Article

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Development of a Website for e-Health Use in Children with Chronic Suppurative Lung Diseases: A Delphi Expert Consensus Study

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Abstract

This study aimed to develop a website providing physiotherapy, exercise, and disease knowledge information as a digital tool for use in children with chronic suppurative lung diseases (CSLDs). Data were analyzed using a mixed qualitative and quantitative approach. Initially, a comprehensive list of the website's content and functions was developed through a focus group study with healthcare professionals (HCPs) and parents. Afterward, two rounds online Delphi survey were conducted with a group of expert HCPs (pediatricians and physiotherapists) who were recruited based on their expertise in the field of pediatric physiotherapy. The focus groups established 10 main themes. Two rounds of Delphi questionnaires established the important items of a website, based on expert consensus from HCPs. A Delphi survey containing 36 outcomes was completed by participants from Greece. The findings support the integration of multidisciplinary and user-centered approaches in the design of pediatric website. This website is expected to enhance disease self-management, improve treatment adherence, and support families in daily care.

Keywords: chronic suppurative lung diseases; delphi method; ehealth; focus groups; website

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1. Introduction

Chronic suppurative lung diseases (CSLDs) are a clinical term describing children with persistent or recurrent wet cough, endobronchial infection, and neutrophilic airway inflammation, without radiographic evidence of bronchiectasis on high-resolution CT (HRCT) [1,2]. Conditions under the CSLDs umbrella include protracted bacterial bronchitis (PBB), non-cystic fibrosis bronchiectasis (NCFB), primary ciliary dyskinesia (PCD), and immunodeficiency-related lung disease [1–3].

CSLDs is increasingly recognized as a major cause of pediatric respiratory morbidity worldwide. It remains prevalent in low-and middle-income countries, especially among socially disadvantaged and indigenous children, highlighting the need for global action and equitable care strategies [3]. Timely diagnosis and treatment are essential, as CSLDs may be reversible, while delayed management increases the risk of progression to irreversible bronchiectasis [4]. Management includes antibiotics, airway clearance, exercise, and regular monitoring [5]. Optimal care can improve and even normalize lung function in children, however, access to multidisciplinary care, especially paediatric physiotherapy, is limited. Personalized, high-quality care is key to preventing decline and improving quality of life [6].

Several studies have demonstrated the potential of digital health sources (DHSs) to improve clinical outcomes and disease management in children with CSLDs. The use of mobile applications, eHealth exercise programs, serious games, and telehealth tools has been associated with improved treatment adherence, better symptom monitoring, enhanced functional capacity, and increased health knowledge [7]. While many interventions show promise, challenges remain regarding accessibility, cultural relevance, and the need for high-quality evidence to support widespread implementation [8–11]. Healthcare professionals (HCPs) and parents of children with CSLDs may play a central role in the development and implementation of digital health solutions, as their perspectives on barriers and enablers are crucial for successful adoption. Considering the vast technological advancements and recognizing the importance of digital health in shaping the future of medical advances is key for the optimization of current and new DHSs [12].

It is essential to acknowledge that a significant gap remains in educational and informational materials specifically designed for children with CSLDs. Families and pediatric patients often have limited access to structured, evidence-based resources related to the disease itself, as well as its pharmacological and non-pharmacological management, including airway clearance techniques, physical activity, and nutrition. The aim of this study was to develop a website that provides reliable, accessible, and practical information on medication, physiotherapy, nutrition, exercise, and disease education for children with CSLDs and their caregivers.

2. Materials and Methods

2.1. Study Design

The present study involved 2 stages; a focus group followed by 2 rounds of Delphi consensus technique questionnaires. The study received ethical approval from the Research Ethics Committee of Physiotherapy Department of the University of Thessaly (ethical approval number: 12599/24). Participant information sheet and consent form was presented before the online survey and a tick box was added to confirm consent.

2.2. Research Questions

The research questions were as follows: a) which is the content and functions of a website for use in children with CSLDs, and b) do you believe that the following items related to content and functions could be incorporated in a website for children with CSLDs.

2.3. Scope

This study aimed to develop a website to inform users regarding disease symptomatology management. It targets children aged 6-12 years, whose main symptoms are productive cough and abnormal sputum.

2.4. Stage 1: Focus Group

Focus groups are a cost-effective, quick, and more efficient alternative to one-on-one interviews for gathering data from multiple participants [13].

2.4.1. Participants

A purposive sampling was used. Two groups were invited to participate in this study, Group A (pediatricians and physiotherapists) and Group B (parents). Consequently, Group A included professionals with a) clinical experience of more than 5 years, b) clinical specialty in pediatrics, and c) working within healthcare services for children with CSLDs. Participants of the Group B a) were parent of a child aged 6-12 years who has been diagnosed with CSLD, b) have a child receiving regular treatment at a pediatric clinic of a public hospital or private clinic in Greece.

