Assessing the Impact of Telemedicine Interventions on Health Care Costs and Utilization: A Scoping Review

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Abstract

Background: The utilization of telemedicine has increased notably since the onset of the pandemic. Understanding the influence of telemedicine on health care costs and utilization can contribute to the monitoring and evaluation of telemedicine programs.

Objective: This scoping review aimed to document the potential impact of telemedicine on health care costs and utilization across diverse health care contexts and to offer a summary of the statistical methodological approaches employed in assessing the impact of telemedicine on health care costs and utilization.

Methods: A literature search was conducted in accordance with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) Extension for Scoping Reviews guidelines, spanning the last 10 years across 3 electronic databases: PubMed/Medline, Web of Science, and Scopus. The search strategy was in accordance with the PICO criteria; patients were defined as the target population; telehealth or telemedicine was defined as the intervention; and standard care or before-and-after self-comparison was defined as the comparison, with health care costs and utilization as the outcome measures. Additionally, the six different structural layers of the TOAST framework for telehealth services were utilized to characterize the interventions. The findings were synthesized and are presented in tables and figures for clarity.

Results: Out of a total of 4,454 identified articles, 14 were selected for review, with approximately 36% (n=5) focusing on chronic conditions. The delivery modalities included telephone call, videoconference, web portal, and smartphone applications, mainly spanning teleconsultation, telemonitoring, and teletherapy with clinicians and nursing support or health care team involvement. Approximately 86% of the studies employed standard face-to-face clinical visits for the control group. Six out of the 12 studies evaluating health care costs and four out of the seven studies assessing health care utilization revealed statistically significant improvements in telehealth compared to the control group. In addition, approximately 43% of the studies conducted univariate and multivariable analyses, with half of the studies incorporating adjusted analyses to control for confounding variables.

Conclusions: Our scoping review suggested that, in the treatment phase, compared with standard face-to-face clinical visits, telemedicine has the potential to decrease health care costs and optimally utilize health resources. Additionally, a regression model was the most commonly used statistical approach for assessing the impact of telemedicine.

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KEYWORDS
telemedicine; telehealth; health care costs; patient acceptance of health care; research methodology; scoping review

Introduction

Digitalization plays a pivotal role in achieving Sustainable Development Goal (SDG) 3, which is focused on promoting good health and well-being, especially in the context of the pandemic and its aftermath [1]. Digital health comprises various technological advancements, including telehealth and telemedicine, which are often interconnected and used interchangeably to advance health care in the Digital Age [2, 3].

Telemedicine facilitates patient access to health care services throughout the entire health care process through means such as prevention [4], diagnosis [5], treatment [6], and recovery [7], effectively overcoming challenges such as extended wait times, geographical distance, and health care personnel shortages, particularly in remote areas. The wide adoption of telemedicine could benefit all stakeholders, such as patients, health care providers, health care institutions, and governments, especially after the COVID-19 pandemic, as evidenced by previous studies [8-10].

Numerous studies with various designs have extensively documented the influence of telemedicine on the perspectives of patients [11], physicians [12], and policy-makers [13]. However, the majority of these studies have tended to narrow their focus to specific disease categories [14, 15] or hospital departments [16, 17] due to the inherent diversity within the realm of telemedicine modalities. There is a need to investigate the potential impact of telemedicine, encompassing its effects on health care costs and utilization across a wide spectrum of telemedicine modalities, disease categories (e.g., chronic disease, cancer, and mental health), and health care settings (e.g., urban or rural areas).

Furthermore, prior evidence has shown that direct-to-consumer (DTC) telemedicine has the potential to improve access to care in a lower-cost setting and increase the frequency of follow-up visits [18, 19], such as follow-up visits for chronic diseases or mental health. DTC telemedicine involves facilitating interactions between health care providers' terminals (such as clinicians and nurses) and patients' terminals within the same institution or practice. In this review, we tailored the intervention services pattern based on DTC telemedicine, which involves the interaction of telehealth services between telemedicine providers and patients, to accurately evaluate the impact of telemedicine on health care costs and utilization.

In addition, the literature lacks clarity regarding the statistical methodologies employed to assess the potential impact of telemedicine on health care costs and utilization. Two prior studies focused on the questionnaires utilized in telemedicine studies [20] and the evaluation methods for assessing telemedicine studies [21]. A previous investigation revealed a hierarchical and embedded relationship between telemedicine utilization and evaluation [2]. However, to date, no study has evaluated the statistical methods employed in assessing the impacts of telemedicine. By consolidating the existing structural knowledge and summarizing methodologies from prior studies, future research can guide the use of appropriate methods to measure the impact of telemedicine.

Therefore, the objectives of this scoping review were twofold: first, to document the potential impact of telemedicine on health care costs and utilization in various health

care contexts (addressing the question of what the potential impact of telemedicine on health care costs and utilization is); and second, to provide a summary of the statistical methodological approaches used in the investigation of the impact of telemedicine (addressing the question of what statistical methodologies have been used to analyze the impact of telemedicine).

