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Barriers and facilitators to implementing telehealth services during the COVID-19 pandemic: A qualitative analysis of interviews with cystic fibrosis care team members ☆

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ABSTRACT

Background: The COVID-19 pandemic forced cystic fibrosis (CF) care programs to rapidly shift from in-person care delivery to telehealth. Our objective was to provide a qualitative exploration of facilitators and barriers to: 1) implementing high-quality telehealth and 2) navigating reimbursement for telehealth services.

Methods: We used data from the 2020 State of Care CF Program Survey (n=286 U.S. care programs) administered in August-September to identify two cohorts of programs, with variation in telehealth quality (n=12 programs) and reimbursement (n=8 programs). We conducted focus groups and semi-structured interviews with CF program directors and coordinators in December 2020, approximately 9 months from onset of the pandemic. We used the Consolidated Framework for Implementation Research to identify facilitators and barriers of implementation, and inductive thematic analysis to identify facilitators and barriers of reimbursement.

Results: Factors differentiating programs with greater and lower perceived telehealth quality included telehealth characteristics (perceived advantage over in-person care, cost, platform quality); external influences (needs and resources of those served by the CF program), characteristics of the CF program (compatibility with workflows, relative priority, available resources); characteristics of team members (individual stage of change), and processes for implementation (engaging patients and teams). Reimbursement barriers included documentation to optimize billing; reimbursement of multi-disciplinary team members, remote monitoring, and telephone-only telehealth; and lower volume of patients.

Conclusions: A number of factors are associated with successful implementation and reimbursement of telehealth. Future efforts should provide guidance and incentives that support telehealth delivery and infrastructure, share best practices across CF programs, and remove barriers.

1. Introduction

The COVID-19 pandemic forced a rapid transition to telehealth within the cystic fibrosis (CF) community. Multiple factors promoted telehealth: stay at home orders limited people with CF (PwCF) from traveling long distances, perceived elevated risk of a severe infection caused many CF programs to temporarily reduce or eliminate in-person clinics, and emergency authorizations from public and private payers allowed flexibility in care delivery methods and telehealth reimbursement [1-3]. This rapid transition [4] provided an opportunity to consider feasibility and impact of telehealth as a long-term method of care delivery [1, 5, 6].

To date, evidence about feasibility and quality of telehealth for CF is limited. Successful telehealth uptake in emergencies around the world, such as weather events and disease outbreaks, has been dependent on effective change-management strategies at health systems, reliable technology, and other factors such as financial viability and education [7-11]. During COVID-19, establishing standardized processes and utilizing quality improvement methodologies were critical in successfully implementing telehealth across diverse healthcare settings and conditions [12].

Sustainable telehealth in CF care necessitates an understanding of facilitators and barriers of implementation. While evidence is emerging on uptake, perceived quality, and reimbursement of telehealth within the CF community [13-15], qualitative research provides an opportunity to explore specific topics in-depth. The Consolidated Framework for Implementation Research (CFIR) is an established framework that can be used to evaluate implementation of health care delivery interventions [16]. It has been used to evaluate implementation of telemedicine-based interventions [17], and in CF to analyze barriers and facilitators of mental health screening and treatment [18]. This paper used CFIR and thematic analysis to qualitatively identify facilitators and barriers to (a) providing high-quality telehealth care for CF, and (b) navigating telehealth reimbursement.

2. Materials and Methods

2.1. Site Selection

We used data from the 2020 State of Care (SoC) CF Program Survey (n=286 U.S. care programs) administered in July-September [4] to identify two cohorts of CF programs, with variation in self-reported quality of telehealth (cohort 1) and reimbursement (cohort 2). The SoC survey included objective and subjective questions [4] and was completed online by CF program directors as part of the CF Foundation (CFF) accreditation process.

Programs were selected from among those meeting criteria described below. To limit participation burden, authors reached consensus in selecting a subset of eligible programs reflecting diversity in geographic distribution, size (small, medium, large), and type (adult, pediatric, affiliate). There was no overlap between programs selected for cohort 1 and 2.

