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Smart Hospital Apps in Breast Cancer Care: A Qualitative Exploration of Patient Experiences, Challenges, and Future Expectations

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ABSTRACT

To explore how patients with breast cancer perceive their interactions with smart hospital applications and what they hope to see in future improvements. A descriptive qualitative approach was used. In-depth interviews were carried out with 40 breast cancer patients who had experience using smart hospital apps. The interview materials were organized and interpreted through content analysis.
A total of five major themes and two supplementary themes emerged. The major themes included: favorable impressions of smart hospital app usage, obstacles caused by cross-campus data fragmentation, communication and emotional adjustment, restricted autonomy in smart healthcare use, and anticipated advancements in smart hospital systems. The two supplementary themes included: accurate information transmission mechanisms and intelligent guidance within healthcare services. Researchers should strengthen patient-centered communication to gain insight into the issues patients encounter when relying on smart hospitals and to better understand their developmental expectations. Future efforts should emphasize lowering barriers to use and speeding up the growth of smart hospital initiatives.

Keywords: Smart hospital, Healthcare experience, Digitalization, Artificial intelligence, Qualitative study

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Introduction

Improving hospital quality has become a fundamental goal of public hospital reform in the new era [1, 2]. In 2021, the General Office of the State Council issued the *Opinions on Promoting the High-Quality Development of Public Hospitals*, which laid out new directions for public hospital advancement and the expansion of smart medical systems. Smart hospitals use Internet-based tools—such as cloud services, IoT technologies, and mobile platforms—to enhance digital operations and automate services. These technologies support more efficient appointment booking, outpatient payment, and inpatient admission processes, aligning with public needs and contributing to health system transformation [3]. During the "14th Five-Year Plan," establishing smart hospitals to elevate public hospital quality has become a central topic in hospital management.
Smart hospitals hold different significance for different groups. From the perspective of patient experience, a smart hospital aims to deliver more accessible medical services, optimize treatment processes, standardize clinical procedures, limit unnecessary care, and ease financial burdens. Although the advantages are evident, patient perspectives on intelligent medical services have not been thoroughly investigated.
Because smart hospitals in China are still in an early phase of development, many unresolved issues remain, such as unclear goals and insufficient implementation pathways [4]. Patients, as a unique user group, require tailored attention [5]. Therefore, conclusions based on commercial digital platforms cannot be directly applied. Although artificial intelligence has accelerated the evolution of smart hospitals and enabled features such as health data viewing and management through apps, current systems only provide data from the most recent three months and

lack clear instructions for use. Patient experience plays a vital role in smart hospital development, yet it has received limited academic focus.

The author suggests that smart hospital advancement depends not only on technological progress but also on the lived experiences and expectations of patients. This study, therefore, examined how breast cancer patients of varying ages, educational backgrounds, and treatment conditions interact with smart medical services. Using patient responses and data interpretation, the study aimed to identify central challenges in smart hospital construction, provide guidance for high-quality design and development, enhance user satisfaction, and support sustainable hospital growth.

The author's institution designed a comprehensive smart hospital framework based on the smart hospital grading evaluation system, encompassing smart logistics, security, engineering, wards, outpatient care, and command coordination. The smart ward platform provides functions such as health education, follow-up questionnaires, medication reminders, results feedback, care planning, health consultation, follow-up notifications, and abnormal event alerts.

Semi-structured interviews were conducted with 40 breast cancer patients regarding their experiences with the smart hospital system. Focusing on patient use of the smart hospital app during medical care, this study sought to understand how patients articulate their usage experiences. Three research questions guided the study:

1. Which factors shape positive patient experiences with the smart hospital app?
2. Which factors contribute to negative patient experiences with the smart hospital app?
3. What developments do patients hope to see in future smart hospitals?

Addressing these questions can support the continued construction and refinement of smart hospitals.

Materials and Methods

Participants

From March to June 2023, participants were recruited intentionally from the breast tumor unit of our hospital. Individuals were eligible if they met the following conditions: ① were at least 18 years old; ② satisfied the diagnostic standards for breast cancer; ③ were capable of using a smartphone and completing the interviews alone or with minimal help; ④ had no communication difficulties; ⑤ had been using the smart hospital application for ≥1 month. Exclusion criteria included: ① having an additional malignant disease; ② presenting with psychiatric illness or cognitive decline. To ensure that the sample reflected a range of viewpoints, factors such as age, gender, diagnosis type, and educational background were considered when selecting interviewees. The final number of participants was determined once data saturation was reached and no new insights emerged. In total, 40 patients were interviewed. Their demographic characteristics are summarized in **Table 1**.

