

Co-Design of an Electronic Patient Record-Integrated COPD Self-Management App: The My Lung Health Coach Companion

Chandra Farrer¹, Daryl Manankil², Kristen Thuringer³, Kinza Ahmed⁴, Kristiann Man⁵, Safiya Ali Tohob¹, Andrew Kouri⁴

¹Department of Quality, Safety Risk & Patient Experience, Women's College Hospital, Toronto, ON, Canada; ²Department of Clinical Applications & Decision Support Operations, Women's College Hospital, Toronto, ON, Canada; ³Department of Medicine, Connected Care Team, University Health Network, Toronto, ON, Canada; ⁴Department of Medicine, Division of Respiriology, Women's College Hospital, Toronto, ON, Canada; ⁵Department of Person Centered Care & Programs, Lung Health Foundation, Toronto, ON, Canada

Correspondence: Andrew Kouri, Department of Medicine, Division of Respiriology, Women's College Hospital, 76 Grenville St. 4th Floor, Toronto, ON, M5S 1B2, Canada, Email Andrew.kouri@wchospital.ca

Purpose: Digital self-management interventions can improve outcomes in COPD, but many are standalone applications that lack care integration, limiting usability, adoption, and sustainability. Embedding such tools within electronic patient records (EPRs) may overcome these barriers, but few COPD interventions have taken this approach.

Patients and Methods: We used a user-centred design process to develop and refine a companion application for the My Lung Health Coach COPD self-management program within the Epic Care Companion platform. First, we developed and face validated a prototype with respirologists and program managers. Next, we iteratively improved the app following focus group and stakeholder evaluations, using a Plan-Do-Study-Act (PDSA) approach. Usability was assessed using the System Usability Scale (SUS) and Likert-style ratings, with qualitative feedback analyzed thematically and mapped to design changes.

Results: Four focus groups (n=7) and two stakeholder meetings were conducted iteratively across six PDSA cycles. Initial usability was low but improved following iterative modifications, reaching “excellent” levels. Likert ratings indicated high satisfaction with functionality and content. Thematic analysis identified key adoption enablers: readability, simplicity, supportive tone, clinician endorsement, and training. Specific modifications included enlarging text, simplifying navigation, rephrasing judgmental language, and clarifying wording. To facilitate use in a future clinical trial, a training module was developed. Integration into Epic ensured data security, workflow alignment, and future scalability.

Conclusion: Through iterative co-design, we developed an EPR-integrated COPD app with sustained usability improvements. Embedding patient and stakeholder feedback throughout development produced a clinically aligned and highly usable tool to complement virtual COPD self-management. This approach addresses longstanding limitations of standalone digital health tools and provides a scalable model for integrating patient-facing digital interventions into routine chronic disease care.

Plain Language Summary: Chronic obstructive pulmonary disease (COPD) is a common condition that makes breathing difficult and often leads to emergency room visits and hospitalization. Good self-management, which includes understanding the disease, medications, and strategies for daily life, can help people with COPD stay healthier. However, many people do not have access to programs that teach these skills, and existing digital tools are often separate from routine care.

Our team developed My Lung Health Coach (MLHC), a free, evidence-based program that connects people living with COPD to trained educators for personalized education and support. To strengthen this program, we also designed a companion app that is built directly into the electronic patient record system used at our hospital. This integration makes the app secure, sustainable, and easier to use in day-to-day care.

We worked closely with patients, caregivers, and healthcare professionals to test and improve the app through several design cycles. Participants told us what worked well and what needed fixing. Based on their feedback, we made changes such as enlarging the text, simplifying navigation, using supportive language, and creating a training module. Usability scores improved from poor to excellent after these changes.



This work shows that when patients and clinicians are included throughout the design process, it is possible to build digital health tools that are practical, acceptable, and aligned with real care workflows. Our next step is to test the app in a clinical trial to see how it can improve health and quality of life for people with COPD.

