

# Systematic review of challenges of telehealth-based intervention in managing cancer pain

Saruveish Mogan, MD<sup>1</sup>, Samprith Ala, MD<sup>2</sup>, Vinoshini Muthusamy, MBBS<sup>3</sup>, Dever Samuganathan, MBBS<sup>4</sup>, Muhammad Talha Zaigham, MBBS<sup>5</sup>, Zuraiz Idrees, MBBS<sup>6</sup>, Loshini Mogan<sup>7</sup>

<sup>1</sup>Faculty of Medicine and Health Sciences, Universiti Malaysia Sarawak (UNIMAS), Kuching, Malaysia, <sup>2</sup>Medicine, Avalon University School of Medicine, Willemstad, Curaçao, <sup>3</sup>Department of Emergency Medicine, Tuanku Ja'afar Hospital, Seremban, Malaysia, <sup>4</sup>Impian Aspire Sdn Bhd, Kuala Lumpur, Malaysia, <sup>5</sup>Ysbyty Cwm Cynon, Wales, UK, <sup>6</sup>Queen Alexandra Hospital, Cosham, Portsmouth, UK, <sup>7</sup>Faculty of Medicine, AIMST University, Bedong, Malaysia,

## ABSTRACT

**Introduction:** Understanding the challenges of telehealth interventions is essential to determining their future direction in cancer pain management, as these are considered complex interventions. This systematic review aimed to identify the challenges associated with telehealth-based interventions in cancer pain management.

**Materials and Methods:** The Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines were followed. A systematic search was conducted from January 19 to February 2, 2022, covering the past 10 years. Databases searched included PubMed and EBSCO. Inclusion criteria were articles published in English focusing on cancer pain in patients with any cancer diagnosis. Data were extracted on participants, interventions, and outcomes, with a particular focus on challenges reported in each study. A total of 320 publications were retrieved and screened; 38 articles met the inclusion criteria.

**Results:** The most reported challenge was limited or slow Internet access, followed by lack of technological expertise among healthcare teams and low computer literacy. Human resource-related challenges were also frequently reported, including inadequate reimbursement mechanisms, concerns over malpractice, increased staff workload, and absence of formal organisational structures. In studies conducted after the COVID-19 pandemic, data-related issues such as data security and management were also highlighted.

**Conclusion:** Telehealth is a rapidly growing technology with the potential to transform healthcare delivery. Addressing the challenges identified in this review may help guide the development and implementation of more effective telehealth interventions in cancer pain management.

## KEYWORDS:

*Cancer, challenge, pain management, telehealth*

## INTRODUCTION

Technological innovations are full of exciting opportunities in the direction of novel approaches to enhance clinical care delivery, and one of the innovations that has recently

grasped the attention of the medical fraternity is telehealth. Telehealth uses telecommunications technology as a modality to deliver clinical care to populations with limited access to care.<sup>1</sup> Common approaches for telehealth are live video teleconferencing, remote monitoring, text, email, mobile health applications, and store-and-forward technology.<sup>2</sup> In the pre-pandemic era, telehealth was mainly used for primary care needs only, but now specialized and urgent care health services are being utilized more than ever before, and this also includes cancer pain management.<sup>1-3</sup>

Cancer is a global health concern. In terms of mortality, cancer is the second cause of death globally (8.97 million deaths) after ischemic heart disease but will probably become the first in 2060 (18.63 million deaths).<sup>4</sup> Regardless of the type of cancer, the potential symptoms of cancer can be a challenging experience for patients, and pain is probably one of the most burdensome of all cancer symptoms for patients and their families.<sup>5-7</sup> Cancer pain is a product of complex interactions among the central and peripheral nervous systems, the immune system, and cancer cells.<sup>7</sup> Cancer cells and the local immune cells produce a variety of biochemical substances that interact with pain receptors.<sup>7</sup>

We believe telehealth is the next milestone in the health delivery system and utilizing it to its full advantage in cancer pain management could lessen the cancer burden faced by cancer patients and their families. While telehealth has improved drastically, especially after the pandemic, there are still some challenges to be addressed to fully utilize it. This systematic review was carried out with the aim of identifying those challenges. This review can facilitate the development of a better remote healthcare delivery system to lessen the cancer burden faced by cancer patients and their families. By addressing the challenges, we also can establish personalized care and able to make sure the patient receives appropriate and timely care when needed, without putting the patient at risk.

## MATERIALS AND METHODS

### Search strategy

The Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines were adopted for the literature search.<sup>8</sup> From January 19 to February 2, 2022, the search for articles was conducted. A research protocol was

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Corresponding Author: Saruveish Mogan  
Email: msaruveish@gmail.com

Table I: PICO concepts used in the review

PICO	Concept
Population	cancer patients
Intervention	Telehealth based intervention
Control	Not applicable
Outcome	Challenge in managing pain