Table 1. General information about participants.

Characteristic	Category	n
Use of smart hospital app	Yes	40
	No	0
Age (years)	26–30	1
	31–35	5
	36–40	4
	41–45	5
	46–50	7
	51–55	9
	56–60	4
	61–65	3
	66–70	2
Sex	Female	40
	Male	0

Education level	Illiterate	2
	Primary school	11
	High school	13
	College or higher	14

Note: Objective sampling was applied to improve diversity. Age, education, and duration of app use were among the variables considered to ensure broad representation.

Research methods

Formulation of the interview outline

The interview guide was shaped by established theoretical perspectives and methodological principles. Among many definitions of user experience, the one proposed by Hassenzahl and Tractinsky [6] was selected because it best matched the analytical focus of this study. According to their understanding, user experience results from the interplay between a person's inner state (needs, expectations, mood, motivation, etc.), the system's attributes (functionality, complexity, usability, intended purpose), and the situation in which the interaction happens (organizational and social environment, meaning of the task, level of voluntariness). Using this framework, the research team reviewed prior studies [7–10] and developed an initial list of interview questions after group consultations. Following trial interviews with three individuals, the final outline included the following items: (1) How did you find out about the smart hospital app and register for it? (2) Do you consider the app convenient to use? Please explain. (3) Have you had experience with apps from other medical institutions, and how did they compare? (4) Which aspects of the app's interface or layout stood out to you? (5) What concerns, if any, arise when you use the app? (6) Would you recommend this app to others, and for what reasons? (7) Do you have any other thoughts or recommendations?

Data collection

A semi-structured, individual interview approach was applied until no new topics appeared and content saturation was confirmed. The interviewer—one of the study researchers—had a decade of clinical experience in breast tumor care, formal training in qualitative interviewing, and prior publications in the field. The purpose and procedures of the study were explained to each participant, written informed consent was obtained, and interview appointments were arranged. Interviews took place in a quiet consultation space within the ward, ensuring comfort and privacy. Audio recordings were made for each session, which typically lasted 20–40 minutes. Although the interviewer followed the guide, probing strategies and sequencing were modified depending on the participant's responses. Non-verbal cues such as emotional tone, gestures, and facial expressions were observed and noted. When participants' statements were unclear, the interviewer asked for elaboration or restated their comments to confirm accuracy, while maintaining a neutral stance. Immediately after each interview, field notes were drafted, capturing the setting, notable interactions, impressions of the participant, and any relevant contextual details.

Data analysis

Interpretative phenomenological analysis (IPA) was used, applying a three-level analytic structure: an initial holistic reading, systematic structural coding, and an integrative interpretation. Throughout the analysis, a reflective log was maintained, and regular discussions were held with the supervisor and clinical colleagues to check assumptions and reduce bias, enhancing both transparency and trustworthiness [11]. Consistent with the principles of interpretive phenomenology, the analysis acknowledged that the researcher's background, beliefs, and prior experiences inevitably shape interpretation, and that each participant's reality is influenced by personal and situational factors. Methodological choices, sampling, and analytical procedures were aligned with this paradigm. To ensure rigor, the less-experienced qualitative researcher referred to established methodological checklists and published guidance documents.

Role of the funding source

The organization that supplied financial support for this research did not participate in shaping the study design, gathering or analyzing data, interpreting the findings, or preparing the manuscript. Complete access to the dataset was held by the corresponding author, who also made the final decision regarding journal submission.

Results and Discussion

Theme one: Positive experiences with using the smart hospital app

A large proportion of participants described the smart hospital application as providing a broad set of digital services oriented toward patient needs. Their comments generally focused on two major benefits.

First, online tools were fully integrated into clinical procedures. These included automated fee-payment systems, platforms for viewing laboratory and imaging results, digital admission/discharge procedures, and mobile consultation channels. Such functions enabled users to schedule visits or seek guidance whenever necessary, significantly reducing physical travel and waiting.