Keywords: COPD, digital health, electronic health record, self-management, app

Background

Chronic Obstructive Pulmonary Disease (COPD) is a highly prevalent condition that affects 2.6 million Canadians and is a leading cause of morbidity, mortality, and healthcare utilization.^{1–5} In Canada, COPD exacerbations are a leading cause of emergency room visits and hospitalizations nationally (~90,000 admissions yearly),⁶ and COPD costs the healthcare system \$1.5B annually.⁷ Effective self-management interventions that educate people about their disease and how to cope independently are known to improve health-related quality of life and decrease respiratory-related hospitalizations.⁸ However, many patients do not have access to these interventions, and poor self-management behaviour remains an important care gap.^{9–11} In Canada, there is currently no uniformly available pathway for patients with COPD to access evidence-based self-management interventions, and individual providers lack the time and resources necessary to provide effective self-management support to all patients.^{12,13}

There is growing interest in using digital health tools to address this important care gap and extend access to COPD self-management resources,¹⁴ driven by systematic reviews of digital tools showing improvements in dyspnea, health-related quality of life, and self-efficacy skills in COPD.¹⁵ However, sustained engagement of digital tools has been a challenge, possibly as most digital solutions have been developed as standalone interventions not integrated into patient and provider care routines (such as patient portals and electronic patient records), and few have thoughtfully considered data security, privacy, and sustainability during their development or implementation.^{15–17}

In an effort to address both the need for high-quality COPD self-management education and the limitations of existing digital health solutions, our team created “My Lung Health Coach” (MLHC), a freely available evidence-based and person-centered COPD self-management program that connects people virtually with experienced certified respiratory educators (CREs) to provide structured COPD self-management education. In order to further augment the quality of MLHC, we also created an electronic patient record (EPR)-integrated companion mobile application for MLHC, allowing patients to seamlessly and securely access program resources and track their progress through their existing patient portal. To our knowledge, this is among the first completely virtual COPD self-management programs with a companion app directly embedded in a hospital EPR system.

The objective of this study was to co-develop and refine the MLHC companion app, engaging patients and other stakeholders in an iterative rapid-cycle user-centered design process. We chose a user-centered design approach in order to ensure our app meets the needs of patients and other important stakeholders, promoting engagement, usability, and acceptance.¹⁸

Methods

Development of My Lung Health Coach Self-Management Program

We developed MLHC iteratively in consultation with an adult respirologist (AK), a certified respiratory educator (LR), the Lung Health Foundation (a lung health charity), and persons living with COPD. MLHC is an evidence-based program based on international COPD guidelines, including the Canadian Thoracic Society guidelines and the Global Strategy for Prevention, Diagnosis, and Management of COPD document.^{2,19} MLHC connects people living with COPD with certified respiratory health educators, using a person-centered approach to provide COPD education and support. The program is delivered virtually through one-on-one meetings. The full 12-week program is provided over 6 individual sessions and covers: general COPD knowledge, smoking cessation, COPD medications, physical activity, mental health and wellness, vaccinations, symptom self-management skills, nutrition, travel, and long-term planning (Figure 1). MLHC is currently available freely to people across Canada (<https://theloop.lunghealth.ca/my-lung-health-coach/>).



Figure 1 Content covered in the My Lung Health Coach Program.

MLHC Care Companion App Development and Evaluation

To enhance the value of the MLHC program, we created a mobile patient journey for patients enrolled in the program at our hospital, allowing them to track their progress and securely access educational resources. To accomplish this, we leveraged the Epic Care Companion architecture, which allows for the creation of applications embedded into the electronic patient record system our hospital uses in specialty care clinics. Care Companion apps are available to patients through their Epic patient portal, which can be accessed on desktop or through a dedicated mobile application.

Phase I: Prototype Development

We developed the MLHC companion app prototype collaboratively and included insights from experts in respiratory medicine (AK), quality improvement (CF), and Epic integration (DM, KT). Using the Care Companion app architecture and applying best principles for patient-facing eHealth tool design,²⁰ we created patient “tasks” corresponding to each of the 6 MLHC sessions. These tasks were categorized as “Education Tasks”, which included PDFs, videos, or external links to educational content, or as “General Tasks”, which prompted users to accomplish specific program-related objectives (see [Appendix 1 Figures 1–3](#)). The app also tracks patient completion of assigned tasks and presents a visual summary of their progress (see [Figure 2](#)). We face

