist with specific experience in metastatic cases for the best care approach.	1	2			2
3	Would you recommend seeking a second opinion?	Seeking a second opinion is often encouraged, especially for complex cases like metastatic breast cancer, to explore all treatment options and gain further insight into your diagnosis and prognosis.	4	3			4
4	What is my prognosis?	Prognosis varies greatly among individuals and is influenced by factors like cancer subtype, extent of spread, response to treatment, and overall health. Your doctor can provide more personalized information based on your case.	4	4	4	4	4
5	Are there things I can do to improve my prognosis?	Maintaining a healthy lifestyle, following treatment plans closely, and managing stress can be beneficial. Participation in clinical trials might also offer access to new therapies that could improve outcomes.	3	3	2		2
6	What are the next steps in my treatment planning?	The next steps may include further diagnostic tests to understand the cancer's characteristics, discussions about treatment options (such as chemotherapy, hormone therapy, targeted therapy),	3	2			3

		and possibly planning for supportive care to manage symptoms.					
7	What are my treatment options?	Treatment options for metastatic breast cancer can include hormone therapy, chemotherapy, targeted therapy, immunotherapy, and supportive care for symptom management. The choice depends on the cancer subtype, previous treatments, and current health status.	1	2			2
8	What types of research are being done for metastatic breast cancer in clinical trials?	Ongoing research includes developing new medications, combination therapies, immunotherapies, and targeted therapies. Clinical trials also explore ways to improve quality of life for patients with metastatic breast cancer.	4	3			4
9	Is there enough information to recommend a treatment plan for me?	This depends on the results from diagnostic tests, including imaging and biomarker tests. If more information is needed, your doctor will recommend further tests to tailor the treatment plan to your specific case.	4	3			4
10	What biomarker tests do you recommend? Why?	Biomarker tests for hormone receptor status, HER2 status, and possibly genetic mutations like BRCA1/BRCA2 are recommended to guide treatment choices. These tests help in identifying the most effective treatments based on the cancer's specific characteristics.	2	2	2		2
11	What is the hormone receptor status of the cancer? What does it mean?	Hormone receptor status indicates whether the cancer grows in response to hormones like estrogen and progesterone. Positive status means treatments that lower hormone levels or block their	3	2			3

		effects might be effective. Negative status suggests other treatments might be more appropriate.					
12	What is the HER2 status of the cancer? What does it mean?	HER2 status shows if the cancer has higher levels of the HER2 protein, which can promote the growth of cancer cells. HER2-positive cancers may be treated with drugs that specifically target HER2. HER2-negative cancers do not benefit from these drugs and require different treatments.	1	2			2
13	If I have already had treatment for non-metastatic breast cancer, do you plan on retesting the hormone receptor status and HER2 status of the cancer?	Retesting might be recommended for metastatic cancer to see if the characteristics of the cancer have changed, which can inform the most effective treatment approach.	4	3			4
14	What treatment plan do you recommend?	Treatment recommendations depend on cancer's characteristics, including hormone receptor and HER2 status, whether it's metastatic, and your overall health. Options can include surgery, radiation, chemotherapy, hormone therapy, targeted therapy, and immunotherapy.	4	2	2		2
15	What is the goal of each treatment? Is it to eliminate the cancer, help me feel better, or both?	The goal depends on the cancer stage and type. It can be to eliminate the cancer, control its growth and spread, relieve symptoms, improve quality of life, or a combination of these.	3	2			2
16	What are the risks of each treatment?	Risks vary by treatment type and can include side effects like fatigue, nausea, risk of infection, and more specific effects related to each therapy's mechanism of action. Your doctor can provide detailed information	2	2	2	2	2

