

Telehealth in patient care by advanced practice nurses: a systematic review

Telessaúde na assistência ao paciente por enfermeiros de prática avançada: revisão sistemática
Salud digital en la atención a pacientes por enfermeros de práctica avanzada: revisión sistemática

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Abstract

Objective: To analyze the results of application of telehealth in patient care by advanced practice nurses.

Methods: This is a systematic review of intervention studies, in accordance with recommendations from the JBI and the Preferred Reporting Items for Systematic Reviews and Meta-Analyses. The search was conducted on August 23, 2023, using the descriptors “telemedicine”, “nurse practitioner”, “patient care” and related keywords. Seven databases were accessed, such as LILACS, PubMed®, CINAHL, Embase, Scopus, Cochrane Database of Systematic Reviews and Web of Science Core Collection. Clinical trials, randomized or not, pre-post testing or before and after studies, without restrictions on publication date or language, that answered the question/PICO “What is the result of the application of telehealth carried out by advanced practice nurses in patient care?”, were included. An analysis of methodological quality was carried out, only studies of moderate and high methodological quality were included, and it was not possible to perform a meta-analysis.

Results: A total of 15 articles were selected, with a population of adult patients, older adults and family members of children with chronic diseases. Interventions involved phone calls, combinations of different devices or programs for education, monitoring or counseling. In 12 studies, positive effects were identified for the primary outcomes: costs; self-management of care, caregiver satisfaction with health management; quality of life, comfort, adaptation to treatment, functional recovery, clinical indicators and vital signs.

Conclusion: The positive effects of using telehealth to obtain clinical data and care management and its safe use, evidenced in the present study, allow us to recommend it.

Resumo

Objetivo: Analisar os resultados da aplicação de telessaúde na assistência ao paciente por enfermeiros de prática avançada.

Métodos: Revisão sistemática de estudos de intervenção, conforme recomendações do *Joanna Briggs Institute I* e do *Preferred Reporting Items for Systematic Reviews and Meta-Analyses*. A busca foi conduzida em 23 de agosto de 2023, utilizando os descritores “telemedicina”, “nurse practitioner”, “patient care” e as palavras-chaves correlatas. Foram acessadas sete bases de dados: LILACS, PubMed®, Cinahl, Embase, Scopus, Cochrane Database of Systematic Reviews e *Web of Science Core Collection*. Foram incluídos ensaios clínicos, randomizados ou não; estudos pré-pós testes ou tipo antes e depois, sem restrição de data de publicação ou idioma, que responderam à questão/PICO “Qual o resultado da aplicação da telessaúde realizada por enfermeiros de prática avançada na assistência ao paciente?” Foi realizada a análise da qualidade metodológica, tendo sido incluídos apenas os estudos de moderada e de alta qualidade metodológica; não foi possível realizar metanálise.

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Conflicts of interest: nothing to declare.

Resultados: Foram selecionados 15 artigos, com população de pacientes adultos, idosos e familiares de crianças com doenças crônicas. As intervenções envolveram telefonemas, combinações de diferentes dispositivos ou programas para educação, monitoramento ou aconselhamentos. Foram identificados, em 12 estudos, efeitos positivos para os desfechos primários: custos; autogestão do cuidado, satisfação do cuidador com gestão da saúde; qualidade de vida, conforto, adaptação ao tratamento, recuperação funcional, indicadores clínicos e sinais vitais.

Conclusão: Os efeitos positivos do emprego da telessaúde para obtenção de dados clínicos e gestão do cuidado e seu uso seguro, evidenciados no presente estudo, permitem recomendá-la.

Resumen

Objetivo: Analizar los resultados de la aplicación de la salud digital en la atención a pacientes por enfermeros de práctica avanzada.

Métodos: Revisión sistemática de estudios de intervención, de acuerdo con las recomendaciones del *Joanna Briggs Institute* I y del *Preferred Reporting Items for Systematic Reviews and Meta-Analyses*. La búsqueda se llevó a cabo el 23 de agosto de 2023, utilizando los descriptores “telemedicine”, “nurse practitioner”, “patient care” y palabras clave relacionadas. Se consultaron siete bases de datos: Lilacs, PubMed®, Cinahl, Embase, Scopus, Cochrane Database of Systematic Reviews y *Web of Science Core Collection*. Se incluyeron ensayos clínicos, aleatorizados o no aleatorizados, estudios prepruebas y pospruebas o del tipo antes y después, sin restricción de fecha de publicación ni idioma, que respondieran la pregunta/PICO “¿Cuál es el resultado de la aplicación de salud digital realizada por enfermeros de práctica avanzada en la atención a pacientes?” Se realizó el análisis de la calidad metodológica y se incluyeron solo los estudios de calidad metodológica moderada y alta; no fue posible realizar metanálisis.

Resultados: Se seleccionaron 15 artículos, con población de pacientes adultos, adultos mayores y familiares de niños y niñas con enfermedades crónicas. Las intervenciones incluyeron llamadas telefónicas, combinaciones de diferentes dispositivos o programas para educación, monitoreo o asesoramiento. En 12 estudios, se identificaron efectos positivos en los resultados primarios: costos, autogestión del cuidado, satisfacción del cuidador con manejo de la salud, calidad de vida, bienestar, adaptación al tratamiento, recuperación funcional, indicadores clínicos y signos vitales.

Conclusión: Es posible recomendar la aplicación de la salud digital gracias a los efectos positivos de obtención de datos clínicos y manejo del cuidado y su uso seguro, observados en el presente estudio.

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Introduction

Telehealth encompasses a broad scope involving telemedicine, telenursing and e-Health and encompasses not only medical services but also remote and non-clinical healthcare services such as healthcare professional training and synchronous healthcare meetings and asynchronous.^(1,2)

Telehealth and telemedicine have been used in a similar way, although telehealth, within the scope of the e-Health strategy, refers to the expansion and improvement of services, with the help of information and communication technologies.⁽³⁾ Telemedicine, in turn, refers to the provision of healthcare services in which distance is a critical factor, involving all healthcare professionals who use information and communication technologies for the exchange of reliable information in the context of diagnosis, treatment and prevention of diseases and injuries, as well as for research, assessment and continuing education activities of healthcare professionals.⁽⁴⁾ Telenursing is considered an activity that uses information and communication technology to perform remote assessment and provide consultation, education and health guidance.^(5,6) Given

the varied use of the aforementioned terms,⁽⁷⁾ in this study, the one with the greatest scope will be considered, i.e., telehealth.

The World Health Organization (WHO), healthcare institutions and systems, and researchers are directing their efforts to integrate and expand the use of telehealth in different contexts and situations, driven by the health situation of the coronavirus disease 2019 (COVID-19) pandemic, which occurred between 2020 and 2022, in which technology was extensively adopted to provide real-time healthcare services and act as a complement to traditional care.^(3,8)

Despite the high demand for remote services, there are still challenges to be overcome, and this technology can improve access to healthcare, healthcare standards and efficiency in healthcare delivery, with just small improvements.⁽⁹⁾ It can also favor the provision of equitable and high-quality care to disadvantaged communities with limited resources, especially when prioritizing the building of trust and relationships, overcoming existing barriers in vulnerable contexts.^(10,11)

While telehealth is an accepted mode of delivering healthcare services, the rules, regulations, and

reimbursement that govern it remain constantly changing.⁽¹²⁾ However, recent studies point to positive results from telehealth in several areas, especially when used for communication, counseling or monitoring chronic conditions. However, authors point out the need for studies focused on implementation and practice-based research.⁽¹³⁾

Equally positive were the results of an Australian study that assessed 38 meta-analyses, from medical or multidisciplinary areas, which showed that telehealth is at least as effective as usual care.⁽¹⁴⁾ The outcomes assessed are discipline-specific, and there is a need for more clinical effectiveness studies involving telehealth.