“Quick treatment significantly alleviates our stress” (P13).

“Long waits and exhausting trips back and forth are physically draining” (P6).

“Family members often have to take time off work to accompany us, which can be frustrating” (P3).

Second, the combination of “intelligent follow-up + guidance after discharge” relied on Internet-based medical services to support file-upload consultations, symptom reporting, and remote advice. Patients said this allowed them to reach healthcare staff promptly when issues arose.

“After being discharged from chemotherapy, unexpected situations can cause great anxiety” (P22).

“I’ve experienced fever, dizziness, and vomiting. Through online consultation, I can contact my attending doctor for help, which puts me at ease” (P15).

Nearly every participant emphasized time savings, ease of use, and practical value—conclusions similar to those reported by Anna Zeller *et al*. [12].

Theme two: Challenges in data sharing across multiple medical institutions

Hospital-to-hospital information exchange within China remains limited, which complicates resource coordination and creates obstacles for patients. Fragmented, inconsistently formatted records make maintenance labor-intensive while reducing data quality. Systems linking multiple hospital campuses are still incomplete, restricting remote collaboration [13].

To receive the best possible care, many patients consult several hospitals, especially during complex illnesses like cancer. However, gaps in data transmission often result in missing files, partial treatment histories, or absent medical records. Because institutions do not share data, tests sometimes must be repeated, raising costs and delaying treatment progress.

“The doctor asked for information on my radiotherapy dosage and frequency from a year ago, which was done at another hospital. My family had to visit four different hospitals to find that radiotherapy record” (P17).

“With all the test forms, reports, and films, we don’t know what we need and what we don’t, so we have to carry all the examination reports every time” (P8).

“I lost my examination reports from other hospitals, and they weren’t available electronically. Retesting is both costly and time-consuming, affecting my treatment” (P29).

Theme three: Interpersonal communication and coping

Throughout treatment, many patients experience heightened emotional vulnerability and rely heavily on clear, caring communication from healthcare professionals. Participants often reported that although they valued the app, they still depended on staff for guidance. Due to heavy workloads, medical personnel were not always able to offer step-by-step explanations, which sometimes created delays or misunderstandings.

“I feel I need more attention from the nurses; I don’t have family, and using a smartphone is too difficult for me” (P34).

“Before chemotherapy, I wanted to know my test results as soon as possible, but doctors and nurses are too busy. I feel like I’m bothering them if I interrupt their work for this” (P28).

“If I could check my blood test results in the app, I would feel more at ease, without worrying about being unable to undergo chemotherapy due to low white blood cell counts” (P33).

Several respondents said that they frequently relied on other patients for help, especially when navigating unfamiliar app functions.

“I often ask for help from fellow patients in the same room” (P40).

Although peer interaction reduced anxiety, it sometimes introduced misinformation.

“I asked a fellow patient to help me register, but she registered me at a different campus, and I only found out on the day of the appointment” (P21).

Theme four: Smart healthcare is not a free choice

All interviewees owned smartphones, but only a little more than half used them beyond basic communication or WeChat messaging. Participants who were older or unable to read reported that they mainly used their phones to answer calls or watch short videos. Many described the app not as something they willingly chose, but as a system they were compelled to use because traditional service counters were reduced or difficult to access. Although they recognized the long-term benefits of digitalization, they worried that limited digital skills might cause them to miss essential services—an observation consistent with Christian Gybel Jensen *et al*. [14]. International studies also report age-based differences in willingness to use digital tools [15].

"My son bought me a smartphone to make it easier for me to register and see a doctor, but I still can't use it, just for calls. The smart hospital functions are great, and the nurse taught me, but I often forget where to tap" (P14).

"Every time I get hospitalized, it feels like a test. Admission procedures, insurance referrals, payments, and appointment bookings—I ask around while doing it. Meanwhile, young people in the same ward say it's easy. Technology advances too fast, and we older folks can't keep up" (P38).

Theme five: Expectations for smart hospital development

Sub-theme 1: Precise information push mechanism

Every participant acknowledged the value of smart hospital initiatives and expressed hopes for more refined functions, especially in how AI could address a wide range of informational needs throughout diagnosis, treatment, and recovery. Access to accurate information is vital for encouraging patients to participate actively in managing their conditions [16]. At present, however, information delivery tends to follow a broad, undifferentiated model, lacking personalization. As a result, patients often receive excessive and unrelated content, making it difficult to locate what is actually useful [17].