Methods

Study Design

This scoping review is part of the work under the World Health Organization (WHO) - Royal Thai Government (RTG) Country Cooperation Strategy (CCS) on Converge Digital Health, 2022-2026 [22]. The present scoping review followed the 5-stage method outlined by Arksey and O'Malley [23] and was consistent with the PRISMA Extension for Scoping Reviews checklist [24].

Eligibility Criteria

Our primary research question addressed whether telemedicine, in comparison to in-person visits, optimized health care costs and utilization. To find eligible studies, we employed the Population, Intervention, Comparison, Outcome (PICO) framework [25], as presented in Multimedia Appendix Table 1. Specifically, the population under consideration consisted of patients with any type of health condition. The intervention could encompass any modality (e.g., telephone call, videoconference, web portal, smartphone application, or mixed modalities), but if multiple modalities were employed, the outcomes derived from each modality had to be individualized. Multiple intervention measures could not be combined into a single outcome. Furthermore, studies in which interactions occurred solely between the telemedicine platform and patients, without the assistance of a human intermediary, were excluded. A comparator was defined as a standard face-to-face clinical visit or before-and-after self-comparison. In this review, our primary focus was on health care costs and health care utilization, which were the key outcomes of interest.

Information Sources and Search

Searches were performed in the PubMed/Medline, Scopus, and Web of Science databases for the past 10 years (2013-2023) using MeSH terms and broad search terms. Given that the purpose of this review was to provide an overview of the large and disparate body of evidence about telemedicine for use by decision-makers and/or stakeholders, both telemedicine and telehealth were used as key words for identifying relevant studies. The search terms used and the number of results for each database are listed in Multimedia Appendix Table 2.

Selection of Sources of Evidence

The literature search results were exported into Endnote (Clarivate Analytics, Philadelphia, USA) to find and remove most duplicates. Covidence systematic review software (Veritas Health Innovation, Melbourne, Victoria, Australia) was subsequently used to review the titles, abstracts (round 1), and full texts (round 2).

The round 1 and round 2 study reviews were conducted by a six-person team with a multidisciplinary health education background (SK, PG, TS, CS, TA, and LS), and the inter-reviewer Cronbach's alpha values were 0.85 and 0.90 for round 1 and 2, respectively [26]. We employed a single-blind approach by giving a code to each team member to reduce bias throughout this scoping review. All studies were screened for eligibility by two researchers independently. Two senior researchers (WI, NK) resolved any conflicts. Any conflicts regarding studies or contradictions were discussed further among the team until a consensus was reached.

The PICO criteria were used in this review to establish a standardized sequence for study selection. When studies met the predetermined criteria, which included the study design, language, publication type, and publication date, we determined exclusion criteria based on the following sequence: (i) population (P); (ii) intervention (I); (iii) comparison (C); and (iv) outcome (O), to ensure a coherent and easily followable workflow for the project.

Data Charting Process and Data Items

The data were extracted using a predefined data extraction table in Microsoft Excel following comprehensive explanations and discussions among team members. The data were collected by five team members (SK, PG, TS, CS, and TA), and the same reviewer (LS) validated the data.

In addition to extracting study characteristics such as the title, publication year, country, income level (upper middle income and high income), data sources (national level, state level, and hospital level), study design (cohort study and randomized controlled trial (RCT)), and study duration (months), this review followed a framework for telehealth services based on our prior work [27]. The TOAST framework comprises six distinct structural layers: 1) the technology employed (tool); 2) health-related outcomes (what); 3) application (for what); 4) service provider (who); 5) time (when); and 6) setting (where), as depicted in Figure 1. To align with the framework of telehealth services and contextual levels used in previous studies [2], we examined the characteristics of telemedicine interventions across three levels: care setting (urban and not available/applicable), patient population (clinical focus, patient type), and telehealth (service provider, technology employed, application).

Moreover, we followed an established statistical methods checklist to extract data related to the statistical methodologies used in the studies. The second objective of the present study included addressing missing data, controlling for confounding factors, conducting subgroup and interaction analyses, and performing sensitivity analysis.

Synthesis of the Results

The data from the included studies were tabulated, and a narrative synthesis was conducted. The data were visualized by grouped and stacked bar plots, which are efficient ways of highlighting the distribution of critical statistical methods for different analysis methods. The x-axis represents the five essential statistical methods, and the y-axis represents the number of studies.

Results

Search Results

Figure 2 illustrates the study selection process using the PRISMA flow diagram. The initial search identified 4,454 studies published between 2013 and June 2023 from the 3 databases, of which 970 (22%) were duplicates. After reviewing the titles and abstracts and the full texts, 3484 and 822 studies, respectively, were excluded. The top three reasons for excluding studies were an out-of-context outcome (306/808, 38%), out-of-context intervention (285/808, 35%), and out-of-context comparator (114/808, 14%). After screening, 14 studies were included in the analysis.

