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Barriers and facilitators of using tele-oncology in cancer care: a scoping review

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Abstract

Background and aim Identifying barriers and facilitators of tele-oncology adoption is essential in enhancing healthcare stakeholders' decision-making on its leverage. This study aims to review the existing literature on barriers and facilitators to understand this topic better.

Materials and methods This scoping review was conducted based on the PRISMA extension for scoping reviews (PRISMA-ScR). The Web of Sciences, PubMed, and Scopus scientific databases were investigated to obtain articles. The data on barriers and facilitators were extracted from the included articles and finalized through the joint meeting. The aggregated barriers and facilitators were synthesized and categorized into themes using qualitative content analysis. This method categorized thematically similar barriers and facilitators into similar themes. We also used the descriptive statistics method of data (frequency and percentage), depicted data in table and figure formats, and synthesized the data narratively to show the findings on the included studies' characteristics.

Results Twelve articles from 685 records retrieved from the databases were employed in this study on this topic. Forty-eight barriers and 92 facilitators of tele-oncology use were obtained, including personal, technical, data management, managerial, and legal factors. The most critical barriers and facilitators were regarding the lack of technical requirements and usability characteristics of technologies in cancer care, respectively.

Conclusion Considering the barriers and facilitators of using tele-oncology in cancer care through analyzing the existing studies can have a key role in optimizing the decision-making of various healthcare stakeholders, including policymakers, managers, and others involved in enhancing the patient care process. It can also be crucial in increasing the chances of technology acceptance in healthcare.

Highlights

- We conducted a scoping review on barriers and facilitators of adopting tele-oncology in cancer care.
- Barriers and facilitators were categorized into managerial, personal, technical, data management and legal.
- The most common barriers and facilitators focused on the technical requirements and usability status of tele-oncology interventions, respectively.

Keywords Tele-oncology, Cancer care, Decision-making, Technology acceptance

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Introduction

Advanced technologies with high-quality network services capability allow people to promote healthcare delivery and make it accessible to more people [1]. As one of these significant technologies, telemedicine has emerged worldwide as an essential resource to restrict the prevalence of diseases by promoting patient surveillance, early identification, and efficient management of diseases, as well as making feasible continuity of care for patients with chronic diseases [2, 3]. The lack of specialist staff, poor access to health care, and inequality in different regions regarding access to specialized care are essential issues that have received the attention of policymakers in healthcare and various health authorities, such as the World Health Organization (WHO) and the Centers for Disease Control and Prevention (CDC), have emphasized using alternative solutions such as telemedicine instead of face-to-face visits [4].

According to the WHO declarations, telemedicine is the provision of medical services, where distance is a crucial factor, by medical care specialists to exchange the required information on diagnosis and treatment, explore and assess the medical information, and observe the instructions of medical care suppliers, aiming to improve the individuals' health status through providing a higher quality of care and bypass the challenges induced by travel [5, 6]. This communication technology has undergone significant advancements in recent years and has progressed in achieving its fundamental aims to ameliorate access to care [1, 7].

One aspect of telemedicine that has substantial technological progress is tele-oncology, which can be described as cancer care provided by oncologists remotely to promote access to care in underserved or rural regions [8–10]. Most cancer patients experience numerous consultations and procedures from various healthcare facilities due to the sophisticated nature of most kinds of this disease [11], so leveraging tele-oncology can bring many advantages for different healthcare stakeholders and cancer patients, especially those who live in remote areas lacking clinical specialists [12, 13]. As an innovative approach, tele-oncology has focused on geographical distance and constrained access to some special cancer services [12, 14], leading to decreased financial burden regarding fewer transportation costs and less time away from service, improving convenience such as scheduling appointments, enhancing communication with care providers by a better understanding of medical instructions, establishing therapy plans to better adherence, and providing better access to specialized medical care [15]. Also, leveraging this technology increases the speed of delivering medical services, decreases unnecessary patient referrals, decreases superfluous procedures and tests, and advances networking communications between healthcare suppliers to provide healthcare services more efficiently [16]. Despite the benefits mentioned, some barriers hinder us from effectively and efficiently leveraging digital technologies such as tele-oncology, which various healthcare stakeholders should address for better adoption [12]. So, paying attention to this technology and its barriers and enablers significantly impacts better implementation and adoption.

To our knowledge, no review study has comprehensively investigated the barriers and facilitators of using tele-oncology in healthcare. Previous studies have focused on barriers and facilitators of tele-oncology among older cancer survivors [17], efficacy, challenges, and facilitators in post-treatment cancer survivorship care [18], and acceptance among older adults [19]. Therefore, the current study aims to conduct a scoping review to give insights into this topic's most common barriers and facilitators.

Table 1 Search strategy in scientific databases

Databases	Web of Sciences (WOS), PubMed, and Scopus
#1	"teleoncology" OR "tele-oncology" OR "telemedicine" [MeSH Terms] OR "digital health" [MeSH Terms] "telecare" OR "telemedicine adoption" OR "virtual consultation" OR "eHealth" OR "Virtual healthcare" OR "mHealth" OR "remote healthcare" OR "digital health care" OR "telehealth"
#2	"cancer" OR "cancer care"
#3	"barrier" OR "challenge" OR "obstacle" OR "hindrance" OR "facilitator" OR "enabler" OR "adoption factors"
#4	#1 AND #2 AND #3

Methods

This scoping review was conducted based on the PRISMA extension for scoping reviews (PRISMA-ScR) guideline [20].

Information sources and search strategy

The current scoping review leveraged articles published until January 3rd, 2025, from three scientific databases, including Web of Sciences (WOS), PubMed, and Scopus, to achieve comprehensive and multidisciplinary search coverage. The search strategy was established using the following keywords in Table 1 to retrieve articles on this topic from scientific databases using a thorough literature analysis and previous studies on similar studies [21, 22].

Inclusion and exclusion criteria

The inclusion criteria for this scoping review were articles written in English, articles indicating barriers and facilitators of tele-oncology adoption, conference papers, articles with full text available, articles focusing on barriers and facilitators, academic journals, and original articles. In contrast, articles on other conditions or diseases,

non-English articles, reviews, books, book chapters, preprints, letters to the editor, conference abstracts, research protocol, and protocol studies were excluded from this review.

Study selection

After searching the databases, the author imported the articles into EndNote, and duplicate studies were excluded from further investigation. Firstly, the titles and abstracts of the articles were investigated independently by the author and one Health Information Management (HIM) expert, according to the inclusion and exclusion criteria. After that, the author and HIM specialist investigated the articles' full text to finalize the primary studies to be leveraged in the current scoping review. In the case of inconsistency in reviewing the articles in all steps, one Medical Informatics (MI) specialist intervened and solved the disagreement.