2.4.2. Procedure

Two online focus groups were conducted via Microsoft Teams, one with HCPs and one with parents of children with CSLDs. Each session lasted approximately 90 minutes and was moderated

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by a professor experienced in qualitative research, assisted by two facilitators. The discussions followed a semi-structured topic guide (Supplementary Table S1), which was previously pilot-tested and refined. Sessions were recorded using OBS Studio and later transcribed verbatim. Participants were recruited through email invitations and verbal referrals, provided informed consent and directly completed the demographic data collection form.

2.4.3. Data Analysis

A thematic analysis was conducted for the current qualitative study. A verbatim transcription was carried out followed by thematic analysis of the discussions. Initiating theme development involved examining all the codes to uncover relationships and connections between them, ultimately resulting in the creation of potential themes.

2.5. Stage 2: Delphi Survey

Consensus on items was achieved using a Delphi survey. The survey involved two rounds, which aided agreement on the most important items [14]. This method has been used widely in the medical and nursing fields and has been suggested for use when seeking national opinion and developing priority issues [15].

2.5.1. Sample and Recruitment

One group was invited to participate: HCPs (pediatricians and physiotherapists) with at least one published work related to CSLDs in the past three years, those who delivered keynote or invited presentations at major meetings focused on pediatric pulmonology or respiratory physiotherapy, and postgraduate certification in CSLDs.

The focus group of HCPs was asked to nominate a list of 50 participants, including pediatricians and physiotherapists, who have adequate scientific training and clinical experience to take part in the Delphi process and possibly expand the sample size. Selecting participants was considered crucial for ensuring the validity of the study’s conclusions. Therefore, purposive sampling was used to target individuals with proven expertise and practical experience, relevant backgrounds related to the study topic, the ability to provide valuable insights, and a willingness to revise their initial or previous judgments to achieve the highest possible level of consensus.

2.5.2. Formulation of the Survey Items

A steering committee was formed to oversee the Delphi process, including preparing the list of items and assessment findings for round 1, evaluating the outcomes of round 1, and reviewing responses to round 2. The committee consisted of three members with expertise in chronic pediatric lung diseases: one Professor of Pediatric Pulmonology and two Professors of Physiotherapy. An online survey was developed and pilot tested to ensure clarity, feasibility, and technical performance before data collection.

2.5.3. Delphi Survey: Round One (R1)

Participants (n=49) were asked to rate each outcome’s importance according to their own experiences and opinions. A three-point Likert scale was used to score items according to their importance. A score of 1 signified an outcome of limited importance, 2 important but not critical, and 3 critical. An open-ended question was added for the participant to suggest any other outcomes, and those were added to the second round if they were not already included in the survey. The survey was open from September 15, 2024 to October 15, 2024. Weekly email reminders were sent to encourage participation.

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2.5.4. Delphi Survey: Round Two (R2)

Participants who completed R1 were sent invitations to complete R2, which was open from November 1, 2024 to December 2, 2024. Items that reached a consensus level between 50-80% were carried forward to the second round, along with new items proposed through the open-ended question in the first round. Participants were asked to consider the previous group ratings and re-evaluate each item using the same Likert scale. Weekly email reminders were sent to encourage participation.

2.5.5. Data Analysis

Data analyses were performed and presented separately for pediatricians and physiotherapists. Participant rating percentages for each item from both the first and second rounds were used to determine the level of consensus, based on predefined criteria. Consensus was defined as agreement equal to or greater than 80%. Near-consensus was defined as agreement between 50–80%, while disagreement (or lack of consensus) was defined as less than 50% agreement for any of the possible responses.

For the descriptive analysis of the data from both the first and second round questionnaires, perimeter statistical testing was performed. The Kolmogorov–Smirnov test was used to assess the normality of distribution. All continuous variables (e.g., demographic characteristics) were expressed as means and standard deviations. Categorical variables (e.g., level of agreement, response rate) were presented as percentages (%). To enhance the clarity of data presentation, percentages and decimal points were rounded where appropriate. Statistical analysis was conducted using SPSS for Mac, Version 29.0 (SPSS Inc., Chicago, IL, USA).

3. Results

3.1. Delphi Participants' Characteristics

Round one was completed by 49 (100%) participants: 12 (24.5%) pediatricians and 37 (75.5%) physiotherapists. In total, 38 (77.6%) respondents were females, while 11 (22.4%) were males.

The second round was completed by 44 participants. Response rate in R2 was 89.8% for all participants; 10 (22.7%) pediatricians and 34 (77.3%) physiotherapists. Detailed demographics of participant groups are displayed in Table 1.

Table 1. Demographic data collection for participants.