Study Characteristics

Table 1 provides an overview of the general characteristics of the included studies. A substantial portion of the studies were published in 2018 (4/14, 29%) and 2020 (3/14, 22%). According to the World Bank's 2022 classification [28] for a country's income level, all except one study (13/14, 93%) was conducted in high-income countries, with the United States being the dominant contributor (5/14, 36%). One study (1/14, 7%) was conducted in China, which was classified as an upper-middle-income country. Most of the studies (10/14, 72%) collected data at the hospital level. Five studies used electronic health records data at the hospital level (1/14, 7%) [29], state level (3/14, 21%) [30-32] and national level (1/14, 7%) [33]. Regarding study design, almost half of the studies (7/14, 50%) employed an RCT design. Additional details can be found in Multimedia Appendix Table 3.

Table 1. General characteristics of the included studies.

Characteristics	N	Percentage
Publication year		
2016	1	7%
2017	2	14%
2018	4	29%
2019	2	14%
2020	3	22%
2021	1	7%
2022	1	7%
Country		
USA	5	36%
Israel	2	14%
Spain	2	14%
Australia	2	14%
UK	2	14%
China	1	7%
Country's income level		
Upper middle income	1	7%
High income	13	93%
Data source type		

National level	1	7%
State level	3	21%
Hospital level	10	72%
Study design		
Cohort - exposed and control	4	29%
Cohort – before/after	2	14%
Cohort (mixed exposed and control with before/after)	1	7%
RCT - parallel	7	50%

Overview of the Characteristics of Telemedicine Interventions

Table 2 compiles key features of telemedicine services, with most of the study settings located in urban areas (9/14, 64%). Almost half of the studies had durations exceeding 12 or 24 months (8/14, 57%). Notably, the review predominantly involved outpatient individuals (12/14, 86%) with chronic conditions (7/14, 50%). The primary support team comprised clinicians (7/14, 50%) and nurses (3/14, 21%), predominantly utilizing telephone-based methods (6/14, 43%) for delivering telemedicine services. Telemedicine functioned as an approach for teleconsultation (4/14, 29%), telemonitoring (3/14, 21%), and teletherapy (2/14, 14%), facilitating interactions between clinicians or nurses and patients. During the four health care processes, the treatment phase (9/14, 64%) dominated. Additionally, nearly 9 out of the 10 studies used standard face-to-face clinical visits as the comparator (12/14, 86%). The principal outcome measure in the majority of the included studies was health care costs (8/14, 57%). Furthermore, more than two of five studies employed univariate and multivariable analyses as statistical methods (6/14, 43%).

Table 2. Characteristics of the telemedicine services used in the included studies.

Characteristics	N	Percentage
Study setting (where)		
Urban	9	64%
Not available/applicable	5	36%
Study duration (when)		
Less than 6 months	3	21%
6 months	2	14%
12 months	4	29%
24 months	4	29%
More than 24 months	1	7%
Population		
Clinical focus		
Chronic conditions	5	36%
Cancers	2	14%
Urological conditions	2	14%
Mental health	2	14%
Others	3	21%
Patient type		

Outpatients only	12	86%
Outpatients and inpatients	2	14%
Intervention		
Service provider (who)		
Clinician	7	50%
Nurse	3	21%
Health care team	2	14%
Third party	1	7%
Physiotherapist	1	7%
Technology employed (tool)		
Telephone	6	43%
Videoconference	5	35%
Web portal	2	14%
Smartphone application	1	7%
Application (for what)		
Teleconsultation	4	29%
Telemonitoring	3	21%
Teletherapy	2	14%
Telepractice	1	7%
Telerehabilitation	1	7%
Tele-mental health	1	7%
Virtual visit	1	7%
Telemonitoring and telecommunication	1	7%
Health care process		
Prevention phase	1	7%
Diagnosis and treatment phase	3	21%
Treatment phase	9	64%
Recovery phase	1	7%
Comparators/Control group		
Standard face-to-face clinical visit	12	86%
Self-comparison	2	14%
Outcomes (what)		
Both	4	29%
Health care costs	8	57%
Health care utilization	2	14%
Analysis method type		
Only descriptive analysis	1	7%
Descriptive and univariate analyses	4	29%
Univariate and multivariate analyses	6	43%
Cost-effectiveness analysis	3	21%

What is the potential impact of telemedicine on health care costs and utilization?

Table 3 reports the effects of telemedicine interventions on health care costs and utilization. Diverse cohort study designs were employed, including exposed and control group designs [29, 32, 34, 35], before and after designs [30, 31], and mixed designs [33]. The shortest (3 months) and longest (27 months) studies involved patients who underwent subacromial decompression surgery [36] and those with cancer [37], respectively. The chronic conditions under examination were broad and included heart failure [34, 38], hypertension [29], and either a single [32] or multiple active chronic diseases [30]. Similarly, a wide range of sample sizes was observed, varying from 18 patients [36] to 238,943 patients [33].