2.1.1. Cohort 1: Quality of Telehealth Care

Programs who perceived telehealth as similar in quality to in-person care were identified based on: perceptions of telehealth quality being about the same or somewhat better than in-person care; having a collection process for sputum/cultures, blood draws, and mental health screening; 25% or more PwCF having a home spirometer; high likelihood to recommend telehealth services as an option for care (score of 9-10 on a 0-10 Likert scale); and institutional interest in expanding in-home options to augment or improve telehealth. Sixteen programs met these criteria, 11 were invited to join a focus group, and 5 programs participated (including 3 directors and 3 coordinators). CF programs with perceived

worse telehealth quality were identified based on: perceptions of telehealth care quality being somewhat or much worse than in-person care; no process for sputum/cultures, blood draws, or mental health screening; and lower likelihood to recommend telehealth services (score of 8 or less on a 0-10 Likert scale). Eight programs met these criteria and were invited to join a focus group; 7 programs participated (including 5 directors and 3 coordinators).

2.1.2. Cohort 2: Reimbursement of telehealth

Programs with similar reimbursement for telehealth compared to pre-pandemic levels were identified based on: about the same or higher reimbursement compared to in-person care; ability for each discipline to be reimbursed; and less than 10% of PwCF lost to follow-up. Twenty-four programs met these criteria, 8 were invited to join a focus group, and directors from 3 programs participated. Programs who experienced reimbursement losses were identified based on: somewhat or much lower reimbursement for telehealth compared to in-person care; inability for all disciplines to be reimbursed; and 10% or more PwCF lost to follow-up. Fourteen programs met these criteria, 7 were invited to join a focus group, and directors from 5 programs participated.

2.2. Data Collection

Focus groups and semi-structured interviews were conducted via Zoom or Microsoft Teams between December 7-11, 2020. Interview guides were developed to elicit themes of greatest prominence. Cohort 1 addressed experiences implementing telehealth; benefits of telehealth; opportunities to improve telehealth; lessons to share with other programs; and CFF role in improving telehealth services. Cohort 2 addressed reimbursement of telehealth services and home monitoring, variation between in-person and telehealth reimbursement, and changes in reimbursement throughout the pandemic (Supplement: Interview Guides). Focus group discussions were conducted by experienced group facilitators and were 60-minutes long (cohort 1: n=3 focus groups; cohort 2: n=2 focus groups). Three to four people participated in each focus group. Individual interviews were 30-minutes long and held with people interested in participating but unable to attend focus groups (cohort 1: n=3 interviews; cohort 2: n=1 interview). All focus groups and interviews were recorded and transcribed.

2.3. Analysis

Key findings were summarized in field notes. We applied CFIR [19] constructs to data related to implementation of telehealth services (cohort 1). CFIR is organized around five domains (innovation characteristics, outer context, inner context, characteristics of individuals, and process of implementation) and 39 constructs associated with effective implementation [16]. CFIR consolidates multiple implementation theories into a single framework, supporting systematic analysis and organization of findings. We coded quotations to identify presence of each construct as a facilitator (positive) or barrier (negative) to telehealth implementation at the program level. Presence of a construct in the absence of an association with implementation was rated as neutral (0).

We applied inductive thematic analysis [20] to data related to reimbursement (cohort 2). To develop themes, we generated an initial set of potential codes/themes using field notes written following each discussion. Notes were synthesized and reviewed with the research team. A revised set of codes were applied to transcripts and further refined with team input.

All transcripts were coded with Atlas.ti (version 8.4.5) by the lead author (AVC), and a 10% sample was coded by a secondary reviewer (PS). All coded quotations were reviewed by a second research team member (cohort 1: PS; cohort 2: OD) to ensure

Table 1
Characteristics of CF Programs Participating in Focus Groups or Semi-structured Interviews.

