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Virtual assessment and management of chronic cough: A scoping review

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Abstract

Background: Chronic cough is a frequent reason for seeking consultation with primary care providers. The recent widespread adoption of virtual care offers a promising alternative that can be used to optimize the assessment and management of this condition. The objective of this review was to map and identify the strategies used to assess and/or manage chronic cough virtually, and to explore their impact on cough severity and patient satisfaction with virtual care.

Methods: A scoping review was conducted in MEDLINE, EMBASE, and CINAHL in May 2023. Research questions were defined based on the Population, Concept, Context mnemonic, and literature search was conducted using a three-step approach. Study selection involved the steps of identification, screening, eligibility, and inclusion. A descriptive synthesis was performed, and quantitative variables were presented as absolute and relative frequencies.

Results: A total of 4953 studies were identified and seven met the inclusion criteria. The following mHealth and telehealth strategies were identified: diagnostic website, specialized online clinic, online speech language therapy, and remote follow-up to assess the effectiveness of in-person interventions. Results indicated that these virtual strategies can be useful to assess chronic cough, treat, and track chronic cough symptoms. Overall, patients were satisfied with the approaches.

Conclusion: Although literature is scarce, evidence suggests that virtual strategies for the assessment and management of chronic cough may be effective and are well-received by patients. However, further research is needed to identify the type and characteristics of virtual approaches leading to optimize and facilitate the care of patients with this condition. This will also help develop a strong body of evidence to support their incorporation into guidelines and clinical practice.

Keywords

Virtual assessment, virtual management, chronic cough, cough severity, patient satisfaction

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Background

Chronic cough in adults is characterized as a cough lasting for at least 8 weeks.[1] Estimates indicate that chronic cough affects approximately 10% of the adult population worldwide, and it is a frequent motive for seeking consultation in primary care settings.[2,3] Clinical uncertainty regarding the etiology of cough may result in symptom-focused care as the last resource rather than the diagnosis or management of the underlying cause.[1,4] Various contributing factors have been associated with chronic cough, including gastroesophageal reflux disease, cough variant asthma, rhinosinusitis associated with postnasal drip syndrome,

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chronic bronchitis, and smoking.[5,6] However, chronic cough may also be idiopathic.[6] It often remains unexplained and unresponsive even with extensive studies and therapeutic trials; thus, impacting physical health and severely disrupting social interactions, daily functioning, and quality of life.[7,8]

Healthcare delivery has changed since March 2020. As a result, virtual care strategies emerged and/or expanded worldwide to mainly support the social distancing.[9] With the acceleration of technological advancements, the concepts of mHealth[10–12] and telehealth[11,13] were also strengthened to ensure and optimize patient care. Virtual care has several definitions.[14–16] The Canadian Medical Association's Virtual Care Task Force defines it as "any interaction between patients and/or members of their circle of care, occurring remotely, using any forms of communication or information technologies, with the aim of facilitating or maximizing the quality and effectiveness of patient care."[17] Existing positive evidence regarding the use of virtual care during the COVID-19 pandemic led to increased interest in the development of virtual programs and resources for the assessment and management of chronic health conditions.[11–13]

In chronic cough, the benefits of virtual care may extend to patients (disease monitoring and control)[18] and providers (improved clinical efficiency).[8] Virtual care may be convenient, safe, time- and cost-efficient[19,20]; however, literature is still scarce about how cough can be effectively assessed and monitored online and which types of virtual care approaches are used for assessing and managing chronic cough. A similar concern was raised by the NEUROCOUGH international Delphi study,[21] which recently highlighted the need for virtual digital clinics to improve the care and management of chronic cough in more healthcare facilities and sparsely populated, low- and middle-income, and small countries. In this sense, it is essential to identify effective evidence-based approaches to assess and manage this condition and use them to inform clinical practice by developing robust clinical guidelines.[1]

Considering the growing landscape of virtual care, the burden of chronic cough, and the scarcity of data on virtual care for this population, this review aimed to map and identify the available evidence on virtual approaches used to assess and/or manage chronic cough. Secondarily, we explored the impacts of these approaches on cough severity and patient satisfaction with virtual care.

