



A systematic scoping review of implementation of telepharmacy during COVID-19

Syed Arman Rabbani^{1*}, Shrestha Sharma², Asiya Mahtab³, Faheem Hyder Pottoo⁴, Sathvik B. Sridhar¹

¹RAK College of Pharmacy, RAK Medial and Health Sciences University, Ras Al Khaimah, United Arab Emirates.

²Amity Institute of Pharmacy, Amity University, Gurgaon Haryana, India.

³School of Pharmaceutical Education and Research, Jamia Hamdard University, New Delhi, India.

⁴College of Clinical Pharmacy, Imam Abdulrahman Bin Faisal University, Dammam, Saudi Arabia.

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ABSTRACT

This systematic scoping review aimed to examine the literature on expanding role of telepharmacy services during the ongoing COVID-19 pandemic. Four electronic databases, PubMed, Scopus, ProQuest, and Cochrane, were searched to identify published studies that reported implementation of telepharmacy services since the start of pandemic (31st December 2019 to 31st May 2022). Twenty-eight studies met the inclusion criteria comprising 15 cross-sectional studies, 12 studies sharing experience and practice related to telepharmacy services, and one pre-post intervention study. Studies reported establishment and implementation of various novel telepharmacy models in different settings; primary, secondary, tertiary, and quaternary care hospitals, hospital and community pharmacies, and specialized care centers. Telepharmacy provided pharmaceutical care to patients with COVID-19, chronic diseases, HIV infection, cancer, cystic fibrosis, and patients on anticoagulants. Pharmaceutical care services like patient counseling services (19 studies), medication order review and medication reconciliation (15 studies), drug therapy optimization (11 studies), adverse drug reaction monitoring and management (7 studies), medication adherence assessment (5 studies), and drug-related problem monitoring (4 studies) were delivered using telepharmacy. Based on the identified evidence, telepharmacy proved beneficial in delivering a range of pharmaceutical care services to the patients during the current pandemic. However, there is a need for more rigorous evidence on the reliability, safety, and effectiveness of telepharmacy in comparison to the traditional face-to-face healthcare delivery model.

INTRODUCTION

The implementation of telepharmacy models began in early 2000s in United States, Australia, and Canada with the aim of providing telehealth services to patients situated at remote locations (Clifton *et al.*, 2003; McDonald, 2009; Nissen and Tett, 2003). Telepharmacy, which falls under the telemedicine umbrella, refers to the provision of pharmaceutical care services through information and communication technologies to the patients in remote areas without direct contact with the pharmacist

(Alexander *et al.*, 2017). Over the years, telepharmacy has been useful in delivering medication-use activities when pharmacists may not be present physically or in situations where there may be limitations of pharmacy resources (Baldoni *et al.*, 2019). Furthermore, it provides an alternative for delivering care services in specialty areas where staffing is limited (Le *et al.*, 2020; Peterson and Anderson, 2004; Poulson *et al.*, 2010; Win, 2017).

Adoption of telepharmacy services has proved beneficial in many aspects. It has improved accessibility of pharmaceutical care services to patients in rural and far-flung areas (Kimber and Peterson, 2006). It has reduced cost and saved time for the patients (Littauer *et al.*, 2017; Traynor, 2013). Furthermore, telepharmacy improved medication adherence (Fensterheim *et al.*, 2015) among patients by enhancing their trust and contentment with the provided services. Telepharmacy has expanded the role of pharmacists by providing an ideal medium for improving

*Corresponding Author

Syed Arman Rabbani, RAK College of Pharmacy, RAK Medial and Health Sciences University, Ras Al Khaimah, United Arab Emirates.
E-mail: arman@rakmhsu.ac.ae

the medication management in patients with chronic diseases (Margolis *et al.*, 2013; McFarland *et al.*, 2012), for identifying and resolving the drug-related problems (McNamara *et al.*, 2021; Wang *et al.*, 2021), for medication monitoring and optimization (Mohiuddin *et al.*, 2021; Surapat *et al.*, 2021), for efficient patient education with enhanced privacy (Hudd and Tataronis, 2011; Lam and Rose, 2009), for adverse drug reaction monitoring (Bindler, 2020; Margusino-Framiñán *et al.*, 2020), and for dealing the social determinants of health (Livet *et al.*, 2021).

The COVID-19 pandemic has changed the way how information technology is utilized in healthcare services (Budd *et al.*, 2020). During the ongoing pandemic, telepharmacy received increased attention and being widely employed all around the world (Killeen *et al.*, 2020). It has emerged as a viable substitute for the provision of face-to-face pharmaceutical care services during the pandemic, especially at a time when people are required to practice social distancing and limit the in-person visits to the healthcare facilities (Ameri *et al.*, 2020; Unni *et al.*, 2021). Therefore, this systematic scoping review aimed at summarizing the expanding role of telepharmacy services in the pandemic era which emerged as a useful tool in delivering the best telehealth services to patients and rebooted the role of clinical and community pharmacists in healthcare system.

Unni *et al.* (2021) conducted a similar scoping review of telepharmacy during COVID-19. However, their literature search was limited to only two databases with different study inclusion criteria. This systematic review employed a comprehensive search of four large databases and included all types of studies that reported implementation of telepharmacy services since the beginning of COVID-19 pandemic.

The objectives of this systematic review were to:

1. Identify the different types of studies that reported implementation of telepharmacy services during the COVID-19.
2. Characterize the pharmaceutical care services provided through telepharmacy during COVID-19.
3. Recognize the different means and tools employed for telepharmacy.
4. Examine the impact or outcomes of telepharmacy services on the study populations.

METHODS

This systematic scoping review was carried out as per the guidance by Joanna Briggs Institute (Peters *et al.*, 2015) and is reported following the Preferred Reporting Items for Systematic Reviews and Meta-analyses Extension for Scoping Reviews (PRISMA-ScR) guidelines (Tricco *et al.*, 2018).

Search strategy

Four electronic databases, PubMed, Scopus, ProQuest, and Cochrane, were searched from 31st December 2019 to 31st May 2022, utilizing recognized search methods for scoping reviews (Peters *et al.*, 2015) to identify relevant published studies. On each of these databases, preliminary searches were carried out to identify relevant search terms. A combination of keywords was used: Coronavirus disease, COVID-19, SARSCoV-2, telepharmacy, tele-pharmacy, telemedicine, tele-medicine, telehealth, tele-health, pharmacist, clinical pharmacist, hospital pharmacist, and community pharmacist. The search terms were

combined using Boolean operators; AND, OR, and NOT. The search strategy was developed in consultation with the university librarian. Furthermore, to identify additional studies the reference lists of all the selected studies were screened.