		on the risks associated with your treatment plan.					
17	How does having reached (or not reached) menopause affect my treatment options?	Menopausal status can influence treatment options, especially hormone therapies, as the body's hormone production changes with menopause, potentially affecting the efficacy of certain treatments.	3	2			3
18	What is chemotherapy? What is hormonal or endocrine therapy? What is targeted therapy? What is immunotherapy?	Chemotherapy uses drugs to kill cancer cells. Hormonal therapy blocks cancer's ability to use hormones. Targeted therapy targets specific molecules involved in cancer growth. Immunotherapy helps the immune system fight cancer.	4	3			4
19	What can I do to get ready for each treatment?	Preparing might include arranging for time off work, setting up support at home, getting nutritional advice, and possibly freezing sperm or eggs if future fertility is a concern. Your healthcare team can provide specific advice based on the treatments you'll be receiving.	4	3			4
20	What are the new research advances for this type of cancer?	Advances in breast cancer research include the development of new targeted therapies, immunotherapies, and better understanding of genetic mutations driving cancer growth, leading to more personalized treatment approaches. Ongoing clinical trials continue to explore these areas.	3	3	2		3
21	What are the potential side effects of each treatment?	Side effects vary depending on the treatment type: chemotherapy can cause nausea, fatigue, and hair loss; hormonal therapy may result in hot flashes and joint pain; targeted therapy and immunotherapy can lead to	3	2			3

		skin reactions and immune-related effects. Your doctor will provide detailed information specific to your treatments.					
22	How will we know if the treatment is working?	Treatment effectiveness is monitored through imaging tests, blood tests, and assessing changes in symptoms. Your doctor will schedule regular follow-ups to track your progress.	1	2			1
23	Who should I contact about any side effects I experience? And how soon?	Contact your oncology team immediately for any severe or unexpected side effects. They usually provide a contact number for urgent issues outside regular hours.	4	3			3
24	What care will be given to help control my symptoms and side effects?	Symptom and side effect management may include medications, lifestyle adjustments, nutritional support, and referral to specialists like palliative care teams.	3	3	3	3	3
25	Will I lose my hair, and can anything be done to prevent hair loss?	Hair loss is a common side effect of some chemotherapy drugs. Cooling caps may reduce hair loss risk, and wigs or headscarves can be used as alternatives.	3	3	2		3
26	How will this treatment affect my daily life? Will I be able to work, exercise, and perform my usual activities?	Treatment impact varies, but fatigue and other side effects may limit activities. Adjustments and accommodations might be necessary. Discuss concerns with your healthcare team for personalized advice.	4	3			4
27	Will this treatment affect my sex life? If so, how and for how long?	Some treatments can affect sexual function or desire temporarily. Open discussion with your healthcare provider can lead to strategies or treatments to manage these effects.	4	2	2		2
28	When do I need to make a treatment decision?	Timelines can vary based on the cancer's aggressiveness and your condition. Your	3	2			2

		doctor will advise you on the urgency of starting treatment and help you weigh your options.					
29	Who will lead my overall treatment?	Typically, an oncologist leads cancer treatment planning and coordination, working closely with a multidisciplinary team to ensure comprehensive care.	2	2	2	2	2
30	Who will be part of my health care team, and what does each member do?	Your team may include medical oncologists, surgeons, radiation oncologists, nurses, nutritionists, social workers, and palliative care specialists, each playing a role in different aspects of your care.	3	2			3
31	If I have questions or problems, who should I call?	Your oncology nurse or doctor is your first point of contact for any questions or concerns. They can direct you to the appropriate team member as needed.	4	3			4
32	Do you communicate with your patients by email or with an electronic health record system?	Many healthcare providers use electronic health records (EHRs) for secure messaging and health information sharing. Ask your doctor about the preferred method of communication.	4	3			4
33	What will happen if this treatment stops working?	If treatment becomes ineffective, your doctor will discuss alternative options, which may include other standard treatments or enrollment in clinical trials.	4	4	4	4	4
34	What will happen if I choose to stop treatment?	Stopping treatment is a personal decision that can have significant impacts. Your healthcare team can provide information on palliative care and support services to manage symptoms and maintain quality of life.	4	4	4	4	4

Table S3: Questions related to survival (n=10)