Data extraction, charting, and synthesis

To elicit data from the selected articles regarding the study's topic, we utilized a data extraction form including data items such as authors, year and location of publication, study's aim, population/sample size, type of cancer in which interventions leveraged, type of intervention, services, barriers, and facilitators concerning tele-oncology. The author and HIM specialist independently extracted the data from the studies regarding each data field. If differences emerged in the data extraction results, they were discussed jointly with one MI specialist through a meeting, and the agreement was finally obtained. The data on barriers and facilitators was analyzed using the content analysis procedure. This way, all data extracted from the included articles were discussed in joint meetings, and finally, all barriers and facilitators were obtained and categorized based on themes. In other words, the barriers and facilitators that were more similar thematically were classified into similar themes. Also, the descriptive statistics method of data (frequency and percentage) of the included studies was used, and the data were depicted in table and figure formats to show the findings and narrative synthesis of the data according to the study's aim.

Results

Study selection

In total, 685 articles were retrieved from the scientific databases. By excluding the articles regarding duplicates ($n = 97$), title and abstract ($n = 372$), full-text ($n = 22$), and other exclusion criteria ($n = 182$), finally, 12 articles remained in the scoping review and were used for data extraction. Figure 1 shows the study selection process and results in each step based on the PRISMA flowchart.

Characteristics of studies

The data on the studies' characteristics are presented in Table 2.

Time of publication

Figure 2 shows the distribution of the literature per year of publication. Most studies were conducted in 2021 ($n = 4$); the minimum number belonged to 2006 ($n = 1$), 2012 ($n = 1$), 2019 ($n = 1$), and 2023 ($n = 1$).

Place of publication

Figure 3 shows the distribution of studies on this topic based on the location. According to Fig. 3, Six studies have been done in the USA ($n = 2$), UK ($n = 2$), and Germany ($n = 2$). Also, six studies were conducted in Austria ($n = 1$), Finland ($n = 1$), Brazil ($n = 1$), Australia ($n = 1$), Canada ($n = 1$), and Singapore ($n = 1$). The distribution of cancer types of populations for whom the tele-oncology services were performed and were reported in studies is depicted in Fig. 4. Gastrointestinal ($n = 4$), breast ($n = 4$), genitourinary ($n = 3$), and hematological ($n = 3$) populations were more frequent types that received the tele-oncology services.

Type of intervention and services

The intervention used as tele-oncology technologies among cancer patients is illustrated in Fig. 5. The most common interventions leveraged for cancer care were video consultation and visit [23, 24, 27–29, 31–34] ($n = 9$) and telephone service [25, 28, 30–33] ($n = 6$). Other technologies used included text messages, Email, social networking, and wearable devices. According to Fig. 6, most services were in consultation ($n = 5$) [24, 28–30, 32] and follow-up ($n = 5$) [25, 27, 31, 33, 34]. Also, in two studies [23, 26], the interventions were introduced as a combination of follow-up and consultation.

Barriers and facilitators of using tele-oncology

Table 3 shows the barriers to tele-oncology in cancer care based on data extracted from studies. According to this, the barriers were personal, technical, data management, managerial, and legal. In total, 48 items of barriers to tele-oncology adoption were identified. Twenty-five items belonged to individual factors, and digital exclusion ($n = 3$), poor patient convenience in using technology ($n = 2$), poor digital literacy ($n = 2$), and technology anxiety ($n = 2$) were the most common personal barriers. Technological factors were 12 items, of which lack of technical requirements ($n = 6$), technical problems ($n = 2$), and lack of usability ($n = 3$) were more critical hindrance factors. Three items, namely, the lack of private data protection ($n = 1$), data security ($n = 1$), and the lack of data interchange ($n = 1$), were known as data managerial concerns. Eight managerial and legal hindrance factors

