Patient Preference and Adherence

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ORIGINAL RESEARCH

The Impact of Google Search versus ChatGPT on Patient Understanding and Potential Adherence in PICC Line Care: A Comparative Analysis

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Objective: To compare the quality and comprehensiveness of information on peripherally inserted central catheters (PICCs) provided by Google and the artificial intelligence (AI) tool ChatGPT, and to identify the implications for patient understanding, informed decision-making, and potential adherence in oncology care.

Methods: In a simulated study, the top 20 PICC-related frequently asked questions (FAQs) were identified via a standardized Google search. These questions were posed to both platforms, and the responses were systematically analyzed and compared for source, type, and content.

Results: Google's answers were fragmented and sourced mainly from government websites (45%). In contrast, ChatGPT provided comprehensive, synthesized responses, primarily from academic sources (70%), as inferred from the content, given its lack of explicit source attribution. Critically, significant discrepancies in key clinical information were found. For instance, Google's top answer for PICC longevity was "two to six weeks", while ChatGPT suggested "up to six months or more", creating a high potential for patient confusion and undermining trust in prescribed care plans.

Conclusion: ChatGPT has the potential to offer more integrated health information than traditional search engines, thereby influencing how patients access knowledge. However, the presence of conflicting and decontextualized information introduces significant risks, such as patient confusion and anxiety, which can negatively impact trust, shared decision-making, and adherence to medical advice.

Keywords: peripherally inserted central catheter, ChatGPT, google, patient preference, adherence, shared decision-making

Introduction

The utilization of peripherally inserted central catheters (PICCs) has increased substantially in recent years, particularly within oncological care.[1,2] For cancer patients, the placement of a PICC is a critical yet often anxiety-provoking event. Effective patient education is paramount for ensuring proper self-care, preventing complications, and improving quality of life.[3,4] PICCs are integral to managing cancer patients, providing essential vascular access for the administration of chemotherapy, antibiotics, or parenteral nutrition.[1,2,5] The benefits of PICCs are notable, including their relative ease of insertion, potential for fewer insertion-related complications, and reliability for long-term access.[3] Nevertheless, PICC use is associated with potential complications, such as thrombosis and bloodstream infections.[4,5] Consequently, comprehensive patient education and accessible, accurate information are crucial for mitigating these risks and promoting patient adherence to necessary care routines.

A growing number of patients are turning to web-based resources for health information, which offer time-efficient and cost-effective access to knowledge.[6] This digital information-seeking behavior significantly impacts health literacy, patient preferences, and ultimately, their adherence to treatment regimens.[7,8] In the United States, around 89% of citizens use search engines like Google for health-related inquiries prior to consulting healthcare professionals.[9] The release of

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the Chat Generative Pre-trained Transformer (ChatGPT), a novel artificial intelligence (AI) tool, by OpenAI in 2022 has further transformed this landscape.[10] ChatGPT uses advanced natural language processing to generate human-like, conversational content.[10,11] With its rising popularity, it is inevitable that patients will turn to ChatGPT for medical information, shaping their understanding and expectations about their care.[11,12]

However, the reliability of online health information remains a major concern that directly affects patient trust and adherence.[13,14] This issue is compounded by the varying levels of health literacy among patients, which affects their ability to find, understand, and apply health information to make informed decisions.[7] The emergence of Large Language Models (LLMs) like ChatGPT introduces a new, interactive dimension to this landscape, but its role in shared decision-making and its influence on patient adherence remains unexplored.[15] Previous research has assessed ChatGPT's responses to various medical conditions, including cardiovascular care, demonstrating its growing presence as an information source.[16–21] Specifically, no study has specifically examined its utility for PICC-related information compared to Google. Understanding the fundamental differences between these information sources is the first step toward developing effective clinical strategies to guide patients. Therefore, this study aims to fill this gap by simulating a typical patient's online search to evaluate the quality of information on PICCs from Google versus ChatGPT, thereby informing future approaches to enhance patient understanding and support adherence. To our knowledge, this is the first study to directly compare these platforms in the context of PICC-related patient education, addressing a previously unexamined, yet clinically critical, use case. We hypothesize that ChatGPT will provide more comprehensive and synthesized information compared to Google, which may have distinct implications for patient education and adherence. This study focuses on content analysis, acknowledging that future research involving patient perspectives is essential to fully understand the implications for comprehension and adherence.