Most of the telemedicine interventions involved prevalent patterns, including home-based telemonitoring [29, 30, 34, 38], clinician-led initiatives [29, 32, 33, 35, 37, 39, 40], and telephone follow-up [30, 31, 34, 35, 39, 41]. The health care team engaged in online interactions involving clinicians, patients, and administrative staff [34] or adopted a personalized medicine approach led by a nurse [30]. Beyond hospital-based entities, third-party involvement in telemedicine service provision was evident, represented by technology companies [42] facilitating interactions between administrators and patients. Regarding the health care process, nine interventions utilized telemedicine during the treatment phase [29, 30, 33-35, 37, 38, 40, 42], three during combined diagnosis and treatment phases [31, 32, 39], and one during the prevention [41] and recovery [36] phases.

Table 3. Characteristics of telemedicine interventions for health care costs and utilization.

No.	Study	Study design	Study duration	Population		Intervention			Comparator	Outcomes
				Clinical focus	Sample size	Service provider	Technology employed	Application		
1	Messina et al. 2016 [34]	Cohort (exposed and control)	4 months	Chronic conditions	218	Health care team	Telephone	Telemonitoring	Standard care	Both
2	Burns et al. 2017 [37]	RCT (parallel)	27 months	Cancers	82	Clinician	Video conference	Telepractice	Standard care	Costs
3	Porath et al. 2017 [30]	Cohort (before/after)	24 months	Chronic conditions	388	Health care team	Telephone	Telemonitoring and telecommunication	Self-comparison	Both
4	Jones et al. 2018 [39]	RCT (parallel)	6 months	Urological conditions	57	Clinician	Telephone	Teleconsultation	Standard care	Costs
5	Levine et al. 2018 [29]	Cohort (exposed and control)	12 months	Chronic conditions	25899	Clinician	Web-based platform	Telemonitoring	Standard care	Utilization
6	Pastora-Bernal et al. 2018 [36]	RCT (parallel)	3 months	Others	18	Physiotherapist	Video conference	Telerehabilitation	Standard care	Costs
7	Watson et al. 2018 [40]	RCT (parallel)	12 months	Mental health	179	Clinician	Web-based session	Teletherapy	Standard care	Costs
8	Adler et al. 2019 [31]	Cohort (before/after)	24 months	Cancers	107	Nurse	Telephone	Teleconsultation	Self-comparison	Both
9	Miah et al. 2019 [35]	Cohort (exposed and control)	4 months	Urological conditions	119	Clinician	Telephone	Teleconsultation	Standard care	Costs
10	Guo et al. 2020 [42]	RCT (parallel)	12 months	Others	405	Third party	Smartphone application	Teletherapy	Standard care	Costs
11	Jiménez-Marrero et al. 2020 [38]	RCT (parallel)	6 months	Chronic conditions	116	Nurse	Video or audio conference	Telemonitoring	Standard care	Both
12	Zhao et al. 2020 [33]	Cohort (mixed exposed and	12 months	Mental health	238943	Clinician	Video conference	Tele-mental health	Standard care	Costs

		control with before/after)								
13	Reed et al. 2021 [32]	Cohort (exposed and control)	24 months	Chronic conditions	178440	Clinician	Video or telephone	Virtual visit	Standard care	Utilization
14	Killedar et al. 2022 [41]	RCT (parallel)	24 months	Others	662	Nurse	Telephone	Teleconsultation	Standard care	Costs

Table 4 offers a comprehensive overview of the health care cost and utilization outcomes derived from the included studies, revealing a diverse array of results. Among the 12 studies that examined health care cost outcomes, six indicated that, compared to standard care, telemedicine substantially reduced costs. Two studies supported these findings, although the p values were not significant. Two studies reported no statistically significant difference between the two groups. Notably, an additional two studies demonstrated a cost-saving trend in the standard care group. Specifically, Adler et al. concentrated on the initial consultation among breast cancer patients in the diagnosis and treatment phase [31]. Furthermore, four studies assessed direct costs, two evaluated indirect costs, and three considered both indices to measure cost outcomes.

In relation to utilization outcomes, four out of seven studies examining health care utilization reported a significant difference between the telemedicine group and the standard care group in terms of different indicators. Porath et al. observed a significant reduction in hospitalization days among elderly patients with complex chronic conditions compared to those in the standard care group [30]. Jones et al. reported that telemedicine significantly reduced consultation time among women with urinary incontinence [39]. Jiménez-Marrero et al. revealed a significantly lower incidence of the first occurrence of the primary endpoint among patients with chronic heart failure in the telemedicine arm than in the control arm [38]. Adler et al. observed a significant increase in outpatient visits among breast cancer patients after the initial consultation [31].

Table 4. Impact of telemedicine interventions on health care outcomes.