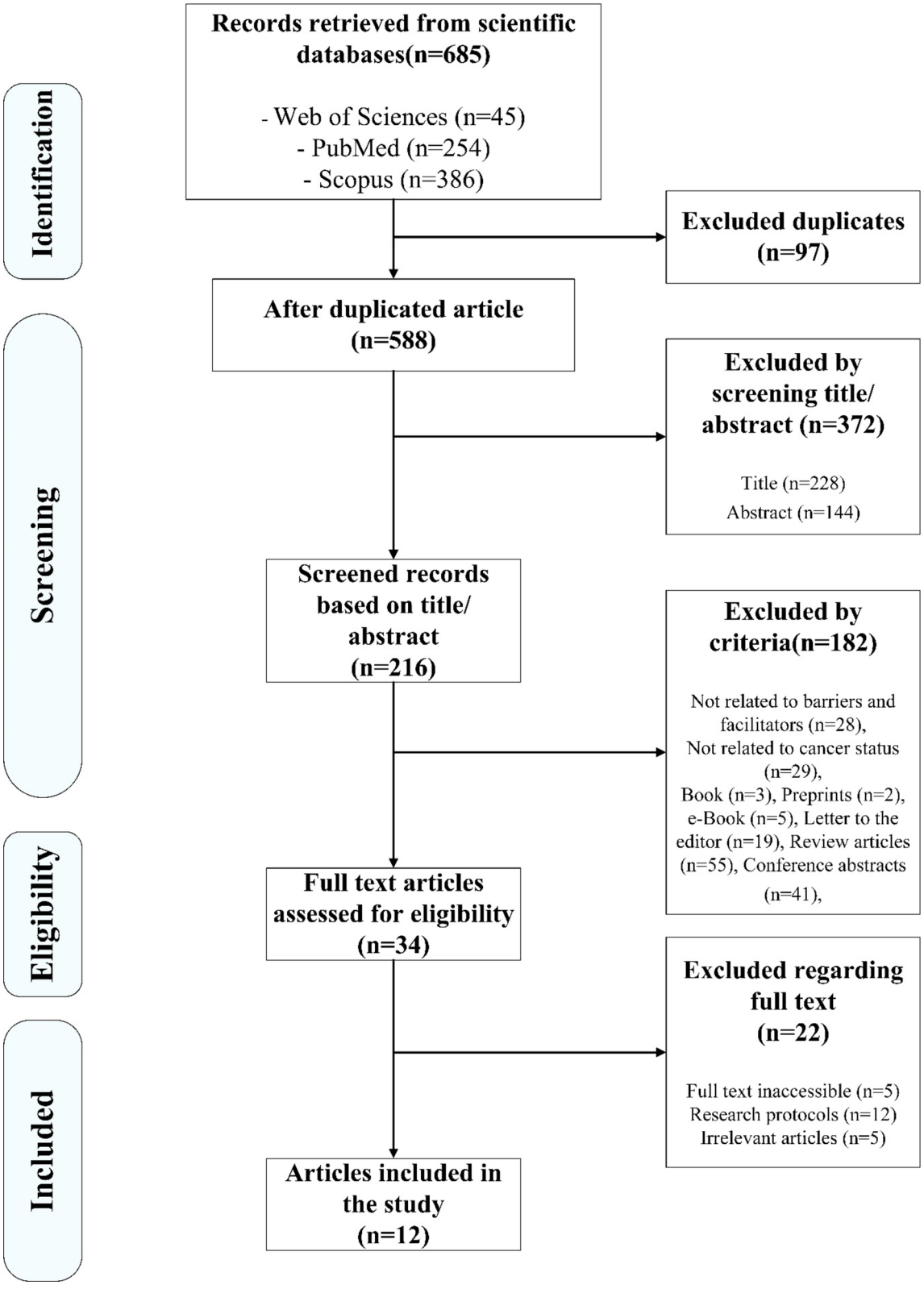

Fig. 1 The study selection process based on the PRISMA flowchart

Table 2 The details of data of studies' characteristics

Authors [Ref]	Year	Country	Purpose	Cancer type	Participants/Sample size	Intervention	Services	Barrier	Facilitator
Nurtsch et al. [23]	2024	Germany	To assess the acceptance of video consultations in cancer care and determine barriers and drivers.	General/NM	Oncological outpatient clinics of different hospitals in North Rhine-Westphalia/350 cancer patients	Video consultations	Follow-up and consultation	• Preference of personal contact with the physician • Lack of technical requirements • Fear of incorrect remote diagnostics • Lack of private data protection • Old age	• eHealth literacy • Stage of the • disease • Female gender • Distance oncologist • Low internet anxiety • High digital confidence • Digital overload • Internet use • personal trust • Effort expectancy • Performance expectancy • Social influence
Nemecek et al. [24]	2019	Austria	To show that telematically augmented palliative care may enhance QoL of patients and family caregivers and decrease hospital readmissions	NSCLC ($n=9$], followed by melanoma ($n=4$) and pancreatic cancer ($n=2$).	oncology patients and their family caregivers/a total of 15 oncological patients with advanced cancer	video call application "VSee"	Consultation	• Technical problems (such as uncharged battery and • logged off the VSee app) • Time-consuming data entry • Lack of usability of the app	• Easy and understandable data entry • Having Technical knowledge • Numerous testing • and careful development of the app • Continuous support • Reliable IT infrastructure • Patient trust
Bärlund et al. [25]	2021	Finland	To evaluate the implementation and added value of digital applications for healthcare specialists monitoring breast cancer patients.	Breast cancer	breast patients for nine years from 2012 to 2020/ from $n=863$ to $n=2223$	Aurora, Noona TeleQ callback application telephone service	Follow-up	---	• Motivational factor • instructions for the use • careful planning of the implementation • service design utilization
Favoreto-Neto et al. [26]	2023	Brazil	To explore the potential benefits of telemedicine in reducing Out-of-pocket costs for oncological patients	Genitourinary and Gastrointestinal	57 patients in the ABC region near São Paulo and 112 patients from the northeastern state of Maranhão	N/M	Consultation and follow-up	• Data security • Implementation and maintenance cost	• Appropriate security measures

Table 2 (continued)

Authors [Ref]	Year	Country	Purpose	Cancer type	Participants/Sample size	Intervention	Services	Barrier	Facilitator
Shepherd et al. [27]	2006	Australia	To identify whether video-conferencing for cancer patients is an acceptable, satisfying, and practical mode of delivery.	N/M	adult cancer patients at regional treatment centers in the NEAHS/54 patients	Video conferencing	Follow-up for telepsychology service	• Delays and interruptions in communications	• Relevant information and support • Considering usability (drawing diagrams or using worksheets) • Emotional well-being in the intervention
Brady et al. [28]	2021	UK	To evaluate and co-design telemedicine services to meet the complex needs of our patients and cares at a tertiary cancer center.	Head and neck, thyroid, gastrointestinal, breast, and hematology	11 patients from the UK cancer center	telephone consultations and video consultations	Consultation	• Patients who may be digitally excluded for speech, voice, language, or cognitive difficulties or did not have the devices and knowledge IT issues, or the patient does not fully understand the instructions for joining a virtual consultation	• Cost-effectiveness of remote consultations • Flexibility of time designated for the appointment rather than many hours to a day off • More comfortable communications • Need for specific training to deliver telemedicine consultations • Need for appropriate infrastructure, including private spaces for consultations, a reliable and safe platform for consultations, including stable internet access. • Standard operating procedure to safe consultation • Clear methods of Communication with the patient • Collaboration and co-design with our patient partners and healthcare providers.
Watanabe et al. [29]	2012	Canada	To assess the feasibility of using video-conferencing to provide specialist multidisciplinary palliative care and palliative radiotherapy consultation with cancer patients	Gastrointestinal, breast, lung, genitourinary, hematological, and others	44 patients from rural northern Alberta	Videoconference	Consultation	• Lack of awareness of the clinic among rural family physicians • Implementing recommendations was delayed due to a lack of efforts in fax, telephone, Internet, and local media • Interview of a patient had to be completed by telephone • Arranging telehealth appointments was more time-consuming compared to in-person appointments • Need to travel significant distances to reach the telehealth site	• Convenience • Reduced travel time and costs • Enhanced access to care • Reduced wait time for consultation • Perceived ability to communicate effectively with the provider • Ease of use and quality of the picture and sound • Telehealth infrastructure within the provincial health care system • Availability of a dedicated multidisciplinary the team at the tertiary cancer center

Table 2 (continued)

Authors [Ref]	Year	Country	Purpose	Cancer type	Participants/Sample size	Intervention	Services	Barrier	Facilitator
Liptrott et al. [30]	2021	UK	To investigate expert nurses' comprehension of patients' needs, use of telephone intervention and acceptability	Hematological	10 nurses from seven European countries	Telephone support	Consultation	• Lack of visual cues • Uneasiness to communicating with healthcare providers • Poor general well-being of the • patient impacting the ability to talk • Language difficulties compromising effective verbal communication	• Critical evaluation of the patient and care context • Providing quick access to the team and timely reassurance • Providing proactive telephone support • Supplementary training for telephone-based communication skills • Organizational support for implementation, such as dedicated time to perform calls • Having dedicated time to perform calls in care providers' roles
Tevaarwerk et al. [31]	2021	USA	To assess oncologist perspectives on telemedicine's present and future impacts	N/M	Opinions of 1038 specialists of NCCN EHR Oncology Advisory Group (Advisory Group)	Phone- and Video-Based Visits	Follow-up	• Patient lack of technology • Inefficient workflows • Need for physical examination • Lack of efficiency and emotional connection • Lack of appropriate telephones or knowledge to set up a telehealth video visit in older adults • Limited resources • Limited technological literacy • Lack of regulatory, licensing, and reimbursement policies	• Need to contemplate clinical workflow integration and patient support issues • Training patients on technology and its utility and role • Facilitating screen sharing to permit review of scans, being able to sketch or take notes for patients, and facilitate multiparty participation
Chan et al. [32]	2022	Singapore	To assess cancer patients' acceptance of telemedicine as a complement to traditional in-person care and identify factors influencing their acceptance.	N/M	278 patients from NCCS, a multidisciplinary cancer center	Phone calls, video calls, text messages, email, social networking, and wearable devices	Consultation	• Resistance to use • Technology anxiety • Perceived risks • Not perceiving Internet access as useful • Cost	• Perceived usefulness • Perceived ease of use • Technology confidence • Internet access • Necessary financial resources • Sufficient knowledge of using • Facilitating timely access to healthcare • Trust