S.No.	Question	General Answer	R1	R2	R3	R4	Score
1.	How long will it take to feel better?	Recovery time varies based on the type of treatment, stage of cancer, and individual health factors. Some may feel better weeks after treatment, while others might take months or longer to recover fully.	4	3			4
2.	What kind of care can I expect after treatment?	Post-treatment care can include follow-up appointments, rehabilitation, support for managing side effects, and monitoring for recurrence. The care plan is tailored to the individual's needs and the specifics of their treatment.	3	2			3
3.	What long-term health issues can I expect?	Long-term health issues depend on the type of cancer and treatment. Possible issues include fatigue, lymphedema, cognitive changes, and increased risk of secondary cancers or other conditions.	3	3	3	3	3
4.	What are the chances the cancer will return?	The risk of recurrence varies by type of cancer, stage at diagnosis, treatment success, and other factors. Specific statistics should be discussed with a healthcare provider.	2	3	2		2
5.	What long-term side effects are possible?	Long-term side effects can include chronic pain, nerve damage, infertility, heart or lung problems, and others, depending on the treatment type.	4	4	3		4
6.	What follow-up care plan will I have after treatment?	A follow-up care plan typically includes regular physical exams, monitoring for recurrence, managing any long-term side effects, and support for recovery. The frequency and type of follow-up vary.	3	3	3	3	3
7.	How often will I need to see a doctor?	Initially, follow-up appointments may be every few months. If no signs of cancer are present, visits may eventually be spaced out to once a year.	4	4	4	4	4
8.	What follow-up tests will I need, and how often will those tests be needed?	Follow-up tests can include blood tests, imaging exams (like CT scans or MRIs), and physical exams, scheduled based on the specific cancer type and individual risk factors.	2	3			3
9.	Can I get copies of my laboratory test results?	Yes, patients have the right to access their medical records, including laboratory test results. You can	4	3			4

		request these from your healthcare provider or the medical records department.					
10	How do I get a treatment summary and survivorship care plan to keep in my personal records?	Ask your healthcare team for these documents at the end of your treatment. They provide a detailed history of the cancer, treatments received, and recommended follow-up care.	3	3	3	3	3

Table S4: Questions related to quality of life (n=49)

S.No.	Question	Answer	R1	R2	R3	R4	Score
1	What level of caregiving will I need at this time?	The level of caregiving required depends on your specific condition, treatment side effects, and daily needs. A healthcare provider can assess your situation to determine the appropriate level of support.	3	2			3
2	Can you refer me to a palliative care/supportive care doctor?	While I can't provide direct referrals, your primary healthcare provider or oncologist can refer you to a palliative care specialist based on your healthcare needs and preferences.	4	3			4
3	Where can I find emotional support for me and my family?	Emotional support can be found through counseling services, cancer support groups, and mental health professionals. Organizations such as the American Cancer Society offer resources and support networks.	3	4			4
4	What other services are available to me and my family?	Services may include nutritional counseling, physical therapy, home health care, spiritual support, and access to social workers to help navigate the care process and support needs.	3	2			3
5	If I am worried about managing the costs of cancer care, who can help me?	Financial counselors at your treatment center, social workers, and organizations like the Patient Advocate Foundation can provide guidance on managing costs and understanding insurance coverage.	2	1			2
6	Do you have a social worker I can speak with?	Most hospitals and cancer treatment centers have social workers available to assist patients and families with various needs, including emotional support, care coordination, and resource navigation.	1	1	2		2
7	What should I tell my employer, if anything, and what laws protect my rights as an employee?	Disclosure to your employer is your choice and may be necessary for accommodations. The Americans with Disabilities Act (ADA) and the Family and Medical Leave Act (FMLA) provide protections for employees with serious health conditions in the U.S.	2	3			3
8	If I have questions or problems, who should I call?	Start with your primary care team or oncologist. They can provide guidance, answer questions, and direct you to other specialists as needed.	3	2			3
9	Will palliative care continue even if I	Yes, palliative care focuses on improving quality of life and can	4	3			4