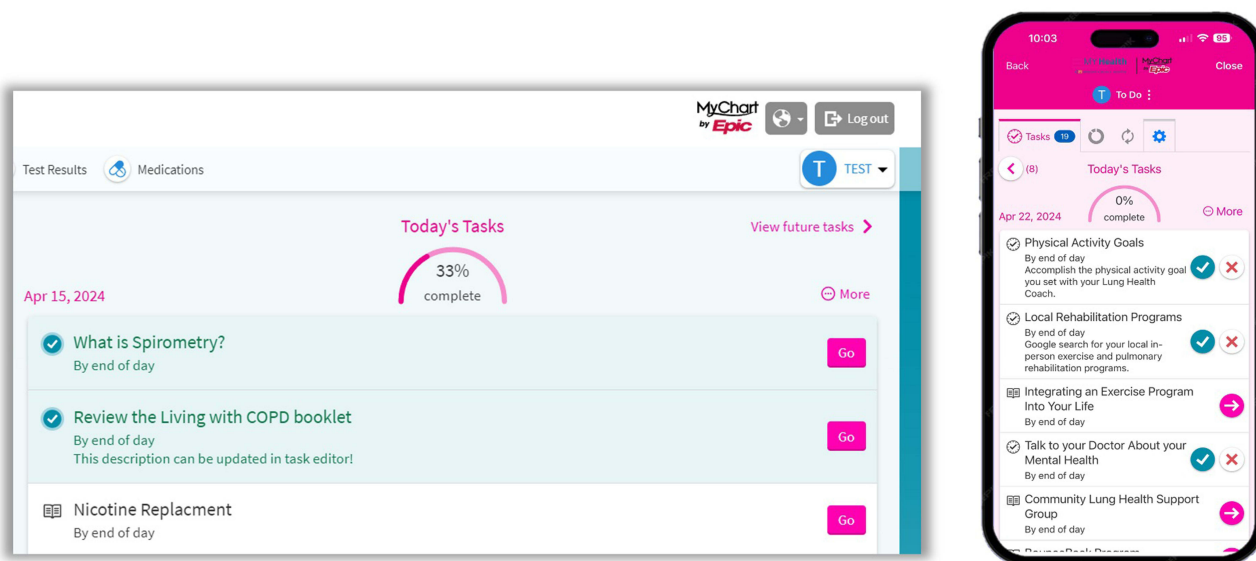


Figure 2 Desktop and app layout of the prototype MLHC companion app.

validated this initial prototype among 3 Adult Respiriologists at Women’s College Hospital and 2 project managers at the Lung Health Foundation. Face validators were asked to provide feedback on app content alignment with national and international COPD guidelines, clinical appropriateness, and feasibility. We used their feedback to refine the structure, language, and layout of the app. After revisions, the final prototype was discussed among all team members.

Phase 2: Rapid-Cycle User-Centered Design Process

We next entered a rapid-cycle user-centered design (UCD) process to iteratively evaluate and improve the app, leveraging patient focus groups and stakeholder meetings.

Focus Group Recruitment

To center our evaluation on the added value of the MLHC app, we recruited participants from a cohort of adults with COPD who had already completed the MLHC program without the app (n=12). We also sought participants with lived experience of COPD from Women’s College Hospital’s Experience Advisor pool. Participants were compensated for their time with a \$50 gift card. All participants provided informed consent prior to participating in focus groups, including publication of anonymized responses/direct quotes. New participants were recruited for each subsequent focus group.

Stakeholder Meetings

We also held stakeholder meetings to discuss revisions. These meetings included members of the study team, the CRE providing the program, and members of the Lung Health Foundation. Member expertise included clinical respiratory care, quality improvement, Epic integration, implementation science, operations, and health policy.