In this systematic review, we are interested in identifying results inherent to remote healthcare services capable of promoting individuals' and their communities' health. Among healthcare professionals who use information and communication technologies to exchange information in the context of diagnosis, treatment and prevention of diseases and injuries, which are central aspects of telemedicine, we chose advanced practice nurses.

This choice is relevant given that advanced practice nurses are professionals whose practice positively impacts outcomes in individuals, families and communities. In international literature, several denominations are found, and all are associated with training requirements, the scope of practice developed and the local legislation that governs such professionals.^(12,15)

In Brazil, there is no term "advanced practice nurse", and specialist clinical nurses are the professionals closest to those who perform advanced practice roles in other countries. It is worth remembering that the Telehealth Program, created in 2007, aimed at improving care, especially in Primary Care, was expanded in 2011, with teleconsultations, teleradiology and tele-education among its focuses.⁽¹⁶⁾ The digital health strategies proposed for the period between 2020 and 2028 bring consistent actions to strengthen telehealth and possibilities for nurses to take a leading role in this area, especially considering the regulation of nursing activities in digital health, through the Federal Nursing Council Resolution 696 of May 17, 2022 and its updates.⁽¹⁷⁾ Furthermore, the success of telehealth implemented

by nurses in national settings for some years now, as well as its intensification during the COVID-19 pandemic period, can be seen, as learned in a reflection on Brazilian nursing practice, among others.⁽¹⁸⁾

As an emerging modality of healthcare delivery, telehealth presents a wide scope for exploration by advanced practice nurses. Therefore, this systematic review aimed to analyze the results of the application of telehealth in patient care by advanced practice nurses.

Methods

The proposed systematic review was conducted in accordance with JBI for systematic reviews of efficacy evidence recommendations.⁽¹⁹⁾ The report adopted includes the Preferred Reporting Items for Systematic Reviews and Meta-Analyses PRISMA Checklist recommendations.⁽²⁰⁾

Selection criteria

The following selection criteria were used, following the PICO strategy: Participants – patients, regardless of age, under the care of advanced practice nurses; Intervention – telehealth (synchronous, asynchronous, remote patient monitoring or use of mobile devices); Comparison – placebo, standard care, other therapy or no treatment; Outcomes – clinical outcomes, patient satisfaction, efficiency of care, improved access to care, quality of care, patient safety, impact on treatment adherence, psychosocial outcomes, self-care outcomes or health education outcomes.⁽²¹⁾ The following research question was developed: What is the result of application of telehealth carried out by advanced practice nurses in patient care?

Search strategy

The review used a comprehensive search strategy. Initially, a search limited to MEDLINE® (PubMed) and the Cumulative Index to Nursing and Allied Health Literature (CINAHL) (Ebsco) was performed on August 7, 2023 to identify relevant keywords and index terms in retrieved articles. Subsequently, text words contained in the titles and

abstracts of relevant articles and indexed terms used to describe the articles were identified. The search test at this stage was conducted in the PubMed® and Latin American and Caribbean Literature in Health Sciences (LILACS) databases.

The definitive search was carried out on August 23, 2023 in LILACS, PubMed®, CINAHL, Embase, Scopus, Cochrane Database of Systematic Reviews and Web of Science Core Collection. Finally, the reference lists of the articles included in this review were independently checked by two reviewers.

The following descriptors and terms in international databases were used in the search equation: (“telehealth” OR “telemedicine” OR “telecare” OR “tele-nursing” OR “Remote Patient Monitoring” OR “Mobile Devices”) AND (“advanced practice nurse” OR “advanced practice registered nurse” OR “nurse practitioner” OR “clinical nurse specialist”) AND (“patient outcomes” OR “patient care” OR “healthcare quality” OR “clinical outcomes” OR Outcome OR “Care Efficiency” OR “Patient Satisfaction”).

Randomized controlled trials, clinical trials without authentic randomization, quasi-experimental studies, pre- and post-test studies, or before-and-after studies, without restrictions on language or time period, were included.

Studies that employed mixed or substantially different methods, qualitative studies, guidelines, randomized controlled trial protocols, feasibility studies, or pilot studies, and those in which the use of telehealth reported only obtaining or providing general information such as appointments or personal data or internet program usability assessment, were excluded. The full texts of three studies cannot be accessed online, through interlibrary loans, online portal (ResearchGate) or directly with the corresponding author.

The identified citations were imported into EndNote software (Clarivate Analytics, PA, United States), where duplicates were removed; then, they were exported to the Rayyan application (Rayyan Systems Inc, Cambridge, MA, United States), used to select studies.^(22,23) A pilot test of screening titles and abstracts was carried out, which proved to be adequate to achieve the purposes of the study.

Subsequently, the full texts of the studies were independently examined by two reviewers against eligibility criteria, with disagreements mediated by a third reviewer.

Although the tools adopted do not have a scoring system, the literature indicates that a greater number of questions answered positively in the items provided for in quality analysis instruments reflects a higher quality of the study.⁽²⁴⁾ In the present systematic review, studies were accepted that achieved at least 50% positive responses in the JBI checklists items for analysis of methodological quality for critical assessment of experimental and quasi-experimental studies.⁽¹⁹⁾ They were considered of moderate quality if 50% to 70% of responses to instrument items were “yes” and high quality if more than 70% of responses to items were “yes”.

For data extraction, the JBI recommendations were considered.⁽²⁵⁾ The following information from each article is included in this systematic review: study, population and sample characteristics; objectives; outcomes (primary and secondary) such as clinical results, patient satisfaction, perceived benefits, adherence rates, differences in rehospitalization rates or follow-up visits, most common challenges or barriers, financial impact on patients or dynamics of nurse-patient relationship and quality of life; and methodological quality. The information is summarized in a narrative form.

It was not possible to perform a meta-analysis, as studies considered sufficiently similar, from a clinical and methodological point of view, in different samples were not identified (Chart 1).

Results

A total of 1,924 records were identified. After removing duplicates and applying the eligibility criteria, the sample resulted in 15 studies (Figure 1).

In this systematic review, the studies were published between 2004 and 2022 in English, predominantly in the United States (n=7), as randomized clinical trials (n=13). Regarding the samples, three studies^(26,35,37) had ramifications for other publications,^(29,30,36,38) respectively. The studies included