Methods

Study Design

The study adopted a cross-sectional design. To analyze the information landscape encountered by a typical patient, this study simulated a common online information-seeking process. Given that the methodology relied entirely on the analysis of publicly available data, it did not involve human participants or animal subjects. This study focuses solely on the content and presentation of information, not on direct patient-level outcomes such as comprehension, behavioral change, or adherence, which are acknowledged as limitations. Consequently, approval from an Institutional Review Board was exempt.

Data Collection and Search Strategy

On January 12, 2025, a meticulous Google Web Search was carried out using a freshly installed Google Chrome browser (Version 112.0.6261.95) to avoid biases from personalized search algorithms. Prior to the search, all browsing history, cookies, and cached data were cleared. It is important to note that due to the dynamic nature of both Google's search algorithms and ChatGPT's model updates, the exact results may vary over time. Future studies could consider repeated searches at multiple time points to assess consistency. The search term "peripherally inserted central catheter" was used. To identify common patient queries in a reproducible manner, the first 20 frequently asked questions (FAQs) and their source websites were directly extracted from Google's "People also ask" section, which appeared below the primary search results. It was observed that beyond 20 samples, the questions began to repeat. The selection of the top 20 FAQs was therefore based on reaching a saturation point, ensuring a representative snapshot of common patient queries without over-sampling redundant information. Questions were included if they explicitly mentioned "peripherally inserted central catheter." Excluded were duplicate questions and those not containing the specified term.

Data Analysis

The following directive was given to ChatGPT (Version GPT-4), utilizing its active web browsing capabilities: "Perform a Google search with the search term 'peripherally inserted central catheter' and record the 20 most popular questions related to the search term". The top 20 questions along with ChatGPT's answers were documented. Additionally, the top

10 questions from the Google search were individually entered into ChatGPT, and the responses were recorded. Using a modified Rothwell system, as detailed in Table 1, questions were categorized into Fact, Policy, and Value topics.[16–18] Further subcategories specific to PICCs were also used. Websites were grouped into categories: commercial, academic, medical practice, and government (Table 1). Two independent investigators conducted the data classification, with discrepancies resolved by a third.

Results

Comparison of FAQs

Upon reviewing the top 20 FAQs, 6 (30%) were similar between Google's "People also ask" feature and ChatGPT's generated list. The analysis revealed distinct patterns. As shown in Figure 1A, Google's top 20 FAQs included 12 fact (60%), 7 policy (35%), and 1 value (5%) inquiries. In contrast, ChatGPT's list comprised 6 fact (30%), 11 policy (55%), and 3 value (15%) questions. A subtype analysis, detailed in Figure 1B, revealed further differences. For Google, the most frequent question subtype was education (8). For ChatGPT, the most frequent subtype was indications/management (7).

Source Analysis of Information

In terms of information sources for the top 20 questions (Figure 2), Google's answers were derived from a mix of sources, with government (9, 45%) being most prevalent, followed by medical practice (8, 40%), commercial (2, 10%), and academic sources (1, 5%) (Supplementary Table S1; Figure 2). Based on an analysis of the content and terminology, ChatGPT's responses predominantly cited academic (14, 70%) and government sources (6, 30%) (Figure 2), though the platform does not provide direct citations. A comparative analysis of the answers to the top 10 questions from Google's search results (Figure 3) showed that Google's responses primarily originated from government (6, 60%) and medical practice (4, 40%) sources. In contrast, ChatGPT's responses to these same questions were mainly sourced from academic (6, 60%) and government (4, 40%) materials.

Qualitative Comparison of Answer Content

A stark qualitative difference was observed in the presentation and content of the answers. As shown in Table 2, Google Search presented fragmented, snippet-like information that required the user to click through multiple links to build a comprehensive understanding. In contrast, ChatGPT provided comprehensive, structured, and integrated responses, often using numbered lists

Table 1 Classification Rules for Questions and Websites

Question topics categorized by Rothwell's classification	
Fact	Asks whether something is true and to what extent, objective information
Education	Educational, cannot be classified into other subcategories
Restriction	Restrictions to activity or lifestyle during recovery
Technical details	Details of the intervention procedure
Policy	Asks whether a specific course of action should be taken to solve a problem
Indications/management	Therapy indications and alternatives, post-intervention management, timing of therapy
Risks/complication	Risks/complications before, during or after intervention, including rehabilitation period
Value	Asks for evaluation of an idea, object, or event
Pain	Related to the timing, severity, and management of pain
Longevity	Longevity of the intervention
Evaluation of intervention	Successfulness, seriousness, or invasiveness of the intervention
Website categorization	
Commercial	Organizations that provide public health information, including medical device/ manufacturing/ pharmaceutical companies and news outlets
Academic	Universities, academic medical centers, or academic societies
Medical practice	Local hospitals or medical groups without clear academic affiliation
Government	Websites maintained by a national government