UCD Process

1. Focus groups: focus groups were moderated by a study team member with qualitative research experience (AK) and attended by 2–3 other team members. Each focus group took ~1.5 hours. Participants were introduced to the project and prompted to autonomously interact with the app on a tablet device (iPad) while “thinking-aloud” (verbalizing their thought process while interacting with the tool). The moderator then led participants through the app in detail, eliciting structured feedback on usability, content, format, acceptability, and comprehensibility (see [Appendix 3](#) for focus group guide). Focus groups were audio recorded and transcribed verbatim.
2. Quantitative measures: Participants completed a usability evaluation questionnaire which included the System Usability Scale²¹ and 15 Likert-style questions related to app functionality, ease of navigation, content, and appearance (see [Appendix 2 Tables 1–5](#)).
3. Qualitative measures: Following each focus group, two study team members (AK and KA) independently reviewed the transcript. Applying a descriptive qualitative approach and using Excel, they used thematic analysis to identify themes inductively reflecting overall system usability, content, format, acceptability, and comprehensibility, accompanied by reflective quotations.^{22–24} Following independent analysis, AK and KA met to review identified themes, resolving any discrepancies through further discussion.
4. PDSA cycles: We employed the Plan-Do-Study-Act (PDSA) cycle methodology to iteratively refine our patient app after each focus group and stakeholder meeting.²⁵ In each cycle we gathered both qualitative and quantitative data from focus group and feedback from stakeholder meetings and refined the app prior to the next cycle. This process was repeated until no new critical issues emerged related to system usability, content, or format. We defined “critical” issues as modifiable app elements felt to be significantly degrading user experience.

Results

We held four focus groups and two stakeholder meetings. The focus groups included a total of 7 participants, 6 of whom were people with COPD who had completed the MLHC program previously without use of the app, and 1 of whom was a Patient Experience Advisor who was a caregiver for someone with COPD. The other 6 MLHC “graduates” approached declined to participate. The mean age of focus group participants was 69.4 years (SD 7.1 years), 6 were women and 1

was a man. Of participants with COPD (n =6), 33.3% had had an exacerbation in the previous year. The mean COPD Assessment Test (CAT) score was 18.1 (SD 6.8), indicating medium disease impact from COPD. We held 2 stakeholder meetings. In total, we completed six PDSA cycles, which led to several prototype changes (Table 1).

Table 1 Iterative Changes Made to App Prototype in Response to Rapid-Cycle Design Process

PDSA Cycle	Key Takeaways	Changes Made Based on User and Stakeholder Feedback
#1 Following first focus group	<ul style="list-style-type: none"> • Tasks lacked organization • Ensure inclusive language • Ensure completed tasks still accessible and easy to locate for future access • Initial training and ongoing tech support considered essential • CRE involvement and endorsement crucial to app acceptability • Unclear language (“I understand” for task completion) 	<ul style="list-style-type: none"> • Established task naming convention and organizational structure (dividing tasks by session) • Moved completed tasks to “Education” section of app for future access • Developed app tutorial training module • Highlighted CRE endorsement as a critical “selling point” for future patient recruitment • Adjusted language where unclear or non-inclusive • Increased font sizes throughout app
#2 Following first stakeholder meeting	<ul style="list-style-type: none"> • Group consensus sought for format and content changes • Workflows between MLHC program delivery and companion app needed refinement 	<ul style="list-style-type: none"> • Discussed greater engagement of CRE with app content during MLHC program delivery • Adjusted task pacing to better align with MLHC program progress (max 10–12 tasks per 2 week period) • Agreed on format and content changes based on focus group feedback, to be tested in next round
#3 Following second focus group	<ul style="list-style-type: none"> • Importance of initial training again emphasized • Importance of CRE “buy-in” to app content again emphasized • Format and navigation changes were positively received • Adaptability across devices was considered an asset • Permanent location for completed tasks positively received • Language clarity reviewed with patients 	<ul style="list-style-type: none"> • Reaffirmed importance of pre-use training and CRE engagement for future app use • Refinements made to app tutorial training module • Minor formatting adjustments (separating tasks with multiple educational links into distinct tasks) • Changed language of task completion to “I’m done” from “I understand” (several options reviewed with focus group participants)
#4 Following third focus group	<ul style="list-style-type: none"> • Importance of initial training again emphasized • Minor formatting issues identified (font size still too small, volume of content on screen not well balanced) • Discussed language for task completion, broad agreement with “I’m done” wording • Discussed training module content preferences 	<ul style="list-style-type: none"> • Reaffirmed importance of pre-use training • To address format issues, increased all font sizes, added clickable photo for PDF links, and embedded video links where possible instead of linking to outside sources • Task completion language settled • App training module components finalized (orientation to user interface, navigating through app tasks and button functionalities, accessing outside links and returning to app content)
#5 Following fourth focus group	<ul style="list-style-type: none"> • Content well aligned with MLHC sessions • Navigation and format comprehensible and straightforward • Training module helpful • Embedded video links an asset to in-app usability • Clickable images for PDF links positively received 	<ul style="list-style-type: none"> • No new critical issues identified
#6 Following second and final stakeholder meeting	<ul style="list-style-type: none"> • Team walkthrough of both mobile and desktop user experiences in app well received • App ready for next stage of research – launch of clinical trial 	<ul style="list-style-type: none"> • Confirmed engagement of CRE for future planned clinical trial to direct patients to app between virtual sessions • Trained research assistant to deliver app training module • Established regular review period (monthly) to ensure content is up to date and links functional