Study	Outcome measure	Health outcomes
Health care cost outcome (n=12)		
Messina et al. 2016 [34]	Total cost*	
Burns et al. 2017 [37]	Indirect cost (costs of staff wages, equipment, patient travel reimbursement)	
Porath et al. 2017 [30]	Direct medical annual costs	
Jones et al. 2018 [39]	Total cost (direct and indirect costs)	
Pastora-Bernal et al. 2018 [36]	Total cost (direct and indirect costs)	
Watson et al. 2018 [40]	Direct cost	
Adler et al. 2019 [31]	Total cost*	
Miah et al. 2019 [35]	Total cost*	
Guo et al. 2020 [42]	Indirect cost (costs of travel and information platform)	
Jiménez-Marrero et al. 2020 [38]	Direct cost	
Zhao et al. 2020 [33]	Direct cost (total insurer-allowed payments for inpatient stays, facility outpatient visits, professional services, and prescription drugs)	
Killedar et al. 2022 [41]	Total cost (direct and indirect costs)	

Health care utilization outcome (n=7)		
Messina et al. 2016 [34]	Readmission within a 30-day period	↓
Porath et al. 2017 [30]	Hospitalization days, primary care visits, emergency room visits	↓
Jones et al. 2018 [39]	Consultation time	↓
Levine et al. 2018 [29]	Primary care visits, specialist visits, emergency department visits, inpatient admissions	↔
Adler et al. 2019 [31]	Hospitalizations, primary care physician visits, emergency room visits, outpatient clinic visits	↑
Jiménez-Marrero et al. 2020 [38]	Hospitalizations	↓
Reed et al. 2021 [32]	Hospitalizations, emergency department visits	↔

Abbreviations and definitions:
*, not available for direct or indirect costs.
↑, ↓, statistically significant increase or reduction.
↔, no statistically significant difference.
↓, reduction with no available p value.

Telemedicine better Control better

What statistical methodologies have been used to analyze the impact of telemedicine?

Figure 3 illustrates the statistical methodologies employed in the included studies to assess the impact of telemedicine, with detailed information provided in Multimedia Appendix Table 4. Overall, controlling for confounding factors was the most utilized methodology in these studies (7/14, 50%), followed by addressing missing data (5/14, 36%). Subgroup analysis (3/14, 21%), interaction analysis (3/14, 21%), and sensitivity analysis (3/14, 21%) were each performed in 3 studies. Univariate and multivariate analyses comprised a comprehensive approach utilizing all five methods, including addressing missing data, controlling for confounding variables, and conducting subgroup analysis, interaction analysis, and sensitivity analysis. In contrast, the other three studies employed only three, one, or none of these methods. Imputation [39, 41] and propensity score matching (PSM) were more frequently utilized to address missing data, and PSM was also employed for controlling for confounders in electronic health records data [29, 30]. Regression models (e.g., multivariable logistic regression modeling) [31, 32] and adjusted analyses (e.g., analysis of covariance (ANCOVA)) [33, 39] were predominantly applied to control for confounders.

Discussion

Principal Findings

This study reviewed the literature from the last decade, focusing on 14 selected studies. The findings suggested that telemedicine has the potential to save health care costs compared to standard care, especially during the treatment phase. Generally, telemedicine enhances patient access to health care for further treatment to improve health outcomes. Most of the studies employed both univariate and multivariable analyses to control for confounding variables.

Utilizing digital health solutions to enhance population health, particularly in the aftermath of COVID-19, has been the predominant trend since the emergence of digital technologies and health innovation [43]. Telemedicine can potentially be more cost effective than standard care according to our primary objective. This finding was consistent with those of prior systematic reviews; one showed a growing body of evidence suggesting a generally favorable impact on costs and health outcomes [44], while the other observed an overall advantage in the cost and effectiveness of telemedicine for chronic neurological diseases as opposed to in-person management [45]. Additionally, this review assessed telemedicine interventions in isolation, without integrating other complementary modalities, such as telemedicine and standard care versus standard care only or mHealth and telephone follow-up versus standard care. This limited intervention approach provides robust and direct affirmation that telemedicine is more cost effective than standard care is, offering policy-makers increased confidence in adopting telemedicine for public health integration.

To better understand the impact of telemedicine on health care utilization, this review included four phases of the health care process: prevention, diagnosis, treatment, and recovery. The diagnosis phase, such as in the study by Adler et al. [31], showed increased costs in the telemedicine group, which was attributed to patients seeking further treatment after the initial consultation. Telemedicine consistently has overwhelmingly positive patient benefits and enhances productivity across various services [46]. Compared with the treatment and recovery phases, heightened health care utilization during the prevention and diagnosis phases not only leads to better health outcomes but is also smarter and more sustainable. Telemedicine is becoming integrated into our daily lives and is anticipated to be increasingly utilized in the future. Establishing appropriate awareness and knowledge for utilizing telemedicine in the early stages of disease is crucial for enhancing the well-being of the public.

For our secondary objective, this review revealed that univariate and multivariate methods were used more frequently than were other methods (cost-effectiveness analysis, descriptive and univariate analysis, and descriptive analysis only). We grouped the methodologies used in the studies based on whether they tested differences in p values. This approach prevented the descriptive analysis from meeting the extracted data requirements in this review. However, it is crucial to emphasize that this review aimed to summarize all methods used without favoring one over another, as the choice of methodology depended on the specific objectives of the studies. Moreover, given the limitations of these studies, certain details, such as how missing data were addressed, might not be expressly stated in prior research. Authors may have undertaken such analyses, yet we did not find these actions in the main text due to constraints on word count, given that academic publications prioritize crucial information over exhaustive details. Nonetheless, employing a suitable statistical methodology could assist researchers in extracting additional insights from the study and, consequently, enhancing the presentation of the results.