	Program type	Geographic distribution [a]	Program size [b]
Cohort 1: Telehealth quality			
Similar quality than in-person care (n=5 programs, including 3 directors, 3 coordinators)	4 adult, 1 pediatric	2 Southeast, 2 West, 1 Northeast	1 small, 3 medium, 1 large
Worse quality than in-person care (n=7 programs, including 5 directors, 3 coordinators)	1 adult, 1 affiliate, 5 pediatric	4 Midwest, 1 Southeast, 1 West, 1 Northeast	2 small, 3 medium, 2 large
Cohort 2: Telehealth reimbursement			
Similar reimbursement to pre-pandemic levels (n=3 programs, including 3 directors)	1 adult, 2 pediatric	1 Southeast; 1 Southwest; 1 Northeast	1 medium, 2 large
Reimbursement loss (n=5 programs, including 5 directors)	3 adult; 2 pediatric	2 Southeast; 1 Southwest; 2 Northeast	1 small, 1 medium, 3 large

[a] Midwest: IA, IL, IN, KS, MI, MN, MO, ND, NE, OH, SD, WI; Northeast: CT, DC, DE, MA, MD, ME, NH, NJ, NY, PA, RI, VT; Southeast: AL, AR, FL, GA, KY, LA, MS, NC, SC, TN, VA, WV; Southwest: AZ, NM, OK, TX; and West: AK, CA, CO, HI, ID, MT, NV, OR, UT, WA, WY
[b] Small: 0-70 patients; Medium: 71-140 patients; Large: 141+ patients

agreement. Disagreements on coding were discussed and resolved through consensus. Human-subjects approval was granted by a central institutional review board (Advarra) after review of protocol Pro00045302 (Marshall, P.I.)

3. Results

3.1. Characteristics of participants

Twelve programs (5 adult, 6 pediatric, and 1 affiliate) participated in focus groups/interviews on telehealth quality and implementation (cohort 1) and eight programs (4 adult, 4 pediatric) participated in focus groups/interviews on reimbursement (cohort 2). Programs served PwCF from different U.S. regions and varied in size (Table 1). Participants included 8 directors and 6 coordinators in cohort 1 and 8 directors in cohort 2. Programs that did not respond to the invitation or were unable to participate were similar to participants.

3.2. Cohort 1: Implementation of telehealth

Fig. 1 shows distribution of CFIR constructs among programs perceiving telehealth as similar quality than in-person visits, compared to programs perceiving telehealth as worse quality. Quotations illustrating facilitators or barriers to telehealth use (e.g., present among over half of programs in either subgroup) and details regarding presence of each construct by care program are shown in Supplemental Materials.

3.2.1. Innovation characteristics, or attributes of telehealth

All programs perceiving telehealth as similar quality to in-person care identified advantages of telehealth relative to in-person care ("Relative advantage"), including convenience for PwCF travel and time away from work, ability to improve access and stay connected with PwCF during the pandemic, and earlier identification of health issues. Programs built upon pre-existing telehealth infrastructure within their organization ("Trialability") that could be adapted to their needs ("Adaptability"). Programs were more likely to experience neutral or minimal financial impact from implementing telehealth ("Cost").

"Without telehealth, we would have been in a lot of trouble for this pandemic, just from a viewpoint of patient care." Program 5, Director, Adult

In contrast, innovation characteristics were often a barrier to programs with lower perceived telehealth quality. These programs often perceived telehealth as inferior to in-person care ("Relative advantage"), citing difficulties communicating with PwCF during challenging conversations or in sensing body language, performing physical exams, or gathering objective vital signs. Capabilities

of telehealth platforms were a barrier to some programs ("Design quality and packaging"). Programs often experienced financial disincentives associated with telehealth ("Cost"), most commonly citing inability to reimburse the full multi-disciplinary team.

"I find it very hard to have difficult conversations [via telehealth]." Program A, Director, Pediatric

Most programs, regardless of perceptions of telehealth quality, found it difficult to provide telehealth ("Complexity").