Characteristics		**Round 1 (n=49)**	**Round 2 (n=44)**
		Mean ± SD	
Age (years)		43.2 ± 9.8	43.7 ± 10.1
Work experience (years)		18.7 ± 9.7	19.1 ± 10.1
		N (%)	
Specialty	Pediatrician	12 (24.5%)	10 (22.7%)
	Physiotherapist	37 (75.5%)	34 (77.3%)
Gender	Male	11 (22.4%)	11 (25%)
	Female	38 (77.6%)	33 (75%)
Level of education	BSc	4 (8.2%)	4 (9.1%)
	MSc	34 (69.4%)	32 (72.7%)
	PhD	11 (22.4%)	8 (18.2%)
Employer	Private clinic	29 (59.2%)	26 (59.1%)
	Public hospital	20 (40.8%)	18 (40.9%)
MSc in pediatrics		22 (44.9%)	19 (43.2%)
Publications related to pediatrics		19 (38.8%)	16 (36.4%)

Data are presented as mean ± SD, numbers (N), and % percentage; BSc: batchelor of sciences; MSc: masters; PhD: doctor of phylosophy; SD: standard deviation.

3.2. Focus gr33.2. Focus Groups Results

3.2.1. Content

Participants in both focus groups emphasized the importance of developing a child-centered website tailored to the daily management of CSLDs. Five main themes emerged: information provision, aesthetics, gamification, evidence, and co-design (Supplementary Tables S2a,b and S3a,b). Key similarities and differences were observed between HCPs and parents, with both groups focusing on the accessibility and engagement of the digital platform.

Information

Both HCPs and parents underlined the need for clear, reliable, and accessible medical information. HCPs stressed the inclusion of evidence-based content about the disease and its treatments:

"The website should include clear explanations of the disease – what chronic suppurative lung disease is and how it affects children." (HCP2)

Parents, in turn, emphasized the challenge of recalling instructions after medical visits and the desire for medically approved, trustworthy resources:

"Sometimes we leave the hospital with so many instructions that it's hard to remember – if it was written on the website, it would help a lot." (P2)

Key areas of interest for both groups included physiotherapy techniques, nutritional guidance, and exercise recommendations tailored to the child's condition.

Aestetics

The aesthetic appeal of the website was considered essential for child engagement. Parents especially noted the need for colorful, joyful, and age-appropriate designs:

"It should be something colorful, something cheerful that catches their attention." (P2)

HCPs echoed this view, adding the need for content to remain dynamic and avoid monotony:

"It should be entertaining and a little different each time – the same ideas but varied presentations." (HCP1)

Simplicity and ease of use were emphasized by both groups.

Gamification

Gamification was seen as a core component for engagement. HCPs proposed the integration of serious games and interactive features like blowing games connected to remote monitoring:

"Games that involve blowing, the measurements of which will be sent directly to the corresponding center of the website." (HCP6)

Parents highlighted the idea of a digital "imaginary friend" or hero to accompany children through their therapy journey:

"A hero could be created who grows with them and experiences the therapy alongside them." (P5)

3D animation was proposed by both groups to enhance engagement during therapy.

Evidence

HCPs emphasized the importance of ensuring that all content is based on clinical evidence and supervised by qualified professionals:

"All information should be drawn from evidence-based research and literature." (HCP4)

"The final advice should come from the specialist paediatric respiratory physiotherapist and the doctor." (HCP6)

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Co-Design

Participants acknowledged that user involvement in the design process enhances acceptability and relevance:

"Children should be part of the design process – they're the end users, and their input is crucial for usability." (HCP2)

"Parents are aware of the daily challenges better than anyone." (HCP6)

3.2.2. Functions

Five main functional themes emerged: technical support, training, remote monitoring, accessibility and multilingual access. The priorities of HCPs focused more on clinical utility and customizability, while parents highlighted communication, support, and daily usability.

Technical Support

Both groups emphasized the importance of system-guided reminders and sound notifications to enhance adherence:

"Some kind of electronic reminders for children, telling them that it's time to take their medication, it's time for physiotherapy." (HCP1)

"A daily reminder or whenever necessary, in a pleasant way that doesn't feel burdensome." (P1)

Additionally, parents requested features such as phone support, email, and chat systems, especially for real-time emotional or technical concerns.