Quantitative Analyses

The System Usability Score was initially low (mean SUS 53.75 in the first focus group - “poor usability” range) but improved and remained high after changes to app content and format (mean SUS ranged from 78.3 to 95 in subsequent focus groups - “good” to “excellent” range, [Figure 3](#)). Overall, participants responded positively to Likert-style questions covering app functionality and content appropriateness, and less positively to ease of navigation and app appearance questions. The mean ratings (on a 1–5 scale) were 4.0 (± 0.5) for functionality, 3.8 (± 0.2) for ease of navigation, 4.1 (± 0.3) for content relevance, and 3.6 (± 0.6) for visual appearance. The principal driver of lower scores for ease of navigation was related to difficulty navigating back to the app from links and for visual appearance was related to font size and readability.

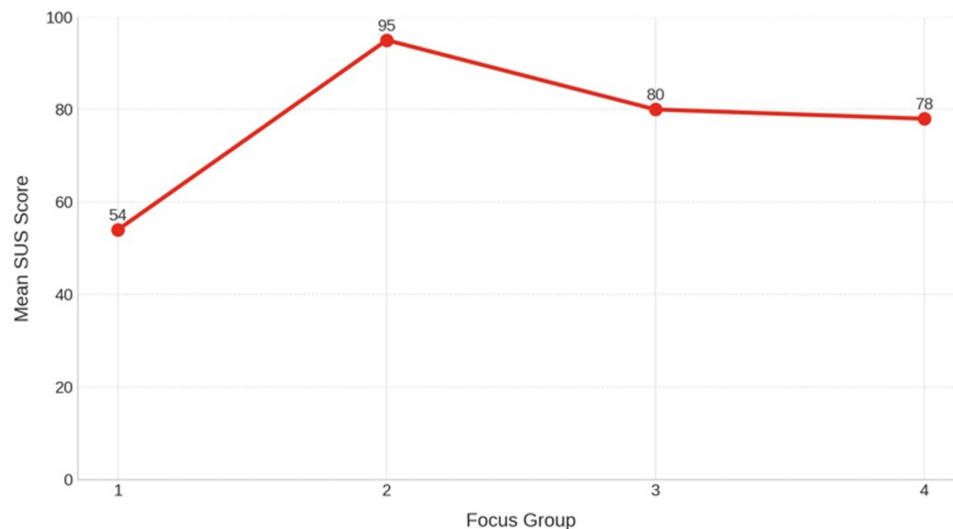


Figure 3 Mean System Usability Scale (SUS) Score by Focus Group.

Qualitative Analysis

Thematic analysis of transcripts revealed important themes related to app content, usability, format, acceptability, and comprehensibility.

In relation to app content, participants valued the quantity and relevance of materials covered in the app, and felt it aligned well with what they learned during the program. One participant commented:

I think this was a lot better than just doing it by Email or getting the site and just going into YouTube yourself, because it keeps you up to date. (FG2, P03)

and another stated: “I think this is fabulous. I think that there is so much information here” (FG1, P02). Some participants felt that not all the materials were individually relevant to them, but that having access was worthwhile. “I smoked for years, always going to be part of my life, so it’s still a good reminder” (FG2, P03). They also appreciated the breadth of information contained in the app, noting:

You need that flexibility because the progression of the disease might mean you need that info later. (FG1, P01)

In terms of app usability, participants emphasized the need for orientation: “I would also want training but once you do it the initial once or twice, then you get the hang of it” (FG2, P03). Participants also appreciated the adaptability across different devices.