Table 2 (continued)

Authors [Ref]	Year	Country	Purpose	Cancer type	Participants/Sample size	Intervention	Services	Barrier	Facilitator
Turner et al. [33]	2022	USA	،o explore oncologists' experiences with telehealth implementation.	Breast, bone marrow, Cutaneous, endocrine tumor, gastrointestinal, genitourinary, gynecologic, head and neck, neuro-oncology, thoracic	40 participants including physicians ($n = 22$), practice provider ($n = 10$), psychologists ($n = 2$), dieticians ($n = 2$), and a pharmacist ($n = 1$)	Videoconferencing and virtual check-ins with phone	Follow-up	• Not integrated within the EHR • Lack of data • Lack of physical exam • Lack of resources such as equipment, space, etc. • Not coordinated with workflows, such as lack of scheduling and lack of patient check-in process	• Importance of overcoming the digital divide • Recommended real-time IT support for patients • Greater telehealth accessibility • Patient education • Real-time information technology support • Optimizing workflow • Policy advocacy • Long-term planning • Sharing best practices • Sharing information about telehealth policy changes • Production support • Web side manner training

Table 2 (continued)

Authors [Ref]	Year	Country	Purpose	Cancer type	Participants/Sample size	Intervention	Services	Barrier	Facilitator
Stamer et al. [34]	2024	Germany	To explore what prospective eHealth applications have to achieve and what facilitating and hindering factors are associated with their implementation.	N/M	($n = 25$) GP and ($n = 25$) patient	Video consultation	follow-up	• Insufficient network coverage • Technical problems • Poor implementation in existing practice management system • Information privacy • Unclear funding • Poor usability • A feeling of talking to a machine • Poor accessibility • Remembrance of illness • Loss of control • Language barriers • Poor digital literacy • Poor interdisciplinary communication • Lack of haptics • Missing nonverbal communication • Lack of olfactory perception • Pharmaceutical sponsoring • Loss of control in doing tasks	• Compatibility with existing practice management system • Technical support • Smart functions • Cross-device use • Training • Free of charge • Location-independent • Use • Information privacy • High Usability • Saving time and effort • Supporting further treatment • Supporting health • Literacy • 24/7 access to care • Familiar contact • Continuity of care • Saving money • Perceived added • value • Low-threshold access • Digital literacy • Higher flexibility • Gamification • Elements • Supported by health insurance • Visual impression • Early inclusion of the general practitioner in decision-making • Low-threshold access to specialist knowledge • Optimized • Monitoring work facilitation • Adequate remuneration