"I want the smart hospital app to send me educational material based on my specific diagnosis, something that fits *my* situation" (P5).

"I hope the hospital can generate a treatment outline tailored to my pathology type so I have a clearer picture of the overall process instead of feeling unsure" (P10).

Sub-theme 2: Intelligent medical navigator

AI has recently demonstrated strong potential to reshape healthcare service structures and help redistribute high-quality medical resources, driven by national strategies, economic conditions, and technological advances [18]. Achieving true "intelligence" requires systems that map out a patient's care pathway and provide real-time voice prompts, essentially turning the smartphone into an on-hand medical navigation device. Many participants mentioned that hospital layouts are confusing and that newcomers often feel as though they have "stepped into a maze" (P25).

"The hospital is enormous—divided into north, south, east, and west zones—so getting lost is easy" (P37).

Unclear procedural steps also emerged as a major frustration. Patients frequently described arriving at the hospital and not knowing the sequence of actions, repeatedly wondering, "What do I do now?"

"The app should work like GPS. Once the doctor orders tests or treatments, it ought to instantly generate my route and give voice instructions at key points" (P25).

This study explored the major elements shaping both favorable and unfavorable patient experiences when using smart hospital apps and summarized expectations for future enhancement. Central insights included the importance of convenience, persistent issues with information exchange, and increasing demand for AI-based customization.

Summary of research findings

Factors influencing positive experiences

Multiple aspects contribute to positive user experiences with smart hospital applications. All participants emphasized that these systems significantly shorten waiting periods, streamline medical visits, and reduce emotional pressure. Remote consultation functions further allow patients to obtain professional advice from home, expanding access—especially for individuals in distant regions or those with mobility limitations.

Ease of use, quick processes, and accessibility are key drivers of digital healthcare adoption, enabling patients to manage their own health more effectively and improving overall satisfaction. Smart platforms also deliver examination results rapidly, which saves time, decreases reliance on medical staff for basic updates, and allows users to grasp their health condition promptly.

Patients also appreciated transparent cost displays within the app, which prevent confusion over fees and enhance trust in the healthcare system. Automated reminders additionally support adherence to follow-up schedules and medication routines.

Taken together, smart hospital applications improve care processes, widen service channels, deliver timely information, and increase financial clarity—benefits that contribute to stronger patient engagement and stimulate ongoing digital transformation in healthcare.

Factors influencing negative experiences

Although smart hospitals simplify tasks such as registration, payments, report retrieval, expense checking, and medical record duplication—thereby reducing departmental workload—not all patients experience these advantages equally. Older adults or individuals with limited education often struggle with digital tools, which restricts their ability to fully utilize smart-based services.

Furthermore, despite the existence of multiple hospital information systems, poor inter-institutional data flow persists. These "information silos" hinder the sharing of patient records across facilities, creating barriers that complicate cross-hospital treatment.

As smart systems evolve, face-to-face contact between patients and medical personnel has decreased. While efficiency improves, patients may feel isolated, unsupported, or emotionally detached in the absence of human interaction. Many expressed a desire for more in-person communication to obtain reassurance and build trust. Such emotional distance can heighten anxiety and reduce motivation for health-seeking behaviors.

Therefore, even though smart hospitals increase operational efficiency, addressing these drawbacks is essential. Enhancing human-centered design, improving data exchange frameworks, strengthening provider–patient interactions, and developing equitable service pathways can help reduce feelings of loneliness and ensure all patients receive accessible and compassionate care.

Patient expectations for smart hospital development

Looking ahead, patients hope to reclaim time by handling registration, exam scheduling, payments, and queue checks directly on their phones without needing to be physically present. They also anticipate smoother inpatient admission procedures, removing the need for repeated manual data entry or waiting at nurse stations. With rapid AI progress, patients further expect hospitals to incorporate intelligent navigation features similar to mapping applications, along with adaptive human–machine systems to assist groups who may be less familiar with digital tools, such as older adults or those with limited education.