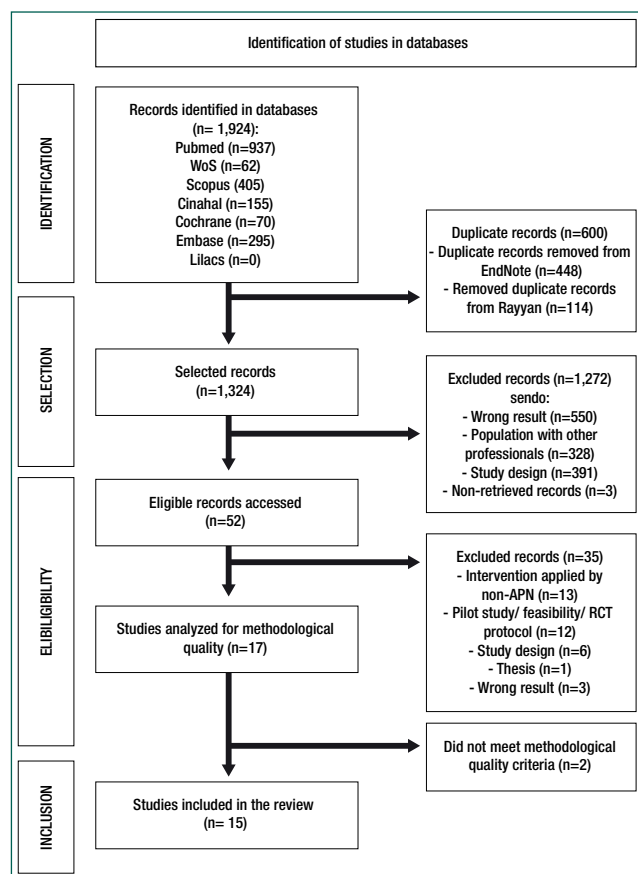
Chart 1. Search strategy

Database	Search strategy	Number of articles retrieved from databases
PubMed	(((((telehealth) OR (telemedicine)) OR (telecare)) OR (tele-nursing)) OR (Remote Patient Monitoring)) OR (Mobile Devices)) AND (((advanced practice nurse) OR (advanced practice registered nurse)) OR (nurse practitioner) OR (clinical nurse specialist)) AND (((patient outcomes) OR (patient care)) OR (healthcare quality)) OR (clinical outcomes) OR (outcome) OR (care efficiency) OR (patient satisfaction))	937
WoS	("Telehealth" OR "Telemedicine" OR "Telecare" OR "Tele-nursing" OR "Remote Patient Monitoring" OR "Mobile Devices") AND ("Advanced practice nurse" OR "Advanced practice registered nurse" OR "Nurse practitioner" OR "Clinical nurse specialist") AND ("Patient outcomes" OR "Patient care" OR "Healthcare quality" OR "Clinical outcomes" OR "Outcome" OR "Care efficiency" OR "Patient satisfaction")	62
Scopus	(TITLE-ABS-KEY ("Telehealth" OR "Telemedicine" OR "Telecare" OR "Tele-nursing" OR "Remote Patient Monitoring" OR "Mobile Devices") AND TITLE-ABS-KEY ("Advanced practice nurse" OR "Advanced practice registered nurse" OR "Nurse practitioner" OR "Clinical nurse specialist") AND TITLE-ABS-KEY ("Patient outcomes" OR "Patient care" OR "Healthcare quality" OR "Clinical outcomes" OR "Outcome" OR "Care efficiency" OR "Patient satisfaction"))	405
CINAHL	"Telehealth" OR "Telemedicine" OR "Telecare" OR "Tele-nursing" OR "Remote Patient Monitoring" OR "Mobile Devices" AND MH "Advanced Practice Registered Nurses" OR "Advanced practice nurse" OR "Advanced practice registered nurse" OR MH "Nurse Practitioners" OR "Nurse practitioner" OR MH "Clinical Nurse Specialists" OR "Clinical nurse specialist" AND "Patient outcomes" OR "Patient care" OR MH "Quality of Health Care" OR "Healthcare quality" OR "Clinical outcomes" OR MH "Outcomes (Health Care)" OR "Outcome" OR "Care efficiency" OR "Patient satisfaction"	155
COCHRANE	"Telehealth" OR "Telemedicine" OR "Telecare" OR "Tele-nursing" OR "Remote Patient Monitoring" OR "Mobile Devices" AND "Advanced practice nurse" OR "Advanced practice registered nurse" OR "Nurse practitioner" OR "Clinical nurse specialist" AND "Patient outcomes" OR "Patient care" OR "Healthcare quality" OR "Clinical outcomes" OR "Outcome" OR "Care efficiency" OR "Patient satisfaction"	70
EMBASE	('telemonitoring'/exp OR 'telehealth' OR 'telemedicine' OR 'telecare' OR 'tele-nursing' OR 'remote patient monitoring' OR 'mobile devices') AND ('nurse practitioner'/exp OR 'advanced practice nurse' OR 'advanced practice registered nurse' OR 'nurse practitioner' OR 'clinical nurse specialist') AND ('patient outcomes' OR 'patient care' OR 'healthcare quality' OR 'clinical outcomes' OR 'outcome' OR 'care efficiency' OR 'patient satisfaction') AND [embase]/lim	295
LILACS (PORTUGUESE)	"Telemedicina" OR "Telemedicina" OR "Telecuidado" OR "Teleenfermagem" OR "Monitoramento Remoto de Pacientes" OR "Dispositivos Móveis" AND "Enfermeiro de prática avançada" OR "Enfermeiro registrado de prática avançada" OR "Enfermeiro praticante" OR "Especialista em enfermagem clínica" AND "Resultados do paciente" OR "Cuidado do paciente" OR "Qualidade dos cuidados de saúde" OR "Resultados clínicos" OR "Resultado" OR "Eficiência no cuidado" OR "Satisfação do paciente"	0
LILACS	"Telehealth" OR "Telemedicine" OR "Telecare" OR "Tele-nursing" OR "Remote Patient Monitoring" OR "Mobile Devices" AND "Advanced practice nurse" OR "Advanced practice registered nurse" OR "Nurse practitioner" OR "Clinical nurse specialist" AND "Patient outcomes" OR "Patient care" OR "Healthcare quality" OR "Clinical outcomes" OR "Outcome" OR "Care efficiency" OR "Patient satisfaction"	0
LILACS (SPANISH)	"Telemedicina" OR "Telemedicina" OR "Telecuidado" OR "Teleenfermería" OR "Monitoreo Remoto de Pacientes" OR "Dispositivos Móviles" AND "Enfermero de práctica avanzada" OR "Enfermero registrado de práctica avanzada" OR "Enfermero practicante" OR "Especialista en enfermería clínica" AND "Resultados del paciente" OR "Cuidado del paciente" OR "Calidad de la atención médica" OR "Resultados clínicos" OR "Resultado" OR "Eficiencia del cuidado" OR "Satisfacción del paciente"	0

the assessment of 1,944 people, 1,144 (58.85%) men; 12 studies^(26-28,30-38) presented the gender variable by group (control or intervention), with, on average, 61.59% of men in control groups and 59.05% in intervention groups. Two studies^(39,40) presented the percentage in general without specifying groups, and one study⁽²⁹⁾ did not describe this variable. Regarding age, of the included studies, seven^(31,32,34-38) described the mean age of adult participants per group, which ranged from 31 to 59.5 for the control group and from 31 to 61.7 for the intervention group. Age varied in children^(26,29,30) between 2 and 15 years old (mean of 7.1 years) and in adults between approximately 30 and 65 years old. There was no uniformity to describe this variable, with one study⁽³⁹⁾ describing the median age; one study⁽⁴⁰⁾ describing the general mean (without discriminating between groups); four studies⁽²⁷⁻³⁰⁾ describing age in intervals; and one did not present this data.⁽³³⁾

Among the 15 studies examined, three carried out interventions with diabetic patients,^(27,37,38) three, with family members of children with complex conditions,^(26,29,30) two, with patients with neoplasms, one, with the presence of an ostomy⁽³⁹⁾ and the other with the presence of pain,⁽³⁴⁾ two, with adult patients with atherosclerosis,^(35,36) one, with post-transplant patients,⁽³³⁾ one, with childhood cancer survivors,⁽²⁸⁾ one, with post-transplant patients - orthopedic surgeries,⁽³¹⁾ one, with patients with cystic fibrosis,⁽³²⁾ and one, with patients from long-term care institutions.⁽⁴⁰⁾

The interventions included use of telephone (monitoring or counseling), telephone and video, video and teleconferences, mobile health application, monitoring platform and online nursing consultation (live iterative sessions). Concerning outcomes, telehealth allowed checking clinical data, clinical assessment, previous diagnosis and care plan as well as encouraging and supervising self-care or



CINAHL - Cumulative Index to Nursing and Allied Health Literature; LILACS - Latin American and Caribbean Literature in Health Sciences; APN - advanced practice nurse; RCT - randomized clinical trial

Figure 1. Studies identified, removed and included in the review

preventing undesirable events. Other relevant results were considered by the researchers, such as satisfaction, benefits, adherence rate, rehospitalization or visits, financial impact of direct and indirect telehealth and quality of life (Chart 2).