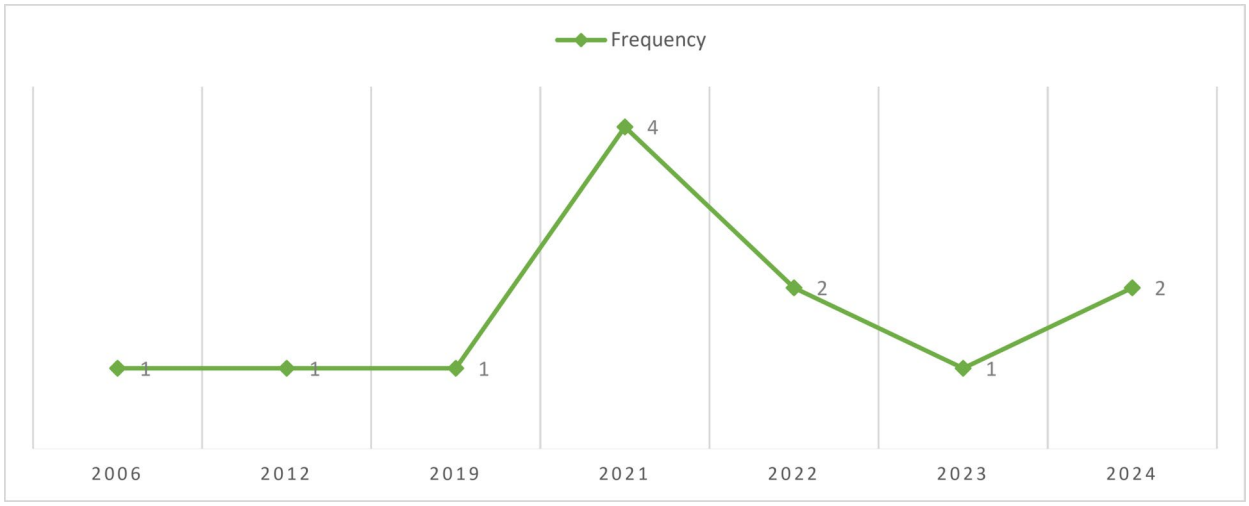

Fig. 2 The frequency of articles published based on the time conducted

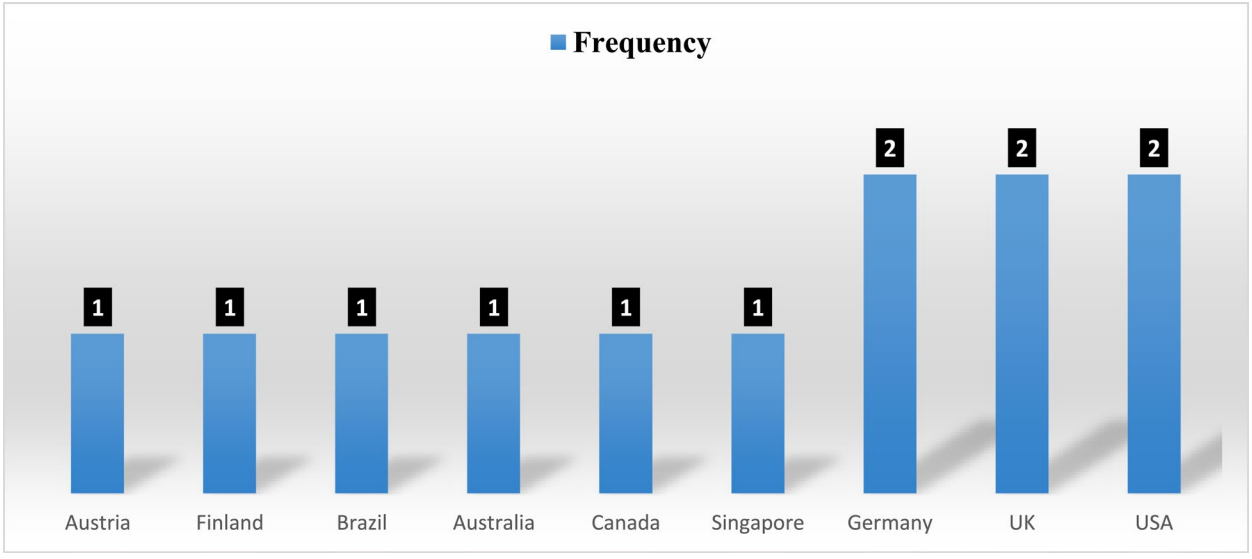

Fig. 3 The frequency of the studies conducted based on the location

were identified. Constraint financial and non-financial resources ($n = 3$) and in coordination with workflow ($n = 2$) were considered critical managerial factors hindering tele-oncology. Also, the lack of regulatory, licensing, and reimbursement policies ($n = 1$) was the legal barrier to reducing tele-oncology utilization.

The facilitators of using tele-oncology are presented in Table 4. As shown in this table, they were classified into personal, data management, technical, managerial, and legal determinants. Altogether, 92 facilitators were obtained based on the literature on this topic. Nineteen personal facilitators were obtained according to the data elicited from studies. Among them, eHealth literacy and sufficient knowledge of using technology ($n = 3$), personal trust ($n = 3$), and high digital confidence ($n = 2$) were regarded as the more essential facilitators. Data overload ($n = 1$) and data privacy ($n = 1$) were recognized as two facilitators regarding data management that should be considered. Thirty technical facilitators were identified. The usability of technology ($n = 11$) was obtained as the most common technical facilitator that has a crucial role in increasing tele-oncology leverage. Training patients on technology and its utility and role [28, 31] and real-time production support [24, 33] were two more frequent technical facilitators than others mentioned in the two studies. Also, 41 managerial facilitators were extracted in articles, and among these, facilitating timely access to healthcare [30, 32–34], ($n = 4$) and training [33, 34] ($n = 2$) were the most common managerial factors in increasing tele-oncology use.

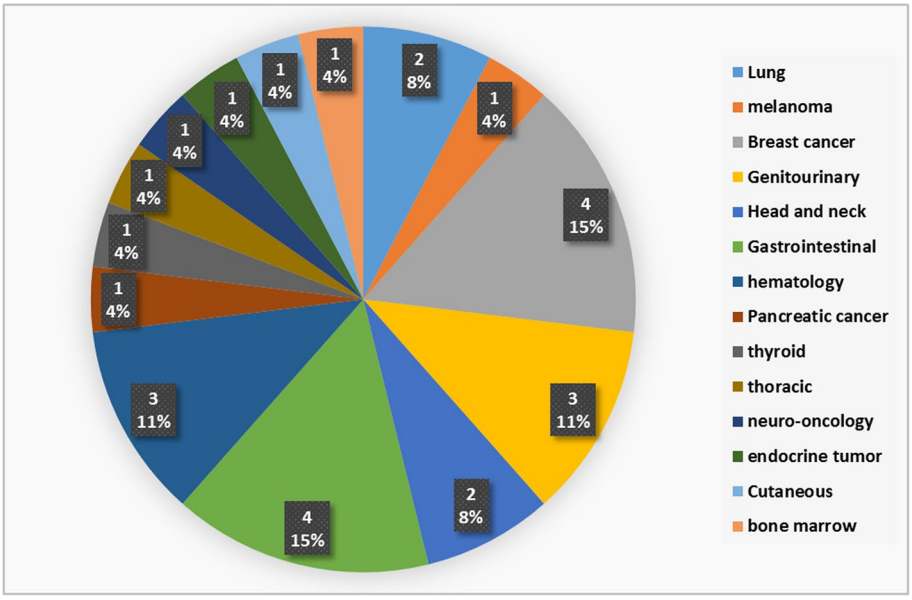

Fig. 4 The frequency of cancer types in populations that leveraged tele-oncology services

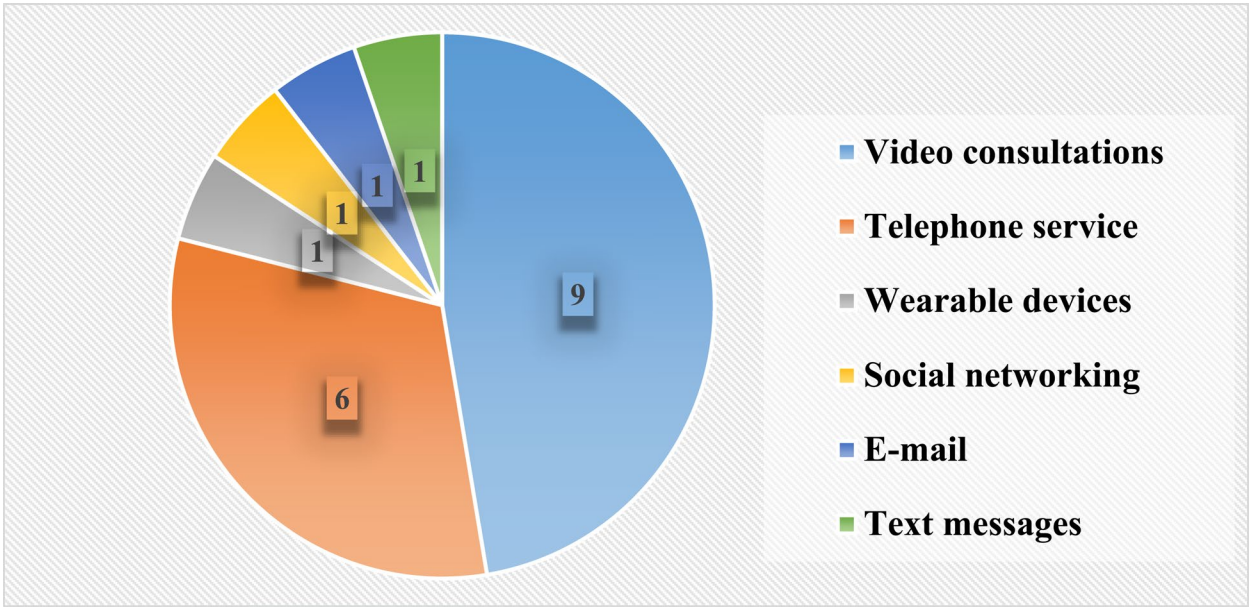

Fig. 5 Tele-oncology interventions used in cancer care

Discussion

Main findings on studies' characteristics

This study explored tele-oncology in cancer by focusing on barriers and enablers through a scoping review of the articles in scientific databases based on the (PRISMA-ScR) guideline. We reviewed articles from PubMed, Scopus, and WOS databases using related keywords to achieve this aim. After a qualitative analysis and narrative syntheses of data gathered from the literature, we organized information on barriers and enablers of tele-oncology leverage among cancer patients. By searching and investigating the articles on this topic based on the inclusion and exclusion criteria, we obtained 12 competent articles to be included in the current review. More frequent articles ($n = 4$) belonged to 2021, and most of them were conducted in Germany ($n = 2$), USA ($n = 2$), and UK ($n = 2$). The most common disease in which the tele-oncology interventions were performed was breast cancer ($n = 4$), gastrointestinal ($n = 4$), genitourinary ($n = 3$), and hematological ($n = 3$). More important tele-oncology interventions among cancer patients were video consultation ($n = 9$) and telephone services ($n = 6$), and the