Methods

Study type

This scoping review was conducted according to the JBI Manual for Evidence Synthesis[22] and reported following the Preferred Reporting Items for Systematic Reviews and Meta-analyses—Extension for scoping reviews checklist.[23] Research ethics committee approval was unnecessary since data were collected in electronic databases and the study did not involve stakeholders.

Definition of research questions and inclusion criteria

For this study, chronic cough was defined as a cough that lasted longer than 8 weeks.[24] Also, as there is no widely accepted definition of virtual care,[14] we considered it to be any health-related information or healthcare service provided using information telecommunications and internet-based technologies when the healthcare provider and patient are separated by distance.[25–28] In this sense, telehealth and mHealth were types of virtual approaches; the former encompassed information and communication technologies used for virtual patient care and education (e.g. videoconferencing and telephone interviews or consulting),[11] whereas mHealth was defined as electronic services accessed via mobile devices (including applications and platforms to diagnose, assess, manage, or monitor chronic cough severity).[10]

The research questions were defined based on the Population, Concept, Context mnemonic: P, individuals with chronic cough; C, virtual approaches to assess and/or manage chronic cough; and C, non-medical settings. The following research questions were defined: (i) what virtual approaches are available for assessing and/or managing chronic cough? and (ii) what are the impacts of virtual approaches on chronic cough severity and patient satisfaction with the intervention?

We included full-text research articles (experience reports, case reports, observational, or intervention studies), research letters, short communications, and conference abstracts involving humans aged >18 years; with a quantitative, qualitative, or mixed design; available in the English language; published in peer-reviewed journals; using virtual interactions, approaches, interventions, or programs for assessing and/or managing chronic cough, including chronic refractory cough; and describing the impacts of virtual strategies on chronic cough severity and/or patient satisfaction. No time filter was applied. Studies on cough related to a specific diagnosis (e.g. asthma, chronic obstructive pulmonary disease, and bronchiectasis), duplicates, literature reviews, protocols, and editorials were excluded.

Search strategy, study selection, and extraction of evidence

The search was conducted on May 1 and 2, 2023, using a three-stage approach: consultation with an experienced health sciences librarian to create the search strategy, subject headings, and keywords, which were further

refined through team discussion (Appendix 1); search in MEDLINE, EMBASE, and CINAHL electronic databases from inception to April 2023; and manual search in the reference lists of the selected publications to retrieve additional studies not found in the initial search.

Study selection involved the steps of identification, screening, eligibility, and inclusion.[29] After duplicate removal using Covidence (www.covidence.org), the titles and abstracts of the identified studies were independently screened by two reviewers (AP and SK), followed by the evaluation of eligibility criteria. A third reviewer (DSR) was consulted if consensus was not reached, and disagreements were resolved through discussion. The following relevant information were extracted independently by two reviewers (AP and SK) using a form based on the JBI Manual for Evidence Synthesis[22]: type of material (research article, research letter, short communication, or conference abstract); journal; type of virtual approach (mHealth or telehealth); name of the first author; year and country of publication; study aims; study design; population characteristics, including number of participants, condition, age, and sex; description of the intervention, program, or approach; outcomes related to cough; and results of chronic cough outcomes and patient satisfaction with the intervention.

Analysis and presentation of results

A descriptive synthesis was performed (qualitative analysis), while quantitative variables (year of publication, number of participants, age, and outcomes related to chronic cough and satisfaction with the program) were presented as absolute and relative frequencies. Results and the narrative synthesis were presented in tables and text according to (a) virtual approaches to assess and manage chronic cough, (b) chronic cough severity, and (c) patient satisfaction.

Results

The search identified 4953 publications. After the removal of 170 duplicates, 4783 studies were retrieved for screening and 55 were assessed for eligibility. Figure 1 presents the reasons for exclusion in all phases of the study. Four studies were included after the eligibility phase, while three publications were added after citation searching.[8,30–35]

Characteristics of included studies

Seven publications describing the use of a virtual intervention or approach for the assessment and/or management of chronic cough were identified[8,30–35]: four research articles, two conference abstracts, and one research letter (Table 1). The studies were completed in the United States (4) and the United Kingdom (3) and were published between 2009 and 2022. In terms of study design, four were prospective cohort studies,[30–33] one was a retrospective cohort review,[34] and two were retrospective cohort reviews with additional follow-up.[8,35] Only the study of Dettmar et al.[30] used mHealth as virtual approach, whereas the other included studies used telehealth. The number of participants involved ranged between 11 and 8546. All studies were conducted on adult patients, except in Lillie et al. where population age was not specified.[31]