These are greatly laid out, you know, like big, and it’s good, especially if you have a tablet [...] Because you know, as you get older, you’d like to see things bigger. (FG2, P03)

Participants likewise emphasized the importance of simple navigation and large text size, with one finding:

That one area where we click into the activities. It could be larger because I had to go look for it [...] larger font would have been better. (FG4, P05)

Regarding the format, participants emphasized the simplicity of the app's layout and lack of clutter:

I think it was simple. There wasn't a lot of stuff on the page, which was really helpful. (FG4, P05)

They did have some concerns with the labeling of materials as “tasks”.

Can we change the word task? [...] I don't want to work. I stopped working. Okay. I'm trying to manage my disease, you know, so maybe there's tools, maybe it's called tools to help me. (FG1, P01)

Acceptability was high. Participants appreciated the flexible pacing of task completion, stating: “I like that there's no time limit. Like with Lung Coach, there was no time limit with her either” (FG2, P03). They noted that an enabler of acceptability would be endorsement from their CRE, as “I think that having the coach, really makes the person comfortable with the tool, it's gonna be very important” (FG1, P02). They also suggested that ensuring the app language was non-judgemental and emotionally supportive would foster acceptability. “There is shame in having COPD a softer approach would be more comforting” (FG1, P02).

To optimize comprehensibility, participants emphasized the importance of clear and simple terminology and instructions. Referring to one of the buttons used to indicate task completion, one participant commented: “For me, ‘I understand’ isn't the same as ‘I'm done’” (FG3, P04). They also felt that access to a dedicated technical support contact would help resolve any issues, as well as having a tutorial available when starting to use the app.

If you have somebody that can help you get around it enough so that you understand what's going on, it might make it easier. (FG4, P07)

Integration of Findings

Across the six PDSA cycles, user feedback consistently informed changes to content, usability, format, acceptability, and comprehensibility of the app. Early sessions identified navigation difficulties, small font size, and unclear terminology, which corresponded with lower SUS scores. Subsequent modifications, such as increasing font size, embedding videos and PDFs, simplifying layout, clarifying task completion language, and rephrasing judgmental text were associated with improvements in SUS scores. Participants also emphasized the importance of CRE endorsement and requested training and access to technical assistance. [Table 1](#) summarizes the specific modifications made in response to participant and stakeholder input ([Appendix 4 Table 6](#) also demonstrate how system changes were mapped to the resulting themes from qualitative analysis). Any disagreements related to proposed changes were settled through discussion in subsequent focus groups and by obtaining majority consensus at stakeholder meetings.

Discussion

We developed and iteratively refined an EPR-integrated companion app to support COPD-self management education. Through six PDSA cycles, we achieved substantial usability gains and identified important enablers of acceptability such as readability, supportive tone, clinician endorsement, and simple navigation. Our findings highlight the value of embedding user and stakeholder input during tool development to ensure alignment with patient needs and health system workflows.

Our results align with a growing body of evidence supporting digital self-management interventions in COPD which endorses the value of user-centered design methods as an effective approach to optimizing tool uptake and usability prior to clinical use.^{26–29} These methods are likely critical to downstream tool success, as though systematic reviews in the past found mixed results relating to the efficacy of digital self-management interventions in COPD,¹⁵ recent trials that have incorporated user-centered design methods during app development have shown more promising clinical impact and sustained patient engagement.^{30,31} Several of the specific usability elements identified by our qualitative analysis,

including adjusting app language, optimizing font size, and the importance of support for patient onboarding, have also been supported as key drivers of usability in previous studies.²⁶ Similarly, our finding that CRE endorsement and tight alignment of app and program content were seen as critical drivers of patient app adoption underscores the notion that digital tools in COPD must complement rather than replace existing care pathways.¹⁴ However, unlike previous COPD digital self-management apps, our app addresses data privacy and care integration concerns that can limit sustained adoption and scaling through EPR-integration into the existing patient portal.^{15–17}