Eligibility criteria

Inclusion criteria

All articles, research, practice innovation, and experience, which reported implementation, application, establishment, modification, and expansion of telepharmacy services, involving pharmacists since the beginning of COVID-19 pandemic, were included in the review. Furthermore, articles only in English language were included. The start of the pandemic was taken as 31st December 2019, when the health authorities in Wuhan confirmed first cases of COVID-19.

Exclusion criteria

Review articles, opinions, letters, articles describing opportunities and challenges, articles related to other healthcare professions (other than pharmacists), knowledge, attitude, and perception articles, and technology-related articles were excluded from the review.

Study selection

Two reviewers Syed Arman Rabbani (SAR) and Shrestha Sharma (SS) performed the screening of the articles (title and abstract screening along with full-text screening for eligibility) based on the eligibility criteria. Other two reviewers Asiya Mahtab (AM) and Faheem Hyder Pottoo (FHP) independently confirmed this screening exercise. In case of any conflict or disagreement during the screening process, opinion of the fifth reviewer Sathvik B. Sridhar (SBS) was sought. Conflict or disagreement was resolved through consensus discussion.

Charting and synthesis of data

Two reviewers (SAR and SS) independently carried out the data extraction or charting. The following information was recorded: authors, country, type of study, study setting, type of pharmaceutical care service offered through telepharmacy, tools/means of telepharmacy, and description and impact of the study.

Methodological quality assessment of the studies included in this review was not carried out as the review aimed to summarize and disseminate the current evidence on telepharmacy implementation during COVID-19. A narrative synthesis of the evidence was completed and presented in the review.

RESULTS

Search results

The literature search generated 270 articles. Following deduplication, screening titles, and abstracts of the articles, 68 full-text articles were reviewed for eligibility. Out of these, 40 articles did not meet the eligibility criteria and were excluded. Reasons for exclusion were: studies related to other healthcare professionals, studies related to knowledge, attitude, perception of telepharmacy, opinions, recommendations, advice, statements, patient experiences, and technology-related studies. In total, 28 studies, which met the inclusion criteria, were included in the review. Figure 1 depicts the details of the literature search and the screening processes.

Characteristics of the studies

The key characteristics of the studies included in the review are outlined in Table 1.

Study design, setting, and country

Majority of the studies were cross-sectional studies ($n = 15$) followed by studies sharing experience and practice related to telepharmacy services ($n = 12$) and one study was pre-post intervention study. Highest number of studies were conducted in United States ($n = 6$) followed by Spain ($n = 4$), Saudi Arabia ($n = 3$), China ($n = 2$), Pakistan ($n = 2$), United Arab Emirates ($n = 2$), Canada ($n = 1$), Brazil ($n = 1$), Malaysia ($n = 1$), Thailand ($n = 1$), Philippines ($n = 1$), Nigeria ($n = 1$), Egypt ($n = 1$), Jordan ($n = 1$), and Republic of Srpska, Bosnia, and Herzegovina ($n = 1$).

Telepharmacy services were implemented in different settings including primary, secondary, tertiary, and quaternary care hospitals, hospital and community pharmacies, and specialized care centers like cancer, stroke, anticoagulation, cystic fibrosis, and pediatric. In addition, rural and remote areas were also served by telepharmacy during the COVID-19.

Participants

Out of the 28 studies, 17 studies reported the different numbers and types of participants. Telepharmacy services were offered to varied populations including COVID-19 patients, cancer patients, patients with cystic fibrosis, patient with HIV infection, patients with other chronic diseases, and patients on anticoagulation therapy, patients with hospital, community pharmacy visits, and general population.

Pharmaceutical care services delivered through telepharmacy during COVID-19

The details of pharmaceutical care services provided using telepharmacy during the ongoing pandemic are summarized in Table 1 and illustrated in Figure 2. In majority of the studies (19 out of 28), patient counseling or education services were provided virtually employing telepharmacy. In 15 studies medication order review or verification and medication reconciliation were delivered remotely through telepharmacy. Drug therapy optimization and medication management services were also offered during COVID-19 with the help of telepharmacy in 11 of the 28 reviewed studies. Moreover, adverse drug reaction monitoring