Figure 2 presents a summary of the effectiveness of telehealth interventions used by advanced practice nurses in the studies in this systematic review.

Of the 15 studies included, six had their methodological quality assessed as moderate (ranging from 61.5 to 70.0%), and nine studies, as high (> 70.0%).

Discussion

The present review was composed of studies with moderate and high methodological quality, which

reinforces the robustness of successful strategies associated with telehealth.

The complexity of the role of care management and its interfaces as well as that of education and research was evident in the studies analyzed. The advanced clinical activities identified are in accordance with those highlighted by the International Council of Nurses (ICN), which include the authority to prescribe medications, order tests and devices, perform diagnoses and advanced health assessments, and make decisions about treatments and therapies.⁽⁴¹⁾

In relation to interventions, the use of electronic information and telecommunications technologies was noted, with the purpose of supporting and promoting the remote provision of clinical healthcare, obtaining physical data, monitoring therapeutic plans, patient education and health administration as well as reducing returns to service or hospitalization. Such results support those in the literature.⁽⁴²⁾

The positive effect of telemonitoring and telephone counseling is worth highlighting.^(27,28,34) Other studies,^(33,39) although they reinforce the tendency to explore telehealth to obtain clinical data or care management, did not present different results compared to usual care.

Daily telemonitoring, carried out for approximately 10 minutes, represents a simple approach, eliminating the need for frequent visits to the clinic by patients; however, the challenges in monitoring patients by telephone and the technical difficulties in implementing telemonitoring have favored the suggestion of using more flexible tools, such as smartphone applications.⁽⁴³⁾

In the present review, three studies used the mobile health application, which facilitated the early detection of respiratory exacerbations and treatment with oral antibiotics⁽³²⁾ and was effective in self-management of behaviors of people with diabetes mellitus.^(37,38) Such results are supported in other research.^(44,45) However, some mHealth applications lack evidence-based support, focus more on the disease than the person, have limited usability, and raise concerns regarding user privacy.⁽⁴⁶⁾

Regarding clinical outcomes, research has examined patient satisfaction with telehealth

Chart 2. Main data extracted from randomized clinical trials and quasi-experimental studies included in the review

Authors, country and year	Objective	Population and sample	Intervention	Expected primary and secondary outcomes	Main results
Randomized clinical trials					
Cady et al. ⁽²⁶⁾ United States (2015)	Test the effectiveness of a care coordination model for children with medical complexities delivered by APN via telehealth.	Population: family members of children with complex clinical conditions Control group: conventional care, n=55 Intervention group: care coordination by telephone, n=54 Intervention group: care coordination via telephone associated with video, n=54	Telehealth (telephone or phone associated with video conferencing)	Primary: improved care coordination, need for help coordinating care, adequacy of help received for care coordination. Secondary: increased satisfaction with telehealth and quality of life.	In both intervention groups, there was a statistically significant increase throughout the study only in the adequacy of the help received for care coordination. The groups reported high levels of satisfaction with the care received, with a reduction in the need to seek healthcare services throughout the study (no statistical difference).
Stone et al. ⁽²⁷⁾ United States (2010)	Compare the effectiveness of home telemonitoring associated with active medication management by a nurse with a low-intensity care coordination intervention for glycemic control in older adults with type 2 diabetes.	Population: older adults with type 2 diabetes Control group: low-intensity care coordination, n=72 Intervention group: home telemonitoring associated with active medication management by a nurse, n=64	Telemonitoring for home care management	Primary: change in glycated hemoglobin level, weight, blood pressure and lipids. Secondary: improved management of medications in use.	In both groups, levels of glycated hemoglobin, blood pressure, lipids (cholesterol, LDL and HDL) improved significantly compared to baseline. In the intervention group, there was a statistically significant reduction in glycated hemoglobin at 3 and 6 months, and LDL was significantly lower at 6 months. The other primary outcomes were similar between the groups. The intervention also provided a difference in the use of medications at 6 months of the study, with more medications or altered doses of antihypertensives, but not lipid-lowering or oral hypoglycemic agents. As for insulin, it provided more adjustments in the insulin dose and higher daily doses of insulin.
Hudson et al. ⁽²⁸⁾ United States (2014)	Investigate whether adding telephone counseling to a paper survivorship care plan improves participation in cardiomyopathy screening of at-risk survivors.	Population: childhood cancer survivors at risk for cardiomyopathy, n=754 Control group: standard care, n=234 Intervention group: standard care associated with telephone counseling, n=238	Telephone counseling in two sessions	Primary: adherence to cardiomyopathies screening.	The intervention significantly increased the likelihood of screening for cardiomyopathy among at-risk childhood cancer survivors. Participants in the intervention group were more likely to identify concerns about insurance coverage for testing, and those in the control group were more likely to identify a lack of medical advice for not completing screening. Other reasons presented did not differ between the groups.
Looman et al. ⁽²⁹⁾ United States (2015)	Assess the effect of telehealth care coordination performed by APN for children with complex clinical conditions (single and/or multiple).	Population: family members of children with complex clinical conditions Control group: conventional care, n=47 Intervention group: care coordination by telephone, n=50 Intervention group: care coordination via telephone associated with video, n=51	Telehealth (telephone or phone associated with video conferencing)	Primary: increased satisfaction of primary caregivers with healthcare services and the perception of the adequacy of the care received in relation to the care needed.	In the total sample, considering the number of complex conditions present in children and family members' satisfaction with communication with healthcare services, there was a significant difference, and, in the group with children with multiple conditions, satisfaction was greater than in the group with children with multiple conditions. group with children with a single complex clinical condition. The intervention was associated with higher family member ratings of caregivers, caregiver communication, overall healthcare, and adequacy of care coordination compared to individuals in the control group (statistically significant differences).
McKissick et al. ⁽³⁰⁾ United States (2016)	Determine whether the intervention reduces the number of unplanned clinical visits and whether the effectiveness of video telehealth technology is superior to telephone-only telehealth.	Population: family members of children with complex clinical conditions Control group: conventional care, n=47 Intervention group: care coordination by telephone, n=50 Intervention group: care coordination via telephone associated with video, n=51	Telehealth (telephone or phone associated with video conferencing)	Primary: reducing the number of unplanned clinical visits.	The following differences were identified in the statistical test: - The number of unplanned visits decreased over time in all groups, with the greatest decrease in the video-linked telephone care coordination intervention group. - The number of planned visits was higher in the telephone care coordination group associated with video in all periods.
Wang et al. ⁽³¹⁾ China (2018)	Assess the impact of an online home orthopedic care platform on functional recovery, quality of life and daily activities after hip arthroplasty.	Population: patients undergoing hip arthroplasty Control group: usual care, n=195 Intervention group: online platform, n=194	Telenursing for online monitoring	Primary: functional recovery of the hip; improvement in the performance of activities of daily living; increased health-related quality of life.	The outcome measurement levels of this study were significantly elevated in the telenursing group compared to the control group.
Wood et al. ⁽³²⁾ Australia (2019)	Investigate the application's contribution to search for care in patients with cystic fibrosis, facilitating early detection of exacerbations and enabling more immediate treatment.	Population: adults diagnosed with cystic fibrosis Control group: usual care, n=31 Intervention group: monitoring patients using the cell phone application (smartphone), n=29	Using an application on a smartphone	Primary: changes in the number of cycles and days of intravenous antibiotics. Secondary: use of healthcare; improvement in clinical data, quality of life, levels of anxiety and depression; adherence to treatment and absenteeism.	Smartphone application use was significantly effective in reducing the time between the detection of an exacerbation of the disease and starting the use of antibiotics, in reducing the use of intravenous antibiotics, which were replaced by oral antibiotics, and in increasing the number of contacts with a nurse. There was no difference between the intervention in secondary outcomes.