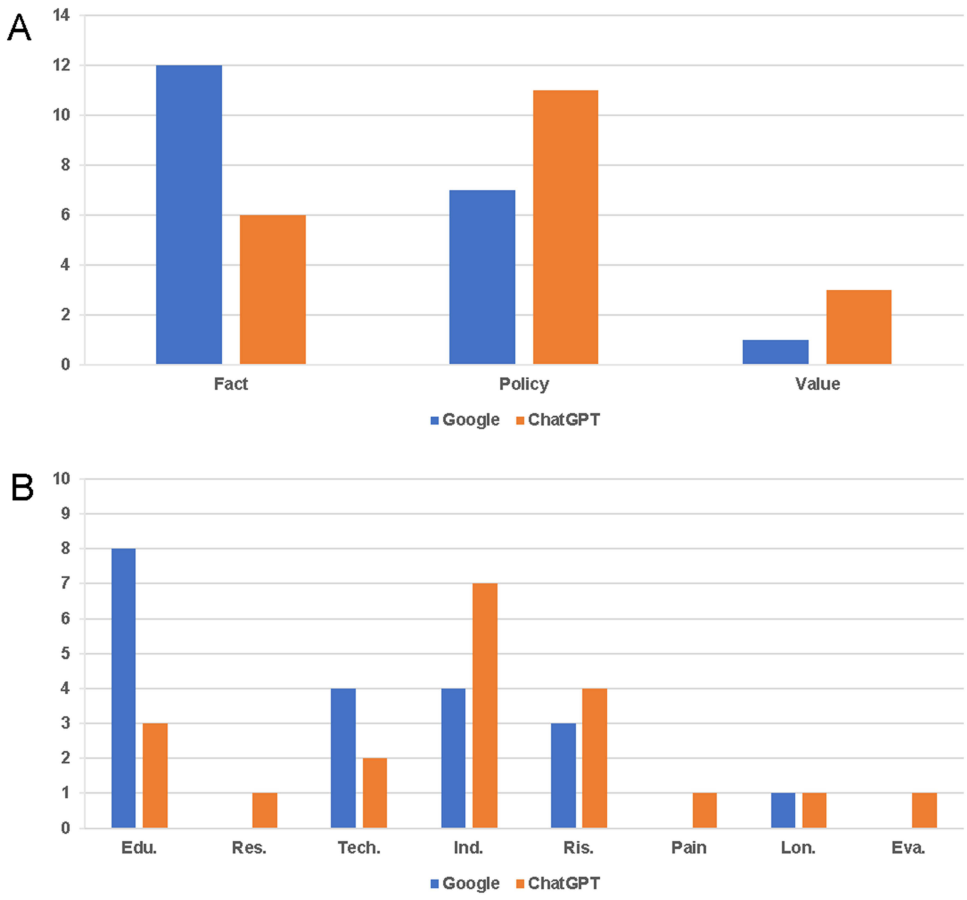

Figure 1 Type distribution of top questions. (**A**) Bar chart showing the distribution of the top 20 questions categorized as Fact, Policy, or Value for both Google and ChatGPT. (**B**) Bar chart showing the subtype distribution of the top 20 questions. Edu., Res., Tech., Ind., Ris., Pain, Lon., and Eva. in the chart refer to education, restriction, technical details, indications/management, risks/complication, pain, longevity, and evaluation of intervention, respectively.

that resembled educational materials (Supplementary Table S1 and S2). This contrast was most pronounced in answers to critical patient questions. For instance, when asked, "How long can a PICC line stay in?", Google's top result (from a medical practice source) provided a concise answer of "typically two to six weeks" (Table 2, Q5), while ChatGPT's response stated that a PICC can be used for "several weeks to months, often up to six months or more", and elaborated on the importance of maintenance and complication monitoring (Supplementary Table S1, Q4). This direct conflict in a key piece of information.