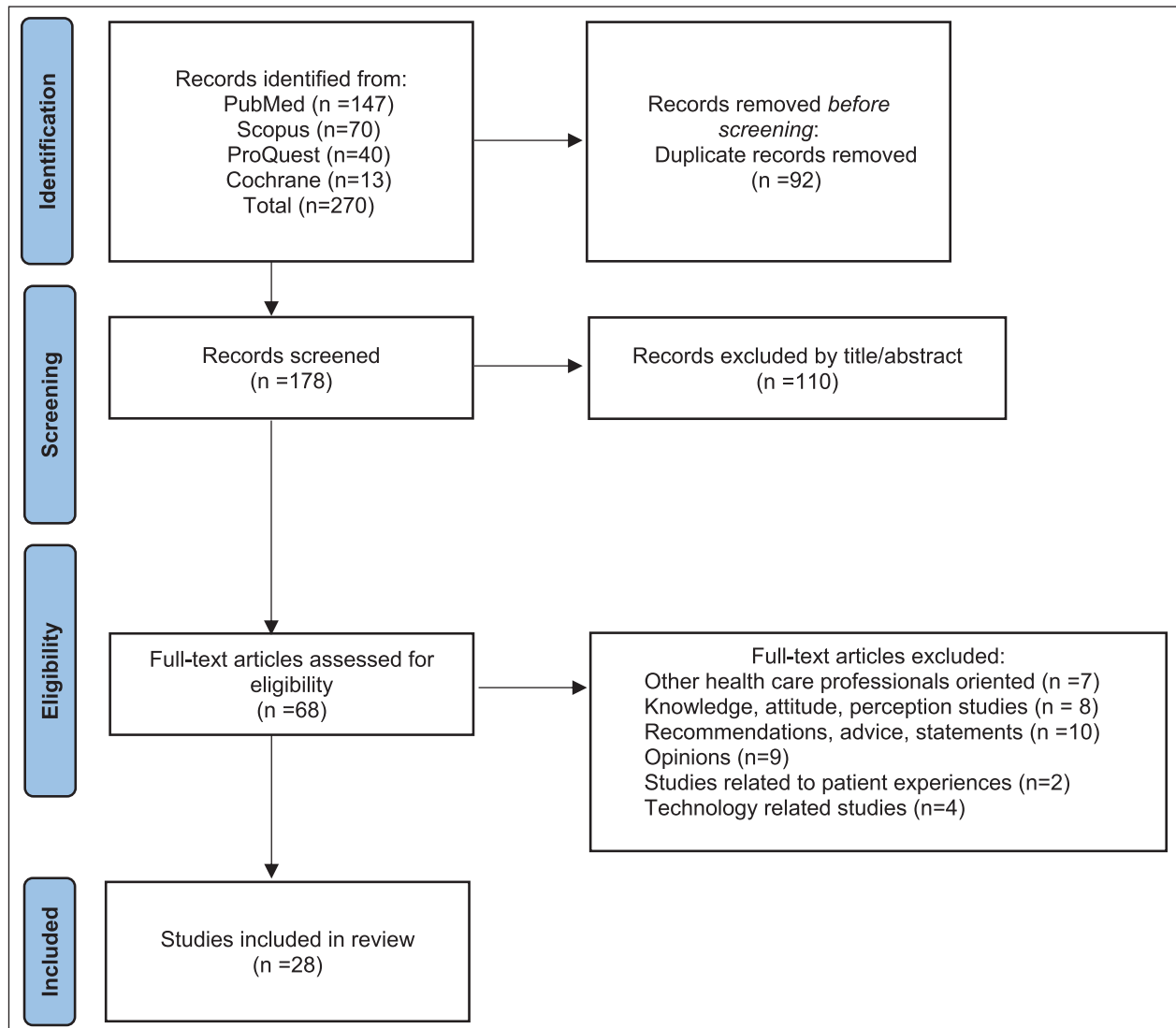


Figure 1. PRISMA flow diagram for study selection.

Table 1. Characteristics of studies included in the scoping review.

Authors	Country	Setting	Type of article (study design)	Type of pharmaceutical care Service offered through telepharmacy	Tools/means used for telepharmacy	Impact/outcomes
Asseri <i>et al.</i> (2020)	Saudi Arabia	University hospital pharmacy	Research (Cross-sectional)	<ul style="list-style-type: none"> Remote medication order review Medication home delivery Online prescription refills Virtual patient counseling 	<ul style="list-style-type: none"> Online Portal WhatsApp Microsoft Teams 	<ul style="list-style-type: none"> Implementation of innovative telepharmacy-based outpatient and inpatient pharmacy workflows utilizing various e-tools like WhatsApp, online portals, and other apps. Telepharmacy approach enhanced the provision of different pharmaceutical care services like better delivery of inpatient and outpatient orders and virtual counseling sessions. Establishment of a telepharmacy-based anticoagulation clinic Clinical pharmacists carried out anticoagulant management telephonically Telephone-based dose adjustments were carried out keeping in view INR results of the patients The telepharmacy model was found to be efficient, cost-effective, and met patient satisfaction. Implementation of telepharmacy-based patient education and medication reconciliations Application of virtual prescription processing Telepharmacy helped in maintaining pharmaceutical care continuity and minimized pharmacist-patient direct contact. Implementation of "Guddi-bajji" telepharmacy model The model connected the rural community to real time healthcare professionals including tele-pharmacists and resulted in better health awareness and medication adherence in the community. Furthermore, the tele-pharmacy model resulted in prevention of medication errors Resolution of medication-related problems during telehealth clinical pharmacist visits
Al Ammari <i>et al.</i> (2021)	Saudi Arabia	Tertiary care hospital, Anticoagulation clinic	Research (Cross-sectional)	<ul style="list-style-type: none"> Medication management – anticoagulation management Tele-patient counseling 	<ul style="list-style-type: none"> Telephone WhatsApp 	
Al-Rabayyah <i>et al.</i> (2021)	Jordan	Cancer center	Experience	<ul style="list-style-type: none"> Virtual prescription processing Telepharmacy-based patient counseling Medication reconciliation Medication home delivery 	<ul style="list-style-type: none"> Telephone Electronic medical record system 	
Bukhari <i>et al.</i> (2021)	Pakistan	Rural areas	Experience	<ul style="list-style-type: none"> e-prescription review and verification Virtual supervision of medication dispensing e-medication counseling e-follow up for medication adherence and adverse drug reaction monitoring 	<ul style="list-style-type: none"> Laptops Tablets Smartphones Telehealth software 	
McNamara <i>et al.</i> (2021)	United States	Primary care clinics	Research (Cross-sectional)	<ul style="list-style-type: none"> Medication-related problem resolution 	<ul style="list-style-type: none"> Telephone 	

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Authors	Country	Setting	Type of article (study design)	Type of pharmaceutical care Service offered through telepharmacy	Tools/means used for telepharmacy	Impact/outcomes
Kjerengtroen <i>et al.</i> (2020)	United States	Quaternary referral medical center, Stroke center	Experience	<ul style="list-style-type: none"> Virtual patient rounds Order verification Patient education Medication history interview Medication management Antibiotic stewardship 	<ul style="list-style-type: none"> Telephone Laptops Audiovisual Software: "TeleHealth AI" Wearable communication device – "Vocera Badge" Video visits through "Connect Care Pro TeleHealth" Television, camera, audio speakers 	<ul style="list-style-type: none"> Introduction of "Remote Pharmacy Services Plan" Clinical pharmacists provided different types of pharmacy services to the patients remotely. Clinical pharmacists were equipped with different software applications and devices to provide remote pharmaceutical care services. Establishment of a remote pharmacy clinical care model for cancer patients Oncology pharmacists conducted medication history interview with baseline assessment followed by care plan development and appropriate medication counseling using remote telephone-based model The model was successful in delivering remote outpatient oncology pharmacy services and was well received by the patients Development and operation of an online telepharmacy service for receiving and processing medication-related queries The online telepharmacy service received medication queries through Google Forms and required medication information was provided by the pharmacists to the user through different modes of communication like email, Facebook messenger, and text messages. Telepharmacists responded to various drug information queries related to drug indication, vitamins and supplement, adverse drug reactions, drug interactions, etc. The users expressed satisfaction with the service.
Marchese <i>et al.</i> (2021)	Canada	Cancer center	Experience	<ul style="list-style-type: none"> Remote medication histories with baseline symptom assessments Virtual care plans Remote medication counseling Virtual follow-up 	<ul style="list-style-type: none"> Telephone 	
Plantado <i>et al.</i> (2021)	Philippines	General public	Research (Cross-sectional)	<ul style="list-style-type: none"> Online drug information service Medication queries resolution 	<ul style="list-style-type: none"> Online platforms Google forms Facebook messenger Email Telephone 	