	stop cancer treatment?	continue regardless of the status of cancer treatment, addressing symptoms, and providing support.					
10	Where can I receive palliative care?	Palliative care can be provided in various settings, including hospitals, outpatient clinics, at home, and sometimes in specialized facilities, based on individual needs and preferences.	4	4	4	4	4
11	How often will I need to see a doctor?	The frequency of doctor visits depends on your current health status, treatment plan, and specific needs. This can vary widely among patients and should be determined in consultation with your healthcare team.	3	2			3
12	What is hospice care? How is hospice care different than palliative care?	Hospice care is specialized care designed for the final months of life when a patient decides to forgo curative treatments. Palliative care is broader, focusing on relieving symptoms and stress of serious illness at any stage, not just the end of life. Hospice care is a form of palliative care for those in the final stages.	3	3	3	3	3
13	Am I at the point where I should consider hospice care? If not, will you tell me when I am?	This decision is highly personal and should be made with input from your healthcare team, considering your prognosis, quality of life, and treatment goals. Your healthcare providers should guide you in making this decision when the time comes.	2	3	3		3
14	Where can I receive hospice care, and how can I manage its costs?	Hospice care can be provided at home, in hospice centers, nursing homes, or hospitals. Costs are often covered by Medicare, Medicaid, and private insurance policies. Financial counselors and social workers can help navigate coverage and costs.	3	3	3	3	3
15	Do I need to choose a health care proxy to make medical decisions for me when I cannot?	Yes, choosing a health care proxy is important to ensure your healthcare wishes are honored if you become unable to communicate your decisions. This person should be someone you trust to act on your behalf.	4	3			4
16	What legal documents should I have in place?	Essential documents include a living will or advance directive to outline your medical treatment preferences, CPR or do-not-resuscitate (DNR) orders, and a POLST form if applicable. These ensure your	3	4			4

		healthcare wishes are known and followed.					
17	Are there resources to help me put my legal, financial, and business affairs in order?	Legal advisors, financial planners, and resources like the National Institute on Aging or local Area Agencies on Aging can provide guidance on putting your affairs in order. Non-profit organizations may also offer support and resources.	4	3			4
18	What services are available to help me and my family with the emotional and spiritual aspects of death and dying?	Counseling services, spiritual care (from chaplains or other spiritual advisors), support groups, and palliative care teams can offer support. Many organizations and healthcare providers specialize in bereavement and end-of-life emotional support.	4	3			4
19	Will palliative care continue even if I stop cancer treatment?	Yes, palliative care is not dependent on continuing cancer treatment. Its goal is to improve quality of life and manage symptoms, regardless of the treatment status.	3	3	2		3
20	Where can I receive palliative care?	Palliative care can be provided in various settings, including hospitals, outpatient clinics, at home, and in some long-term care facilities, tailored to meet the patient's needs and preferences.	1	2			2
21	How often will I need to see a doctor?	The frequency of doctor visits varies based on your condition, treatment plan, and the phase of care you're in. Your healthcare team will provide a schedule that best suits your needs.	4	3			4
22	What is hospice care? How is hospice care different than palliative care?	Hospice care is specialized care for the final phase of a terminal illness, focusing on comfort rather than cure. It's a type of palliative care, which can be provided at any stage of illness to relieve symptoms and stress. Hospice is specifically for when life expectancy is six months or less.	4	4	4	4	4
23	Am I at the point where I should consider hospice care? If not, will you tell me when I am?	The decision to transition to hospice care depends on your health status, prognosis, and treatment goals. Your healthcare team will discuss this option with you when it becomes appropriate based on your condition.	4	2			4
24	Where can I receive hospice care, and how can I manage its costs?	Hospice care can be provided at home, in hospice centers, nursing homes, or hospitals. Medicare, Medicaid, and most private insurances cover hospice care. Your	4	3			4

		social worker or financial counselor can help navigate these options.					
25	Do I need to choose a health care proxy to make medical decisions for me when I cannot?	Yes, selecting a healthcare proxy ensures your medical decisions are made according to your wishes if you're unable to communicate. This person acts on your behalf based on your preferences.	3	3	3	3	3
26	What legal documents should I have in place?	Essential documents include a living will or advance directive, CPR or do-not-resuscitate (DNR) orders, and a POLST form, to clearly communicate your treatment preferences.	2	3			2
27	Are there resources to help me put my legal, financial, and business affairs in order?	Legal advisors, financial planners, and eldercare resources can assist in organizing your affairs. Organizations like the National Council on Aging offer guidance on these topics.	4	3			2
28	What services are available to help me and my family with the emotional and spiritual aspects of death and dying?	Services include counseling, support groups, spiritual care provided by chaplains or pastoral care, and palliative care teams equipped to address these needs.	3	2			3
29	Will palliative care continue even if I stop cancer treatment?	Yes, palliative care is about improving quality of life and can continue regardless of the status of your cancer treatment.	4	3			4
30	Where can I receive palliative care?	Palliative care is available in hospitals, outpatient clinics, at home, and in some long-term care facilities, depending on your needs.	4	4			4
31	How often will I need to see a doctor?	The frequency of doctor visits depends on your specific condition, treatment plan, and any changes in your health. It's tailored to individual needs, so your healthcare team will guide you.	3	2			3
32	What is hospice care? How is hospice care different than palliative care?	Hospice care is end-of-life care for patients who are no longer seeking curative treatments, with a life expectancy of six months or less. Palliative care is broader, aiming to relieve symptoms and stress of a serious illness at any stage, not limited to end-of-life.	3	3			3
33	Am I at the point where I should consider hospice care?	This decision is based on your overall health, prognosis, and treatment goals, in consultation with your healthcare team. They will	2	4			2