Virtual assessment

Five studies performed assessments using telehealth.[8,30,32,33,35] In one study,[8] providers from numerous medical specialties assessed patients via synchronous telehealth visits, while another study assessed the quality of life, cough severity, and self-belief in controlling symptoms at weeks 1, 4, and 10 of a virtual speech and language therapy group program.[32] Two studies used telehealth to remotely assess the responses to in-person behavioral speech therapy[33,35] provided by a speech-language pathologist. The platforms used for the follow-up of patients included mail, telephone, text, e-mail, and online links.[33,35] Patients completed the Leicester Cough Questionnaire via a remote platform pre- and post-treatment.[33,35] In one study, a follow-up interview regarding treatment adherence and self-reported cough improvement was conducted by telephone at least 6 months after treatment.[35]

Only one study aimed to diagnose the underlying cause of chronic cough and support its management accordingly using mHealth.[30] Authors used an internet-based diagnostic questionnaire for adults with chronic cough. Based on answers of respondents, a diagnostic algorithm differentiated between the three most common causes of chronic cough (reflux, asthma, and rhinitis). Once this diagnosis was made, a letter including information about the diagnosis and the recommended treatment was generated for the respondent to take to their general practitioner.[30]

Virtual management

Four studies used telehealth to virtually manage chronic cough.[8,31,32,34] One study developed a virtual multidisciplinary clinic to manage the cause of refractory chronic cough,[8] in which an individualized clinical plan was created following the initial visit. Three studies focused on remote speech therapy interventions for treating refractory chronic cough.[31,32,34] At least one speech-language pathologist or therapist delivered the intervention using a videoconferencing application (Zoom™, Skype™, or Microsoft Teams™).[31,32,34] The speech therapy provided included behavioral cough speech therapy and general speech-language therapy.[31,32,34] One study delivered the intervention in group sessions of three to eight patients.[32] Another study also included patients with vocal cord dysfunction, and results regarding symptom improvement were presented separately for the two conditions examined.[31]