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Authors	Country	Setting	Type of article (study design)	Type of pharmaceutical care Service offered through telepharmacy	Tools/means used for telepharmacy	Impact/outcomes
Yong <i>et al.</i> (2021)	Malaysia	Outpatient pharmacy	Experience (Cross-sectional)	<ul style="list-style-type: none"> Virtual medication counseling 	<ul style="list-style-type: none"> Computer, microphone, speaker, webcam web platforms like Google Meet or Zoom 	<ul style="list-style-type: none"> Implementation of virtual medication counseling services using a novel and interactive web-based application Patient's request for virtual medication counseling was received, patient's prescription was uploaded to the web-based platform, virtual medication counseling session was scheduled and delivered using Google Meet or Zoom Implementation of hospital telepharmacy services for patients living in rural areas Telepharmacists provided proactive and outcome-based interventions using telephone and social media applications like WhatsApp Pharmaceutical care provided to COVID-19 patients in rural areas by six telepharmacy teams of clinical pharmacists. Telepharmacy assisted in providing optimal pharmaceutical care to patients residing in rural areas. Pharmaceutical care services were provided to COVID-19 patients using remote services Pharmacies with telepharmacy services provided significantly higher number of COVID-19-related recommendations as compared to pharmacies without telepharmacy services. In addition, pharmacies with telepharmacy services had lower incidence of medication dispensing errors as compared to pharmacies without telepharmacy services. Telepharmacy services augmented patient access to pharmaceutical care and reduced medication-dispensing errors.
Al Meslamani <i>et al.</i> (2021)	Egypt	Hospitals	Research (Cross-sectional)	<ul style="list-style-type: none"> Prescription error identification Drug therapy optimization Patient education 	<ul style="list-style-type: none"> Telephone WhatsApp 	
Ibrahim <i>et al.</i> (2020)	United Arab Emirates	Community pharmacies	Research (Cross-sectional)	<ul style="list-style-type: none"> Patient counseling Medication dispensing errors identification 	<ul style="list-style-type: none"> Video-conferencing software Telephone Websites 	

Continued

Authors	Country	Setting	Type of article (study design)	Type of pharmaceutical care Service offered through telepharmacy	Tools/means used for telepharmacy	Impact/outcomes
Al Mazrouei <i>et al.</i> (2021)	United Arab Emirates	Community pharmacies	Research (Cross-sectional)	<ul style="list-style-type: none"> • Remote consultation • Remote prescription refills • Remote medication review • Home delivery of medication • Pharmacists interventions 	<ul style="list-style-type: none"> • Video conferencing software • Phone calls • Social media websites 	<ul style="list-style-type: none"> • Implementation of telepharmacy services potentiated the clinical significance of pharmacist interventions related to over the counter medicine abuse. • Older and vulnerable patients accessed telepharmacy services more compared to younger patients.
Warda <i>et al.</i> (2021)	United States	Cystic fibrosis care center	Practice innovation	<ul style="list-style-type: none"> • Pharmacist-led virtual medication tours • Medication history interview • Medication storage evaluation • Medication reconciliation 	<ul style="list-style-type: none"> • Telephone • Video communication 	<ul style="list-style-type: none"> • Implementation of a pharmacist-led virtual medication tour in a cystic fibrosis care center. • During the virtual medication tour, the cystic fibrosis pharmacist asked the patients to provide a virtual tour of their medications. • The pharmacist carried out medication reconciliation and medication storage evaluation during this virtual tour. • This practice innovation integrated with the multidisciplinary telehealth visits and well received by the patients. • Application of tele-pharmacy services in pharmacist-led medication management clinic
Mohiuddin <i>et al.</i> (2021)	Saudi Arabia	Tertiary care hospital, Ambulatory care pharmacy department	Experience	<ul style="list-style-type: none"> • Virtual patient education and counseling • Medication refill extension • Medication delivery services • Medication synchronization • De-prescribing • Drug therapy monitoring • Chronic disease management 	<ul style="list-style-type: none"> • Telephone • Video consultation through applications like "MyChart" and "Extended care" using computer/smartphone/tablet 	<ul style="list-style-type: none"> • Various pharmaceutical care services were provided to the patients by employing audio-visual communication technologies, which resulted in better patient outcomes including, improved medication adherence, minimized adverse drug reactions, and polypharmacy issues. • Clinical pharmacy telehealth services were offered to patients in different specialty areas like anticoagulation, pain management, oncology, primary care including diabetes and specialty pharmacy • Remote telehealth visits presented substantial advantages including flexibility in arranging chemotherapy education, anticoagulation, pain management visits, specialty care, and primary care disease management.
Segal <i>et al.</i> (2020)	United States	Primary care and specialty clinics	Experience	<ul style="list-style-type: none"> • Medication review • Medication adherence assessment • Adverse drug reaction monitoring • Patient education • Medication box reviews 	<ul style="list-style-type: none"> • Telephone • Computer – video call, emails 	<ul style="list-style-type: none"> • Remote telehealth visits presented substantial advantages including flexibility in arranging chemotherapy education, anticoagulation, pain management visits, specialty care, and primary care disease management.