Training

HCPs called for structured training within clinic visits and through asynchronous platforms:

"Training is needed...dedicating time and frequent practice. Repetition is the key to learning." (HCP1)

"There should also be a video on YouTube demonstrating the use of medications or airway clearance techniques." (HCP5)

Parents appreciated the value of visual aids to support correct implementation at home:

"A video that shows them how to do their respiratory physiotherapy." (P5)

Remote Monitoring

The potential for integrating remote monitoring was acknowledged. HCPs referred to tools such as electronic spirometers and tracking forms:

"Spirometry measurements should be recorded so that we can also monitor the progress of our patients." (HCP5)

Parents echoed the desire for feedback on treatment effectiveness and health progression:

"I want to monitor the child's progress – whether there is a steady course, whether things are being done well." (P3)

Accessibility

The issue of affordability was mentioned as a potential barrier. Both groups emphasized that the website should be free of charge:

"Perhaps it could be provided to families through donations." (HCP4)

"If it's free, they will be able to do it regularly and sustain it." (P5)

Multilingual

The importance of offering content in different languages to accommodate non-Greek speakers was raised:

> *"It should definitely be available in multiple languages." (HCP6)*

3.3. Delphi Results

Of the total 36 items included in the first-round questionnaire, 31 items that reached a consensus level of ≥80% were included in the final questionnaire (Supplementary Table S4). Five items with a consensus level between 50–80% were re-evaluated in the second round. Participants suggested three new items.

Regarding the second round of the questionnaire, many of the items were identical to those presented in the first round, and the consensus threshold remained at an agreement level of ≥80%. Of the total 8 items in the second-round questionnaire, 5 items that reached ≥80% agreement were included in the final questionnaire. Three items achieved no consensus (Supplementary Table S5). No new items or suggestions emerged.

Table 2 presents the percentage of participants (pediatricians and physiotherapists) who rated an item as "agree".

Table 2. Details of the Delphi study results. The percentage of participants (Pediatricians and Physiotherapists) that scored an outcome as critical (score: 3).

Voting Results (% Extremely Important 3)	**Round 1**			**Round 2**		
Outcomes	P	PT	S	P	PT	S
1. Information (medical, physiotherapy, nutrition, exercise)	100%	94.6%	**95.9%**	-	-	-
2. Simple	100%	94.6%	**95.9%**	-	-	-
3. User friendly	100%	94.6%	**95.9%**	-	-	-
4. Interactive (e.g. diary)	100%	94.6%	**95.9%**	-	-	-
5. Colorful	91.7%	86.5%	**87.8%**	-	-	-
6. Gamification	100%	94.6%	**95.9%**	-	-	-
7. Imaginary friend (avatar)	91.7%	83.8%	**85.7%**	-	-	-
8. 3D animation	66.7%	86.5%	**81.6%**			
9. Evidence based content	100%	94.6%	**95.9%**	-	-	-
10. Co-design	83.3 %	89.2%	**87.8%**	-	-	-
11. Electronic leaflets*	-	-	-	41.7 %	43.2%	49%
12. Reminders	91.7%	89.2%	**89.8%**	-	-	-
13. Sound notification	100%	81.1%	**85.7%**	-	-	-
14. Communication form	91.7%	75.7%	79.6%	80%	82.4%	**81.8%**
15. User manual	100%	86.5%	**89.8%**	-	-	-
16. Updates	91.7%	86.5%	**87.8%**	-	-	-
17. Modular	83.3%	73%	75.5%	100%	78.4%	**83.7%**
18. Calendar/Weekly questionnaire	91.7%	75.7%	**89.8%**	-	-	-
19. Evaluation form	91.7%	73%	77.6%	90%	79.4%	**81.8%**
20. Telephone support	100%	89.2%	**91.8%**	-	-	-
21. Email	83.3%	86.5%	**85.7%**	-	-	-
22. Chat box	66.7%	83.8%	79.6%	90%	82.4%	**84.1%**
23. Social media	66.7%	78.4%	75.5%	80%	82.4%	**81.8%**
24. Diary	66.7%	86.5%	**81.6%**	-	-	-
25. Child's training	91.7%	89.2%	**89.8%**	-	-	-
26. Parent's training	100%	91.9%	**93.9%**	-	-	-
27. Healthcare professional's training	100%	91.9%	**93.9%**	-	-	-

28. Video	100%	97.3%	**98%**	-	-	-
29. Multilingual	91.7%	89.2%	**89.8%**	-	-	-
30. Compatible with other devices	91.7%	94.6%	**93.9%**	-	-	-
31. Interaction between patients and HCPs	100%	94.6%	**95.9%**	-	-	-
32. Image uploading	100%	94.6%	**95.9%**	-	-	-
33. Portable forms (pdf)	75%	97.3%	**91.8%**	-	-	-
34. Easy navigation	91.7%	97.3%	**95.9%**	-	-	-
35. Language adaptability	100%	94%	**95.9%**	-	-	-
36. Strict privacy policies	83.3%	89.2%	**87.8%**	-	-	-
37. Free supply	100%	94.6%	**95.9%**	-	-	-
38. Live video conference*	-	-	-	41.7%	24.3%	28.6%
39. Emergency button*	-	-	-	41.7%	42.9%	42.9%

HCPs: healthcare professionals; P: pediatrician; PT: physiotherapist; S: score; * indicates the items suggested from round 1.