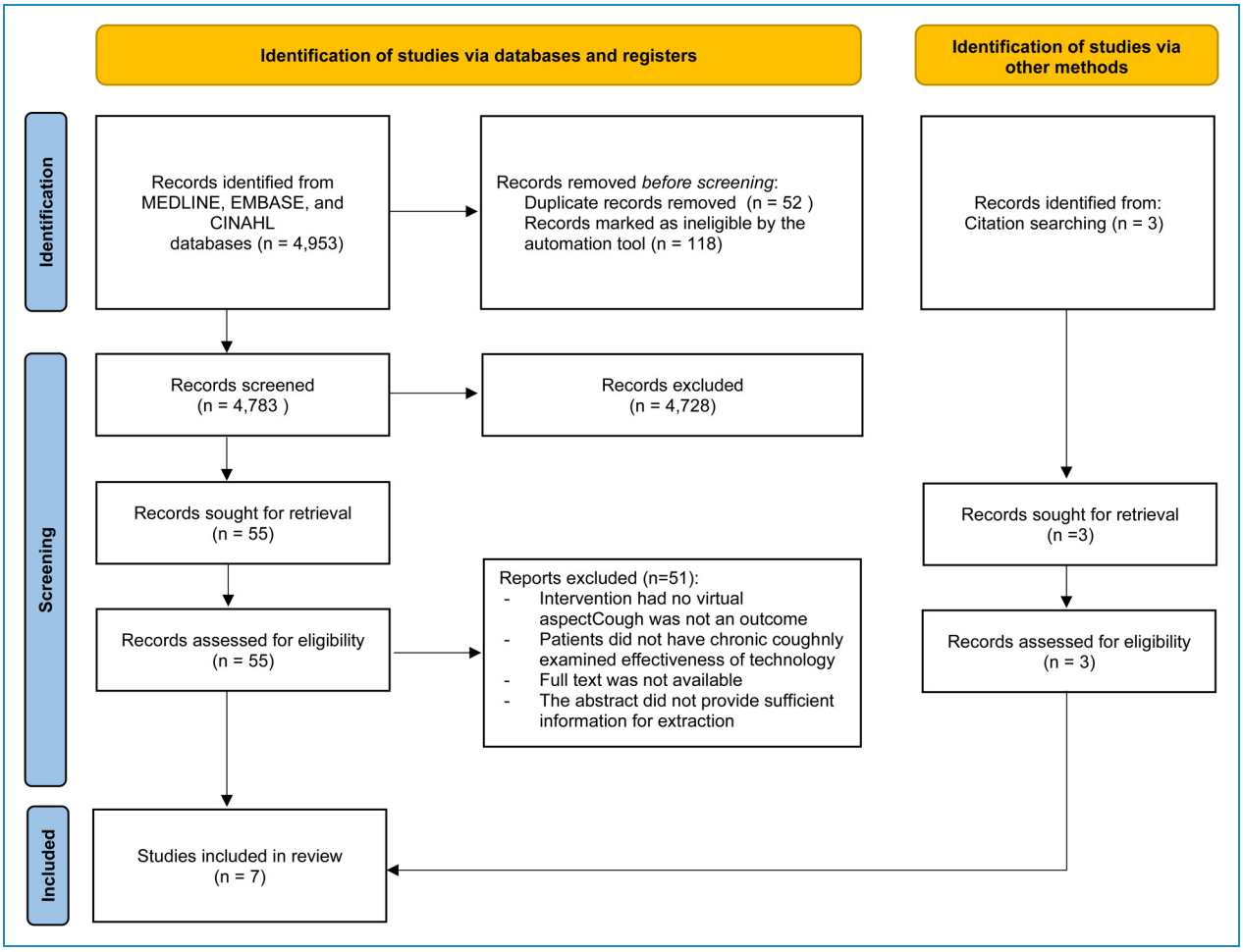

Figure 1. PRISMA flowchart diagram.

Chronic cough severity

Two studies[8,30] examined the underlying causes of chronic cough, and the suggested diagnoses included gastroesophageal reflux disease, asthma, rhinitis, cough hypersensitivity syndrome, interstitial lung disease, chronic eosinophilic pneumonia, and unrecognized ACE-I use. The most prevalent diagnosis was gastroesophageal reflux disease, with just under half of the patient population being affected in both studies.

Remote speech therapy interventions were associated with significant improvements in cough severity and self-belief in controlling symptoms.[31,32,34] Cough severity was assessed using the Leicester Cough Questionnaire,[31–33,35] the Cough Severity Index,[8,34] a visual analog scale,[32] or a Likert scale from 0 to 10.[30] Of these, the Leicester Cough Questionnaire and the Cough Severity Index are valid and reliable measures, containing questions that quantify the severity of cough by examining the impact on quality of life.[36,37] Self-belief in controlling cough symptoms was also assessed using a visual analog scale.[32] Reduction in cough severity and self-reported cough improvement following in-person interventions were identified using online tools.[33,35] Self-reported cough improvement was also assessed in follow-up surveys.[35,37] These data indicate that virtual strategies may positively impact the assessment, management, and follow-up of patients with chronic cough severity.

Patient satisfaction

Four studies directly examined satisfaction with the virtual intervention or program used. In general, patients were satisfied[8,30–32] with the virtual platforms accessed and found the interventions helpful.[8,30,31] Participants also reported high comfort levels in seeing providers via telemedicine and would recommend virtual treatment options to others.[8] For remote speech therapy delivered in group sessions, participants valued meeting others living with chronic cough and felt less alone.[32] Last, participants self-reported good compliance and adherence to in-person behavioral speech therapy during remote follow-ups.[35,37]

Table 1. Summary of the studies.