Authors	Country	Setting	Type of article (study design)	Type of pharmaceutical care Service offered through telepharmacy	Tools/means used for telepharmacy	Impact/outcomes
Margusino-Framiñán <i>et al.</i> (2020)	Spain	Outpatient hospital pharmacy	Research (Cross-sectional)	<ul style="list-style-type: none"> Medication review Medication adherence assessment Adverse drug reaction and drug-drug interactions detection Medication home delivery Patient counseling 	<ul style="list-style-type: none"> Telephone 	<ul style="list-style-type: none"> Implementation of Hospital Pharmacy Service with hospital outpatient through telepharmacy. Telepharmacy services were employed in the hospital pharmacy setup to coordinate with patients, primary care pharmacists, and community pharmacists. Remote pharmacy services were adopted using different processes and platforms.
Elson <i>et al.</i> (2020)	United States	Pediatric medical center	Experience	<ul style="list-style-type: none"> Interdisciplinary inpatient rounds Medication therapy monitoring Medication query resolution Patient education 	<ul style="list-style-type: none"> Telephone Microsoft Teams Remote access to electronic medical record 	<ul style="list-style-type: none"> Interdisciplinary rounds were done using Microsoft Teams, medication therapy management was done using electronic medical record remote access and patient education and counseling were done through telephone and Microsoft Teams Establishment of virtual clinical pharmacy services in pediatric and neonatal intensive care units.
Allison <i>et al.</i> (2021)	United States	Pediatric hospital and tertiary care center	Experience	<ul style="list-style-type: none"> Virtual rounds Virtual recommendation to multidisciplinary team Patient discharge counseling 	<ul style="list-style-type: none"> Telephones Computers with videoconferencing programs Electronic medical record with chat option Pagers 	<ul style="list-style-type: none"> Clinical pharmacists during virtual rounds provided real time recommendations to medical team using video conferencing and provided discharge counseling to the patients. Pharmacists provided efficient and effective pharmaceutical care to the patients remotely using virtual clinical pharmacy services.
Hedima and Okoro (2020)	Nigeria	Remote or rural areas	Experience	<ul style="list-style-type: none"> Medication order review Drug therapy monitoring Patient counseling Medication adherence assessment Medication home delivery 	<ul style="list-style-type: none"> Telephone Smartphone-based telepharmacy app 	<ul style="list-style-type: none"> Implementation of telepharmacy-based services via telephone calls and ingenious telepharmacy app. Telepharmacy helped in providing pharmaceutical care to remote communities.
Hussain <i>et al.</i> (2020)	Pakistan	Tertiary care hospital	Experience	<ul style="list-style-type: none"> Virtual patient rounds Medication order review Patient education Medication adjustment Evidence-based drug evaluations 	<ul style="list-style-type: none"> Telephone WhatsApp Videoconference 	<ul style="list-style-type: none"> Tele-clinical pharmacists activities were implemented in a tertiary care hospital Clinical pharmacists provided different types of pharmaceutical care services in a resource-limited setting to the patients remotely in response to the pandemic.

Authors	Country	Setting	Type of article (study design)	Type of pharmaceutical care Service offered through telepharmacy	Tools/means used for telepharmacy	Impact/outcomes
Li <i>et al.</i> (2021)	China	Tertiary hospitals	Research (Cross-sectional)	<ul style="list-style-type: none"> • Online free consultation • Medication selection • Dosage and usage issue resolution • Medications for special population • Medication therapy management • Management of adverse drug reactions • Chronic disease management 	<ul style="list-style-type: none"> • Telephone • WeChat app 	<ul style="list-style-type: none"> • Establishment of remote pharmacy service model based on social media software • Introduction of “Cloud Pharmacy Care” platform using “WeChat” app. • Medication-related problems were resolved using the telepharmacy model. • This well-timed and interactive model facilitated medication therapy management in chronic patients • Telepharmacy approach was found to be useful in delivering anti-retroviral medication to patients with HIV infection • This approach greatly helped HIV patients who needed great care as they are more prone to infection during the pandemic
Quiros-González <i>et al.</i> (2021)	Spain	University hospital	Research (Pre-post intervention)	<ul style="list-style-type: none"> • Home delivery of medicines • Telephonic consultations 	<ul style="list-style-type: none"> • Telephone 	<ul style="list-style-type: none"> • Establishment of a clinical pharmacist team for monitoring COVID-19 patients. • The team tele-monitored the patients using the hospital's computerized physician order entry system. • Tele-monitoring helped in detection of drug-related problems and adverse drug reactions in COVID-19 patients. • Different pharmaceutical care services were provided through telepharmacy including drug dosage regimen design for COVID-19 patients. • Telepharmacy was found to be viable and effective method for clinical pharmacists to provide pharmaceutical care services. • Development and implementation of telepharmacy for providing pharmaceutical care to outpatients in hospital pharmacy • The telepharmacy model aided in remote dispensing and home delivery of medications during the pandemic.
Surapat <i>et al.</i> (2021)	Thailand	Tertiary care hospital	Experience	<ul style="list-style-type: none"> • Therapeutic drug monitoring • Drug dosing consultation in special population • Dosage adjustment for patients with impaired renal function • Medication reconciliation • Adverse drug reaction monitoring 	<ul style="list-style-type: none"> • Telephone • Mobile chat app 	<ul style="list-style-type: none"> • Teleconsultation • Remote dispensing • Home delivery of medicines
Tortajada-Goitia <i>et al.</i> (2020)	Spain	Hospital Pharmacies	Research (Cross-sectional)	<ul style="list-style-type: none"> • Teleconsultation • Remote dispensing • Home delivery of medicines 	<ul style="list-style-type: none"> • Telephone 	<ul style="list-style-type: none"> • Establishment of remote pharmacy service model based on social media software • Introduction of “Cloud Pharmacy Care” platform using “WeChat” app. • Medication-related problems were resolved using the telepharmacy model. • This well-timed and interactive model facilitated medication therapy management in chronic patients • Telepharmacy approach was found to be useful in delivering anti-retroviral medication to patients with HIV infection • This approach greatly helped HIV patients who needed great care as they are more prone to infection during the pandemic