4. Discussion

The study contributes to the limited body of literature on digital health sources for improving self-management in children with CSLDs. It is the first to document the development and implementation process of a website designed to provide physiotherapy, exercise, and disease-related information for pediatric CSLD. Using mixed qualitative and quantitative approaches, presents a comprehensive overview of the website's required content and functionalities that are most likely to support a successful adoption of a digital health resource. The website was developed through a human-centered design approach with a focus on children, incorporating the perspectives of HCPs and parents, and addressing the daily management of CSLD. Patient-centered care is essential in the design of digital health technologies, particularly for pediatric populations [16]. The enhanced communication between providers and patients or families can also support the development and implementation of child-centered digital health technologies by encouraging relationship-centered skills in team-based care [17].

Initially, the comprehensive list of the website’s content and functions that developed using a focus-group study with HCPs and parents, established 10 main themes. Similarities and differences were observed between HCPs and parents, with both groups focusing on the accessibility and engagement of the digital platform. HCPs and parents underlined the need for clear, reliable, accessible medical information and evidence-based content. Key areas of interest for both groups included physiotherapy techniques, nutritional guidance, and exercise recommendations tailored to the child’s condition. Evidence-based content and access to accurate information strengthen parents’ and patients’ knowledge about the treatment and increase their self-efficacy [18]. Users of a mobile health platform for self-management of pediatric cystic fibrosis also preferred a mobile application with multiple functions that facilitate access to information, automate disease management, and facilitate communication with the health care team [19].

The aesthetic appeal of the website was considered essential for child engagement. A colorful, joyful, and age-appropriate design is important. Simplicity and ease of use were emphasized by both groups. As reported in other studies regarding digital health, a user-friendly, relevant, and aesthetically pleasing digital environment enhances user satisfaction [20]. Moreover, user-friendly elements, such as incorporating colored line graphs to represent symptom states, are all considered equally important [21]. Gamification was seen as a core component for engagement in remote monitoring. Recent studies have also shown that when the digital environment is presented as a game, it becomes more appealing for systematic and consistent use, such as in practicing respiratory physiotherapy techniques, making gamification a desirable feature [21,22].

Furthermore, HCPs emphasized the importance of ensuring that all content is based on clinical evidence and supervised by qualified professionals. Communication with HCPs, as noted in other studies, also supports the concept of self-management [23]. Co-design is equally important, with participants acknowledging that user involvement in the design process enhances both acceptability and relevance. Other studies have also shown that involving end users in all stages of mHealth development, along with collaboration with healthcare system experts, may result in apps that maintain engagement, improve co-production of services, and ultimately impact self-management and health outcomes [19]. Co-design holds promise as an effective and empowering approach for developing interventions aimed at improving adolescents' digital health literacy [24].

Regarding the function of the website five main themes emerged: technical support, training, remote monitoring, accessibility and multilingual access. HCPs focused on clinical utility and customizability, while parents highlighted communication, support, and daily usability. Both groups emphasized the importance of system-guided reminders and sound notifications. Additionally, parents requested features such as phone support, email, and chat systems. Moreover, HCPs called for structured training within clinic visits and through asynchronous platforms. Parents appreciated the value of visual aids to support correct implementation at home.

In previous studies, HCPs and parents also agreed that accessibility and technical support are essential in promoting the adoption of digital health technologies. Reminders, telephone supports, user-friendly manuals, audio assistance, etc. improved the ability to handle health situations [16,25]. Additionally, preparation and training time is needed to identify and address technical issues (e.g. internet connection) when they arise, and patients should be gradually introduced to the app features [18]. By allowing patients to engage with the app in a manner tailored to their immediate needs, they gradually recognized the increasing value of the digital tool over time without experiencing additional burden [16].

In our study, the potential for integrating remote monitoring was also acknowledged. HCPs referred to tools such as electronic spirometers and tracking forms. Parents echoed a desire for feedback on treatment effectiveness and their children's health progression. Previous studies have shown that collecting patient-generated health data can lead to more scalable and dynamic platforms, facilitating the use and implementation of mHealth apps [19]. The issue of affordability was mentioned as a potential barrier. Both groups emphasized that the website should be free of charge. Developing affordable and accessible digital health is crucial, as socioeconomic factors significantly affect the use, with users of higher digital literacy and resources benefiting more [26,27]. Finally, the importance of offering content in different languages to accommodate non-Greek speakers was raised, making the multilingual aspect of a website an important factor. Although not a website, the First Nations-specific multilingual Asthma App was found to be easy to use and acceptable for use by HCPs, demonstrating how culturally and linguistically tailored digital tools can effectively support health education in diverse populations [28]. Similarly, a file-based approach was developed to support a multilingual platform, allowing dynamic updates to medication and treatment lists based on clinician input and patient preferences [19].