Table II: Keywords and MeSH terms used in the search in PubMed

Free keywords	MESH terms
Growth' OR 'tumor' OR 'malignancy' OR 'sarcoma' OR 'carcinoma' OR 'neoplasm' OR 'melanoma' OR 'tumour' OR 'lymphoma' OR 'myeloma' OR 'fibroadenoma' OR 'meningioma' OR 'metastasis' OR 'neurofibroma' OR 'teratoma' OR 'neoplasia' OR 'malignant growth' OR 'cancerous growth' OR 'malignant tumor' OR 'lump' OR 'polyp' OR 'tumefaction disease' OR 'bump' OR 'excrescence' OR 'outgrowth'	("Neoplasms"[Mesh] AND "Thyroid Cancer, Papillary"[Mesh] AND "Breast Cancer Lymphedema"[Mesh] AND "Cancer-Associated Fibroblasts"[Mesh] AND "Prostatic Neoplasms, Castration-Resistant"[Mesh] AND "Neoplasms, Second Primary"[Mesh] AND "Head and Neck Neoplasms"[Mesh] AND "Colorectal Neoplasms, Hereditary Nonpolyposis"[Mesh] AND "Uterine Cervical Neoplasms"[Mesh] AND "Colitis-Associated Neoplasms"[Mesh] AND "Urologic Neoplasms"[Mesh] AND "Sigmoid Neoplasms"[Mesh] AND "Liver Neoplasms"[Mesh] AND "Unilateral Breast Neoplasms"[Mesh] AND "Urogenital Neoplasms"[Mesh] AND "Testicular Neoplasms"[Mesh] AND "Stomach Neoplasms"[Mesh] AND "Pharyngeal Neoplasms"[Mesh] AND "Oropharyngeal Neoplasms"[Mesh] AND "Gallbladder Neoplasms"[Mesh] AND "Ear Neoplasms"[Mesh] AND "Endometrial Neoplasms"[Mesh] AND "Vulvar Neoplasms"[Mesh] AND "Vaginal Neoplasms"[Mesh] AND "Uterine Neoplasms"[Mesh] AND "Urethral Neoplasms"[Mesh] AND "Ureteral Neoplasms"[Mesh] AND "Tonsillar Neoplasms"[Mesh] AND "Thymus Neoplasms"[Mesh] AND "Splenic Neoplasms"[Mesh] AND "Rectal Neoplasms"[Mesh] AND "Prostatic Neoplasms"[Mesh] AND "Penile Neoplasms"[Mesh] AND "Pelvic Neoplasms"[Mesh] AND "Pancreatic Neoplasms"[Mesh] AND "Ovarian Neoplasms"[Mesh] AND "Nose Neoplasms"[Mesh] AND "Nasopharyngeal Neoplasms"[Mesh] AND "Mouth Neoplasms"[Mesh] AND "Mediastinal Neoplasms"[Mesh] AND "Lung Neoplasms"[Mesh] AND "Laryngeal Neoplasms"[Mesh] AND "Kidney Neoplasms"[Mesh] AND "Intestinal Neoplasms"[Mesh] AND ( "Granulosa Cell Tumor"[Mesh] OR "Endocrine Gland Neoplasms"[Mesh] OR "Esophageal Neoplasms"[Mesh] OR "Colonic Neoplasms"[Mesh] OR "Breast Neoplasms"[Mesh] OR "Urinary Bladder Neoplasms"[Mesh] OR "Appendiceal Neoplasms"[Mesh] OR "Adrenal Cortex Neoplasms"[Mesh] OR "Carcinoma, Ovarian Epithelial"[Mesh] OR "Triple Negative Breast Neoplasms"[Mesh] OR "Neoplasms, Germ Cell and Embryonal"[Mesh] OR "Jejunal Neoplasms"[Mesh] OR "Ileal Neoplasms"[Mesh] OR "Gastrointestinal Neoplasms"[Mesh] OR "Anus Neoplasms"[Mesh] OR "Duodenal Neoplasms"[Mesh] OR "Adrenal Gland Neoplasms"[Mesh] OR "Inflammatory Breast Neoplasms"[Mesh] OR "Muscle Neoplasms"[Mesh] OR "Trophoblastic Neoplasms"[Mesh] OR "Tongue Neoplasms"[Mesh] OR "Thyroid Neoplasms"[Mesh] OR "Skin Neoplasms"[Mesh] OR "Salivary Gland Neoplasms"[Mesh] OR "Pituitary Neoplasms"[Mesh] OR "Parotid Neoplasms"[Mesh] OR "Parathyroid Neoplasms"[Mesh] OR "Lip Neoplasms"[Mesh] OR "Jaw Neoplasms"[Mesh] OR "Heart Neoplasms"[Mesh] OR "Eye Neoplasms"[Mesh] OR "Digestive System Neoplasms"[Mesh] OR "Cecal Neoplasms"[Mesh] OR "Brain Neoplasms"[Mesh] OR "Biliary Tract Neoplasms"[Mesh] OR "Bile Duct Neoplasms"[Mesh] OR "Non-Muscle Invasive Bladder Neoplasms"[Mesh] OR "Retinal Neoplasms"[Mesh] OR "Breast Neoplasms, Male"[Mesh] OR "Neoplasms, Squamous Cell"[Mesh] OR "Neoplasms, Basal Cell"[Mesh] OR "Neoplasms, Post-Traumatic"[Mesh] OR "Carcinoma, Merkel Cell"[Mesh] OR "Retinoblastoma"[Mesh] OR "Paranasal Sinus Neoplasms"[Mesh] OR "Maxillary Sinus Neoplasms"[Mesh] OR "Carcinoma, Hepatocellular"[Mesh] OR "Fallopian Tube Neoplasms"[Mesh] OR "Bone Neoplasms"[Mesh] OR "Prostate cancer, familial" [Supplementary Concept] OR "Thyroid cancer, Hurthle cell" [Supplementary Concept] OR "Hematologic Neoplasms"[Mesh] OR "Infratentorial Neoplasms"[Mesh] OR "Colorectal Neoplasms"[Mesh] OR "Supratentorial Neoplasms"[Mesh] OR "Otorhinolaryngologic Neoplasms"[Mesh] OR "Meningeal Neoplasms"[Mesh] OR "Hypothalamic Neoplasms"[Mesh] OR "Cerebellar Neoplasms"[Mesh] OR "Hypopharyngeal Neoplasms"[Mesh] OR "Carcinoma, Non-Small-Cell Lung"[Mesh] OR "Carcinoma, Renal Cell"[Mesh] )
'Web-based intervention' OR 'technology intervention' OR 'internet intervention' OR 'telehealth intervention' OR 'telecare' OR 'telehealth' OR 'tele-dermatology' OR 'teleradiology' OR 'tele-education' OR 'e-health' OR 'tele-medicine' OR 'tele-mental'	"Telemedicine"[Mesh] AND "Telerehabilitation"[Mesh]
'Pain control' OR 'numbing' OR 'analgesia' OR 'pain killing' OR 'pain relief' OR 'pain control' OR 'pain therapy' OR 'opiate' OR 'morphine' OR 'anesthesia'	"Acute Pain"[Mesh] AND "Pain Management"[Mesh] AND "Breakthrough Pain"[Mesh] AND "Musculoskeletal Pain"[Mesh] AND "Chronic Pain"[Mesh] AND "Visceral Pain"[Mesh] AND "Nociceptive Pain"[Mesh] AND "Eye Pain"[Mesh] AND "Pain, Referred"[Mesh] AND "Flank Pain"[Mesh] AND "Shoulder Pain"[Mesh] AND "Complex Regional Pain Syndromes"[Mesh] AND "Pelvic Pain"[Mesh] AND "Neck Pain"[Mesh] AND "Low Back Pain"[Mesh] AND "Abdominal Pain"[Mesh] AND "Facial Pain"[Mesh] AND "Chest Pain"[Mesh] AND "Back Pain"[Mesh] AND "Pain, Procedural"[Mesh] AND "Cancer Pain"[Mesh] AND "Pain"[Mesh]
'Challenges OR 'limitations' OR 'barriers' OR 'issues' OR 'concerns' OR 'control' OR 'restriction' OR 'control'	Not applicable.