"There was a lot of growing pains that I think three months out are still happening." Program B, Director, Pediatrics

3.2.2. Outer setting, or external influences

Programs perceiving telehealth as similar quality to in-person care saw it aligning with interests, needs, and capabilities of PwCF ("Needs and resources of those served by the organization") (e.g., those who traveled long distances, were otherwise lost to follow-up, or that closely monitored health changes). Programs perceiving telehealth as worse quality had mixed perceptions. Barriers included PwCF disinterest in telehealth; lower engagement in care; shorter travel distances; and fewer financial or technology resources (e.g., tablet, computers, or internet connectivity).

"We see people more often [with telehealth] than we used to because a lot of people, they're so busy working and they have families, they just stopped coming in." Program 1, Coordinator, Adult

3.2.3. Inner setting, or characteristics of the organization

All programs perceiving telehealth as similar quality to in-person care identified availability of institutional resources as a facilitator ("Available resources"). Resources included telehealth software and systems, dual-monitor computer systems, remote monitoring equipment distributed to PwCF, information technology resources, and fully-staffed multidisciplinary care teams. Telehealth aligned with team values and systems; and teams often created synchronous or asynchronous workflows that allowed the multidisciplinary team to participate in visits ("Compatibility"). They felt it was important to implement telehealth ("Relative Priority"). Other organizational characteristics supporting implementation included engagement of institutional leadership ("Leadership engagement"), perceived necessity for change ("Tension for change"), and ability to access information to support implementation ("Access to knowledge and resources").

"The most important lesson is team and institutional engagement with telehealth." Program 2, Director, Adult

In contrast, these constructs were often absent or barriers to programs with lower perceived quality of telehealth. While several programs had home monitoring equipment available, they often had limited availability of the multidisciplinary team or limited numbers of computers or monitors to provide telehealth ("Available resources"). They found it difficult to incorporate telehealth
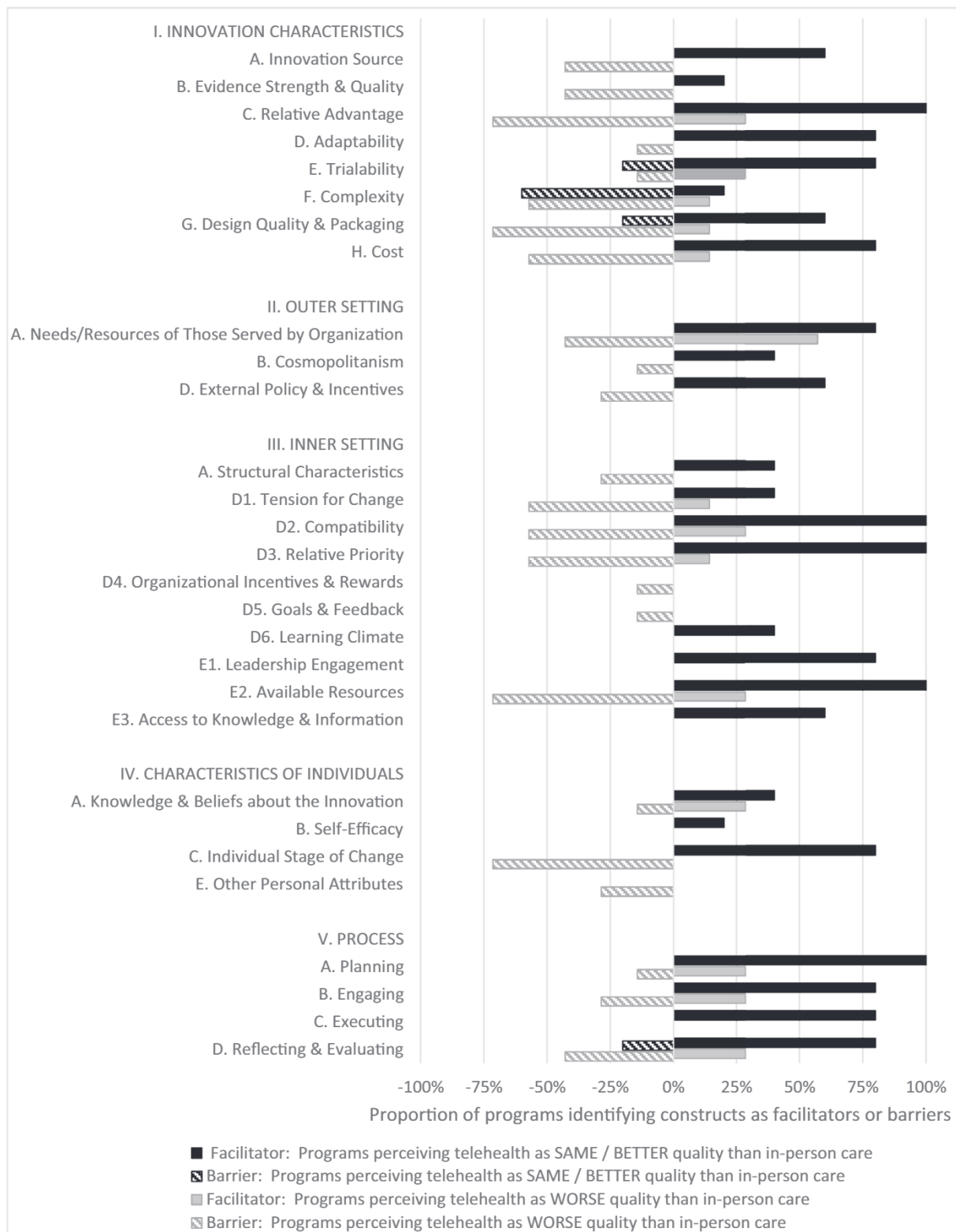
Fig. 1. Presence of CFIR constructs among CF programs perceiving telehealth as similar (n=5) or worse (n=7) quality than in-person care.