The Delphi process yielded a high level of agreement among HCPs, with 31 items reaching consensus in R1 and an additional 5 items in R2. These results highlight the shared priorities among pediatricians and physiotherapists regarding the content, design, and functionalities that should be incorporated in a website.

A notable finding was the strong consensus on the inclusion of content related to physiotherapy techniques, exercise, and disease education—core pillars in the management of CSLDs. These outcomes reflect current clinical best practices and underscore the role of digital tools in enhancing continuity of care and self-management. Furthermore, the prioritization of interactive features (such as gamification and training videos), alongside practical elements (like reminders, technical support, and multilingual access), suggests that HCPs value engagement and accessibility as key elements in a successful pediatric website.

The Delphi results also demonstrated the experts' awareness of caregiver and family needs. The inclusion of items related to parent support, communication tools, and remote monitoring indicates an understanding of the broader psychosocial and logistical challenges families face. These elements align with emerging trends in pediatric digital health interventions, where holistic and family-centered design is increasingly emphasized.

Interestingly while in some cases, the Delphi method is often characterized by variability in consensus levels, our study achieved a relatively high and consistent agreement across two rounds. This may reflect the fact that participants were carefully selected based on expertise and recent academic or clinical contributions in the field. It may also suggest a growing convergence of opinion on the minimum digital standards expected in pediatric care for CSLDs.

Compared to previous core outcome sets or digital design Delphi studies, the present study focused not only on what information should be delivered, but also how it should be accessed and experienced by children and families [29]. Thus, the resulting website model incorporates both clinical and experiential dimensions, marking a shift toward more user-centered and participatory approaches in tool development.

This study followed a rigorous, two-phase Delphi methodology with high response rates and expert participation from both pediatricians and physiotherapists. The inclusion of a broad set of items reflecting clinical, technical, and user-centered aspects strengthens the relevance and applicability of the findings. The systematic identification and prioritization of features through consensus enhances the potential for real-world implementation and adoption. However, the panel was limited to Greek-speaking healthcare professionals, which may affect the generalizability of the findings to international contexts. In addition, while expert consensus was achieved, validation through end-user testing with children and caregivers is needed to confirm usability and long-term impact.

5. Conclusions

This study contributes significantly to the limited literature on digital health interventions for children with CSLDs by documenting the development process of a website designed to support physiotherapy, exercise, and disease management. Through a child-centered design approach and mixed qualitative and quantitative approaches, the study identified key content and functional features that are essential for successful adoption by both healthcare providers and families. Some of the most important features are evidence-based medical information, simplicity, interactivity, gamification, multilingual access, and free availability.

Supplementary Materials: The following supporting information can be downloaded at the website of this paper posted on Preprints.org. Table S1: Semi-structured interview guide for online focus group discussions; Table S2: Content and Functions of a website for use in children with chronic suppurative lung diseases: Professionals' Focus Group; Table S3: Content and Functions of a website for use in children with chronic suppurative lung diseases: Parents' Focus Group; Table S4: Delphi Survey Round 1; Table S5: Delphi Survey Round 2.

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Abbreviations

The following abbreviations are used in this manuscript:

CSLDs	chronic suppurative lung diseases
DHS	digital health sources
HCPs	healthcare professionals
HRCT	high-resolution CT
NCFB	non-cystic fibrosis bronchiectasis
PCD	primary ciliary dyskinesia
PPB	protracted bacterial bronchitis