Reflections on the research findings

Establishing smart hospitals requires increased human and financial input

The medical domain contains an exceptionally broad and intricate body of knowledge. Large language models for healthcare must be trained on sizeable collections of medical literature, clinical guidelines, academic research, and authentic case information, including physicians' diagnostic notes and multidimensional patient data such as demographics, laboratory indicators, family backgrounds, and environmental exposures [19]. Because GPT-based systems are closely tied to patient safety and clinical outcomes, their generated content must maintain extremely high accuracy. Throughout the prolonged training and deep learning cycles, healthcare professionals need to repeatedly evaluate randomly selected medical questions, verify the system's responses, and continuously adjust training materials and outputs. Moreover, individuals' ability to use electronic information tools varies with factors such as age and educational background [20]. Therefore, these differences should be fully considered when developing smart hospitals. Medical staff should provide instructional brochures, prepare educational videos, and, when necessary, offer in-person guidance to help patients adopt and operate the system. During implementation, patient feedback should be rapidly communicated to the information department to enhance dissemination effectiveness. Timely responses from the medical system are essential to meeting heavy patient volumes.

Constructing smart hospitals also demands significant financial resources for technological innovation, hardware infrastructure, and staff skill development. GPT-like AI relies on large-scale models, massive data sets, and extensive computing resources, requiring powerful server configurations. Because training large models exceeds the capacity of traditional CPU servers, extensive computing clusters made up of numerous CPU servers and high-performance networks are needed to handle massive data flows, resulting in substantial cost burdens [21]. Thus, building large AI computing platforms cannot depend solely on individual hospitals but must be supported by strong national-level resource allocation.

Eliminating "information barriers" to strengthen interoperability among smart hospitals

The coexistence of diverse information systems and limited data sharing has produced widespread "information islands," which confine smart medical services within single institutions [22]. These obstacles restrict the development of regional smart healthcare and make it difficult to shift from basic informatization to true intelligent healthcare. Smart hospitals enhance service efficiency, streamline medical processes, and improve communication between physicians and patients. Through optimized appointment systems, smoother in-consultation services, and intelligent post-consultation follow-up, they remove many of the obstacles encountered before, during, and after medical visits [23]. Patients can upload images of examination results obtained from other healthcare providers, allowing physicians to review records comprehensively and enabling institutions to make informed clinical decisions [24]. Extending medical services beyond the physical institution creates a continuous diagnostic and treatment cycle in both time and space, embodying the convenience and effectiveness of intelligent healthcare. Furthermore, medical sciences must work closely with AI and big data technologies to advance precision medicine software and achieve high-quality clinical service delivery. The future development of smart hospitals should move beyond isolated institutions and rely instead on coordinated medical networks or alliances. With advanced technologies, these networks can dismantle barriers between facilities and create a cloud-based, patient-centered collaborative platform.

Strengthening the intelligent service capacity of smart hospitals

At present, the digital transformation of public hospitals in China remains in its early phase, and efforts in "smart management" still lag behind developments in "smart healthcare" and "smart services" [25]. Nevertheless, the rapid evolution of AI technologies is expected to propel further intelligence-driven progress in healthcare. Tools such as ChatGPT and GPT can employ human–machine interaction interfaces to produce question–answer sets from new cases, generate individualized narratives, and convey medical information more effectively through interactive dialogue [26–28]. Using natural language processing, machine learning, and deep learning, traditional consultation models can be fundamentally reshaped, facilitating a comprehensive and integrated intelligent service framework covering pre-consultation, consultation, and post-consultation stages across both online and offline environments.

Pre-consultation:

Intelligent appointment and triage systems allow patients to communicate remotely, enabling preliminary assessments based on symptom descriptions, providing guidance on care-seeking, and suggesting appropriate departments and clinicians. Patients can arrange appointments digitally and receive real-time notifications about visit schedules, navigation routes inside the hospital, procedural steps, and relevant instructions. Once on-site, mobile AI applications can assist patients with check-in procedures, queue information, and waiting-time updates. During this period, an AI-enabled mobile consultation robot can emulate a physician's reasoning process, conducting preliminary inquiries through structured Q&A. It transforms patient statements into structured chief complaints, present illness descriptions, and past medical histories, supporting clinicians by pre-generating components of electronic medical records. By cross-referencing patient symptoms and histories, the system can offer initial assessments and propose potential diagnostic tests. Leveraging medical knowledge bases and extensive medical data, GPT can form a robust case-matching mechanism. For instance, if a cancer patient reports fever, fatigue, and reduced appetite over several days, GPT may preliminarily identify possible leukopenia, recommend a complete blood count for verification, and provide relevant treatment suggestions to help physicians make accurate and timely clinical decisions.