into workflows or coordinate and sequence care using telehealth ("Compatibility"). They were less likely to see telehealth as a priority ("Relative Priority") or as an essential alternative to in-person care ("Tension for change").

"It has not been a priority to set up those remote things because I would prefer to see the patient and quite frankly, the families would too." Program E, Director, Affiliate

3.2.4. Characteristics of individuals

Readiness to adopt telehealth ("Individual stage of change") was a facilitator for programs that saw telehealth as similar quality to in-person care and barrier for programs that saw telehealth as worse quality.

"There was a perfect confluence of the institution, our team, and individuals being willing to do their individual pieces to make it [telehealth] happen." Program 2, Director, Adult

3.2.5. Process of implementation

Each of four Process constructs ("Planning", "Engaging", "Executing", and "Reflecting & evaluating") was a facilitator of implementation among programs that saw telehealth as similar quality to in-person care. These programs planned for telehealth implementation, engaged PwCF and care team members in use of telehealth, enacted plans, and evaluated telehealth usage and perceptions. Several programs initiated quality improvement projects to improve telehealth services (e.g., mental health screening), or gathered feedback from PwCF around telehealth quality indicators. There was limited or mixed identification of these constructs within programs that saw telehealth as worse than in-person care.

"The more you are prepared for the telehealth, the better it will be." Program 4, Director, Adult

3.3. Cohort 2: Reimbursement strategies

Common themes were identified by programs with similar reimbursement to pre-pandemic levels and with reimbursement losses (Supplement: Exemplar Quotations).

Most programs saw external policies and incentives (e.g., temporary rules for providing telehealth) as facilitators for providing telehealth. Policies allowed for telehealth reimbursement, yet uncertainty surrounding longevity of emergency orders impacted programs' perceived ability to plan. Licensing authorization to provide telehealth to out-of-state PwCF was a facilitator for some programs and barrier for others.

"The thing that's been hard is there's been this deadline. [...] You don't know if the coverage is going to continue." Program 6, Director, Pediatric

The most common barriers to reimbursement (among half or more programs) included identifying optimal billing structures within the context of time-based billing, as opposed to complexity-based billing; limited reimbursement for home monitoring or telephone-only telehealth; inability to bill for the full multi-disciplinary team; and lost revenue associated with lower patient volumes.