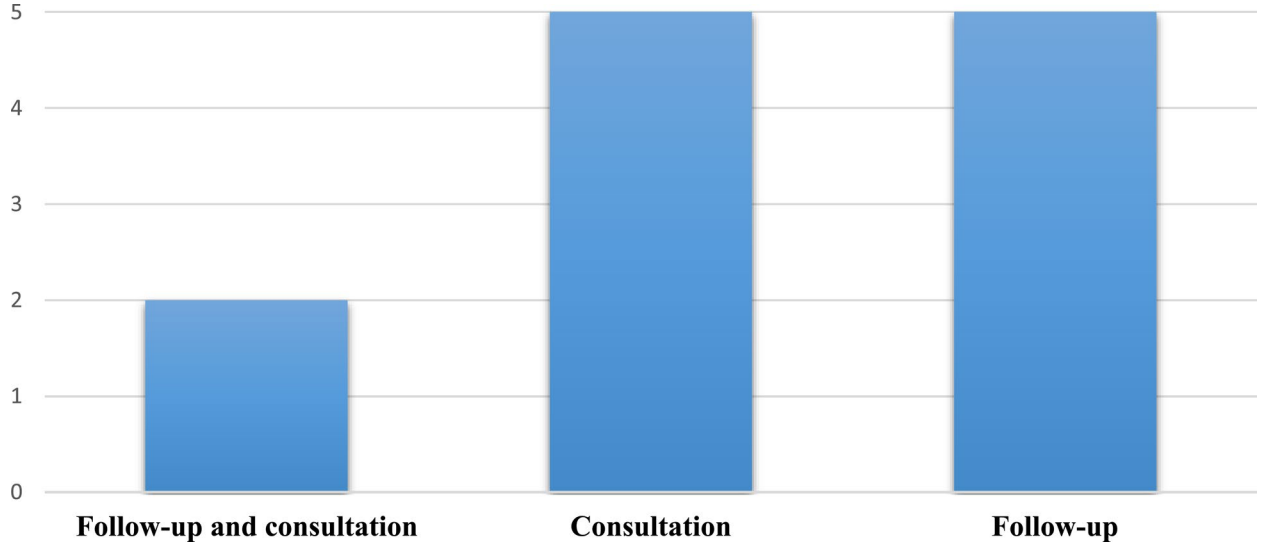

Fig. 6 Tele-oncology services provided among cancer patients

most common services were found as consultation ($n = 5$) [24, 28–30, 32] and follow-up ($n = 5$) [25, 27, 31, 33, 34]. Based on data elicitation from the publications reviewed, 48 and 92 items belonging to barriers and enablers of tele-oncology use were identified, respectively. Barriers and facilitators were classified into personal, technical, data management, managerial, and legal factors.

The scoping review shows that video consultation and visit [24, 28–30, 32] and telephone services [25, 27, 31, 33, 34] were the most common tele-oncology interventions. Video consultation is a specified type of telemedicine that leverages technology to bring real-time visual and audio assessment of patients from distance-independent areas [35]. Kitamura, in a systematic review on the effect of video consultation in cancer care, showed that video consultation poses a positive impact on patients, including more patient satisfaction due to more convenience and reduced travel costs and time, decreased wait time for receiving various services such as appointment and consultation, and optimized access to care, more effectively communications with physicians and other care providers, convenient of use of technology, and higher quality of sounds and images [35]. A meta-analysis by Uemoto to investigate tele-oncology efficiency among outpatient cancer patients revealed that the video consultation with patient satisfaction (standardized mean difference of 0.11; 95% CI, −0.18 to 0.40), complete outpatient attendance ratio of risk difference, 0.02%; 95% CI, −0.04 to 0.09) might be effective as face to face intervention [36]. Moreover, Banerjee et al. [37], Felheim et al. [38], and Bouma et al. [39] reported in their studies that video consultation has a positive impact on cancer care.

Telephone service [25, 28, 30–33] ($n = 6$) was another most common technology leveraged as tele-oncology intervention. Based on the studies reviewed, this technology has been used in various tasks for enhancing healthcare among cancer patients, including virtual check-ins [33], phone calls and consultations [28, 32], along with video consultations and visits [28, 31], care support [30], and callback services [25]. Despite some disadvantages cited in studies on this technology, telephone service showed some positive impacts on enhanced patient safety and care provider support [40, 41], higher satisfaction [42, 43], reduced physical and emotional travel burden in addition to travel problems such as cost and duration [41], better management of disease and better experience [43]. This review showed video conferences and telephone services as more frequent tele-oncology interventions used for patients, so focusing more on the enablers and barriers and attempting to enhance the adoption of these technologies would increase the effectiveness and efficiency of tele-oncology in cancer care.

The services were consultation [24, 28–30, 32] and follow-up [25, 27, 31, 33, 34] in cancer care. Some studies [23, 26] mentioned tele-oncology services as a combination of these two interventions. Follow-up care services are a comprehensive and interdisciplinary approach to decreasing the late impacts of disease burden among patients, focusing on early detection and preventing tumor recurrence through surveillance, training the survivors on disease-related complications, and motivating patients to adopt preventive and healthy behavior lifestyles [44, 45]. As indicated in this review, the follow-up services constitute a significant application in tele-oncology services. Despite the drawbacks of tele-oncology in cancer care, it significantly impacts follow-up care [46]. In one study on leveraging telemedicine among gynecological and breast cancers in follow-up visits, acceptable satisfaction, increased accessibility, enhanced care,