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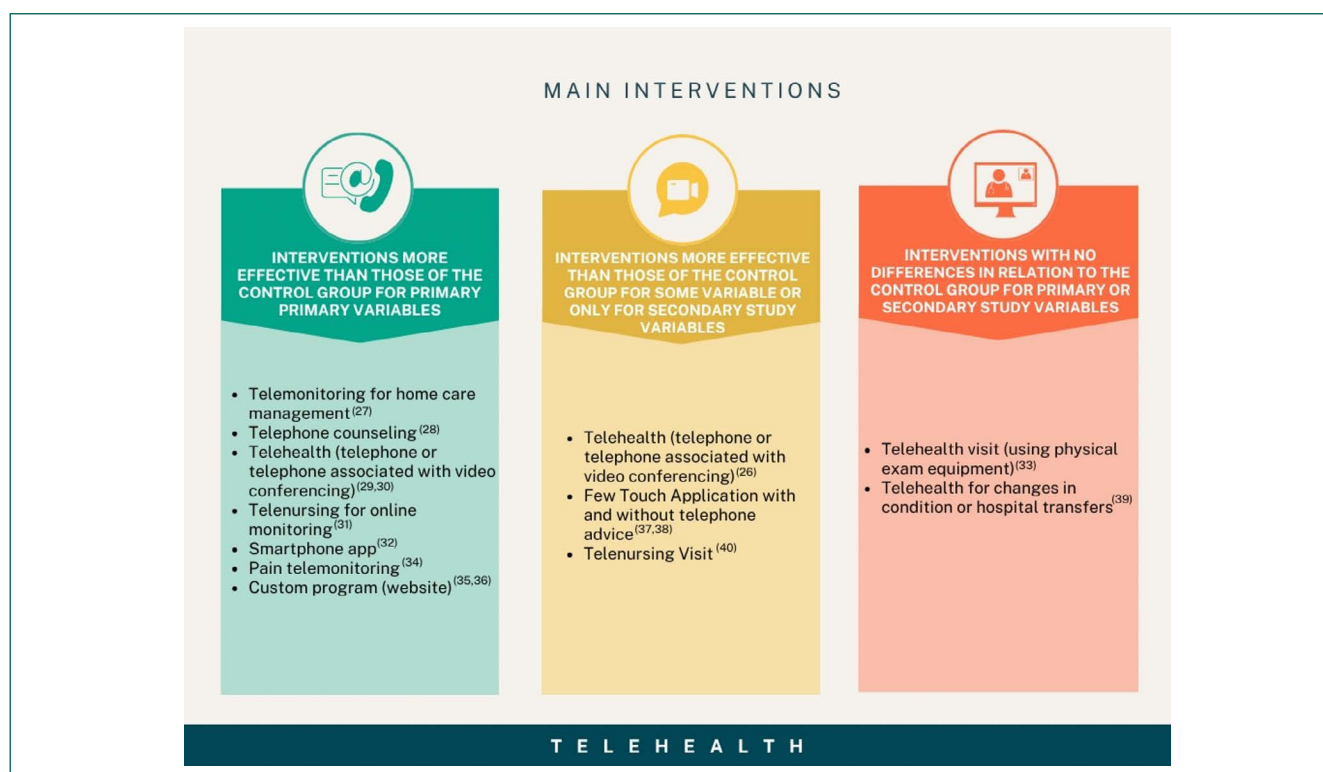
Authors, country and year	Objective	Population and sample	Intervention	Expected primary and secondary outcomes	Main results
Leimig et al. ⁽³³⁾ United States (2008)	Compare the occurrence of infection, rejection, and hospitalization in individuals randomized to telehealth or standard post-transplant care.	Population: patients undergoing transplants Control group: standard treatment, n=53 Intervention group: telehealth, n=53	Telehealth visit (using physical exam equipment)	Primary: occurrence of infection, transplant rejection and hospitalization.	No differences were found between groups for infections, rejections or hospitalizations at the study end point (6 months).
Kim et al. ⁽³⁴⁾ Republic of Korea (2013)	Test the effectiveness of an educational intervention and telemonitoring in improving pain, anxiety, depression, anguish and quality of life in patients with advanced tumors.	Population: outpatients with advanced tumors with moderate to severe cancer-related pain Control group: educational intervention on pain management, n=54 Intervention group: educational intervention on pain management associated with telemonitoring, n=54	Pain telemonitoring	Primary: reduction in pain level. Secondary: improvement in levels of anguish, anxiety, depression, quality of life, performance of daily activities and clinical parameters.	Telemonitoring showed effectiveness in improving pain in 1 week, including pain levels indicated as worst and average intensities. There was a significant reduction in the proportion of patients whose pain scale was ≥ 4 , in anxiety and depression and an improvement in quality of life (fatigue and insomnia) and in the performance of activities. There was no improvement in the level of suffering. Patient outcomes did not differ when examining primary cancer types.
Greving et al. ⁽³⁵⁾ Netherlands (2015)	Assess the cost-effectiveness of a nurse-led online program for managing vascular risk factors added to usual care compared to usual care alone for patients with vascular disease.	Population: patients with atherosclerosis with clinical manifestations and two uncontrolled risk factors, n=330 Control group: usual care, n=166 Intervention group: online program based on a website associated with usual care, n=164	Custom program (website)	Primary: improvement in cost-effectiveness. Secondary: improvement in quality of life.	Patients in both groups equally experienced health and quality of life benefits at 1 year. The intervention was associated with lower total costs (219 euros) over 1 year compared with usual care and had a small effect on vascular risk factors.
Vernooij et al. ⁽³⁶⁾ Netherlands (2012)	Assess the effectiveness of an online nursing self-management program compared to conventional care in reducing vascular risk factors in patients with clinically manifest vascular disease.	Population: patients with atherosclerosis with clinical manifestations and two uncontrolled risk factors, n=330 Control group: usual care, n=166 Intervention group: online program based on a website associated with usual care, n=164	Website-based online program	Primary: reduction in Framingham cardiac risk score. Secondary: changes in risk factor scores, proportions of patients achieving treatment goals.	When comparing the results obtained with the intervention in relation to the control group, the intervention promoted a statistically significant reduction in the Framingham cardiac risk score after 12 months, a reduction in cholesterol (LDL) levels and smoking.
Torbj�rnsen et al. ⁽³⁷⁾ Norway (2014)	Assess whether introducing technology-supported self-management using the Few Touch Application diabetes diary with or without health counseling contributes to improved glycated hemoglobin levels, self-management, behavior change and quality of life.	Population: people with type 2 diabetes, age ≥ 18 years and glycated hemoglobin level $\geq 7.1\%$, n=151 Control group: usual care, n=50 Intervention group: Few Touch Application use, n=51 Intervention group: Few Touch Application use with telephone counseling, n=50	Few Touch Application with and without telephone advice	Primary: change in glycated hemoglobin level, quality of life, behavior and cost-benefit. Secondary: improvement in people's clinical characteristics and lifestyle.	There were no differences in glycated hemoglobin levels between groups after 4 months, but there was a decline in all groups. In both intervention groups, there were statistically significant changes in self-management using the application. In the group that used only the application, there was a significant improvement in acquisition of skills and techniques for managing symptoms compared to the control group. The other outcomes analyzed did not change.
Holmen et al. ⁽³⁸⁾ Norway (2014)	Test whether a cell phone self-management system, used for one year, with or without telephone counseling for four months, contributes to improving glycated hemoglobin levels, self-management and quality of life compared to usual care.	Population: people with type 2 diabetes, age ≥ 18 years and glycated hemoglobin level $\geq 7.1\%$, n=151 Control group: usual care, n=50 Intervention group: Few Touch Application use, n=51 Intervention group: Few Touch Application use with telephone counseling, n=50	Few Touch Application with and without telephone advice	Primary: change in glycated hemoglobin level after 1 year. Secondary: improvement of self-management, quality of life.	The level of glycated hemoglobin decreased in all groups, but did not differ between them, after one year of study. The use of the application associated with health counseling showed an improvement (significant difference) in self-management of care and acquisition of skills and techniques for self-care compared to the other groups in the study. The other outcomes analyzed did not change.
Quasi-experimental studies					
Hullick et al. ⁽³⁹⁾ Australia (2022)	Determine whether adding video telehealth visits to the Aged Care Emergency program further reduces emergency room visits and hospital admissions.	Population: Nursing Homes within a catchment area of the hospital emergency department, n=1271 Control group: healthcare in hospital services, n=461 Intervention group: telehealth consultations with nurses when an acute condition was detected by the Nursing Home team and patient follow-up after initial care, n=201	Telehealth for changes in condition or hospital transfers	Primary: reduction in the number of hospital admissions. Secondary: reduction in emergency room visits.	There was a 2% reduction in hospitalizations among the institutions undergoing the intervention when compared to the period before the intervention was offered. Among institutions that did not receive the intervention, there was a 3% increase in hospitalizations. The difference between the groups was 5% less hospitalization for the intervention group. As for emergency service consultations, there was a reduction of 11% for the intervention group and 6% for the control group. The differences were not statistically significant.