During consultation:

Once the patient proceeds to the consultation stage, the physician can already review the patient's previous history, current symptoms, and examination findings through the AI-generated electronic medical record. This preparation reduces the time spent manually documenting information, enabling the clinician to allocate more attention to assessment and treatment through observation, questioning, and physical examination. The physician only needs to revise and confirm the pre-generated record, which raises both the accuracy and efficiency of care, shortens consultation duration, and improves patient satisfaction.

When prescribing medications, GPT assists physicians by referencing pharmacological principles, medical studies, and past cases, alerting them to critical details such as indications, precautions, adverse reactions, and contraindications. This aids in drug-selection decisions, strengthens medication safety, and enhances the overall quality and productivity of clinical work.

Post-consultation:

The patient's medical journey does not conclude once the consultation ends. AI-supported systems continue to monitor the patient's condition, observe medication responses, and track ongoing symptom changes. Based on patient-reported information, AI formulates individualized health-management strategies, including suitable dietary plans, exercise routines, and targeted health-education content, effectively acting as a personalized health-management assistant.

By integrating data captured from medical-grade wearable devices used by chronic-disease patients—recording continuous physiological indicators in daily activities (working, exercising, and sleeping)—alongside self-logged health information from mobile devices, AI enables remote data exchange and long-term storage in the hospital's medical records. These data are processed and evaluated using AI tools to track health trends, help clinicians optimize treatment strategies, elevate care standards, and support ongoing follow-up management for cancer patients. The key components of these intelligent services are summarized in **Table 2**.

Table 2. Framework of intelligent service themes to enhance patient experience.

Service Node	Service Feature	Description of Intelligent Features
Pre-Consultation Services	**Intelligent Triage**	Applies AI tools, including natural language processing, to interpret patient-provided symptom descriptions (spoken or written) and suggest the most appropriate department or physician.
	Process Optimization	Uses AI together with big data analysis to redesign and streamline outpatient procedures, improving the utilization of medical resources and decreasing patient wait time; overall consultation steps are simplified.
	Self-Assessment Assistance	Virtual assistants or smart robots guide patients through basic self-checks and preliminary screenings before seeing a doctor. By interacting with the system, patients can receive early insights and suggestions regarding their health conditions.
	Disease Prediction	AI-driven analysis of patient health data identifies potential disease risks in advance, using machine learning and big data techniques to detect possible issues at early stages.
During Consultation Services	**Information Generation**	Through speech-recognition and natural language processing, the system records doctor–patient communication in real time and automatically produces essential clinical information, including medical notes and diagnostic documentation.
	Diagnostic Assistance	AI decision-support modules review medical imaging and pathology data to offer diagnostic recommendations, helping clinicians make more precise assessments.
	Precision Treatment	Employs AI to support therapeutic decisions, such as calculating medication dosages or assisting in surgical procedures, ensuring that treatment plans are more accurately tailored to patient needs.
	Digital Systems	Establishes an integrated medical-management platform using AI and information technologies to enable partial "zero-staff" services and continuous full-process monitoring.

Post-Consultation Services	**Follow-up and Rehabilitation**	Intelligent systems track patient recovery after discharge, using remote monitoring and real-time data evaluation to modify rehabilitation strategies as needed.
	Health Management	AI tools oversee ongoing patient health status, delivering personalized guidance, alerts, and interventions through predictive modeling and data analysis.

On artificial intelligence

Artificial intelligence has rapidly progressed in the medical sector in recent years, especially in improving medical software performance and enabling efficient processing of extensive datasets [29]. With the expansion of large language models and natural language processing systems such as ChatGPT, AI is increasingly positioned to become an essential element of future clinical practice [30]. Peter Lee, Microsoft's Global Senior Vice President, and several experts have described a "three-party model" linking clinicians, patients, and intelligent systems, predicting that advanced models such as GPT-4 will significantly reshape the healthcare landscape. On February 25, 2023, the National Institute of Health and Medical Data (Shenzhen) introduced the medical AI model "Hua Tuo GPT." On May 25, 2023, a domestic online-health platform, the Medical Consortium, launched "MedGPT," the first domestically produced medical large language model developed using the Transformer framework, with the goal of enabling automated diagnostic and therapeutic workflows. Meanwhile, Google Health presented its medical LLM Med-PaLM2, which achieved "expert-level" performance after extensive multicenter testing before release. Google is also investigating multimodal functions, including using AI to interpret X-ray images to support diagnosis and care.