**Table III: Inclusion and exclusion criteria used in the review**

Inclusion criteria	Exclusion criteria
Patient with any type of cancer Studies involved cancer pain only Peer reviewed conference proceedings, journal, or preprints Papers Written in English Papers translated to English Any article published between 2012 and 2022	Animal test subject Patient who underwent nerve ablation procedure. Not peer reviewed articles Articles in any language other than English

agreed upon before the review. There was no pre-registration or publication of the research protocol.

Both PubMed and EBSCO were searched for relevant articles. To construct a search syntax, we employed the Population, Intervention, Control, and Outcome (PICO) framework. The PICO concept was used in a search query to focus on current questions in a clinical setting.<sup>9</sup> The PICO framework was used to choose keywords for this study (Table I).

The keywords and MeSH terms were used to search PubMed for articles for this systemic review based on the PICO concept (Table II). Whereas, the EBSCO search solely utilised free keywords.

#### Selection of studies

A set of inclusion and exclusion criteria were utilized in this review (Table III). Due to our review's emphasis on peer-reviewed publications in academic journals, the grey literature was left out. English-language publications with publication dates between 2012 and 2022 comprised the articles chosen from these databases.

#### Data extraction, synthesis and analysis

There were three phases to the screening process with peer reviewing. Three reviewers independently screened the titles and abstracts of all publications identified by the search during the first stage, and the results were compared. To decide whether a certain publication should be included, differences were discussed.

The full texts of publications identified as relevant in the first phase were reviewed by three reviewers during the second screening phase, and differences were discussed. The authors of several of the articles in the publications that were screened were contacted to obtain the full version of their works because they weren't readily available. Some authors sent us their full papers in response to our request.

The reference lists of the articles chosen in the second phase were reviewed during the third screening phase to determine if any relevant publications had been missed. The same inclusion and exclusion criteria were used for all three screening steps (Figure 1).

In this study, Excel 2019 was used for data extraction. The extraction fields included the study characteristics (year of publication, author, countries which were involved in the study, study design), challenges of telemedicine-based intervention addressed in the study and effect of the challenges of telemedicine-based intervention.

The Excel method is efficient, cost-free, and able to generate clear and comprehensive reports on systematic reviews. It is a credible substitute for the systematic reviews created by cutting-edge software and equipment.<sup>1</sup> After the data extraction, the information was synthesised and presented narratively.

#### Quality assessment

All publications included in the review were assessed for risk of bias qualitatively. The assessment included risk of bias in reporting and evidence selection, as well as risk of bias in the primary study, detection, performance, attrition, and outcome reporting bias. The Cochrane Collaboration Risk of Bias Tool 2.0 for interventional studies and the Newcastle-Ottawa Scale for observational studies are two tool that were used to evaluate the validity and reliability of the studies used in this review paper. A thorough evaluation was performed for each study by four authors of this paper.

## RESULTS

### Study Description

A total of 320 publications were retrieved and then assessed based on our inclusion and exclusion criteria. Of those publications, 27 articles were removed as duplications, and 258 were filtered out as they did not meet the inclusion criteria for this review. There was no automation tool used for exclusion or detection of duplication. Thus, 38 of the 320 articles were accepted for review (Table IV).

### Summary of Evidence

The findings are presented according to year, as we believed the advancement of telehealth in a yearly manner may influence the challenges possessed by it (Table VI).<sup>11</sup> The most reported challenge, regardless of year, was limited or slow Internet access, followed by a lack of technological expertise among the healthcare team and computer literacy (Table VI). An interesting finding from the review was the human resource-related challenges, including reimbursement mechanisms for healthcare providers, concerns regarding malpractice-related issues, longer staff time, and a lack of formal organisational structures (Table VI). In studies conducted after the COVID-19 pandemic (2021 and 2022), data-related deterrents, including data security and data management, were some of the challenges reported (Table VI).