Moreover, this review identified a limited number of service providers as third-party entities involved in telemedicine. Third parties in the health care process, through telemedicine, can potentially alleviate health care professionals' workload to an extent by addressing conflicts between clinicians and patients regarding waiting and response times. However, there are evident drawbacks, such as excessive medical treatment and waste of medical resources. Further research could explore the necessary balance among policy-makers, hospitals, physicians, and patients to achieve cost-effectiveness, safety, and sustainability.

Strengths and Limitations

This scoping review contributes insights into the impact of telemedicine on health care costs and utilization across diverse contexts, focusing on the effects of a single telemedicine modality. Additionally, the statistical methodologies employed in the included studies were summarized, offering researchers a comprehensive perspective to improve the presentation of their study results. However, this review has several limitations. To address our research questions promptly, we conducted a scoping review, which, unlike systematic reviews and meta-analyses, cannot provide robust evidence. Moreover, this review did not explore the gray literature and concentrated solely on a 10-year retrospective period. Finally, this scoping review addressed only two outcomes, health care costs and utilization, without delving into clinical outcomes.

Conclusions

This scoping review showed that, compared to standard face-to-face clinical visits, telemedicine has the potential to decrease health care costs and optimize health service utilization in various health care settings. Controlling for confounding factors via regression was the most commonly used methodology in the studies included in this review to study the impact of telemedicine on the health care system.

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Conceptualization: WI; data curation: SL, SK, PG, TS, CS, and TA; formal analysis and software: SL; funding acquisition: WI and NK; methodology: SL; project administration: SL; supervision and validation: WI and NK; writing – original draft: SL; writing – review and editing: All authors.

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Conflicts of Interest

The authors have no conflicts of interest to declare.

Abbreviations

PRISMA: preferred reporting items for systematic reviews and meta-analyses
DTC: direct-to-consumer
PICO: population, intervention, comparison, outcome
RCT: randomized controlled trial

Multimedia Appendix

Appendix Table 1 The inclusion and exclusion criteria; Appendix Table 2 Search terms used and the number of results for each database; Appendix Table 3 General characteristics of the included studies; Appendix Table 4 Detailed characteristics of the statistical methodologies of the included studies.