Hence, identifying effective methods for applying AI to match medical resources accurately, ensure precise service delivery, and create individualized treatment pathways has become an essential challenge for healthcare institutions pursuing smart-hospital development.

Research status of AI in tumor intelligent screening and risk assessment

Improving public access to tumor-related knowledge is vital for enabling intelligent prediction of cancer-risk levels. Lightweight AI-driven tumor-risk assessment tools can now be easily embedded into hospital mobile platforms, such as official accounts and mini-programs. These tools offer screening questionnaires for conditions like lung nodules or lung cancer and can automatically flag high-risk individuals. By providing personalized cancer-screening recommendations, they guide at-risk populations and raise local screening rates. In addition, by leveraging large AI models, the system can automatically generate and distribute individualized tumor-prevention information, strengthening public awareness of early detection, diagnosis, and treatment, and improving cancer-prevention literacy.

A recent Nature Medicine study created the largest standardized CT dataset for pancreatic tumors to date [31], including 3,208 real cases, and trained an AI-based screening model combining non-contrast CT with intelligent analysis. In multicenter global trials, the model reached a sensitivity of 92.9% and a specificity of 99.9% for detecting pancreatic cancer in asymptomatic individuals undergoing health examinations.

Another study focused on a breast-tumor segmentation model using dynamic contrast-enhanced MRI (DCE-MRI) [32]. By constructing a specialized DCE-MRI dataset, researchers designed a tumor-sensitivity module with a segmentation-loss strategy, substantially enhancing the precision of tumor-edge recognition. The model achieved a Dice score of 0.78 on its test dataset. AI can also autonomously perform BI-RADS scoring, support clinicians in rapid and accurate diagnosis, and generate structured image and text reports. These developments hold significant promise for the early detection and diagnostic management of breast cancer.

Clinical practice

Smart-hospital applications have become integral to clinical operations and greatly elevate both patient experience and service efficiency. By simplifying steps such as appointment booking, registration, payments, report retrieval, and medical record access, these applications allow patients to obtain care more conveniently and reduce waiting times and administrative burdens. This is especially advantageous for individuals living in rural or remote regions, where telemedicine capabilities offer immediate access to professional consultation services.

Patients can also track medical expenses and test results in real time, strengthening transparency and trust in healthcare processes. Furthermore, smart-hospital platforms support patients in managing personal health data, improving ongoing monitoring, and follow-up management. Although factors such as age, literacy, and data-security concerns may influence acceptance, digital healthcare tools continue to accelerate the modernization and enhancement of medical services. Overall, smart-hospital apps not only streamline clinical visits but also deliver more tailored, patient-centered healthcare experiences, representing meaningful progress toward digital and intelligent transformation in the medical system.

Study limitations

This study has several constraints. First, qualitative interviews were conducted with only 40 breast cancer patients, which may introduce selection bias in the findings. Second, the research was confined to the breast tumor department of a single tertiary hospital in Wuhan. Future work should involve multi-center studies that integrate both qualitative and quantitative approaches to gain a more comprehensive understanding of patients' expectations for smart-hospital development, thereby offering more robust evidence and direction for future research.

Conclusion

Through qualitative interviews with 40 breast cancer patients who had experience using a smart-hospital application, this study sought to obtain a deeper understanding of patients' usage experiences and their perspectives on the future development of smart hospitals. The results show that patients require diverse information throughout the entire medical pathway—from diagnosis and treatment to recovery—and that adequate informational support plays a key role in helping them effectively manage their health.

Additionally, the study identified several shortcomings and challenges in current smart-hospital construction, including the existence of "information islands," concerns about data security, limited service functions, and insufficient intelligent capabilities. Therefore, the findings provide meaningful insights for guiding future improvements and strategic planning in smart-hospital development.

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