## DISCUSSION

### Main Challenges in Telehealth-Based Cancer Pain Management

The challenges of telehealth-based intervention in cancer

Table IV: Selected article's characteristics

Publication Number	Title	Author	Year of Publication	Type of study	Country	Reference
1.	Supportive Care Interventions for People With Cancer Assisted by Digital Technology: Systematic Review	Michael Marthick, PhD, Deborah McGregor, MHS, Jennifer Alison, PhD, Birinder Cheema, PhD, Haryana Dhillon, PhD, and Tim Shaw, PhD	2021	Systematic Review	Australia	25
2.	Improving health-related quality of life in women with breast, blood, and gynaecological Cancer with an eHealth-enabled 12-week lifestyle intervention: the women's wellness after Cancer program randomised controlled trial	Charllotte Seib, Debra Anderson, Amanda McGuire, Janine Porter-Steele, Nicole McDonald, Sarah Balaam, Diksha Sapkota, and Alexandra L. McCarthy	2022	RCT	Australia	53
3.	Use of home telehealth in palliative cancer care: a case study	Anita Stern†, Ruta Valaitis*, Robin Weir*† and Alejandro R Jadad†1	2012	RCT	Canada	37
4.	The eCALM Trial-eTherapy for cancer applying mindfulness: online mindfulness-based cancer recovery program for underserved individuals living with cancer in Alberta: protocol development for a randomized wait-list controlled clinical trial	Kristin A Zernicke1,2, Tavis S Campbell1,2, Michael Speca1,2,3, Kelley McCabe-Ruff4, Steven Flowers5,6, Dale A Dirkse1,2 and Linda E Carlsson1,2.	2013	RCT	Canada	28
5.	Development of a mHealth RealTime Pain Self-Management App for Adolescents With Cancer: An Iterative Usability Testing Study	Lindsay A. Jibb, PhD, RM1,2, Joseph A. Cafazzo, PhD, PEng2,3, Paul C. Nathan, MD, MSc1,2, Emily Seto, PhD, PEng2,3, Bonnie J. Stevens, PhD, RN1,2, Cynthia Nguyen, MPH1, and Jennifer N. Stinson, PhD, RN-EC1,2	2017	Cohort study	Canada	22
6.	Wearable Respiratory Monitoring and Feedback for Chronic Pain in Adult Survivors of Childhood Cancer: A Feasibility Randomized Controlled Trial From the Childhood Cancer Survivor Study	Nicole M. Alberts, PhD1,2; Wendy M. Leisenring, ScD3; Jessica S. Flynn, MS1; Jillian Whittton, MSc3; Todd M. Gibson, PhD4; Lindsay Jibb, PhD, RN5; Aaron McDonald, PhD1; James Ford, PhD1; Neema Moraveji, PhD6; Blake F. Dear, PhD7; Kevin R. Krull, PhD1; Leslie L. Robison, PhD1; Jennifer N. Stinson, RN, PhD5; and Gregory T. Armstrong, MD, MSCE1	2020	RCT	Canada	45
7.	Nurse-led telehealth interventions for symptom management in patients with cancer receiving systemic or radiation therapy: a systematic review and meta-analysis	Chanel Kwok, Charlena Degen, Narges Moradi, and Dawn Stacey	2022	systematic review	Canada	49
8.	Development of mobile health-based self-management support for patients with lung cancer: A stepwise approach	Xiaosha Ni1,2   Yan Lou1   Wenyi Hu3   Hemei Wang4   Hong Xu1   Shuaini Li5   Yunxian Zhou6   Yisha Ni1	2021	structured interactions	China	50
9.	Efficacy of virtual reality-based interventions for patients with breast cancer symptom and rehabilitation management: a systematic review and meta-analysis	Huayi Zhang, Hui Xu, Zhen-xiang Zhang, and Qiushi Zhang	2022	Sytematic review and Meta-analysis	China	57
10.	Approaches and best practices for managing cancer pain within the constraints of the COVID-19 pandemic in India	A. Damani, A. Ghoshal, N. Salins, S. Bhatnagar, P. Sanghavi, V. Viswanath, S. Ostwal, G. Chinchalkar and N. Vallath	2020	structured interactions	India	16
11.	Management of Cancer Patients in the COVID-19 Crisis Using Telemedicine: A Systematic Review	Fatemeh SALEH1a, Leila MASHHAD1b, Kamran KHAZENIC, Zahra EBRAHIM1d,1	2022	Systematic review	Iran	31
12.	Telerehabilitation and Monitoring Physical Activity in Patient with Breast Cancer: Systematic Review	Leila Keikha 1, Elham Maserat 2, Zeinab Mohammadzadeh	2022	Systematic Review	Iran	23
13.	Satisfaction with Telemedicine for Cancer Pain Management: A Model of Care and Cross-Sectional Patient Satisfaction Study	Marco Cascella 1, Sergio Coluccia 2, Mariacinzia Grizzutti 1, Maria Cristina Romano 1, Gennaro Esposito 1, Anna Crispo 2, * and Arturo Cuomo	2022	cross-sectional study	Italy	40
14.	Providing Supportive and Palliative Care Using Telemedicine for Patients with Advanced Cancer During the COVID-19 Pandemic in Mexico	YANIN CHAVARRI-GUERRA, a WENDY ALICIA RAMOS-LOPEZ, b ALFREDO COVARRUBIAS-GÓMEZ, b SOFÍA SANCHEZ-ROMÁN, c PAULINA QUIROZ-FRIEDMAN, c NATASHA ALCOCER-CASTILLEJOS, c MARIA DEL PILAR MILKE-GARCÍA, d MÓNICA CARRILLO-SOTO, e ANDREA MORALES-ALFARO, f MILDRED MEDINA-PALMA, f JOSÉ CARLOS AGUILAR-VELAZCO, f KAREN MORALES-BARBA, d ANDREA RAZCON-ECHEGARAY, d JENNY MALDONADO, d ENRIQUE SOTO-PÉREZ-DE-CELISf	2020	cohort study	Mexico	