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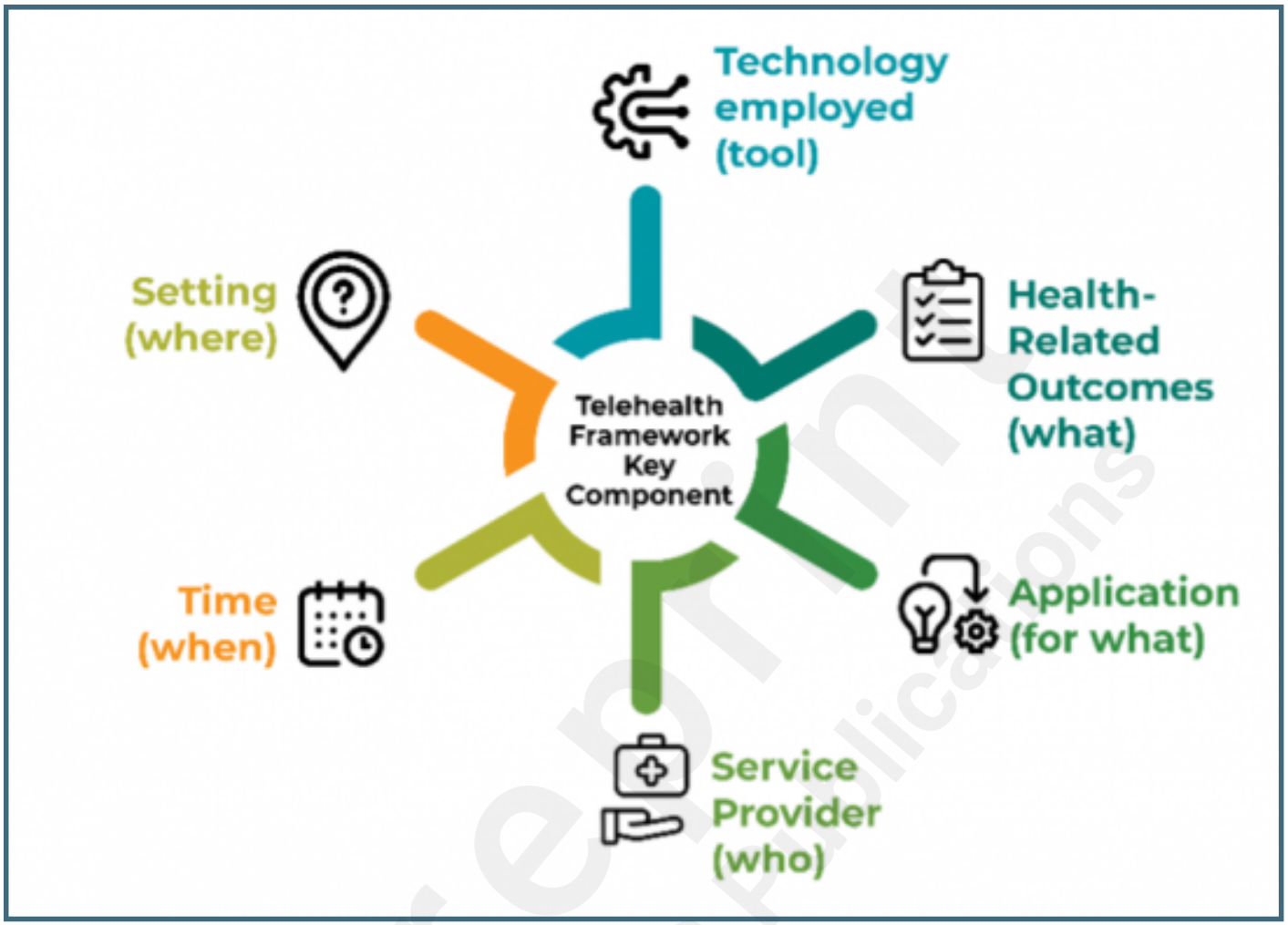
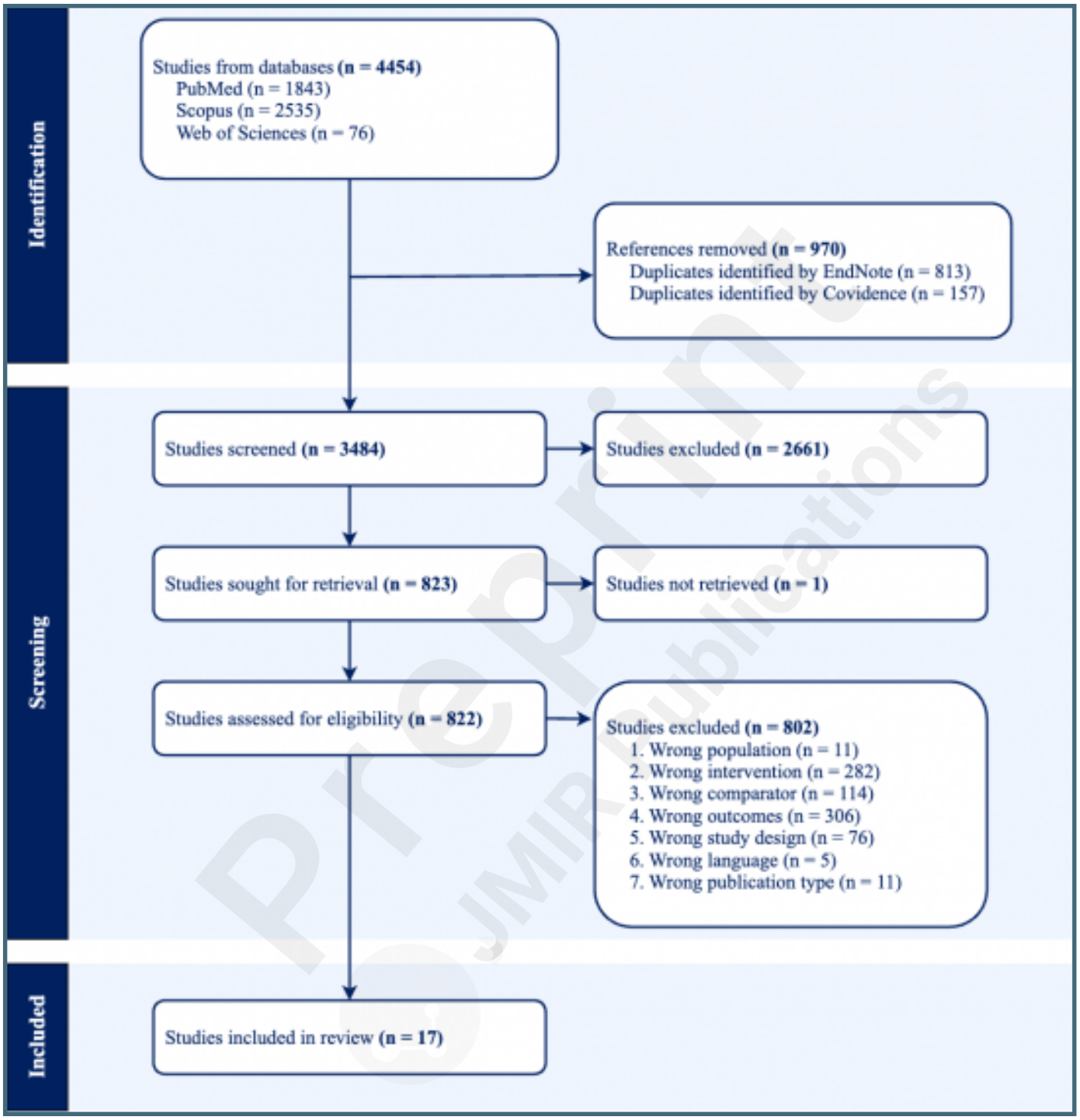
Supplementary Files