Discussion

This study simulated a patient's online search to compare the effectiveness of ChatGPT and Google in providing health information on PICCs. Our findings reveal significant differences in the information provided, with profound implications for patient education, health literacy, and the dynamics of shared decision-making and treatment adherence. To our knowledge, this is the first study to systematically evaluate ChatGPT for this purpose, framing the results within the context of patient care and preference formation. This pioneering work contributes significantly to the literature by specifically analyzing how these distinct information ecosystems address patient inquiries regarding PICC line care, an area critical to oncology and previously unexplored in this comparative context.

Principal Findings: A Shift from Fragmented Search to Synthesized Dialogue

Our analysis confirms that ChatGPT and Google operate on fundamentally different principles. Google acts as a retrieval engine, presenting a list of links that the user must independently evaluate and synthesize.[16–18] As our results show (Table 2), this often leads to brief, decontextualized snippets of information. ChatGPT, a generative LLM, functions

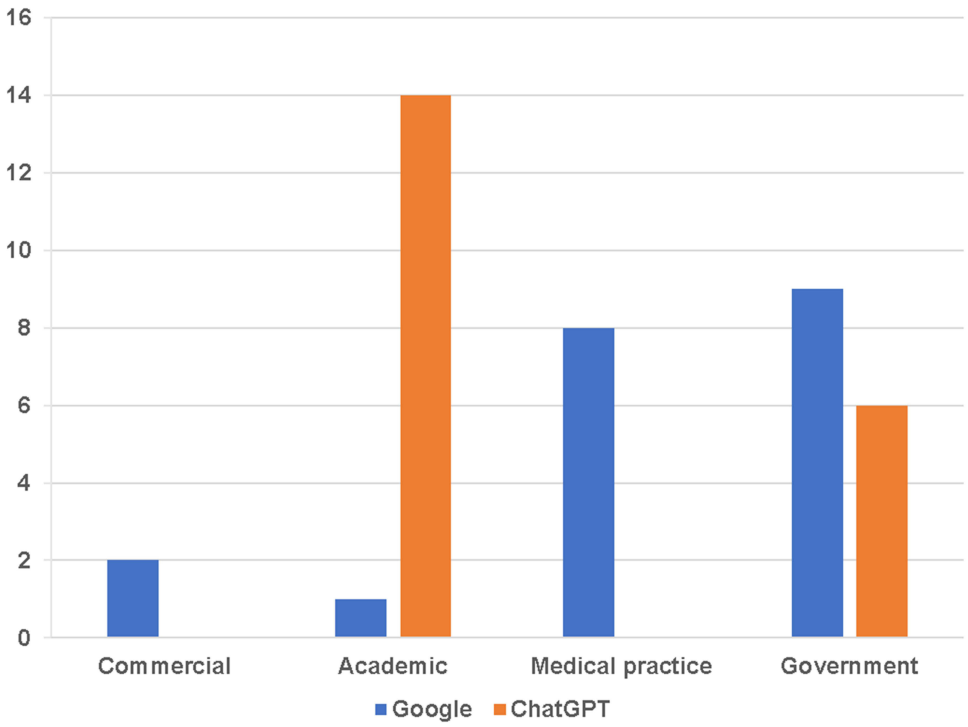

Figure 2 Type distribution of sources for answers to the top 20 questions. The bar chart displays the number of answers originating from different source types (Commercial, Academic, Medical practice, Government) for both Google and ChatGPT.