Author, year; country; journal	Aim	Study design and type of material	Population: Number of participants	Population: Condition	Population: Age	Population: Sex	Intervention (type of virtual approach)	Outcomes	Results
Dettmar PW, et al. 2009; United Kingdom; *European Respiratory Journal*	To describe the Cough Clinic website and its role in diagnosing chronic cough and patient appreciation of the pathway	Prospective cohort study; Research article	8546	Chronic cough	Mean 46 years (range 18–86)	4871 (57%) female	**The online Cough Clinic, an internet-based diagnostic site for chronic cough (mHealth).** An internet-based diagnostic questionnaire was developed for adults suffering from chronic cough in the United Kingdom on the Cough Clinic website (www.coughclinic.org.uk). Before proceeding with the questionnaire, the patient was required to confirm that a normal chest radiograph had been obtained, as it was mandatory for the investigation of chronic cough. Depending on the response to 16 specific questions, the medical condition responsible for the chronic cough of the patient was ascertained according to a predetermined diagnostic algorithm designed to differentiate the three common causes of chronic cough (reflux, asthma, and rhinitis). When the diagnosis was made, a letter was generated for the patient to take to their general practitioner. This included the completed questionnaire, the probable diagnosis of chronic cough, and the most suitable treatment trial. After 2 months, the patient received a request to complete an online follow-up questionnaire. This allowed for the assessment of current symptoms, medications, compliance, and efficacy of the treatment.	**Cough:** The patient was asked about the length of time that they have suffered with cough, and a Likert scale (0–10) was used to score the severity of the cough. **Other:** Cough cause and patient satisfaction.	**Cough:** The mean (standard deviation) score for cough among the patients was 5.85 (2.1). The cough score varied depending on their suggested diagnosis ($p < 0.0001$), with those patients diagnosed with reflux scoring 5.4 (2.2), those diagnosed with rhinitis scoring 5.8 (2.08), and those diagnosed with asthma scoring 6.4 (2.15). No follow-up information. **Cough cause:** A total of 3936 (46.1%) patients were diagnosed with reflux, 3310 (38.7%) were diagnosed with asthma, and 1300 (15.2%) were diagnosed as having rhinitis. **Satisfaction:** Of the 1047 patients completing the follow-up questionnaire, 94% said they found the website easy to use, 73% found the advice helpful, while 60% stated that it helped them communicate with their general practitioner and 62% reported taking the recommended treatment.
Kuruvilla M, et al. 2021; United States; *International Forum of Allergy & Rhinology*	To describe the development of a novel multidisciplinary model using telemedicine for the management of refractory chronic cough	Retrospective cohort review + follow-up survey; Research letter	30	Refractory chronic cough	Mean 60.2 years (range 40–60)	22 (73%) female	**Virtual MDCCC (Telehealth).** The virtual clinic based at Emory University included providers from the following specialties: allergy/immunology, pulmonology, interventional pulmonology, gastroenterology, otolaryngology, and speech-language pathology. Patients referred from within the healthcare system at Emory completed an online history and symptom questionnaire before their visit.	**Cough:** Cough Severity Index scores (0–40) **Other:** Cough cause and patient satisfaction.	**Cough:** Baseline Cough Severity Index score was available for 26 patients, with a mean score of 23.72. No post- encounter information. **Cough cause:** Cough hypersensitivity syndrome, consistent with neurogenic cough/irritable larynx syndrome in 13 (43.3%) patients, reflux/esophageal dysmotility in 13 (43.3%), unrecognized ACE-I use in 1 (0.03%), asthma in 1

(continued)

Table 1. Continued.

Author, year; country; journal	Aim	Study design and type of material	Population: Number of participants	Population: Condition	Population: Age	Population: Sex	Intervention (type of virtual approach)	Outcomes	Results
							MDCCC visits were conducted virtually via synchronous, two- way audiovisual encounters. During the visit, each provider asked questions, which, when taken together, generated a history of present illness and past medical history. A limited examination was performed. Following the visit, the specialists convened recommended further testing and drafted a clinical plan. All providers billed individual virtual office visits and, depending on the decision made at the end of the session, patients were then billed for any appropriate testing or further visits on a case-by-case basis. Patients were also contacted to complete a post- encounter survey consisted of five questions grading patient satisfaction with their visit.		(0.03%), interstitial lung disease in 1 (0.03%), and chronic eosinophilic pneumonia in 1 (0.03%). Rhinitis/ rhinosinusitis was not identified as the primary diagnosis in any of the patients. Associated possible contributors or secondary diagnoses included cough hypersensitivity syndrome in 10 (33.3%) patients, gastroesophageal reflux disease in 2 (0.06%), asthma in 2 (0.06%), and upper airway cough syndrome in 1 (0.06%). **Satisfaction:** Out of the 17 patients that responded to a post-encounter survey, 76.4% rated the convenience of seeing multiple providers via a single visit as 9 or 10. Also, 88% strongly agreed that the treatment plan was clearly communicated and that the providers explained their condition in an understandable manner. A total of 70% stated that they would strongly recommend the virtual MDCC to others.