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Wang <i>et al.</i> (2021)	China	Tertiary hospital	Research (Cross-sectional)	<ul style="list-style-type: none"> Medical education through broadcast station Medication reconciliation Medication therapy optimization Drug-related problem resolution Adverse drug monitoring Psychological counseling 	<ul style="list-style-type: none"> Radio Telephone WeChat App 	<ul style="list-style-type: none"> Through telepharmacy the clinical pharmacists provided pharmaceutical care interventions including resolution of drug-related problems like inappropriate drug selection, unclear drug indication, drug duplication, and untreated indication. Provided psychological support to the patients and relieved their COVID-19-associated fears and concerns. With telepharmacy, clinical pharmacists can successfully minimize and prevent drug-related, life-related, and COVID-19-associated problems. Implementation of telepharmacy workflow for providing teleconsultations to patients on oral anticancer agents. Remote consultations helped in assessing the medication adherence and adverse drug reaction monitoring.
Wergles <i>et al.</i> (2021)	Brazil	Military hospital	Research (Cross-sectional)	<ul style="list-style-type: none"> Teleconsultation Medication Adherence assessment Adverse drug events monitoring Patient education 	<ul style="list-style-type: none"> Telephone 	<ul style="list-style-type: none"> Delivery of telepharmacy-based pharmaceutical care services in a community pharmacy setting Community pharmacists provided a range of interventions to patients with chronic/acute conditions during COVID-19.
Kovačević <i>et al.</i> (2021)	Republic of Srpska, Bosnia, and Herzegovina	Community pharmacy	Research (Cross-sectional)	<ul style="list-style-type: none"> Medication history interview Drug information Patient counseling, COVID-19-related counseling Medication review Adverse drug reaction and drug-drug interaction information Drug-related problem resolution 	<ul style="list-style-type: none"> Telephone 	<ul style="list-style-type: none"> Implementation of a unique and novel telepharmacy-based medication delivery service involving hospital pharmacy and community pharmacy Medications delivered to the patients using a circuit delivery service involving, community pharmacy, college of pharmacists, hospital pharmacy, and pharmaceutical cooperative. The service was well received by the patients.
Bejarano <i>et al.</i> (2021)	Spain	Community and hospital pharmacies	Research (Cross-sectional)	<ul style="list-style-type: none"> Medication review Medication optimization Medication delivery 	<ul style="list-style-type: none"> Telephone 	<ul style="list-style-type: none"> Medications delivered to the patients using a circuit delivery service involving, community pharmacy, college of pharmacists, hospital pharmacy, and pharmaceutical cooperative. The service was well received by the patients.

and management were carried out remotely in seven studies. Five studies reported medication adherence assessment and in four of the studies, drug-related problem monitoring and management were done using telepharmacy mode. Other pharmaceutical care services included medication history interview, chronic disease management, therapeutic drug monitoring, antibiotic stewardship, and psychological counseling.

Means and tools for telepharmacy

Different tools and means like telephones, smartphones, online platforms/portals, social media apps, and dedicated telepharmacy software were employed for the implementation and execution of telepharmacy services (Fig. 3).

Impact or outcomes of implementation of telepharmacy services

Table 1 describes the impact or outcomes of implementation of telepharmacy services during COVID-19. Studies reported that telepharmacy model provided efficient and effective pharmaceutical care services to the patients during the ongoing pandemic ($n = 5$). Telepharmacy services facilitated risk-free virtual patient education and counseling ($n = 17$), helped in resolution and minimization of different drug-related problems

($n = 5$), resulted in improved medication adherence among the patients ($n = 3$), identification and prevention of medication errors ($n = 3$), better medication management ($n = 3$), symptom assessment ($n = 1$), and giving out COVID-19 related recommendations to the patients ($n = 5$).

DISCUSSION

This systemic review mainly focused upon the implementation of telepharmacy in response to COVID-19 for providing pharmaceutical care services all around the world. The sudden onset of COVID-19 demanded swift restructuring of healthcare systems for ensuring delivery of pharmaceutical care and forced to revamp the roles of clinical and community pharmacists in the healthcare system. With a series of COVID-19 waves, frequent lockdowns and mobility restrictions have become a norm and with this new normal telepharmacy emerged as a valuable tool for providing healthcare services at home. Telepharmacy was used for delivering pharmaceutical care services within the purview of pharmacist's responsibilities while maintaining the temporal and spatial distance between the patients and the healthcare providers.

This review describes the different types of pharmaceutical care services that are being offered through telepharmacy in the ongoing pandemic worldwide and their

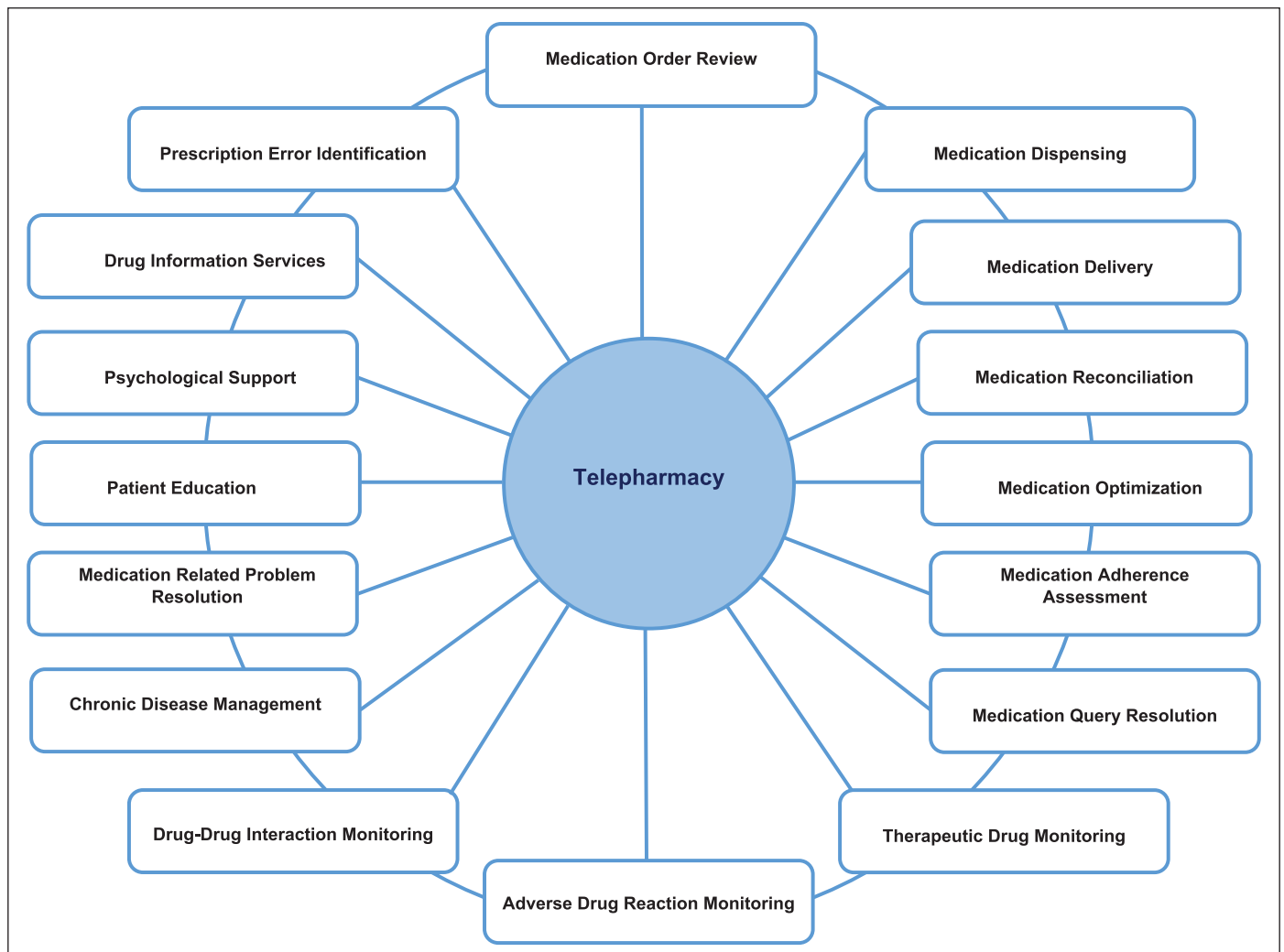


Figure 2. Type of pharmaceutical care services offered through telepharmacy.