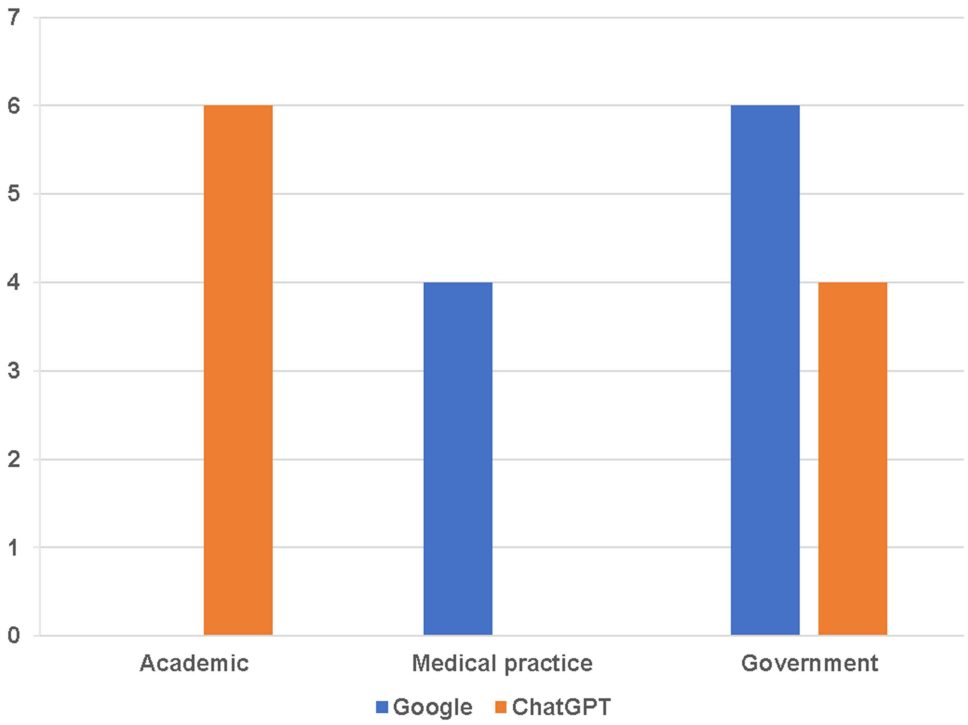

Figure 3 Type distribution of sources for answers to the top 10 questions from Google. The bar chart displays the number of answers originating from different source types (Academic, Medical practice, Government) for both Google and ChatGPT.

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Table 2 Top 20 Questions and Answers from Google Web Search

	Question	Answer
1	What is a peripherally inserted central catheter used for? (fact, education)	A PICC is a thin, flexible tube that is inserted into a vein in the upper arm and guided (threaded) into a large vein above the right side of the heart called the superior vena cava. It is used to give intravenous fluids, blood transfusions, chemotherapy, and other drugs. (government)
2	What is the difference between a PICC line and a CVC? (fact, education)	A CVC serves as a way to access your blood and helps your medical team deliver medication, blood products, nutrients, or fluids directly into your bloodstream or to draw blood samples. A peripherally inserted central catheter, also known as a PICC, is just one type of central venous catheter. (medical practice)
3	Why do we use PICC line instead of IV? (fact, education)	A PICC line is thicker and more durable than a regular IV. It's also much longer and goes farther into the vein. Health care providers use a PICC line instead of a regular IV line because: It can stay in place longer. (medical practice)
4	Why use PICC over CVC? (fact, education)	PICCs have several advantages over other CVCs. They provide medium-term venous access for several weeks up to 6 months, whereas non-tunneled centrally inserted venous catheters typically use for several days. (government)
5	How long can a PICC line stay in? (value, longevity)	The benefit of a PICC is that the catheter can remain for a long period, typically two to six weeks, over which a course of medication such as antibiotics can be delivered. (medical practice)
6	What vein is best for PICC line? (fact, technical details)	Right-arm access through the basilic or brachial vein may be more appropriate for successful nonfluoroscopic PICC insertion compared with the access through the left arm and the cephalic vein. (government)
7	Is a PICC line safer than a central line? (policy, risks/complication)	A systematic review by Chopra and colleagues in 2013 demonstrated a lower risk of central line–associated bloodstream infection with PICC lines when compared with central venous catheters. (government)
8	What is safer a port or PICC line? (policy, risks/complication)	The results suggested that port has a superior safety profile, with lower incidences of overall adverse effects, catheter-related thrombosis, and allergic reactions than typically expected with PICC. (government)
9	What are the indications for a PICC line? (policy, indications/management)	Indications for PICC line placement include: IV infusion of irritant medications (chemotherapy); Total parenteral nutrition; Long-term administration of medications (antibiotics, antifungals); Monitoring of interventions (central venous pressure and repeat blood sampling). (government)
10	Can nurses insert PICC lines? (fact, technical details)	It's usually done in a procedure room that's equipped with imaging technology, such as X-ray machines, to help guide the procedure. PICC line insertion can be done by a nurse, doctor or other trained medical provider. (medical practice)
11	Can you give IV fluids through a PICC line? (fact, education)	They are occasionally placed through a vein on the side of the neck or near the collar bone. You may hear the term "midline" catheter. This is a type of PICC, but it is a bit shorter and usually goes through a vein in the upper arms. Your care team will use the PICC line to give IV medications or fluids. (academic)
12	What are the nice guidelines for nursing care of PICC line? (policy, indications/management)	The routine care and maintenance of a PICC involves weekly flushing and dressing. However, if the PICC is used for the administration of drugs or fluids, the PICC has to be flushed immediately post completion of the infusion. Security devices such as statlock/griplock requires changing once every 4 weeks. (government)
13	Can you shower with a PICC line? (fact, education)	If the PICC gets wet it will increase the risk of infection. You can shower provided that the PICC line has a dressing and in addition you cover the PICC with plastic wrap to protect it from getting wet. Submerging your arm with the PICC in a bath is not recommended as it increases your risk of developing an infection. (medical practice)
14	What is the difference between a port and a PICC line? (fact, education)	Although PICC lines and ports have the same purpose, there are a few differences between them: PICC lines can stay in for several weeks or months. Ports can stay in as long as you need treatment, up to several years. PICC lines require daily special cleaning and flushing. (commercial)