Table IV: Selected article's characteristics

Publication Number	Title	Author	Year of Publication	Type of study	Country	Reference
15.	The effect of weekly specialist palliative care teleconsultations in patients with advanced cancer – a randomized clinical trial	Patrick D. Hoek1*, Henk J. Schers2, Ewald M. Bronkhorst3, Kris C. P. Vissers1 and Jeroen G. J. Hasselaar1	2017	RCT	Netherlands	20
16.	Telehealth system (e-CUIDATE) to improve quality of life in breast cancer survivors: rationale and study protocol for a randomized clinical trial	Noelia Galiano-Castillo1*, Angelica Ariza-García1,2, Irene Cantarero-Villanueva1, Carolina Fernández-Lao1, Lourdes Díaz-Rodríguez3, Marta Legerén-Alvarez4, Carmen Sánchez-Salado5, Rosario Del-Moral-Avila6 and Manuel Arroyo-Morales	2013	RCT Protocol	Spain	17
17.	Telehealth System: A Randomized Controlled Trial Evaluating the Impact of an Internet-Based Exercise Intervention on Quality of Life, Pain, Muscle Strength, and Fatigue in Breast Cancer Survivors	Noelia Galiano-Castillo, PhD1,2; Irene Cantarero-Villanueva, PhD1,2,3; Carolina Fernandez-Lao, PhD 1,2,3; Angelica Ariza-Garcia, MSc2,4; Lourdes Diaz-Rodriguez, PhD1,3,5; Rosario Del-Moral-Avila, MD 6; and Manuel Arroyo-Morales, PhD	2016	RCT	Spain	18
18.	mPalliative Care Link: Examination of a Mobile Solution to Palliative Care Coordination Among Tanzanian Patients With Cancer	Mamsau Ngoma, MD1; Beatrice Mushi, MD2; Robert S. Morse, BS3; Twalib Ngoma, MD2; Habiba Mahuna, RN1; Kaley Lambden, MS4; Erin Quinn, MA4; Sarah B. Sagan, BA4; Yun Xian Ho, PhD4; F. Lee Lucas, PhD5; Joshua Mimarí, BS1; and Susan Miesfeldt, MD5	2021	cross-sectional study	Tanzania	26
19.	How a Digital Case Management Platform Affects Community-Based Palliative Care of Sub-Saharan African Cancer Patients: Clinician-Users' Perspective	Yun Xian Ho, Robert S. Morse, Kaley Lambden, Beatrice P. Mushi, Mamsau Ngoma, Habiba Mahuna, Twalib Ngoma, and Susan Miesfeldt	2022	structured interactions	Tanzania	41
20.	Using information and communication technologies to improve the management of pain from advanced cancer in the community: Qualitative study of the experience of implementation for patients and health professionals in a trial	Julia Hackett University of Leeds, UK; University of York, UK Matthew J Allsop University of Leeds, UK Sally Taylor The Christie NHS Foundation Trust, UK Michael I Bennett Bridgette M Bewick	2020	RCT	UK	19
21.	Telephone interventions for symptom management in adults with cancer (Review)	Ream E. Hughes AE, Cox A, Skarparis K, Richardson A, Pedersen VH, Wiseman T, Forbes A, Bryant A	2020	Literature review	USA	36
22.	A Randomized Trial of Weekly Symptom Telemonitoring in Advanced Lung Cancer	Susan E. Yount, PhD, Nan Rothrock, PhD, Michael Bass, MS, Jennifer L. Beaumont, MS, Deborah Pach, RN, MSN, Thomas Lad, MD, Jyoti Patel, MD, Maria Corona, BA, Rebecca Weiland, BA, Katherine Del Ciello, MSW, and David Cella, PhD	2013	RCT	USA	56
23.	Automated Pain Intervention for Underserved Minority Women With Breast Cancer	Karen O. Anderson, PhD, MPH1; Guadalupe R. Palos, DrPH, LMSW, RN2; Tito R. Mendoza, PhD1; Charles S. Cleeland, PhD1; Kai-Ping Liao, PhD, MHA3; Michael J. Fisch, MD, MPH4; Araceli Garcia-Gonzalez, MD, DSc1; Alyssa G. Rieber, MD4; L. Arlene Nazario, MD4; Vicente Valero, MD5; Karin M. Hahn, MD, MPH6; Cheryl L. Person, MD7; and Richard Payne, MD8	2014	RCT	USA	46
24.	The electronic self report assessment and intervention for cancer: promoting patient verbal reporting of symptom and quality of life issues in a randomized controlled trial	Donna L Berry1,2*, Fangxin Hong3, Barbara Halpenny2, Anne Partridge4, Erica Fox2, Jesse R Fann5,6, Seth Wolpin1, William B Lober1, Nigel Bush7, Upendra Parvathaneni8, Dagmar Amtmann9 and Rosemary Ford6	2014	RCT	USA	47
25.	Web-Based Symptom Management for Women With Recurrent Ovarian Cancer: A Pilot Randomized Controlled Trial of the WRITE Symptoms Intervention	Heidi S. Donovan, PhD, RN, Sandra E. Ward, PhD, RN, FAAN, Susan M. Sereika, PhD, Judith E. Knapp, PhD, LCSW, Paula R. Sherwood, PhD, RN, CNRM, FAAN, Catherine M. Bender, PhD, RN, FAAN, Robert P. Edwards, MD, Margaret Fields, MSN, RN, and Renee Ingel, MSN, RN	2014	RCT	USA	34
26.	Web-Based Collaborative Care Intervention to Manage Cancer-Related Symptoms in the Palliative Care Setting	Jennifer L. Steel, PhD1,2,3; David A. Geller, MD2; Kevin H. Kim, PhD2; Lisa H. Butterfield, PhD5; Michael Spring, PhD6; Jonathan Grady, PhD6; Weing Sun, MD7; Wallis Marsh, MD2; Michael Antoni, PhD8; Mary Amanda Dew, PhD4; Vicki Heigesson, PhD9; Richard Schulz, PhD3; and Allan Tsung, MD2	2015	RCT	USA	54
27.	Trajectories of change during a randomized controlled trial of internet-delivered psychological treatment for adolescent chronic pain: how does change in pain and function relate?	Tonya M. Palermo,a,b,*; Emily F. Lawa,b, Chuan Zhoua,b, Amy Lewandowski Holley,c, Deirdre Logand, Gabrielle Tai Tamara J. Somers, PhD, Amy P. Abernethy, MD, PhD, Sara N. Edmond, MA, Sarah A. Kelleher, PhD, Anava A. Wren, MA, Greg P. Samsa, PhD, and Francis J. Keefe, PhD	2015	RCT	USA	51