Table 3 Hindrance to using tele-oncology in cancer care

Category	Barrier [Ref]	Frequency	Percentage
Personal	Preference of personal contact with the physician [23]	1	2.08%
	Fear of incorrect remote diagnostics [23]	1	2.08%
	Old age [23]	1	2.08%
	Patients who may be digitally excluded (speech, voice, language, cognitive difficulties, did not have the devices and knowledge of IT issues) [28, 30, 34]	3	6.25%
	Lack of olfactory perception [34]	1	2.08%
	Loss of control in doing tasks [34]	1	2.08%
	Lack of awareness of the clinic among rural family physicians [29]	1	2.08%
	Poor patient convenience in using technology [30, 34]	2	4.16%
	Need for physical examination [31]	1	2.08%
	Technology cost use [31]	1	2.08%
	Resistance to use [32]	1	2.08%
	Poor digital literacy [28, 34]	2	4.16%
	Perceived risks [32]	1	2.08%
	Technology anxiety [29, 32]	2	4.16%
	Uneasiness to communicate with healthcare providers [30]	1	2.08%
	Not perceiving Internet access as useful [32]	1	2.08%
	Poor accessibility to telemedicine technology and the Internet [34]	1	2.08%
	Lack of remembrance of illness in patients [34]	1	2.08%
	Missing nonverbal communication [34]	1	2.08%
	Pharmaceutical sponsoring [34]	1	2.08%
Technical	Lack of technical requirements (Interview had to be completed by telephone, lack of haptics, lack of appropriate telephones, knowledge to set up a telehealth video visit in older adults, insufficient network coverage, and lack of interoperability to integrate with other systems such as EHR) [23, 29, 31, 33, 34]	6	12.5%
	Technical problems (such as uncharged battery and logged off the app) [24, 34]	2	4.16%
	Lack of usability of the app (such as lack of visual cues, lack of efficiency and emotional connection, and time-consuming data entry and consultation) [24, 29–31, 34]	3	6.25%
	Implementation and maintenance cost [26]	1	2.08%
Data management	Lack of private data protection [23]	1	2.08%
	Lack of data security [26]	1	2.08%
	Lack of data (such as images and vital signs to represent to physician) [33]	1	2.08%
Managerial and legal	Limited resources (financial and non-financial) [31, 33, 34]	3	6.25%
	Lack of regulatory, licensing, and reimbursement policies [31]	1	2.08%
	Not coordinated with workflow, such as lack of scheduling and lack of patient check-in process, and physical examination [31, 33]	2	4.16%
	Poor implementation in the existing practice management system [34]	1	2.08%
	Poor interdisciplinary communication [34]	1	2.08%

and privacy were reported after using this intervention, and it has been concluded that the typical therapy care cancer be replaced by tele-oncology, especially among higher-educated women [47]. Aguiar et al. showed that leveraging tele-oncology improves treatment and oncological management in physical examination among cancer patients satisfactorily during follow-up care [48]. Other studies also showed the beneficial role of tele-oncology in enhancing follow-up care and increasing patient satisfaction [49–51].

Several studies have focused more on tele-oncology services for consultations [24, 28–30, 32] in cancer care. Teleconsultation services can be leveraged at the initial assessment and during ongoing provision in cancer care [23, 28]. As a frequent tele-oncology application in the current review, teleconsultation experienced many positive effects in cancer care for initial assessment of patients and follow-up care, including enhanced quality of life [52], higher patient satisfaction [35, 53], and an acceptable method to provide cancer care by oncologists [54].

Barriers and facilitators of tele-oncology adoption

Personal factors

According to surveying the literature, digital exclusion ($n = 3$), poor patient convenience in using technology ($n = 2$), poor digital literacy ($n = 2$), and technology anxiety ($n = 2$) were considered more critical personal hindrances regarding tele-oncology adoption. Digital exclusion can occur among healthcare stakeholders due to a lack of access to the appropriate device, data, and Internet or the

Table 4 Facilitators of using tele-oncology in cancer care

Category	Facilitator [Ref]	Frequency	Percentage
Personal	eHealth literacy and sufficient knowledge of using technology [23, 32, 34]	3	3.26%
	Stage of the disease [23]	1	1.08%
	Female gender [23]	1	1.08%
	High digital confidence [23, 32]	2	2.17%
	Internet use [23]	1	1.08%
	Personal trust [23, 24, 32]	3	3.26%
	Low internet anxiety [24]	1	1.08%
	Convenience [29]	1	1.08%
	Perceived ability to communicate effectively with the provider [29]	1	1.08%
	Perceived added value [34]	1	1.08%
	Motivational factors [25]	1	1.08%
	Perceived usefulness [32]	1	1.08%
	Perceived ease of use [32]	1	1.08%
	Internet access [32]	1	1.08%
Data management	Lowering digital overload [23]	1	1.08%
	Focusing on data privacy [34]	1	1.08%
Technical	Effort expectancy [23]	1	1.08%
	Performance expectancy [23]	1	1.08%
	Having Technical knowledge [24]	1	1.08%
	Reliable IT infrastructure [24]	1	1.08%
	Real-time production support [24, 33]	2	2.17%
	Service design utilization [25]	1	1.08%
	Relevant information and support [27]	1	1.08%
	Considering usability (drawing diagrams or using worksheets, easy and understandable data entry, emotional well-being in the intervention, more comfortable communications, ease of use and quality of the picture and sound, high usability, higher flexibility, gamification elements, visual impression, smart functions, and cross-device use) [27–29, 34]	11	11.95%
	Collaboration and co-design with the patient partners and healthcare providers [28]	1	1.08%
	Numerous testing and careful development of the app [24]	1	1.08%
	Providing proactive telephone support [30]	1	1.08%
	Facilitating screen sharing to permit review of scans, being able to sketch or take notes for patients, and facilitating multiparty participation [31]	1	1.08%
	Training patients on technology and its utility and role [28, 31]	2	2.17%
	Telehealth infrastructure within the provincial healthcare system [29]	1	1.08%
	Web side manner training [33]	1	1.08%
	Importance of overcoming the digital divide [33]	1	1.08%
	Location-independent use [34]	1	1.08%
	Technical support [34]	1	1.08%

Table 4 (continued)

Category	Facilitator [Ref]	Frequency	Percentage
Managerial and legal	Critical appraisal of the patient and care context [30]	1	1.08%
	Supplementary training for telephone-based communication skills [30]	1	1.08%
	Organizational support for implementation, such as dedicated time to perform calls [30]	1	1.08%
	Having dedicated time to perform calls in care providers' roles [30]	1	1.08%
	Compatibility with existing practice management system [34]	1	1.08%
	Training [33, 34]	2	2.17%
	Free of charge [34]	1	1.08%
	Supporting further treatment [34]	1	1.08%
	Supporting health literacy [34]	1	1.08%
	Familiar contact [34]	1	1.08%
	Continuity of care [34]	1	1.08%
	Saving money [34]	1	1.08%
	Supported by health insurance [34]	1	1.08%
	Early inclusion of the general practitioner in decision-making [34]	1	1.08%
	Highly access to specialist knowledge [34]	1	1.08%
	Optimized monitoring work facilitation [34]	1	1.08%
	Adequate remuneration [34]	1	1.08%
	Need to contemplate clinical workflow integration and patient support issues [31]	1	1.08%
	Reduced travel time and costs [29]	1	1.08%
	Facilitating timely access to healthcare [30, 32–34]	4	4.34%
	Necessary financial resources [32]	1	1.08%
	Optimizing workflow [33]	1	1.08%
	Policy advocacy [33]	1	1.08%
	Long-term planning [33]	1	1.08%
	Sharing best practices [33]	1	1.08%
	Sharing information about telehealth policy changes [33]	1	1.08%
	Instructions for the use [25]	1	1.08%
	Careful planning of the implementation [25]	1	1.08%
	Appropriate security measures [26]	1	1.08%
	Clear methods of communication with the patient [28]	1	1.08%
	Standard operating procedure for safe consultation [28]	1	1.08%
	Need for appropriate infrastructure, including private spaces for consultations, a reliable and safe platform for consultations, including stable internet access [28]	1	1.08%
	Cost-effectiveness of remote consultations [28]	1	1.08%
	The flexibility of time designated for the appointment rather than many hours to a day off [28]	1	1.08%
	Enhanced access to care [29]	1	1.08%
	Reduced wait time for consultation [29]	1	1.08%
	Availability of a dedicated multidisciplinary team at the tertiary cancer center [29]	1	1.08%