(*Continued*)

Table 2 (Continued).

	Question	Answer
15	How often do you need to flush a PICC line? (fact, technical details)	You may need to flush it after each use. If the PICC line is not in active use, you may need to flush it once a day. Or you may only need to flush it once a week. Talk with your healthcare provider about how often you should do this. (medical practice)
16	What precautions should be taken during PICC line? (policy, indications/management)	No strenuous activity or heavy lifting for first 48 hours after line is placed. Never use scissors to remove tape/dressing from around the line. Always tape line to your arm to prevent it from snagging on objects. Cover with plastic when showering so the dressing does not get wet. (medical practice)
17	Can you take a blood pressure below a PICC line? (fact, education)	Do not take the patient's blood pressure on the arm with the PICC. Cuff pressure can cause bleeding at the insertion site, increase the risk of thrombus formation, and cause retrograde blood flow, raising the risk of catheter occlusion. (commercial)
18	What is the disadvantage of PICC? (policy, risks/complication)	PICCs are widely used for hospitalized patients and among outpatients. Despite many advantages, PICC-related complications can occur such as infection, thrombosis or mechanical complications. (government)
19	Where is the ideal PICC line placed? (fact, technical details)	The tip of a PICC or CVC should be placed in a large vein without contacting the vein or heart wall. The recommended catheter tip location is between the lower 1/3 of the superior vena cava and cavo-atrial junction (government)
20	How often should a PICC line be changed? (policy, indications/management)	Your PICC line can remain in place for several months and in some cases PICC lines have been in place for up to a year or longer. If your PICC line is functioning and there have been no complications your line will not require routine replacement. (medical practice)

Abbreviations: PICC, Peripherally inserted central catheter; CVC, Central venous catheter; IV, Intravenous.

as a synthesizer, providing a single, coherent, and conversational answer based on its training data.[17,18,20] This shift from fragmented search to synthesized dialogue represents a potential major change in the online information ecosystem. While ChatGPT's ability to deliver consolidated, well-structured information is a key strength, it also obscures the original sources, making critical appraisal by the patient more difficult.[16–20]

Implications for Patient Education and Health Literacy

The two platforms present distinct challenges for patient education. Google's fragmented results require a high level of health literacy and motivation for the patient to piece together a complete picture.[7] Conversely, ChatGPT's comprehensive—but often lengthy and technical—responses (Supplementary Table S1) appeared to be challenging for patients with lower health literacy.[16–18] Future research could utilize objective measures to quantify readability. This raises a critical concern: while AI may make information more accessible, it does not automatically make it more understandable or actionable, and may inadvertently widen health literacy gaps.[22] Furthermore, the "black box" nature of ChatGPT, which does not easily allow for source verification, hinders the development of a patient's ability to critically evaluate health information, a core tenet of patient empowerment and informed preference.[8]

The Clinician's Role in an AI-Informed World: From Gatekeeper to Curator

The rise of AI-driven health information tools does not diminish the clinician's role; it transforms it. This new reality demands that clinicians, particularly nurses who are often the primary educators for PICC care, evolve from being primary information providers ("gatekeepers") to expert "information curators" and "navigators".[23–25] This new role involves proactively inquiring about patients' online research to open a dialogue and directly address any misinformation or anxieties that may have arisen.[23,25] It then requires them to act as expert navigators who help contextualize the generic, often decontextualized advice from an AI within the patient's specific clinical situation. This may even involve the collaborative use of these tools during consultations, turning a potential source of misinformation into a teachable moment that strengthens the therapeutic alliance and fosters shared decision-making, a cornerstone of patient-centered care and adherence.[22–25]