"The volume of people we see is less now because our flow is not the same." Program J, Director, Adult

4. Discussion

While nearly all accredited CF programs shifted to telehealth during the COVID-19 pandemic [4], several factors differentiated those that felt this transition was successful and sustainable. Use of qualitative methods [16,20] enabled in-depth analysis of implementation and reimbursement experiences. Programs commonly found telehealth more difficult than in-person care, yet successful programs overcame barriers. Programs with higher perceived telehealth quality differentiated themselves from those with lower perceived quality by readiness to embrace telehealth and beliefs that telehealth was a priority and had advantages over in-person care. Programs were differentiated by the extent to which they felt telehealth met needs of PwCF, resources were available to support telehealth, workflows could be adapted, and PwCF and care teams were involved in implementation. Perceptions of cost further differentiated programs, including cost of implementation and limitations in achieving sustainable reimbursement.

While we sought a well-balanced sample, adult programs were more heavily represented among programs with higher perceived quality of telehealth, whereas pediatric programs were more heavily represented among those identifying telehealth as worse than in-person care. This distribution aligns with findings from a nationally-representative survey of CF program directors [13], where adult programs had more positive perceptions of telehealth than pediatric programs. Because of the small number of participating programs, we were unable to fully assess differences between pediatric and adult programs.

To our knowledge, this is the first study to apply CFIR to identify facilitators and barriers of telehealth implementation within the CF community. It adds to a growing literature using CFIR to explore telehealth implementation in chronic conditions [17, 21, 22]. Our findings align with recent CF program surveys of telehealth implementation [13, 23], and provide a narrative on providing high quality telehealth and navigating reimbursement.

Program experiences sit within the context of national efforts to support transition to telehealth services for CF care during the COVID-19 pandemic (Personal communication, Kathryn Sabadosa). CFF leaders formed a medical advisory committee which met weekly to discuss issues from the field and national agencies' responses to COVID-19, and to review and react to CFF materials and programming decisions. This group issued weekly digests to CF programs, including numbers of PwCF with COVID-19, announcements of webinars, and information to share with PwCF [24]. To expedite rapid learning, the CFF organized a quality improvement workgroup, which met weekly and developed a Telehealth Index which organized supportive resources generated by CF programs and the CFF and could be easily accessed for rapid dissemination. Town halls and clinical care team discipline-specific events were organized as listening and learning opportunities.

Despite such national efforts to support telehealth, concerns persist with respect to conducting physical exams, collecting routine labs and cultures, and accuracy of home monitoring. These views were common among programs with lower perceived quality of telehealth.

Our study had several limitations. First, interview guides were not structured to align with CFIR constructs, but rather focused on open-ended questions to elicit themes of greatest prominence. This strategy may miss themes of lower prominence that differentiate programs. Second, use of focus groups may have limited our ability to link unique perspectives of each program to the presence of facilitators and barriers, as participants may not have commented on areas they felt were sufficiently addressed by other focus group members. Third, our methodology combined focus groups and individual interviews due to scheduling availability of directors. While the techniques have methodologic differences, this strategy allowed for inclusion of perspectives from additional programs. Fourth, the lead author was involved in selection of programs and collection and primary coding of interview data, and thus was not blinded to participants' perceptions of telehealth quality or ease of navigating reimbursement. To minimize this risk, duplicate coding was conducted of 10% of interviews and 100% of all coded quotations by a coder blinded to program status. Fifth, programs selected to participate were chosen to represent opposite ends of the spectrum on telehealth implementation and reimbursement. While this strategy can identify the strongest facilitators and barriers, it does not explore perspectives of CF programs that fell between these extremes. Finally, generalizability of findings regarding telehealth reimbursement may be limited by a lower response rate from sites that successfully navigated reimbursement, and may be limited in healthcare settings with different reimbursement mechanisms.