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Publication Number	Title	Author	Year of Publication	Type of study	Country	Reference
28.	A Pilot Study of a Mobile Health Pain Coping Skills Training Protocol for Patients With Persistent Cancer Pain	Tamara J. Somers, PhD, Amy P. Abernethy, MD, PhD, Sara N. Edmond, MA, Sarah A. Kelleher, PhD, Anava A. Wren, MA, Greg P. Samsa, PhD, and Francis J. Keefe, PhD	2015	RCT	USA	27
29.	The Effect of Technology-Based Interventions on Pain, Depression, and Quality of Life in Patients With Cancer: A Systematic Review of Randomized Controlled Trials	Stephen O Agboola, MD, MPH, Woong Ju, MD, PhD, MPH, Aymen Elfiky, MA, MD, MPH, Joseph C Kvedar, MD, and Kamal Jethwani, MD	2015	Systematic review	USA	44
30.	Internet-delivered cognitive-behavioral treatment for adolescents with chronic pain and their parents: a randomized controlled multicenter trial	Tonya M. Palermo, b, * Emily F. Lawa, b, Jessica Falesc, Maggie H. Bromberg, Tricia Jessen-Fiddick, b, Gabrielle Taib	2016	RCT	USA	52
31.	The rationale, design, and methods of a randomized, controlled trial to evaluate the effectiveness of collaborative telecare in preserving function among patients with late stage cancer and hematologic conditions	Andrea L. Cheville, Timothy Moynihan, Jeffrey R. Basford, John A. Nyman, Marty L. Tuma, Debra A. Macken, Terry Therneau, Daniel Satelei, Kurt Kroenke	2017	RCT	USA	14
32.	Challenges in a Technology-Based Cancer Pain Management Program Among Asian American Breast Cancer Survivors	Eun-Ok Im, PhD, MPH, FAAN, Xiaopeng Ji, PhD, Sangmi Kim, PhD, Eunice Chee, BSE, Ting Bao, MD, DABMA, MS, Jun J. Mao, MD, MSCE, Wonshik Chee, PhD	2018	Cohort study	USA	21
33.	Effect of Collaborative Telerehabilitation on Functional Impairment and Pain Among Patients With Advanced-Stage Cancer A Randomized Clinical Trial	Andrea L. Cheville, MD, MSCE; Timothy Moynihan, MD; Jeph Herrin, PhD; Charles Loprinzi, MD; Kurt Kroenke, MD	2019	RCT	USA	15
34.	"My Surgical Success": Effect of a Digital Behavioral Pain Medicine Intervention on Time to Opioid Cessation After Breast Cancer Surgery—A Pilot Randomized Controlled Clinical Trial	Beth D. Darnall, PhD, * Maisa S. Ziadni, PhD, * Parthasarathy Krishnamurthy, PhD, † Pamela Flood, MD * Lauren Heathcote, PhD, * Ian G. Mackey, * Chloe Jean Taub, MA, ‡ and Amanda Wheeler, MD§	2019	RCT	USA	58
35.	Cost-effectiveness of the Collaborative Care to Preserve Performance in Cancer (COPE) trial tele-rehabilitation interventions for patients with advanced cancers	Colleen F. Longacre   John A. Nyman   Sue L. Visscher   Bijan J. Borah   Andrea L. Cheville	2019	RCT	USA	35
36.	A Stepped-Wedge Randomized Controlled Trial: Effects of eHealth Interventions for Pain Control among Adults with Cancer in Hospice	Wilkie DJ, Yao Y, Ezenwa MO, Suarez ML, Dyal BW, Gill A, Hipp T, Shea R, Miller J, Frank K, Nardi N, Murray M, Glendenning J, Perez J, Carrasco JD, Shuey D, Angulo V, McCurry T, Martin J, Butler A, Wang ZJ, Molokie RE	2019	RCT	USA	55
37.	A pilot study of the preliminary efficacy of Pain Buddy: A novel intervention for the management of children's cancer-related pain	John F. Hunter   Amanda M. Acevedo   Sergio Gago-Masague   Alexandra Kain   Christine Yun   Lilibeth Torno   Brooke N. Jenkins   Michelle A. Fortier	2020	RCT	USA	48
38.	Behavioral cancer pain intervention using videoconferencing and a mobile application for medically underserved patients: Rationale, design, and methods of a prospective multisite randomized controlled trial	Sarah A. Kelleher a, Joseph G. Winger a, Hannah M. Fisher a, Shannon N. Miller a, Shelby D. Reed b,c, Beverly E. Thorn d, Bonnie Spring e, Gregory P. Samsa f,g, Catherine M. Majestic a, Rebecca A. Shelby a, Linda M. Sutton h, Francis J. Keefe a, Tamara J. Somers a, *	2021	RCT	USA	24

**Table V: General description of the 38 publications included in the review**

Classification category	Subcategories	N (%)*	Reference
Country of research	Australia	5.26	1,2
	Canada	13.16	3-7
	China	5.26	8,9
	India	2.63	10
	Iran	5.26	11,12
	Italy	2.63	13
	Mexico	2.63	14
	Netherland	2.63	15
	Spain	5.26	16,17
	Tanzania	5.26	18,19
	United Kingdom (UK)	2.63	20
	United States of America (USA)	47.37	21-38
Research approach	Cohort	7.89	3, 14,22
	Cross-sectional	5.26	13,18
	Literature review	2.63	21
	Randomised clinical trial (RCT)	57.89	1,4,5,6,15,16,20,23,24,25,26,27,28,29,30,31,32,33,34,35,36,37
	Protocol of RCT	2.63	17
	Structured interaction	7.89	8,10,19
Year of publication	Systematic review	15.79	2,7,9,11,12,39
	2012	2.63	3
	2013	7.89	4,16,23
	2014	7.89	23,24,25
	2015	10.53	26,27,28,29
	2016	5.26	17,30
	2017	7.89	5,15,31
	2018	2.63	32
	2019	10.53	33,34,35,36
	2020	15.79	6,10,14,20,21,37
2021	10.53	1,8,18,38	
2022	18.42	2,7,9,13,14,15,19	

\* percentages show the share of the total publications reviewed.

pain management were explored in this review. Regardless of the year, slow or limited Internet access, a lack of technological know-how among the healthcare team, and computer literacy were the most frequently reported.<sup>12-28</sup> A study in 2020 also elucidated a similar finding, and the researchers believed access to the Internet was critical for successful telehealth implementation.<sup>29</sup> Poor connections to networks and slow Internet connections adversely impact communication between healthcare workers and patients during telehealth consults. If the Internet connection is slow, it will also be challenging to perform a visual examination, which requires higher-resolution imaging and may create a space for medical error or misdiagnosis.<sup>30</sup>

**Technological and Computer Literacy Barriers**

‘Lack of technological expertise among healthcare teams’ was a challenge noticed in 2018, 2020, 2021, and 2022.<sup>19,21,23,25,31</sup> This finding is consistent with a study conducted in 2022, which indicated that any novel technology’s efficacy and future development are significantly impacted by factors including user awareness and comprehension of the concept, implementation skills, and a work setting that fosters technology adoption.<sup>32</sup> Clinicians’ inadequate understanding of telemedicine appears to have shaped how they perceive the technology. Consequently, giving healthcare workers additional knowledge about new innovations, like telemedicine, can aid in getting a more accurate depiction of their perspectives.<sup>12</sup>

In 2013, 2016, 2017, and 2019, the common challenge was ‘computer literacy’.<sup>14,18,22,28</sup> A Philippine study found that after completing computer literacy training, their participants had a positive attitude towards computers and the internet. Their comfort with using a computer and their favourable opinion of the advantages of the internet largely influenced their behavioural intention to use telehealth. These results demonstrate the significance of computer literacy training as a crucial element of an effective telehealth programme.<sup>33</sup> Patients can efficiently learn how to utilise computers and the internet via proper computer literacy training, and they can also comprehend how important it is to support their interests in using telehealth.