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Authors, country and year	Objective	Population and sample	Intervention	Expected primary and secondary outcomes	Main results
Bohnenka et al. ⁽⁴⁰⁾ United States (2004)	Assess the impact of telenursing on patients discharged with ostomies resulting from oncological treatment in relation to cost, and on patient satisfaction and adaptation and self-care.	Population: individuals who, due to cancer treatment, required an ostomy, n=28 Population: people with ostomies, n=28 Control group: traditional home care, n=14 Intervention group: traditional home care and telenursing, n=14	Telenursing Visit	Primary: change of costs, patient satisfaction, and patient adjustment. Secondary: change in the number of days to exchange the independent exchange.	Both groups reported more than 80% satisfaction. Patients in the intervention group reported higher levels of satisfaction and comfort (statistically significant difference). There was no statistical difference between the groups for any item that assessed self-care and the measure of patient adjustment. Costs (consultation, scholarship and total cost) were equivalent between the groups. It is noteworthy that the control group needed one more consultation than the intervention group, but this group had 3.6 telenursing consultations in addition to traditional care. The number of days for independent exchange did not show statistically significant differences between the groups.

APN - advanced practice nurses; LDL - low density lipoprotein; HDL - high density lipoprotein.

**Figure 2.** Effectiveness results of telehealth interventions used by advanced practice nurses in relation to study outcomes (n=15)

services.^(26,29,40) Of these, two showed high levels of satisfaction among parents/caregivers.^(26,29) Although one of the studies did not show significant differences between the groups over a 30-month period,⁽²⁶⁾ the other, over two years, showed higher scores on several satisfaction measures, both for the group that was employed the phone and for the video group.⁽²⁹⁾ The third study recorded significantly higher satisfaction than home consultation.⁽⁴⁰⁾ Also in a survey from

Australia, the majority of participants expressed satisfaction with telehealth, emphasizing the quality of information, comfort and trust in the healthcare professionals consulted.⁽⁴⁷⁾

In relation to the benefits perceived by patients in relation to access and convenience of telehealth provided by advanced practice nurses, four studies highlighted an increase in the adequacy of assistance in care coordination,⁽²⁶⁾ improvement in self-management of chronic non-communicable diseases,

such as diabetes,⁽³⁸⁾ increased family caregiver satisfaction with telehealth intervention,⁽³⁵⁾ and constant contact with a single nurse, characterized as fundamental for perceived benefits, regardless of the intervention.^(26,40) These findings reinforce those of the study which points out that using the telephone and the internet contribute to reducing time associated with treating conditions such as cancer.⁽⁴⁸⁾ Furthermore, this approach has the potential to expand access to evidence-based interventions for disease prevention and control, monitoring, supportive care and therapeutic decision-making.

Some studies have investigated the effect of using telehealth on adherence rates and compliance with the treatment plan.^(26-28,32,37,38) The results indicate improvements in the adherence of these groups when compared to those who receive in-person care, evidenced by the increase in the adequacy of help in care coordination,^(26,37,38) closer control of clinical indicators,⁽²⁷⁾ increase in the completion of screening of risks⁽²⁸⁾ and increase in the number of consultations.⁽³²⁾ A Spanish study also found that an educational intervention via the web can be effective in adhering to a healthy diet.⁽⁴⁹⁾ Another revealed that video conferencing is effective in improving adherence to HIV treatment.⁽⁵⁰⁾

Regarding rehospitalization rates or follow-up visits between patients who use telehealth and those who receive traditional care, four studies showed that there was a reduction in length of stay,⁽²⁶⁾ two studies found no significant difference in rates of hospital admission or emergency room visits,^(33,39) and a study found that the group followed by tele-nursing carried out, on average, one fewer in-person consultation than the control group, however, they had, on average, 3.6 more virtual consultations.⁽⁴⁰⁾

The financial impact of telehealth provided by advanced practice nurses, compared to in-person care, was addressed directly^(26,35) and indirectly^(28,29,40) by few studies (33%) in this review. A study mentioned that institutions involved in caring for children with complex medical conditions recognized the benefits of care coordinators (advanced practice nurses) for this group. The authors also highlighted that outcome indicators of the

role of care coordinator should be included in cost calculation models.⁽²⁶⁾ Another revealed equivalent health benefits and lower costs over 1 year.⁽³⁵⁾ In indirect approaches, the growing importance of results linked to healthcare reimbursement^(28,29) and the number of visits stands out, objects of study that verified the effect of telehealth in reducing unplanned medical visits⁽³⁰⁾ and related to the savings associated with fewer device changes in the care context, even though the total cost of care did not show a statistical difference, comparing traditional care and telenursing.⁽⁴⁰⁾

In a scoping review, with the aim of characterizing literature reviews on digital health and telehealth interventions used to monitor people with cancer, it was also observed that the percentage of primary studies that included health economic outcomes ranged from zero to 31% of included studies, addressing aspects such as direct costs, cost minimization and cost-benefit analysis.⁽⁴⁹⁾ More consolidated information on the diverse economic impacts of digital health and telehealth interventions will be valuable to decision-makers when considering coverage and implementation of these interventions.