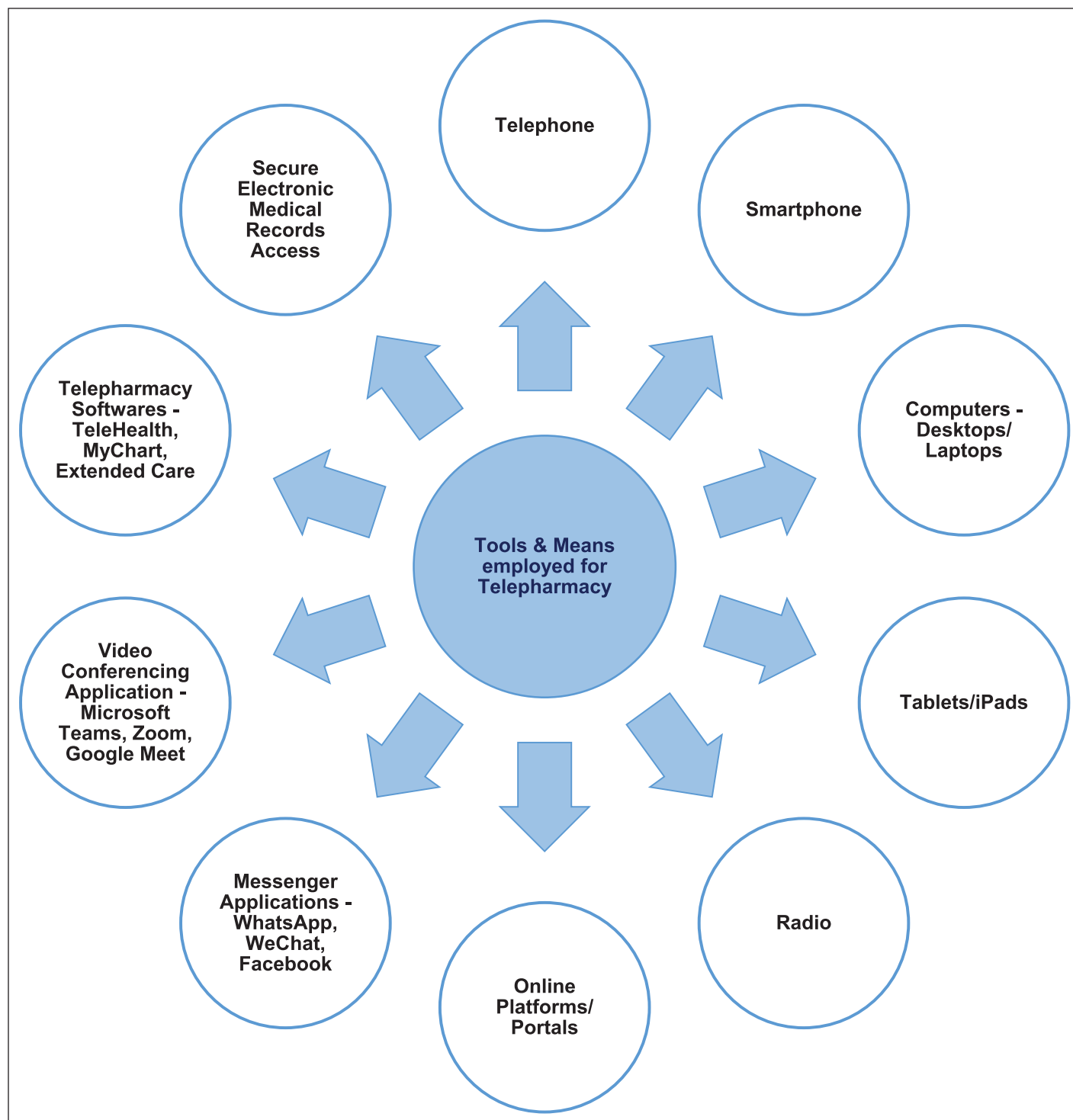


Figure 3. Tools and means employed for telepharmacy.

impact. These tele-pharmaceutical care services were well received by both the patients and other healthcare professionals as they ensured uninterrupted patient care, accessibility to medicines, and proved their significance in these testing times.

A myriad of pharmaceutical care services were provided using telepharmacy including medication order review, medication dispensing, medication reconciliation, medication management and optimization, medication adherence assessment, medication query resolution, therapeutic drug monitoring, adverse drug

reaction monitoring, drug–drug interaction monitoring, chronic disease management, medication-related problem resolution, patient education, psychological support, and drug information services. Telepharmacists employed different means and tools for discharging these services including smartphones, telephones, online platforms and portals, and different applications and software. Telepharmacy provided pharmaceutical care to COVID-19 patients, patients with HIV, cancer, cystic fibrosis, and other chronic diseases, patients on anticoagulants, and patients

presenting to hospital and community pharmacies and general population.

Studies reported the establishment and implementation of various novel telepharmacy models during COVID-19. A study conducted in Pakistan reported a novel multi-stakeholder collaboration telepharmacy model called “Guddi-baji” (Bukhari *et al.*, 2021). The model effectively connected the rural community patients to real time healthcare professionals including doctors and telepharmacists through female-healthcare workers. The pharmacists performed virtual prescription verification, dispensing, and counseling for the patients. The model resulted in better health awareness and medication adherence in the community. Furthermore, it resulted in prevention of medication errors.