		inform you when hospice care may be the appropriate next step.					
34	Where can I receive hospice care, and how can I manage its costs?	Hospice care can be received at home, in hospice facilities, hospitals, or nursing homes. Its costs are often covered by Medicare, Medicaid, and private insurance. Financial counselors and social workers can assist with understanding and managing these costs.	2	3			3
35	Do I need to choose a health care proxy?	Yes, selecting a health care proxy ensures that someone you trust can make medical decisions on your behalf if you're unable to do so. This is a crucial step in advance care planning.	1	2			2
36	What legal documents should I have in place?	It's important to have a living will or advance directive, CPR/do-not-resuscitate orders, and a POLST form, if applicable, to document your healthcare preferences clearly.	2	2			1
37	Are there resources to help me put my legal, financial, and business affairs in order?	Legal advisors, financial planners, and organizations such as the National Institute on Aging provide resources and guidance for organizing your affairs. Local agencies on aging can also be helpful.	3	3	3	3	3
38	What services are available to help me and my family with the emotional and spiritual aspects of death and dying?	Counseling, spiritual care services, support groups, and bereavement services can support you and your family. These services are often provided by hospices, hospitals, and community organizations.	4	3			4
39	What level of caregiving will I need at this time?	The level of caregiving required depends on your health status, mobility, daily activity needs, and the complexity of your medical care. Assessment by healthcare professionals can help determine your needs.	3	4			2
40	Can you refer me to a palliative care/supportive care doctor?	While I can't provide direct referrals, your primary care physician or specialist can refer you to a palliative care or supportive care doctor based on your condition and healthcare needs.	3	3			3
41	Where can I find emotional support for me and my family?	Emotional support is available through counseling services, support groups, and mental health professionals specializing in chronic illness and cancer care. Organizations such as the American	3	2			3

		Cancer Society offer resources and support networks.					
42	What other services are available to me and my family?	Services may include home healthcare, nutritional counseling, rehabilitation services, transportation assistance, and hospice care. Local community organizations and hospitals often provide a range of support services.	3	2			3
43	If I am worried about managing the costs of cancer care, who can help me?	Financial counselors at healthcare facilities, patient advocacy groups like the Patient Advocate Foundation, and social workers can provide assistance with understanding insurance coverage and exploring financial assistance options.	4	3			4
44	Do you have a social worker I can speak with?	Most hospitals and cancer treatment centers have social workers on staff who can assist with navigating care, understanding resources, and providing emotional support.	3	2			1
45	What should I tell my employer, if anything, and what laws protect my rights as an employee?	Disclosure to your employer is a personal decision. Laws such as the Americans with Disabilities Act (ADA) and the Family and Medical Leave Act (FMLA) offer protections for employees dealing with serious health conditions.	4	3			1
46	If I have questions or problems, who should I call?	Start with your primary healthcare provider or oncologist for medical concerns. For support services, a social worker or patient navigator at your treatment center can be helpful.	3	4			4
47	Will palliative care continue even if I stop cancer treatment?	Yes, palliative care focuses on comfort and quality of life and is not contingent upon receiving active cancer treatment. It can continue regardless of treatment decisions.	3	2			3
48	Where can I receive palliative care?	Palliative care can be provided in various settings including hospitals, outpatient clinics, at home, and sometimes in nursing homes, depending on the level of care needed and preferences.	3	3			3
49	How often will I need to see a doctor?	The frequency of doctor visits depends on your condition, phase of treatment, and specific care needs. This will be determined in collaboration with your healthcare team to ensure appropriate monitoring and support.	4	3			1