**Human Resource and Reimbursement Issues**

Another food for thought that emerged from the review was the human resource-related challenges that involve telehealth. This includes reimbursement mechanisms for healthcare providers, concerns regarding malpractice-related issues, longer staff time, and a lack of formal organisational structures.<sup>13,14,18,31,34,35,36,37</sup> Among these, \*\*reimbursement mechanisms for healthcare providers were recorded in most of the years (2019, 2020, and 2022).<sup>31,35,36</sup> Despite evidence from earlier studies elucidating that clinicians were generally in support of its utilisation, it would be challenging for them to afford to deliver the service without payment.<sup>38</sup> Payment rates should also be in line with the cost of the service to prevent paying too much if physicians can deliver more visits per session using telehealth. To prevent unintentionally

**Table VI: Major challenge of telehealth-based intervention in cancer pain management identified in this review**

Year	Types of challenges	References
2012	<ul style="list-style-type: none"> <li>• Large variances between care delivery systems and a lack of standardization in home telehealth devices.</li> <li>• Questionable role of remote monitoring of vital signs.</li> <li>• Difficulty in operating the software/ app leads to frustration among patients.</li> </ul>	37
2013	<ul style="list-style-type: none"> <li>• Limited or slow Internet access.</li> <li>• Computer-illiteracy.</li> <li>• Excessive time needed for tele-consultation represents an overwhelming burden for some who are struggling to cope with advanced stage of cancer.</li> </ul>	17,18,56
2014	<ul style="list-style-type: none"> <li>• Contacting the patient for feedback and follow up was often a challenge.</li> <li>• Patients' complaint of "symptoms and quality-of-life" issues.</li> <li>• It took significantly longer than anticipated for participants to complete the consultation session with physician.</li> </ul>	34,46,47
2015	<ul style="list-style-type: none"> <li>• Patients showed only small improvements over the treatment period.</li> <li>• The routine utilization of telehealth is limited by persistent patient access barrier.</li> </ul>	27,44,51,54
2016	<ul style="list-style-type: none"> <li>• Longer staff time required.</li> <li>• Limited or slow Internet access.</li> <li>• Computer-illiteracy.</li> </ul>	18,52
2017	<ul style="list-style-type: none"> <li>• Excessive number of steps required to complete a function in telehealth-based intervention.</li> <li>• Difficulty in operating the software/ app leads to frustration among patients.</li> <li>• The constrained screen size of smartphones diminishes the capacity of patient to interact with the device.</li> <li>• High workload and burnout detected among healthcare workers.</li> <li>• Computer-illiteracy.</li> </ul>	14,20,22
2018	<ul style="list-style-type: none"> <li>• Lack of technological expertise among healthcare team.</li> <li>• Limited or slow Internet access</li> </ul>	21
2019	<ul style="list-style-type: none"> <li>• Lack of delivery models that match patients' challenges and needs.</li> <li>• Reduced engagement of patient due to time burden involved in telehealth intervention.</li> <li>• Patients receiving hospice care may be too ill to benefit from and utilize of telehealth intervention.</li> <li>• Reimbursement mechanisms for healthcare providers.</li> <li>• Computer-illiteracy</li> </ul>	15,35,55,58
2020	<ul style="list-style-type: none"> <li>• Questionable role of remote monitoring of vital signs.</li> <li>• Challenges multidisciplinary pain management.</li> <li>• Ethical challenges.</li> <li>• Policy issues.</li> <li>• Concerns regarding malpractice-related issues.</li> <li>• Lack of formal organizational structures.</li> <li>• Reimbursement mechanisms for healthcare providers.</li> <li>• Lack of technological expertise among healthcare team.</li> <li>• Poor interest from health care workers.</li> <li>• Social/cultural challenge.</li> <li>• Privacy issues.</li> <li>• Limited or slow Internet access.</li> <li>• Longer staff time required.</li> <li>• Difficult to motivate patients to adopt behaviour change.</li> </ul>	13,16,19,36,45,48
2021	<ul style="list-style-type: none"> <li>• Limited or slow Internet access.</li> <li>• Lack of technological expertise among healthcare team.</li> <li>• Reduced engagement of patient due to time burden involved in telehealth intervention.</li> <li>• Data security.</li> <li>• Display of content in software/app lacks attractiveness.</li> <li>• Lack of electricity.</li> <li>• Limited availability and expense of maintaining a professional workforce to deliver telehealth.</li> </ul>	24,25,26,50
2022	<ul style="list-style-type: none"> <li>• Concerns regarding malpractice-related issues.</li> <li>• Lack of formal organizational structures.</li> <li>• Reimbursement mechanisms for healthcare providers.</li> <li>• Lack of technological expertise among healthcare team.</li> <li>• Poor interest from health care workers.</li> <li>• Social/cultural challenge.</li> <li>• Prescription issue.</li> <li>• The complexity of the technology used.</li> <li>• Data management challenges.</li> <li>• Large variances between care delivery systems and a lack of standardization in home telehealth devices.</li> <li>• High workload and burnout detected among healthcare workers.</li> </ul>	23,31,40,41,49,53,57