Though health apps are growing in use clinically, the quality of their development process and the content they contain is highly variable. For example, a recent review of self-management apps across chronic diseases found that user-centered design was inconsistently applied and that 87% of apps failed to incorporate available clinical evidence.³² Our two-phase development process for the MLHC companion app directly addressed these shortcomings, resulting in an evidence-based and patient-centered tool to complement the virtual self-management program we developed. Our use of iterative redesign informed by quantitative and qualitative patient and stakeholder feedback identified several critical system changes supported by previous digital health literature. Another important strength of our app is its integration into the hospital's electronic patient record. Previous research has shown that integrating self-management tools into patient portals enhances patient self-management behaviours,³³ and it also addresses potential data security and privacy concerns present with other standalone apps.³² Finally, developing the app within Epic Care Companion will also greatly facilitate any future efforts to scale and integrate our solution to other institutes using Epic, as no new IT infrastructure will be required, and patients and providers will already be familiar with the system interface, enhancing workflow fit and facilitating clinical oversight.

Our study has important limitations. We felt that knowledge of the MLHC program was integral to assessing the added value of the app, which limited our focus group recruitment population to 12 individuals who has already completed the program (6 of whom declined), and introduced some selection bias as participants who completed the MLHC program are likely more motivated to improve their disease self-management. Given that we did not identify any new critical issues by our 4th focus group, that our SUS scores were consistently high following our first round of changes, and that up to 85% of usability issues can be identified by as few as 5 users,³⁴ we felt confident finalizing our app development process after 4 focus groups. However, we will also continue to track app usability during the next phase of this research project – a prospective pilot study. Our study also did not include longitudinal usability assessment, which would be necessary to fully understand long-term user engagement and sustainability of the app's impact. In order to address these limitations, we are planning a larger pilot study of MLHC with the companion app, which will include both feasibility and clinical outcomes over time.

Conclusion

Through an iterative, user-centred design process, we developed and refined an Epic EPR-integrated companion app for the My Lung Health Coach COPD self-management program. Usability improved from the poor to excellent range across six PDSA cycles, with patient and stakeholder input driving key changes in readability, navigation, tone, and clinician endorsement. Unlike most COPD self-management apps, our intervention is embedded directly within the electronic patient record, addressing privacy, workflow, and sustainability challenges that have limited adoption and scalability in prior digital tools. By aligning with patient needs, clinical pathways, and organizational infrastructure, our approach offers a model for integrating digital health into routine COPD care, which has the potential to offer the benefits of self-management support and education at a scale not possible using conventional resources. Future research will evaluate the feasibility and clinical impact of this approach in real-world practice to determine whether these usability gains translate into sustained system engagement, ultimately leading to reduced healthcare utilization and improved quality of life.

Data Sharing Statement

Summary of qualitative data analysis available upon reasonable request.

Ethics Approval

This study received ethics approval as a quality improvement initiative through The Women's College Hospital Assessment Process for Quality Improvement Projects (APQIP) pathway (APQIP, # 2024-0015-P), and complies with the Declaration of Helsinki.

Author Contributions

All authors made a significant contribution to the work reported, whether that is in the conception, study design, execution, acquisition of data, analysis and interpretation, or in all these areas; took part in drafting, revising or critically reviewing the article; gave final approval of the version to be published; have agreed on the journal to which the article has been submitted; and agree to be accountable for all aspects of the work.

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Disclosure

AK has received speaking fees from AstraZeneca. Other authors have no conflicts of interest to declare.