References

1. **Redding, G.J.; Carter, E.R. Chronic Suppurative Lung Disease in Children: Definition and Spectrum of Disease.** *Front. Pediatr.* **2017**, *5*, **30.** https://doi.org/10.3389/fped.2017.00030
2. Chang, A.B.; Redding, G.J. Bronchiectasis and Chronic Suppurative Lung Disease. In *Kendig's Disorders of the Respiratory Tract in Children*; Wilmott, R.W., Deterding, R.R., Li, A.M., Bush, A., Ratjen, F., Eds.; Elsevier: Amsterdam, The Netherlands, **2018;** pp. 439–459. https://doi.org/10.1016/B978-0-323-44887-1.00026-2
3. McCallum, G.B.; Binks, M.J. The Epidemiology of Chronic Suppurative Lung Disease and Bronchiectasis in Children and Adolescents. *Front. Pediatr.* **2017**, *5*, 27. https://doi.org/10.3389/fped.2017.00027
4. Chang, A.B.; Bush, A.; Grimwood, K. Bronchiectasis in children: Diagnosis and treatment. *Lancet* **2018**, *392*, 866–879. https://doi.org/10.1016/s0140-6736(18)31554-x
5. Grimwood, K.; Kennedy, E.; Toombs, M.; Torzillo, P.J.; Chang, A.B. Chronic suppurative lung disease and bronchiectasis in children, adolescents and adults in Australia and New Zealand: TSANZ position statement summary. *Med. J. Aust.* **2023**, *219*, 516–519. https://doi.org/10.5694/mja2.52160
6. Chang, A.B.; Boyd, J.; Bush, A.; Goyal, V.; Grimwood, K.; Hill, A.T.; Kapur, N.; Wilson, A.C.; Zernotti, M.E. Children's Bronchiectasis Education Advocacy and Research Network (Child-BEAR-Net): An ERS Clinical Research Collaboration on improving outcomes of children and adolescents with bronchiectasis. *Eur. Respir. J.* **2021**, *58*, 2101657. https://doi.org/10.1183/13993003.01657-2021
7. Kortianou, E.; Mavronasou, A.; Sapouna, V.; Moriki, D.; Douros, K. Challenges and Recommendations on Digital Health Sources in Pediatric Chronic Suppurative Lung Diseases. *Encyclopedia* **2024**, *5*, 1. http://dx.doi.org/10.3390/encyclopedia5010001
8. Mavronasou, A.; Kortianou, E.A.; Sapouna, V.; Douros, K.; Spinou, A. Effects of eHealth Exercise on Paediatric Suppurative Lung Diseases: A Systematic Review and Meta-Analysis. *ERJ Open Res.* **2025,** *in press*. https://doi.org/10.1183/23120541.00977-2024
9. Silva, D.F.; Andrade, E.S.; Sousa, T.R.; Mendes, M.F. Effectiveness of Digital Health Interventions in Pediatric Asthma: A Brazilian Perspective. *Rev. Paul. Pediatr.* **2024,** *42*, e2022111. https://doi.org/10.1590/1984-0462/2024/42/2022111
10. Tapp, H.; Kuhn, L.; Bynum, S.; Young, R. Mobile Health Tools to Support Self-Management in Cystic Fibrosis: A Scoping Review. *J. Cyst. Fibros.* **2023**, *22*, 754–762. https://doi.org/10.1016/j.jcf.2023.04.009
11. Yau, C.; Chan, K.C.; Li, J.W. Digital Interventions to Improve Asthma Outcomes in Children and Adolescents: A Systematic Review. *Clin. Exp. Allergy* **2022,** *52*, 1064–1076. https://doi.org/10.1111/cea.13793
12. Sapouna, V.; Spinou, A.; Mavronasou, A.; Douros, K.; Kapreli, E.; Kortianou, E. A. Barriers and enablers of digital health use in managing chronic suppurative lung diseases in children and adolescents: perspectives from healthcare professionals and parents. *Respir. Med.* **2025**, *242*, 108102. https://doi.org/10.1016/j.rmed.2025.108102
13. Krueger, R.A.; Casey, M.A. *Focus Groups: A Practical Guide for Applied Research*. 5th ed.; Sage publications, Thousand Oaks, CA, 2014.
14. Hsu, C.C.; Sandford, B.A. The Delphi Technique: making Sense of Consensus. *Practical Assess Res Eval*. **2007**, 12, 1-8. https://doi.org/10.7275/pdz9-th90
15. Nasa, P.; Jain, R.; Juneja, D. Delphi methodology in healthcare research: How to decide its appropriateness. *World J Methodol*. **2021**, *11*, 116-129. https://doi.org/10.5662/wjm.v11.i4.116