(continued)

Table 1. Continued.

Author, year; country; journal	Aim	Study design and type of material	Population: Number of participants	Population: Condition	Population: Age	Population: Sex	Intervention (type of virtual approach)	Outcomes	Results
Sundholm N, et al. 2022; United States; *Journal of Voice*	To evaluate the effectiveness of BCST delivered via telehealth at a university clinic during the COVID-19 pandemic	Retrospective cohort review; Research article	51	Refractory chronic cough	Mean 60 years (range 28–85)	45 (88%) female	**BCST via synchronous telehealth visits (Telehealth).** Patients received BCST via telehealth at the Emory Voice Centre between March 2020 and February 2022. BCST with a voice and upper airway- specialized speech-language pathologist was conducted via Zoom (two-way audiovisual sessions). All patients included in the study completed one or more sessions. Treatments included laryngeal efficiency in voice and breathing, as well as emphasis on urge- to-cough awareness and cough suppression techniques. The urge-to-cough awareness training included identification of cough triggers, perception of patients on the amount time between urge-to-cough and cough onset, and successes and failure of avoidance strategies. Patients were instructed in a variety of cough suppression techniques, including semi-occluded vocal tract postures during respiration and phonation, pursed-lip breathing, effortful swallow, and chin-tuck swallow.	**Cough:** Cough was evaluated using the Cough Severity Index pre- and post-treatment.	**Cough:** Cough Severity Index scores decreased significantly (improved) post-treatment (mean = −4.55; 90% CI = −2.84, −6.25; $p < 0.0001$).
Lillie SF, et al. 2014; United Kingdom; *Thorax*	To describe the experience of delivering SLT via videoconfere (Skype™)	Prospective cohort study; Conference abstract	11	Chronic cough and vocal cord dysfunction	N/R	N/R	**SLT via Skype calls (Telehealth).** Patients received speech and language therapy via Skype videoconferencing, delivered by a speech and language therapist. This was a 6-month pilot study. Before therapy, all patients were seen by a respiratory consultant and speech and language therapist for assessment and flexible laryngoscopy. All patients completed a minimum of four sessions, held weekly. Symptom questionnaires were completed pre- and post-therapy. Participants also completed a patient satisfaction questionnaire.	**Cough**: Leicester Cough Questionnaire. **Other:** Patient satisfaction.	**Cough:** Patients with chronic cough had an increase on the Leicester Cough Questionnaire score pre- and post-therapy (median [range] 6.4 [4.6–8.2 vs 12.2 [10–14.6]) **Satisfaction:** All patients scored their satisfaction with the intervention as "very satisfied" or greater.

(continued)

Table 1. Continued.

Author, year; country; journal	Aim	Study design and type of material	Population: Number of participants	Population: Condition	Population: Age	Population: Sex	Intervention (type of virtual approach)	Outcomes	Results
de Looper A, et al. 2022; United Kingdom; *Thorax*	To report the effectiveness of a virtual SLT-led cough therapy group	Prospective cohort study; Conference abstract	28	Refractory chronic cough	Mean 55 years (range 29–79)	24 (86%) female	**Virtual cough therapy group (Telehealth).** Eligible patients referred between January and June 2022 from two specialist cough clinics were invited to join the virtual cough therapy group. Sessions were led by at least one speech and language therapist. There were four sessions at weekly intervals, with a review at week 10. Group size ranged from three to eight patients; sessions were conducted via Microsoft Teams.	**Cough:** Patients were asked to complete a visual analogue scale for cough severity ("no cough" to "worst cough ever"), self-belief in controlling their symptoms ("no self-belief" to "complete self-belief"), and the Leicester Cough Questionnaire at weeks 1 and 4. **Other:** Patient satisfaction.	**Cough:** There was a reduction in mean cough severity (63.2% to 36.6%), an increase in mean self-belief (37.3% to 60.2%), and an increase in Leicester Cough Questionnaire scores (9.6 to 12) following the online group speech and language therapist sessions. **Satisfaction**: Participants valued meeting other people with chronic refractory cough and not feeling alone.
Slovarp LJ, et al. 2021 United States; *Cough and Speech Language Pathology*	To describe treatment patterns, treatment course, and quality of life of patients with refractory chronic cough who underwent BCST	Prospective cohort study; Research article	164	Refractory chronic cough	Mean 58 years (range 18–89)	137 (84%) female	**Remote follow-up to assess responses to in-person BCST sessions (Telehealth).** Participants referred for BCST were recruited by speech language pathologists at 13 clinics involved in the study. Patients completed an initial survey within one day of completing the BCST evaluation session. Following enrolment, participants were contacted by mail, phone, text, and/or e-mail every 4 to 6 weeks with a follow-up survey to monitor change.	**Cough:** Leicester Cough Questionnaire and satisfaction with cough status continued to be gathered every 4 to 6 weeks until the participants reported a satisfaction with cough status, or until they were no longer making progress or no longer wished to participate in the study. **Other:** Questions related to compliance with treatment and effectiveness of treatment.	**Cough:** Over half (58%) reported they were *quite satisfied* ("cough is nearly gone") to *completely satisfied* with their treatment response ("my cough is gone"). The mean change in the Leicester Cough Questionnaire for those who improved with BCST was 6.61. The average time from enrollment to study completion was 64 days. Data suggest that most participants who improved with BCST did so within 5 to 9 weeks. **Compliance:** No significant difference ($U = 1626$, $z = -1.159$, $p = 0.246$) was found in the compliance score between those who improved (3.16) and those who did not (3.00). **Effectiveness:** Data suggested that BCST is at least as, or more, effective, and with a much lower risk profile.