The quality of life of patients or family members/caregivers was analyzed in seven studies, the majority of which found no differences in the measurement scores of this variable.^(26,32,35,37,38) Similar results have already been described in the literature.⁽⁵¹⁾ However, among the studies currently examined, one that used online monitoring of recovery after arthroplasty⁽³¹⁾ and another that assessed the effect of an educational intervention associated with telemonitoring, differences were observed in quality of life, which was greater in the telehealth group.⁽³⁴⁾

This systematic review, composed of 15 international studies, addressing the use of remote interventions, provides valuable contributions to the discussion on the benefits that the use of telehealth by advanced practice nurses can add to patient care at different levels of complexity and scenarios. Furthermore, analysis includes reflection on the contribution of this professional and telehealth as facilitators of teamwork and care

coordination in collaboration with other professionals or with other services or care agencies in the community.

The absence of specific studies on advanced practice nurses in the Brazilian context in this systematic review indicates the lack of formalization of the role of this professional in our health system, despite the existence of available knowledge on the use of telehealth technologies in various areas. However, controlled clinical trials assessing telehealth interventions delivered by specialist nurses who perform functions similar to those of advanced practice nurses are still needed.

As limitations, the impossibility of carrying out more robust statistical analyses, not accessing all references, and the diversity of remote practices and interventions used in the studies analyzed, which can make it difficult to identify clear patterns or definitive conclusions about the effectiveness of interventions, stand out. However, the results provide opportunities for future research to fill gaps and improve understanding of the role of advanced practice nurses and remote interventions in the health-care context, particularly in Brazil.

Conclusion

The results of this systematic review emphasize the safety of employing telehealth by advanced practice nurses in patient care. In the two studies in which efficacy was not found, the results of its use were, at least, similar to those of traditional care. Evidence of effectiveness for all or part of the primary outcomes in 12 studies and secondary outcome in only one study indicates that the use of telehealth by advanced practice nurses can result in notable benefits in patient care management. This includes cost reduction, improved patient or family member satisfaction, improved quality of life and advances in various clinical health or health promotion indicators. The conclusion of this study reinforces the feasibility of this innovative approach in clinical practice, highlighting telehealth as a valuable tool for elevating the quality of healthcare provided by advanced practice nurses.

References

1. Doraiswamy S, Abraham A, Mamtani R, Cheema S. Use of telehealth during the COVID-19 Pandemic: scoping review. *J Med Internet Res*. 2020;22(12):e24087.
2. Cohen BH, Busis NA, Ciccarelli L. Coding in the World of COVID-19: non-face-to-face evaluation and management care. *Continuum (Minneapolis)*. 2020;26(3):785-98.
3. Brasil. Ministério da Saúde. Secretaria de Ciência, Tecnologia e Insumos Estratégicos Departamento de Ciência e Tecnologia. Guia Metodológico para Programas e Serviços em Telessaúde. Brasília, DF: Ministério da Saúde; 2019 [citado 2024 Mai 6]. Disponível em: https://bvsms.saude.gov.br/bvs/publicacoes/guia_metodologico_programas_servicos_telessaude.pdf
4. World Health Organization (WHO). A health telematics policy in support of WHO's health-for-all strategy for global health development: report of the WHO Group Consultation on Health Telematics 11–16 December, Geneva, 1997. Geneva: WHO; 1998 [cited 2024 May 6]. Available from: <https://iris.who.int/handle/10665/63857>
5. Kamei T. Telenursing and artificial intelligence for oncology nursing. *Asia Pac J Oncol Nurs*. 2022;9(12):100119.
6. Schlachta-Fairchild L, Varghese SB, Deickman A, Castelli D. Telehealth and telenursing are live: APN policy and practice implications. *J Nurse Pract*. 2010;6(2):98-106.
7. Toffoletto MC, Tello JD. Telenursing in care, education and management in Latin America and the Caribbean: an integrative review. *Rev Bras Enferm*. 2020;73(5):e20190317.
8. Schorn MN, Myers CR, Barroso J, Hande K, Hudson T, Kim J, et al. Changes in Telehealth experienced by Advanced Practice RNs during COVID-19: US survey results. *Comput Inform*. 2023;41(7):507-13.
9. Bashir MS, Lalithabai DS, Alotaibi S, Abu-Shaheen A. Health care professionals' knowledge and attitudes toward telemedicine. *Front Public Health*. 2023;11:957681.
10. Westby A, Nissly T, Giesecker R, Timmins K, Justesen K. Achieving Equity in Telehealth: "Centering at the Margins" in access, provision, and reimbursement. *J Am Board Fam Med*. 2021;34(Suppl):S29-S32.
11. Yee V, Bajaj SS, Stanford FC. Paradox of telemedicine: building or neglecting trust and equity. *Lancet Digit Health*. 2022;4(7):e480-1.
12. Garber K, Chike-Harris K, Vetter MJ, Kobeissi M, Heidesch T, Arends R, et al. Telehealth Policy and the Advanced Practice Nurse. *J Nurse Pract*. 2023;19(7):104655.
13. Totten AM, Womack DM, Eden KB, McDonagh MS, Griffin JC, Grusing S, et al. Telehealth: Mapping the evidence for patient outcomes from systematic reviews. Rockville (MD): Agency for Healthcare Research and Quality; 2016.
14. Snoswell CL, Chelberg G, Guzman KR, Haydon HH, Thomas EE, Caffery LJ, et al. The clinical effectiveness of telehealth: A systematic review of meta-analyses from 2010 to 2019. *J Telemed Telecare*. 2023;29(9):669-84.
15. Wheeler KJ, Miller M, Pulcini J, Gray D, Ladd E, Rayens MK. Advanced practice nursing roles, regulation, education, and practice: a global study. *Ann Glob Health*. 2022;88(1):42.
16. Brasil. Ministério da Saúde. Portaria nº 2.546, de 27 de outubro de 2011. Redefine e amplia o Programa Telessaúde Brasil, que passa a ser denominado Programa Nacional Telessaúde Brasil Redes (Telessaúde Brasil Redes). Brasília, DF: Ministério da Saúde; 2011 [citado 2024 Mai 6]. Disponível em: https://bvsms.saude.gov.br/bvs/saudelegis/gm/2011/prt2546_27_10_2011.html