lack of the necessary skills in cancer care, and it is significantly influenced by income, literacy, language, culture, and ethnicity [55]. Some solutions, such as providing appropriate strategies to enhance eHealth literacy, sufficient knowledge of using technology among healthcare stakeholders [23, 32, 34], and Internet use and access [23, 32], can be advantageous in increasing the acceptance rate of this technology in healthcare environments. Poor patient convenience in using technology is among other barriers to leveraging tele-oncology. Low convenience in leveraging technology and technical anxiety in tele-oncology can have technical and personal causes. Considering this hindrance occurrence as a technical issue, some enablers, such as considering usability in designing appropriate hardware and software elements, lead to higher convenience for persons. In contrast, focusing on personal enablers such as increasing the knowledge of technology [23, 32, 34], raising digital confidence, and promoting digital engagement [23, 32] are crucial to increase using tele-oncology.

Technical factors

Lack of technical requirements such as performing interviews by telephone, lack of haptics, lack of appropriate telephones, knowledge to set up a telehealth video visit in older adults, lack of network coverage, and lack of interoperability to integrate with other systems [23, 29, 31, 33, 34], technical problems such as uncharged battery

and logged off the app [24, 34], and lack of usability of the app (such as lack of visual cues, lack of efficiency and emotional connection, and time-consuming data entry and consultation) [24, 29–31, 34] were amongst technical barriers to leverage tele-oncology. To cope with these issues, proactive telephone support provision [30], Collaboration, and co-design with the patient partners and healthcare providers [28] to consider the technical problems regarding software and hardware features, enhancing telehealth infrastructure such as leveraging standards in the healthcare system [29] could promote technical efficiency and effectiveness of this technology. Real-time production support [24, 33] and technical support [34] are beneficial strategies amongst technical solutions to address the technical challenges and enhance the acceptability of tele-oncology. Usability considerations involve software and hardware development strategies, so paying attention to these facilitators, such as drawing diagrams or using worksheets, emotional well-being in the intervention, more comfortable communications, ease of use and quality of the picture and sound, time-consuming data entry and consultation, flexibility, gamification elements, visual impression, smart functions, and cross-device use, as most common usability consideration in tele-oncology should be considered [27–29, 34].

Data management

Lack of private data protection [23], data security [26], and lack of data such as images and vital signs to represent physicians [33] are three concerns of tele-oncology use regarding data management. Despite the advantages of telemedicine in promoting cancer care, its implementation confronts limitations and challenges. One major concern is the lack of data security and privacy, especially when dealing with sensitive data on cancer patients transmitted via the tele-oncology system. So, it is vital to establish and boost security measures to ensure data privacy and security [26]. Some security measures to enhance data security and privacy include documented informed consent [56], standard operating procedure for safe consultation [28], need for appropriate infrastructure, including private spaces for consultations, a reliable and secure platform for consultations, including stable internet access [28], the encrypted transmission of patient data via systems, hiding identifying information from other clinical data, storing all data on a secure and password-protected system, establishing an audit trail of data access, and implementing a protocol to support of breach prevention and management [56]. One barrier to telehealth visit delivery is the lack of data on images, vital signs, biometric data, and patient-reported outcomes to assess patients. In this regard, it is necessary to pay attention to some long-term and strategic planning by managers, policymakers, and health stakeholders regarding the use of some automated tools, including the use of wearable biosensors, in order to establish and promote the automatic collection of health data among cancer patients and eliminate this challenge [33]. Also, lowering digital overload [23] is another factor that should be considered to increase the chance of using and implementing tele-oncology. In this regard, simplifying and automating some cancer care processes can wipe out this challenge and help to overcome overload [57].

Managerial and legal factors

The inconsistency between technology and processes, such as lack of schedule in the patient check-in process, physical examination [32, 34], and financial and non-financial resources [31, 33, 34], are two common managerial bottlenecks in leveraging tele-oncology in the review. To confront the inconsistency between technology and processes, considering to contemplate clinical workflow integration and patient support issues [31], compatibility with existing practice management system [34], organizational support for implementation, such as dedicated time to perform calls [30], early participation of healthcare stakeholders in decision-making on tele-oncology project and business process [34], optimized monitoring work facilitation [34], and optimizing workflow [33] improves consistency and better tele-oncology utilization significantly. Limited financial and non-financial resources are another deterrent to establishing, implementing, and leveraging cancer care technology [31, 33, 34]. In this respect, taking into account the cost-effectiveness of tele-oncology services [29], saving money [34], reducing travel time and costs [29], and facilitating timely access to healthcare [30, 32–34] are crucial in addition to the necessity of financial resources [32] to raise the chance of the technology acceptance. Lack of regulatory, licensing, and reimbursement policies [31] is an important legal issue, and to overcome this challenge, healthcare stakeholders should establish policy advocacy, such as medical licensure policies, to protect tele-oncology and monitor the technology's effectiveness and efficiency in improving patient outcomes and providing healthcare [33].

Limitations and recommendations

This scoping review searched scientific databases, including WOS, PubMed, Scopus, and English-written articles. We recommend searching more databases in different written languages to obtain more articles on this topic.

Conclusion

In this study, we attempted to investigate the most common barriers and facilitators of adopting tele-oncology in cancer care by reviewing the existing studies. We found more frequent barriers and facilitators to tele-oncology in five categories: personal, technical, data management, and management and legal factors. Knowing the

most common obstacles and facilitators has a key role for policymakers, managers, designers of health information systems, and other healthcare stakeholders to obtain more insight into them and make an effort to increase the chance of acceptance and usage of tele-oncology in cancer care.

Supplementary Information

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Supplementary Material 1.

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Data availability
The datasets used and/or analyzed during the current study are available from the corresponding author upon reasonable request.

Declarations

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