(continued)

Table 1. Continued.

Author, year; country; journal	Aim	Study design and type of material	Population: Number of participants	Population: Condition	Population: Age	Population: Sex	Intervention (type of virtual approach)	Outcomes	Results
Wright ML, et al. 2021; United States; *Speech Therapy for Chronic Cough*	To investigate the long-term treatment outcomes (≥6 months) in individuals diagnosed with refractory chronic cough, and whose treatment outcomes were clinically undocumented.	Retrospective cohort review + follow-up interview; Research article	29	Refractory chronic cough	Mean 58 years (12.1)	20 (69%) female	**Remote follow-up to assess responses to in-person behavioral speech therapy sessions (Telehealth).** Individuals who completed an evaluation for refractory chronic cough were identified from the University of Utah Health electronic medical record database and invited to participate. Of the consenting participants, 27 were referred to behavioral speech therapy, delivered by a speech-language pathologist. To be included in the study, participants had to be at least 6 months post-treatment. An average of 1.3 sessions were completed by participants. Participants completed the Leicester Cough Questionnaire via online link, e-mail, mail, or telephone. All consenting participants also completed a telephone-based interview (follow-up).	**Cough**: Leicester Cough Questionnaire. Participants self-reported cough reduction. **Other:** Participant adherence with treatment and recommendations.	**Cough:** A statistically significant improvement in the Leicester Cough Questionnaire total scores occurred post-BCST ($n = 22$). A total of 16 (73%) participants had the minimally important clinical difference (≥1.3) in the Leicester Cough Questionnaire total score from pre- to post-treatment. Participants indicated that their cough symptoms reduced (48%) or were eliminated (8%) with behavioral speech therapy. Also, 40% reported no change in their cough symptoms and 4% reported cough worsening. **Adherence**: Participants were evenly split between reporting they attended all (32%), some (32%), and no sessions (32%). When asked how fully they completed the recommended strategies taught during therapy sessions, 24% reported that they followed all and 48% followed most of the behavioral speech therapy strategy recommendations.

N/R: not reported; BCST: Behavioral Cough Speech Therapy; MDCCC: Multidisciplinary Chronic Cough Clinic.

Discussion

Literature is scarce regarding the virtual interventions or approaches used to assess and/or manage chronic cough and their impacts on chronic cough severity and patient satisfaction. The virtual strategies identified in this review included diagnostic websites, specialized online clinics, online speech-language therapy, and remote follow-up to assess the effectiveness of in-person interventions.[8,30–35] Results indicated that these virtual strategies were well-received by patients and could be useful in assessing the causes of chronic cough, tracking, and treating chronic cough symptoms.