17. Conselho Federal de Enfermagem (Cofen). Resolução Cofen nº 696/2022. Dispõe sobre a atuação da Enfermagem na Saúde Digital, normatizando a Telenfermagem. Brasília, DF: Cofen; 2022.
18. Muniz VO, Mota TN, Sousa AR. Saúde digital à brasileira e a prática clínica em enfermagem: do que estamos falando? *Enferm Foco*. 2023;14:e-202336.
19. Tufanaru C, Munn Z, Aromataris E, Campbell J, Hopp L. Systematic reviews of effectiveness. In: Aromataris E, Munn Z, editors. *JBIManual for Evidence Synthesis*. 2020.
20. Page MJ, McKenzie JE, Bossuyt PM, Boutron I, Hoffmann TC, Mulrow CD, et al. The PRISMA 2020 statement: an updated guideline for reporting systematic reviews. *Syst Rev*. 2021;10(1):89.
21. Galvão MC, Ricarte IL. Systematic literature review: concept, production and publication. *Logeion: Filosofia da Informação*. 2019;6(1):57-73.
22. Ouzzani M, Hammady H, Fedorowicz Z, Elmagarmid A. Rayyan-a web and mobile app for systematic reviews. *Syst Rev*. 2016;5:210.
23. Mendes KD, Silveira RC, Galvão CM. Use of the bibliographic reference manager in the selection of primary studies in integrative reviews. *Texto Contexto Enferm*. 2019;28:e20170204.
24. Moola S, Munn Z, Tufanaru C, Aromataris E, Sears K, Sfetcu R, et al. Chapter 7: Systematic reviews of etiology and risk. In: Aromataris E, Munn Z, editors. *JBIManual for Evidence Synthesis*; 2020.
25. Brasil. Ministério da Saúde. Diretrizes metodológicas: elaboração de revisão sistemática e meta-análise de ensaios clínicos randomizados. Brasília, DF: Ministério da Saúde; 2021 [citado 2024 Mai 6]. Disponível em: https://rebrats.saude.gov.br/phocadownload/diretrizes/20210622_Diretriz_Revisao_Sistemtica_2021.pdf
26. Cady RG, Erickson M, Lunos S, Finkelstein SM, Looman W, Celebreeze M, et al. Meeting the needs of children with medical complexity using a telehealth advanced practice registered nurse care coordination model. *Matern Child Health J*. 2015;19(7):1497-506.
27. Stone RA, Rao RH, Sevvick MA, Cheng C, Hough LJ, Macpherson D, et al. Active care management supported by home telemonitoring in veterans with type 2 diabetes: the DiaTel randomized controlled trial. *Diabetes Care*. 2010;33(3):478-84.
28. Hudson MM, Leisenring W, Stratton KK, Tinner N, Steen BD, Ogg S, et al. Increasing cardiomyopathy screening in at-risk adult survivors of pediatric malignancies: a randomized controlled trial. *Am J Clin Oncol*. 2014;32(35):3974-81.
29. Looman WS, Antolick M, Cady RG, Lunos SA, Garwick AE, Finkelstein SM. Effects of a telehealth care coordination intervention on perceptions of health care by caregivers of children with medical complexity: a randomized controlled trial. *J Pediatr Health Care*. 2015;29(4):352-63.
30. McKissick HD, Cady RG, Looman WS, Finkelstein SM. The impact of telehealth and care coordination on the number and type of clinical visits for children with medical complexity. *J Pediatr Health Care*. 2017;31(4):452-8.
31. Wang J, Tong Y, Jiang Y, Zhu H, Gao H, Wei R, et al. The effectiveness of extended care based on Internet and home care platform for orthopaedics after hip replacement surgery in China. *Clin Nurs*. 2018;27(21-22):4077-88.
32. Wood J, Jenkins S, Putrino D, Mulrennan S, Morey S, Cecins N, et al. A smartphone application for reporting symptoms in adults with cystic fibrosis improves the detection of exacerbations: Results of a randomised controlled trial. *J Cyst Fibros*. 2020;19(2):271-6.
33. Leimig R, Gower G, Thompson DA, Winsett RP. Infection, rejection, and hospitalizations in transplant recipients using telehealth. *Prog Transplant*. 2008;18(2):97-102.
34. Kim HS, Shin SJ, Kim SC, An S, Rha SY, Ahn JB, et al. Randomized controlled trial of standardized education and telemonitoring for pain in outpatients with advanced solid tumors. *Support Care Cancer*. 2013;21(6):1751-9.
35. Greving JP, Kaasjager HA, Vernooij JW, Hovens MM, Wierdsma J, Grandjean HM, et al. Cost-effectiveness of a nurse-led internet-based vascular risk factor management programme: economic evaluation alongside a randomised controlled clinical trial. *BMJ Open*. 2015;5(5):e007128.
36. Vernooij JW, Kaasjager HA, Graaf Y, Wierdsma J, Grandjean HM, Hovens MM, et al. Internet based vascular risk factor management for patients with clinically manifest vascular disease: randomised controlled trial. *BMJ*. 2012;344:e3750.
37. Torbjørnsen A, Jenum AK, Småstuen MC, Arsand E, Holmen H, Wahl AK, et al. A low-intensity mobile health intervention with and without health counseling for persons with type 2 diabetes, part 1: baseline and short-term results from a randomized controlled trial in the Norwegian part of RENEWING HEALTH. *JMIR Mhealth Uhealth*. 2014;2(4):e52.
38. Holmen H, Torbjørnsen A, Wahl AK, Jenum AK, Småstuen MC, Arsand E, et al. A mobile health intervention for self-management and lifestyle change for persons with type 2 diabetes, part 2: one-year results from the Norwegian randomized controlled trial RENEWING HEALTH. *JMIR Mhealth Uhealth*. 2014;2(4):e57.
39. Hulleck C, Conway J, Hall A, Murdoch W, Cole J, Hewitt J, et al. Video-telehealth to support clinical assessment and management of acutely unwell older people in Residential Aged Care: a pre-post intervention study. *BMC Geriatr*. 2022;22(1):40.
40. Bohnenkamp SK, McDonald P, Lopez AM, Krupinski E, Blackett A. Traditional versus telenursing outpatient management of patients with cancer with new ostomies. *Oncol Nurs Forum*. 2004;31(5):1005-10.
41. International Council of Nurses (ICN). Guidelines on advanced practice nursing. Geneva: ICN; 2020 [cited 2024 May 6]. Available from: https://www.icn.ch/system/files/documents/2020-04/ICN_APN%20Report_EN_WEB.pdf
42. Rodrigues MA, Hercules AB, Gnatta JR, Coelho JC, Mota AN, Pierin AM, et al. Teleconsultation as an advanced practice nursing during the COVID-19 pandemic based on Roy and Chick-Meleis. *Rev Esc Enferm USP*. 2022;56:e20210438.
43. Suso-Ribera C, Castilla D, Zaragoza I, Mesas Á, Server A, Medel J, et al. Telemonitoring in chronic pain management using smartphone apps: a randomized controlled trial comparing usual assessment against app-based monitoring with and without clinical alarms. *Int J Environ Res Public Health*. 2020;17(18):6568.
44. Moreno-Ligero M, Moral-Munoz JA, Salazar A, Failde I. mHealth intervention for improving pain, quality of life, and functional disability in patients with chronic pain: systematic review. *JMIR Mhealth Uhealth*. 2023;11:e40844.
45. Milne-Ives M, Lam C, De Cock C, Van Velthoven MH, Meinert E. Mobile apps for health behavior change in physical activity, diet, drug and alcohol use, and mental health: systematic review. *JMIR Mhealth Uhealth*. 2020;8(3):e17046.
46. Quevedo Rodríguez A, Wägner AM. Mobile phone applications for diabetes management: a systematic review. *Endocrinol Diabetes Nutr (Engl Ed)*. 2019;66(5):330-7.
47. Thomas E, Lee CM, Norman R, Wells L, Shaw T, Nesbitt J, et al. Patient use, experience, and satisfaction with Telehealth in an Australian population (reimagining health care): web-based survey study. *J Med Internet Res*. 2023;25:e45016.

48. Shaffer KM, Turner KL, Siwik C, Gonzalez BD, Upasani R, Glazer JV, et al. Digital health and telehealth in cancer care: a scoping review of reviews. *Lancet Digit Health*. 2023;5(5):e316-27.
49. Martín-Payo R, Martínez-Urquijo A, Zabaleta-Del-Olmo E, Del Mar Fernandez-Alvarez M. Use a web-app to improve breast cancer risk factors and symptoms knowledge and adherence to healthy diet and physical activity in women without breast cancer diagnosis (Precam project). *Cancer Causes Control*. 2023;34(2):113-22.
50. Osingada CP, McMorris B, Piehler TF, Tracy MF, Porta CM. Acceptability, feasibility, and efficacy of telehealth interventions for hiv testing and treatment in adult populations. *Telemed J E Health*. 2023;29(7):1001-13.
51. Hirani SP, Rixon L, Cartwright M, Beynon M, Newman SP. The effect of telehealth on quality of life and psychological outcomes over a 12-month period in a diabetes cohort within the whole systems demonstrator cluster randomized trial. *JMIR Diabetes*. 2017;2(2):e18.