Our findings have real-world implications for clinical practice, research, and policy. Future care models should consider the potential for a hybrid approach that brings together telehealth and in-person care; and should provide guidelines and incentives that support telehealth delivery and infrastructure, share best practices across programs, and remove implementation and reimbursement barriers. Further research is needed to determine the level of institutional investment and steps needed to embed telehealth infrastructure in a health system, and to examine the relationship between cost or reimbursement challenges and perceptions of telehealth quality. At the policy level, consideration should be given to maintaining or increasing flexibility for telehealth reimbursement, and developing a business case to support telehealth.

Declarations of interest

None.

CRediT author statement

Aricca D. Van Citters: Conceptualization, Methodology, Formal analysis, Investigation, Data curation, Writing original draft, Writing review & editing, Visualization, Project administration. **Olivia Dieni:** Methodology, Investigation, Writing original draft, Writing review & editing. Peter Scalia: Formal analysis, Writing original draft, Writing review & editing. **Christopher Dowd:** Conceptualization, Methodology, Writing review & editing. **Kathryn A. Sabadosa:** Conceptualization, Methodology, Writing review & editing. **Jill D. Fliege:** Writing review & editing, Visualization. Manu Jain: Writing review & editing, Visualization. **Robert W. Miller:** Conceptualization, Writing review & editing. **Clement L. Ren:** Writing review & editing, Visualization.

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Supplementary materials

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References

[1] Compton M, Soper M, Reilly B, Gettle L, List R, Bailey M, et al. A Feasibility Study of Urgent Implementation of Cystic Fibrosis Multidisciplinary Telemedicine Clinic in the Face of COVID-19 Pandemic: Single-Center Experience. Telemed J E Health 2020;26:978–84. doi:10.1089/tmj.2020.0091.

[2] Koonin LM, Hoots B, Tsang CA, Leroy Z, Farris K, Jolly BT, et al. Trends in the Use of Telehealth During the Emergence of the COVID-19 Pandemic — United States, January–March 2020. MMWR Morb Mortal Wkly Rep 2020;69:1595–9.

[3] Farfour E, Picard C, Beaumont L, Lesprit P, Ballester MC, Ackermann F, et al. COVID-19 in lung-transplanted and cystic fibrosis patients: Be careful. J Cyst Fibros 2020;19:e16–ee7. doi:10.1016/j.jcf.2020.03.021.

[4] Dowd C, Van Citters AD, Dieni O, Willis A, Powell L, Sabadosa K. Design and methods for understanding the state of cystic fibrosis care amid the COVID-19 pandemic. J Cyst Fibros 2021;20(S3):S3–8.

[5] List R, Compton M, Soper M, Bruschwein H, Gettle L, Bailey M, et al. Preserving Multidisciplinary Care Model and Patient Safety During Reopening of Ambulatory Cystic Fibrosis Clinic for Nonurgent Care: A Hybrid Telehealth Model. Telemed J E Health 2021;27:193–9. doi:10.1089/tmj.2020.0247.

[6] Womack C, Farsin R, Farsad M, Chaudary N. Emerging Alternatives to Conventional Clinic Visits in the Era of COVID-19: Adoption of Telehealth at VCU Adult Cystic Fibrosis Center. Int J Gen Med 2020;13:1175–86. doi:10.2147/IJGM.S274193.

[7] Ketchell RI. Telemedicine is the way forward for the management of cystic fibrosis - the case in favour. Paediatr Respir Rev 2018;26:19–21. doi:10.1016/j.prrv.2017.03.004.

[8] Cox NS, Alison JA, Rasekaba T, Holland AE. Telehealth in cystic fibrosis: a systematic review. J Telemed Telecare 2012;18:72–8. doi:10.1258/jtt.2011.110705.

[9] Wood J, Mulrennan S, Hill K, Cecins N, Morey S, Jenkins S. Telehealth clinics increase access to care for adults with cystic fibrosis living in rural and remote Western Australia. J Telemed Telecare 2017;23:673–9. doi:10.1177/1357633X16660646.

[10] Lenney W. Telemedicine is the way forward for the management of cystic fibrosis- the case against. Paediatr Respir Rev 2018;26:22–3. doi:10.1016/j.prrv.2017.03.005.