The COVID-19 pandemic highlighted the utility of virtual services as additive or substitute for in-person care.[38] During the various waves of the pandemic, emphasis was placed on telehealth, particularly remote assessment and treatment of COVID-19 and, subsequently, other health conditions, to greatly reduce close contact and the risk of infection.[39] Now that the healthcare system has adjusted somewhat to normal, there is the potential to shift the focus of eHealth services from acute to chronic conditions and use them where care can be improved based on some of the advantages of indirect patient care. Indeed, the recent expansion of virtual care as a result of the COVID-19 pandemic is highlighted by the fact that five out of the seven studies identified in this review were published after 2021, demonstrating the growing interest and the need for more robust knowledge about the virtual assessment and management of chronic cough. Virtual interventions and services for individuals with chronic conditions can be a cost-effective and efficient way of maintaining and improving quality of life, enhancing personalized care, and reducing hospitalizations.[40] Since people with chronic conditions, including chronic cough, are great users of healthcare services, virtual care may also improve the efficiency of healthcare delivery.[40,41]

The findings of the present study align with evidence from previous research that examined the feasibility of telemonitoring patients with chronic cough due to underlying lung conditions, such as chronic obstructive pulmonary disease and asthma, via mobile applications and platforms.[42,43] Results indicated that these mHealth systems were useful for tracking symptom changes and improving patient care. However, it was also suggested that low compliance with completing the daily questionnaires could delay in detecting symptom exacerbation and subsequent management. Therefore, the authors suggested using simple and short questionnaires to limit the burden on patients.[42]

The virtual assessment, management, and follow-up of chronic cough is a potential addition to the healthcare system.[33] There is a consensus that virtual strategies can be used to enhance convenience, efficiency, and continuity of care.[11,44] Giving patients with chronic cough the option to access virtual healthcare services may reduce costs and treatment attrition and improve visit attendance.[34] Not only the diagnosis and management of chronic cough[30,34] but also the availability and clinical efficiency of chronic cough providers may be improved using virtual strategies.[8] The multidisciplinary virtual care reported by Kuruvilla et al.[8] allowed patients to see up to five providers simultaneously, whereas Looper et al.[32] conducted a virtual cough therapy group with three to eight patients, both in line with the need for digital clinics raised by the NEUROCOUGH Clinical Research Collaboration.[21] The high satisfaction of patients with the virtual interventions and the growing development of technology could also favor the implementation of this goal. Although out of the scope of this review, lessons from experiences related to developing and applying information and communication technologies in other chronic respiratory diseases could help enhance the adoption, delivery, and monitoring of care for patients with chronic cough.[45–49] Evidence also showed that mHealth might benefit chronic disease management and control.[50] Despite this, virtual care has some limitations to consider. Potential issues include technical difficulties, security breaches, variations in regulations depending on the region, limitations with performing examinations, ease of use by healthcare providers and patients, and the cost of implementation.[11,51] In this sense, sufficient planning and resource allocation are solutions that can be used to minimize the scope of these problems.[11]

Mapping and identifying the existing evidence on the assessment and management of chronic cough are the first step for identifying gaps; raising the awareness of patients, providers, and the scientific community; enhancing knowledge; and increasing the interest in developing clinical practice guidelines that consider virtual care strategies for patients with chronic cough. Despite the limited literature available, the results of the present study suggest that virtual assessment and management strategies for chronic cough are valuable tools that can be used to improve patient care. Therefore, healthcare providers, along with policy and decision-makers should be aware of the potential benefits and support them. Considering the growing landscape of telehealth, future studies are needed to identify the types and characteristics of virtual approaches, their feasibility, and effectiveness in optimizing and facilitating the care of patients with chronic cough. Specific scales for assessing chronic cough severity[52,53] and evidence regarding whether virtual approaches are equivalent or more clinically effective than usual health in these patients are also needed.[54]

Limitations and strengths

There is limited evidence regarding the type and impact of virtual interventions in the assessment and management of patients with chronic cough. Few publications were

identified, and two abstracts that did not have the full text available were included in this review. Gray literature and other databases (LILACS and Scielo) were not included. Despite these limitations, the results of this study contribute to bridging a significant knowledge gap regarding the current virtual strategies used to assess and/or manage chronic cough and their effect.

Conclusion

Although the literature is scarce, evidence suggests that virtual strategies can be valuable alternatives to optimize and facilitate the care of patients with chronic cough, and they are well-received by patients. However, more research is needed to develop a strong body of evidence supporting their incorporation into guidelines and clinical practice.

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