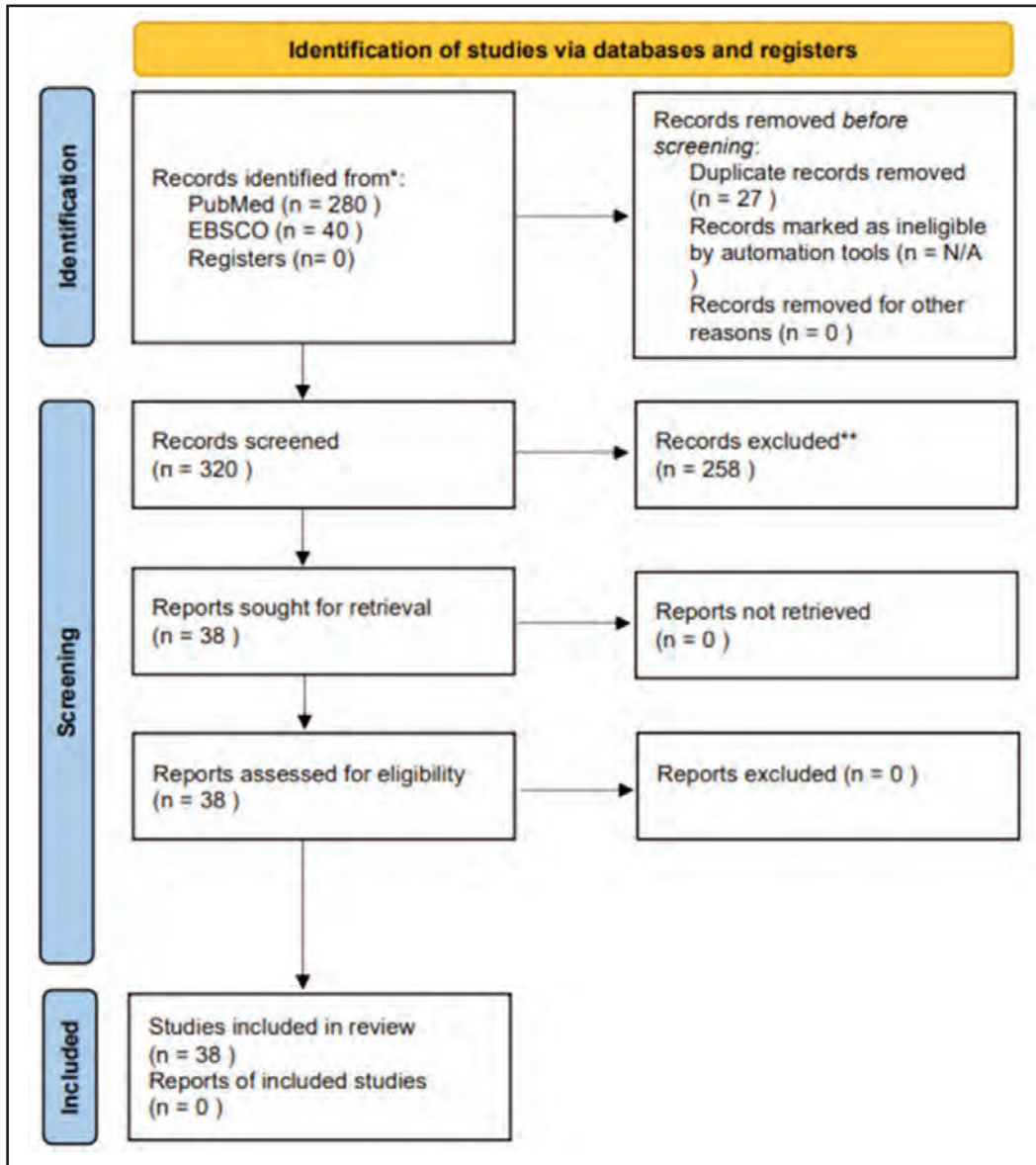


Fig. 1: Prisma flowchart diagram of the screening process

encouraging the use of telehealth interactions, the idea of payment equality is emerging. This payment parity is an important step because some clinics have made a significant change, raising the percentage of telehealth consultations from 10% prior to the pandemic to more than 90% during the pandemic.<sup>39</sup> After the pandemic, regulatory reform dictating payment parity will need to be maintained, and proper reimbursement for telemedicine will be a key element in ensuring widespread usage. Without these adjustments to reimbursement, fewer physical clinical visits may force some small practices, particularly those in rural regions, to run into financial difficulties.

**Data Security and Privacy Concerns**

Another interesting finding that was noticed in studies that were conducted after the COVID-19 pandemic (2021 and 2022) was data-related deterrents, including data security and data management.<sup>25,40,41</sup> To protect patients and increase public trust, a comprehensive policy framework is required to secure the privacy and security of data gathered by telehealth

technologies. Lack of limits or controls on the collection, use, and disclosure of sensitive personal data is one of the privacy concerns of telehealth. Specifying the types of security threats that telehealth systems should be protected against is necessary when describing the security risks and suitable security controls.<sup>42</sup> There are several technical safeguards that can guard against these security threats. By using complex mathematics and encryption keys to electronically lock data, data encryption can assure that even if an attacker obtains access to the raw data, the data will be useless.<sup>43</sup>

**Limitations of the Review**

There are a few limitations in our review. The relative scarcity of studies from certain years, particularly 2012, 2016, and 2018, may limit the accuracy of estimating the magnitude of the problem during those periods. Selection bias was a key limitation, as the reviewed studies did not consistently account for patients with different cancer types and stages.<sup>44</sup>

Additionally, our review was restricted to English-language publications and studies indexed in a limited number of academic databases. This linguistic restriction may have led to the exclusion of relevant studies published in other languages, particularly those from non-English-speaking regions where telehealth adoption may differ. Consequently, this could have introduced a geographical bias and limited the generalizability of our findings. Future research should aim for a more inclusive approach by incorporating studies in multiple languages and broadening the database search strategy.

Another potential source of bias stems from the process of data extraction and study evaluation, which was primarily conducted by a single researcher. Although we mitigated this bias to some extent through verification by a second and third researcher, the risk of subjective interpretation remains. Despite our efforts to apply a rigorous and comprehensive search strategy, it is possible that some relevant studies were inadvertently overlooked, particularly those under consideration for publication or indexed in other databases.

## CONCLUSION

The use of telehealth in clinical settings for managing chronic medical conditions, including cancer pain, is expanding rapidly, particularly in the wake of the COVID-19 pandemic. While this technology presents opportunities, its adoption remains hindered by multiple challenges. As telehealth continues to evolve, healthcare providers, researchers, and policymakers must consider strategies to optimize its implementation. To enhance telehealth adoption and overcome existing barriers, we recommend that healthcare policymakers establish clear guidelines and regulations to standardize telehealth-based interventions for cancer pain management. This includes addressing legal concerns, ensuring data security, and developing reimbursement models that incentivize telehealth services without imposing financial burdens on providers. Furthermore, efforts should be made to integrate telehealth training into healthcare education programs to improve technological literacy among medical professionals.

Telehealth developers should tailor their technologies to the specific needs and capacities of different populations, considering factors such as infrastructure limitations and digital literacy. The insights from this analysis can guide the design of more accessible and effective telehealth solutions. By proactively addressing these challenges, telehealth has the potential to significantly improve cancer pain management and patient outcomes. We hope that the findings from this review will contribute to shaping future research and policy discussions, ensuring that telehealth interventions are both effective and sustainable.

## CONFLICT OF INTEREST

The authors have no conflicts of interest.

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Not relevant since this is a systematic review.

## REGISTRATION OF PROTOCOL

This protocol was not registered.

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