Figures

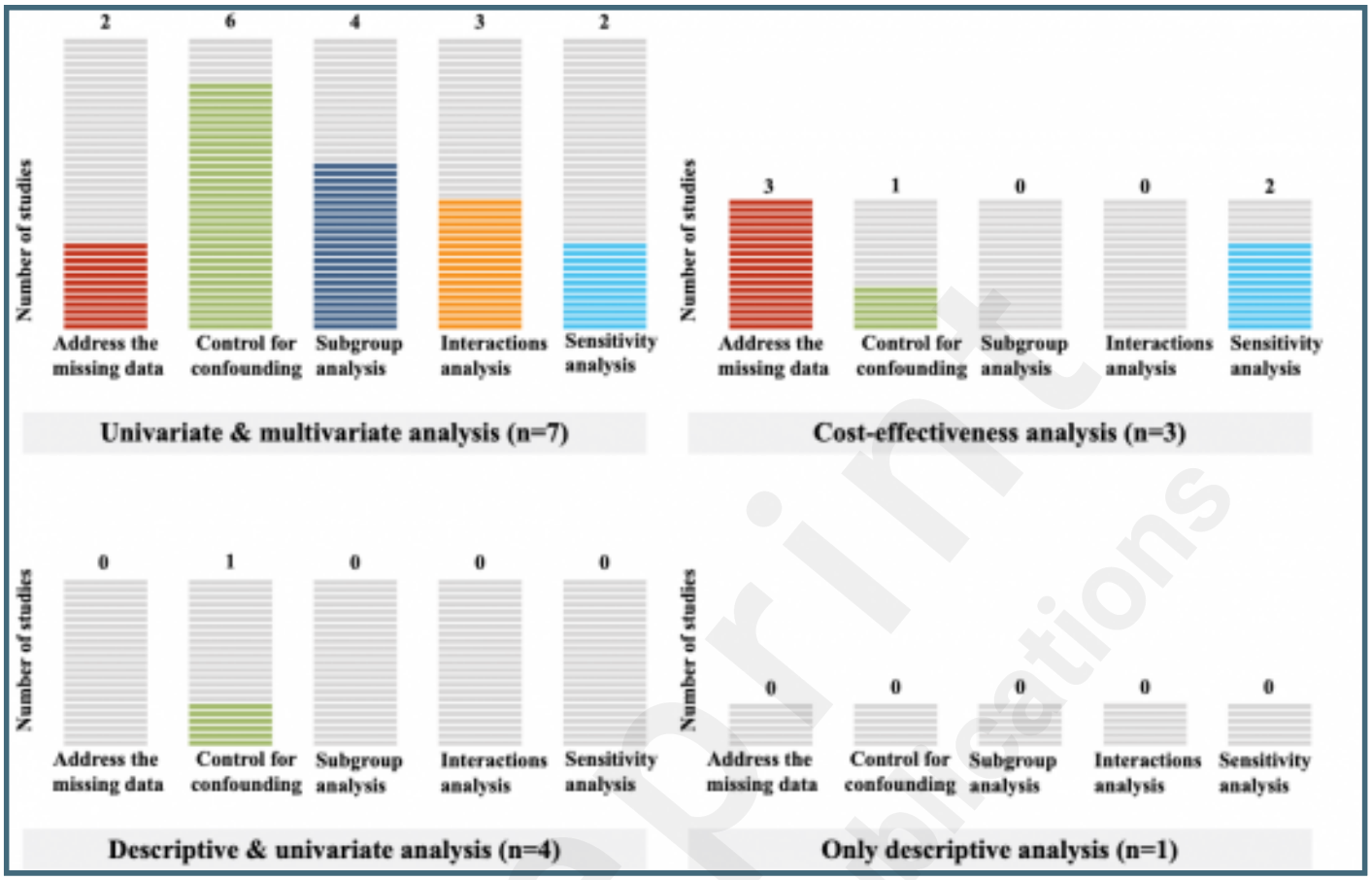
Framework for telehealth services.



Study selection process using the PRISMA flow diagram.



Methodology for assessing the impact of telehealth intervention on healthcare cost and utilization.



Multimedia Appendixes

The inclusion and exclusion criteria.
URL: http://asset.jmir.pub/assets/ef9258531bcfc7f14f0df0084ff0579e.docx

Search terms used and the number of results for each databases.
URL: http://asset.jmir.pub/assets/137d1273305310a320dd7f4c00fc1785.docx

General characteristic of included studies.
URL: http://asset.jmir.pub/assets/a8bee1355598e2d5ff335304694cbdde.docx

Detailed characteristic of statistically methodology of included studies.
URL: http://asset.jmir.pub/assets/8b73e72b28caf83de81da6fbcd8d467e.docx