16. Longacre, M.; Grande, S.; Hager, A.; Montan, M.; Bergquist, R.P.; Martensson, M.; Kotzbauer, G. Clinical Adoption of mHealth Technology to Support Pediatric Cystic Fibrosis Care in Sweden: Qualitative Case Study. *JMIR Pediatr. Parent.* **2018**, *2*, e11080. https://doi.org/10.2196/11080
17. Oates, G.R.; Mims, C.; Geurs, R.; Bergquist, R.; Hager, A.; Guimbellot, J.S.; Hartzes, A.M.; Gutierrez, H.H. Mobile Health Platform for Self-Management of Pediatric Cystic Fibrosis: Impact on Patient-Centered Care Outcomes. *J. Cyst. Fibros.* **2023**, *22*, 823–829. https://doi.org/10.1016/j.jcf.2023.04.009
18. Floch, J.; Vilarinho, T.; Zettl, A.; Ibanez-Sanchez, G.; Calvo-Lerma, J.; Stav, E.; Haro, P.H.; Aalberg, A.L.; Fides-Valero, A.; Bayo Montón, J.L. Users' Experiences of a Mobile Health Self-Management Approach for the Treatment of Cystic Fibrosis: Mixed Methods Study. *JMIR Mhealth Uhealth* **2020**, *8*, e15896. https://doi.org/10.2196/15896
19. Rutland, S.B.; Bergquist, R.P.; Hager, A.; Geurs, R.; Mims, C.; Gutierrez, H.H.; Oates, G.R. A Mobile Health Platform for Self-Management of Pediatric Cystic Fibrosis: Qualitative Study of Adaptation to Stakeholder Needs and Integration in Clinical Settings. *JMIR Form. Res.* **2021**, *5*, e19413. https://doi.org/10.2196/19413
20. Hilliard, M.E.; Hahn, A.; Ridge, A.K.; Eakin, M.N.; Riekert, K.A. User Preferences and Design Recommendations for an mHealth App to Promote Cystic Fibrosis Self-Management. *JMIR Mhealth Uhealth* **2014**, *2*, e44. https://doi.org/10.2196/mhealth.3599
21. Sapouna, V.; Dimitriadis, Z.; Douros, K.; Kapreli, E.; Kortianou, E.A. Technical Factors That May Influence mHealth Adherence in Children with Chronic Pulmonary Diseases: Scoping Review. *Pediatr. Phys. Ther.* **2023**, *35*, 468–477. https://doi.org/10.1097/pep.0000000000001039
22. Yau, K.; Tang, T.; Görges, M.; Pinkney, S.; Amed, S. Using Human-Centered Design and Cocreation to Create the Live 5-2-1-0 Mobile App to Promote Healthy Behaviors in Children: App Design and Development. *JMIR Pediatr. Parent.* **2023**, *6*, e44792. https://doi.org/10.2196/44792
23. Floch, J.; Zettl, A.; Fricke, L.; Weisser, T.; Grut, L.; Vilarinho, T.; Stav, E.; Ascolese, A.; Schauber, C. User Needs in the Development of a Health App Ecosystem for Self-Management of Cystic Fibrosis: User-Centered Development Approach. *JMIR Mhealth Uhealth.* **2018**, *6*, e113. https://doi.org/10.2196/mhealth.8236
24. Lewis, C.C.; Taba, M.; Allen, T.B.; Caldwell, P.H.; Skinner, S.R.; Kang, M.; Henderson, H.; Bray, L.; Borthwick, M.; Collin, P.; McCaffery, K.; Scott, K.M. Developing an Educational Resource Aimed at Improving Adolescent Digital Health Literacy: Using Co-Design as Research Methodology. *J. Med. Internet Res.* **2024**, *26*, e49453. https://doi.org/10.2196/49453
25. Vilarinho, T.; Floch, J.; Stav, E. Co-Designing a mHealth Application for Self-Management of Cystic Fibrosis. In *Proceedings of the 16th IFIP TC 13 International Conference on Human-Computer Interaction (INTERACT)*; Springer: Mumbai, India, 25–29 September 2017; pp. 3–22. https://doi.org/10.1007/978-3-319-67687-6_1
26. Shin, G.; Jarrahi, M.H.; Fei, Y.; Karami, A.; Gafinowitz, N.; Byun, A.; Lu, X. Wearable Activity Trackers, Accuracy, Adoption, Acceptance and Health Impact: A Systematic Literature Review. *J. Biomed. Inform.* **2019**, *93*, 103153. https://doi.org/10.1016/j.jbi.2019.103153
27. Staunton, C.; Barragan, C.A.; Canali, S.; Ho, C.; Leonelli, S.; Mayernik, M.; Prainsack, B.; Wonkham, A. Open Science, Data Sharing and Solidarity: Who Benefits? *Hist. Philos. Life Sci.* **2021**, *43*, 115. https://doi.org/10.1007/s40656-021-00468-6
28. Versteegh, L.A.; Chang, A.B.; Chirgwin, S.; Tenorio, F.P.; Wilson, C.A.; McCallum, G.B. Multi-Lingual "Asthma APP" Improves Health Knowledge of Asthma among Australian First Nations Carers of Children with Asthma. *Front. Pediatr.* **2022**, *10*, 925189. https://doi.org/10.3389/fped.2022.925189
29. Chang, A.B.; Boyd, J.; Bush, A.; Hill, A.T.; Powell, Z.; Zacharasiewicz, A.; Alexopoulou, E.; Chalmers, J.D.; Collaro, A.J.; Constant, C.; Douros, K.; Fortescue, R.; Griese, M.; Grigg, J.; Hector, A.; Karadag, B.; Mazulov, O.; Midulla, F.; Moeller, A.; Proesmans, M.; Wilson, C.; Yerkovich, S.T.; Kantar, A.; Grimwood, K. Quality standars for managing children and adolescents with bronchiectasis: an international consensus. *Breathe (Sheff).* ***2022***, *18*, 220144. https://doi.org/10.1183/20734735.0144-2022