Reconciling Conflicting Information: A New Barrier to Patient Adherence

A critical finding of this study is the potential for AI to create direct conflicts with standard information, a new and serious challenge for patient counseling and treatment adherence. Our example of PICC longevity—"two to six weeks" (Google) versus "up to six months or more" (ChatGPT)—is a perfect illustration. A patient encountering such a stark discrepancy is likely to experience anxiety, confusion, and distrust toward either the online source or their healthcare provider,[22,23,25] highlighting a significant potential for non-adherence to the recommended duration of therapy. This directly impacts the counseling process and threatens adherence. For instance, a patient who believes their PICC line is "expired" based on online information may question the necessity of a longer treatment plan, potentially leading to premature requests for removal or reduced vigilance in long-term care. This highlights a critical pathway through which online misinformation can translate into poor clinical outcomes. Clinicians must be prepared to anticipate and address these discrepancies, explain the nuances (eg, "While some sources say X, in your specific case, given your treatment plan, we expect Y"), and reaffirm their guidance as the most reliable source. Failure to do so can undermine patient adherence and the trust essential for a healthy patient-provider relationship. Therefore, a proactive clinical approach is imperative. Clinicians should integrate questions about online information-seeking into routine consultations. Asking directly, "Have you looked up information about your PICC line online? What have you found?" can open a safe channel for dialogue, allowing clinicians to identify and address misinformation before it negatively affects a patient's willingness to adhere to the care plan. When confronted with conflicting AI-generated information, clinicians should use it as a teachable moment to validate the patient's effort, explain the rationale behind their personalized care plan, and reinforce the most critical, patient-specific advice, thereby fostering the trust necessary for adherence.

Our study has several limitations. First, we only analyzed the top 20 FAQs, which provides a snapshot but may not capture the full breadth of queries. Second, the dynamic nature of both Google's algorithm and ChatGPT's model means that results can change over time. Most importantly, this study did not involve real patients. We analyzed the information itself, but not how patients actually interpret, trust, or act upon it. Future research should prioritize qualitative studies and mixed-method designs involving actual patients to validate these findings in real-world settings, assessing direct patient outcomes such as comprehension, behavioral change, and adherence.

Conclusion

This study is the first to evaluate ChatGPT's utility as an informational tool for PICC-related patient questions. ChatGPT is potentially reshaping the patient information landscape, offering more comprehensive and seemingly authoritative answers than traditional search engines. While this presents an opportunity to combat fragmented information, it also introduces significant risks of patient confusion and anxiety from conflicting or de-contextualized data, which can severely compromise treatment adherence. Our findings underscore that the critical role of healthcare professionals is not diminished but transformed. Clinicians must evolve into expert navigators and counselors, proactively engaging with patients about their online findings and guiding them through the complex, AI-driven information ecosystem to ensure safe, effective, and empowered patient care built on a foundation of shared understanding and trust. Furthermore, healthcare organizations should consider developing new educational resources, such as patient-facing guides on how to critically appraise online health information. Empowering patients with these skills can mitigate the risks of AI while harnessing its potential to support patient engagement and long-term adherence to essential therapies. To fully realize this potential and mitigate risks, future research, particularly qualitative and mixed-method studies involving real patients, is crucial to understand the real-world impact of AI-driven information on patient decision-making and adherence.

Abbreviations

PICCs, Peripherally inserted central catheters; ChatGPT, Chat Generative Pre-trained Transformer; FAQs, Frequently asked questions; AI, Artificial intelligence; LLMs, Large Language Models.

Data Sharing Statement

Data are available on reasonable request to the two corresponding authors, Fang Yang and Zhuang Du.

Ethics Approval

No approval of Institutional Reviewed Board was needed due to not involving human and animals in this study.

Author Contributions

All authors made a significant contribution to the work reported, whether that is in the conception, study design, execution, acquisition of data, analysis and interpretation, or in all these areas; took part in drafting, revising or critically reviewing the article; gave final approval of the version to be published; have agreed on the journal to which the article has been submitted; and agree to be accountable for all aspects of the work.

Disclosure

The authors declare that they have no financial conflicts of interest or personal relationships that could have influenced the research presented in this paper.

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