A number of studies conducted in United States described different telepharmacy and remote pharmacy services. Kjerengtroen *et al.* (2020) shared implementation of a remote pharmacy services plan as part of COVID-19 preparedness in a quaternary referral medical trauma and stroke center. Clinical pharmacists were equipped with different software applications like “TeleHealth AV”, “Connect Care Pro TeleHealth”, and devices like “Vocera Badge” to provide remote pharmaceutical care services to the patients. Virtual clinical pharmacy services were established in pediatric and neonatal intensive care units where during virtual rounds clinical pharmacists provided real time recommendations to medical team using video conferencing and provided discharge counseling to the patients. Efficient and effective pharmaceutical care was provided to the patients remotely using these virtual clinical pharmacy services (Allison *et al.*, 2021).

In China, a well-timed and interactive telepharmacy service model, “Cloud Pharmacy Care” utilizing social software “WeChat app,” model facilitated medication therapy management in chronic patients. In addition, the model effectively provided patient education and addressed medication-related problems of the patients (Li *et al.*, 2021). Furthermore, with the help of radio and telephone, clinical pharmacists provided pharmaceutical care interventions including resolution of drug-related problems, psychological support, and relieved patients’ COVID-19-associated fears and concerns (Wang *et al.*, 2021).

In United Arab Emirates, telepharmacy services augmented patient’s accessibility to pharmaceutical care and reduced medication-dispensing errors (Al Mazrouei *et al.*, 2021; Ibrahim *et al.*, 2020). Pharmacies with telepharmacy services provided significantly higher number of COVID-19-related recommendations as compared to pharmacies without telepharmacy services. In addition, pharmacies with telepharmacy services had lower incidence of medication dispensing errors than pharmacies without telepharmacy services. Furthermore, implementation of telepharmacy services potentiated the clinical significance of pharmacist interventions related to over the counter medicine abuse. Older and vulnerable patients accessed telepharmacy services more compared to younger patients (Al Mazrouei *et al.*, 2021; Ibrahim *et al.*, 2020).

Telepharmacy services were also extended to support patients on anticoagulant (Al Ammari *et al.*, 2021), antineoplastic (Marchese *et al.*, 2021), and antiretroviral (Quirós-González *et al.*, 2021) agents in Saudi Arabia, Canada, and Spain, respectively. Clinical pharmacists provided different pharmaceutical care services to these patients including remote medication history

interview, care plan development, telephone-based dose adjustments, telephonic medication counseling, medication adherence assessment, and medication delivery.

Studies included in this review reported either implementation of telepharmacy services or assessed established telepharmacy services. These studies advocated that telepharmacy models enhanced the provision of different pharmaceutical care services with augmented patient access and minimized pharmacist–patient direct contact. The telepharmacy models were found to be efficient, cost-effective, and met patient satisfaction. These advantages and benefits are consistent with the previous literature reviews on telehealth and telepharmacy (Monaghesh and Hajizadeh, 2020; Shafiee Hanjani *et al.*, 2020; Unni *et al.*, 2021). In addition to these advantages and benefits, the studies identified many barriers and challenges to the implementation of telepharmacy. The major barriers to the successful application of telepharmacy services included poor technological and network connectivity in remote areas (Allison *et al.*, 2021; Al Meslamani *et al.*, 2021), lack of technology familiarity, and knowledge and resources among the patients (Al Meslamani *et al.*, 2021; Marchese *et al.*, 2021). Other barriers included legal issues, confidentiality, privacy, and security concerns (Al Meslamani *et al.*, 2021; Hedima and Okoro, 2020), insurance payments and reimbursement, government licensing issues, and lack of coordination among the different healthcare providers (Tortajada-Goitia *et al.*, 2020). Execution and implementation of extensive and uniform telepharmacy laws and regulations remain a challenge to the future of telepharmacy (Hedima and Okoro, 2020; Kovačević *et al.*, 2021).

The main strength of this scoping review is that it has examined the emerging evidence on telepharmacy services in the current ongoing pandemic. Furthermore, this review employed a comprehensive search of large databases and included all types of studies related to telepharmacy services. The methods and search strategies employed in this review might help in the protocol development for future systematic reviews on this subject. However, this review had some limitations. First, we followed scoping review approach instead of systematic review approach, as the purpose was first to determine the scope and coverage of existing body of literature on telepharmacy services during COVID-19, investigate the telepharmacy evidence rapidly emerging during this pandemic and identify the types of studies conducted on the topic. This approach, however, lacked critical appraisal. Second, the review did not take into account the studies published in languages other than English. Third, majority of the studies were descriptive and were not consistent in outcomes reported, which precluded any conclusive take on intervention effectiveness. Fourth, existing telepharmacy models that are being used in practice but not published were not captured.

CONCLUSION

This scoping review reports increased use of telepharmacy for delivering pharmaceutical care services during the ongoing COVID-19 pandemic. The review gathered evidence on the implementation of telepharmacy services during COVID-19 and selected 28 studies describing the establishment, implementation, modification, and expansion of telepharmacy services. Based on the identified evidence, telepharmacy proved beneficial in delivery of a myriad of pharmaceutical care services to the patients, including medication order review, medication

dispensing, medication reconciliation, medication optimization, medication adherence assessment, medication query resolution, therapeutic drug monitoring, adverse drug reaction monitoring, drug–drug interaction monitoring, chronic disease management, medication-related problem resolution, patient education, psychological support, and drug information services.

The review highlights the scope and coverage of emerging evidence on telepharmacy services in light of COVID-19, paving the way for future systematic reviews and meta-analyses. Telepharmacy has the potential to revolutionize pharmaceutical care in the future. However, there is an urgent need for development and adoption of unified telepharmacy laws and regulations; development of robust telepharmacy platforms; mechanisms for monitoring and evaluation of these services; provision for continuing professional development programs and integration of telepharmacy consultations into the health insurance plans. Furthermore, there is a need for more rigorous evidence on the reliability, safety, and effectiveness of telepharmacy in comparison to the traditional face-to-face healthcare delivery model.

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AUTHOR CONTRIBUTIONS

Syed Arman Rabbani: Conceptualization, Methodology, Formal analysis, Investigation, Writing – original draft, Writing – review & editing. Shrestha Sharma: Conceptualization, Methodology, Formal analysis, Investigation, Writing – original draft, Writing – review & editing. Asiya Mahtab: Methodology, Formal analysis, Investigation, Writing – original draft, Writing – review & editing. Faheem Hyder Pottoo: Formal analysis, Investigation, Writing – review & editing. Sathvik B Sridhar: Formal analysis, Investigation, Writing – review & editing.

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This study does not involve experiments on animals or human subjects.

DATA AVAILABILITY

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