[11] Smith AC, Thomas E, Snoswell CL, Haydon H, Mehrotra A, Clemensen J, et al. Telehealth for global emergencies: Implications for coronavirus disease 2019 (COVID-19). J Telemed Telecare 2020;26:309–13. doi:10.1177/1357633X20916567.

[12] Lieneck C, Garvey J, Collins C, Graham D, Loving C, Pearson R. Rapid Telehealth Implementation during the COVID-19 Global Pandemic: A Rapid Review. Healthcare (Basel) 2020;8 10.3390/healthcare8040517.

[13] Gifford AH, Ong T, Dowd C, Van Citters AD, Scalia P, Sabadosa KA, et al. Evaluating barriers and promotors of telehealth during the COVID-19 pandemic at cystic fibrosis programs to inform new models of CF care. J Cyst Fibros 2021;20(S3):S14–15.

[14] Sawicki GS, Van Citters AD, Dieni O, Powell L, Sabadosa KA, Willis A, et al. Financial impacts of the COVID-19 pandemic on cystic fibrosis care: lessons for the future. J Cyst Fibros 2021;20(S3):S16–20.

[15] Solomon GM, Bailey J, Lawlor J, Scalia P, Sawicki GS, Dowd C, et al. Patient and family experience of telehealth care delivery as part of the CF chronic care model early in the COVID-19 pandemic. J Cyst Fibros 2021;20(S3):S41–6.

[16] CFIR Research Team 'Consolidated Framework for Implementation Research: Constructs'; 2021. Accessed April 28 https://cfirguide.org/constructs/.

[17] Batsis JA, McClure AC, Sette D, Rotenberg S, Stevens CJ, et al. Barriers and facilitators in implementing a pilot, pragmatic, telemedicine-delivered healthy lifestyle program for obesity management in a rural, academic obesity clinic. Implement Sci Commun 2020;1(83) 10.1186/s43058-020-00075-9.

[18] Quittner AL, Abbott J, Hussain S, Ong T, Uluer A, Hempstead S, et al. Integration of mental health screening and treatment into cystic fibrosis clinics: Evaluation of initial implementation in 84 programs across the United States. Pediatric Pulmonology 2020;55:2995–3004. doi:10.1002/ppul.24949.

[19] Kirk MA, Kelley C, Yankey N, Birken SA, Abadie B, Damschroder L. A systematic review of the use of the Consolidated Framework for Implementation Research. Implement Sci 2016;11(72) 10.1186/s13012-016-0437-z.

[20] Nowell LS, Norris JM, White DE, Moules NJ. Thematic analysis: Striving to meet the trustworthiness criteria. International Journal of Qualitative Methods 2017;16 10.1177/1609406917733847.

[21] Ware P, Ross HJ, Cafazzo JA, Laporte A, Gordon K, Seto E. Evaluating the Implementation of a Mobile Phone-Based Telemonitoring Program: Longitudinal Study Guided by the Consolidated Framework for Implementation Research. JMIR Mhealth Uhealth 2018;6:e10768 10.2196/10768.

[22] Stevenson L, Ball S, Haverhals LM, Aron DC, Lowery J. Evaluation of a national telemedicine initiative in the Veterans Health Administration: Factors associated with successful implementation. J Telemed Telecare 2018;24:168–78. doi:10.1177/1357633X16677676.

[23] Perkins RC, Davis J, NeSmith A, Bailey J, Powers MR, Chaudary N, et al. Favorable Clinician Acceptability of Telehealth as Part of the Cystic Fibrosis Care Model during the COVID-19 Pandemic. Ann Am Thorac Soc; 2021. 10.1513/AnnalsATS.202012-1484RL.

[24] Cystic Fibrosis Foundation 'COVID-19 Community Questions and Answers'; 2021. Accessed August 29 https://www.cff.org/Life-With-CF/Daily-Life/Germs-and-Staying-Healthy/CF-and-Coronavirus/COVID-19-Community-Questions-and-Answers/.