References

1. Evans CY, Camp PG, Bowie DM, McRae L. Estimating the prevalence of COPD in Canada: reported diagnosis versus measured airflow obstruction - Document - Gale In Context: Canada. *Health Rep.* 2014;25(3):3.
2. Global Initiative for Chronic Obstructive Lung Disease, Inc. Global strategy for the diagnosis, management, and prevention of chronic obstructive pulmonary disease (2023 Report). 2023.
3. Halpin DMG, Decramer M, Celli BR, Mueller A, Metzdorf N, Tashkin DP. Effect of a single exacerbation on decline in lung function in COPD. *Respir Med.* 2017;128:85–91. doi:10.1016/j.rmed.2017.04.013
4. Seemungal TA, Donaldson GC, Paul EA, Bestall JC, Jeffries DJ, Wedzicha JA. Effect of exacerbation on quality of life in patients with chronic obstructive pulmonary disease. *Am J Respir Crit Care Med.* 1998;157(5 Pt 1):1418–1422. doi:10.1164/ajrccm.157.5.9709032
5. Mittmann N, Kuramoto L, Seung SJ, Haddon JM, Bradley-Kennedy C, Fitzgerald JM. The cost of moderate and severe COPD exacerbations to the Canadian healthcare system. *Respir Med.* 2008;102(3):413–421. doi:10.1016/j.rmed.2007.10.010
6. Amegadzie JE, Lee TY, Sadatsafavi M, Lynd LD, Sin DD, Johnson KM. Trends in hospital admissions for chronic obstructive pulmonary disease over 16 years in Canada. *CMAJ.* 2023;195(35):E1172–9. doi:10.1503/cmaj.221051
7. Canadian Institute for Health Information (CIHI). COPD: a focus on high users [Internet]. 2017 [cited 2023 Sept 6]. Available from: <https://www.cihi.ca/en/copd-a-focus-on-high-users-infographic#:~:text=In%20Canada%2C,estimated%201.5%20billion%20dollars%20annually>. Accessed February 18, 2025.
8. Schrijver J, Lenferink A, Brusse-Keizer M, et al. Self-management interventions for people with chronic obstructive pulmonary disease. *Cochrane Database Syst Rev.* 2022. doi:10.1002/14651858.CD002990.pub4
9. Boulet LP, Bourbeau J, Skomro R, Gupta S. Major care gaps in asthma, sleep and chronic obstructive pulmonary disease: a road map for knowledge translation. *Can Respir J.* 2013;20(4):265–269. doi:10.1155/2013/496923
10. Stellefson ML, Shuster JJ, Chaney BH, et al. Web-based health information seeking and eHealth literacy among patients living with chronic obstructive pulmonary disease (COPD). *Health Commun.* 2018;33(12):1410–1424. doi:10.1080/10410236.2017.1353868
11. Nakken N, Janssen DJA, van den Bogaart EHA, et al. Knowledge gaps in patients with COPD and their proxies. *BMC Pulm Med.* 2017;17(1):136. doi:10.1186/s12890-017-0481-8
12. Perez X, Wisnivesky JP, Lurslurchachai L, Kleinman LC, Kronish IM. Barriers to adherence to COPD guidelines among primary care providers. *Respir Med.* 2012;106(3):374–381. doi:10.1016/j.rmed.2011.09.010
13. Ferrone M, Masciantonio MG, Malus N, et al. The impact of integrated disease management in high-risk COPD patients in primary care. *NPJ Prim Care Respir Med.* 2019;29(1):8. doi:10.1038/s41533-019-0119-9
14. Morrison D, Mair FS, Yardley L, Kirby S, Thomas M. Living with asthma and chronic obstructive airways disease: using technology to support self-management – an overview. *Chron Respir Dis.* 2017;14(4):407–419. doi:10.1177/1479972316660977
15. McCabe C, McCann M, Brady AM. Computer and mobile technology interventions for self-management in chronic obstructive pulmonary disease. *Cochrane Database Syst Rev.* 2017;2017(5):1.
16. Zhuang M, Hassan II, Ahmad WMAW, et al. Effectiveness of digital health interventions for chronic obstructive pulmonary disease: systematic review and meta-analysis. *J Med Internet Res.* 2025;27(1):e76323. doi:10.2196/76323
17. Verma A, Behera A, Kumar R, Gudi N, Joshi A, Islam KM. Mapping of digital health interventions for the self-management of COPD: a systematic review. *Clin Epidemiol Global Health.* 2023;24:101427.
18. Duffy A, Christie GJ, Moreno S. The challenges toward real-world implementation of digital health design approaches: narrative review. *JMIR Human Factors.* 2022;9(3):e35693. doi:10.2196/35693
19. Bourbeau J, Bhutani M, Hernandez P, et al. 2023 Canadian thoracic society guideline on pharmacotherapy in patients with stable COPD. *Chest.* 2023;164(5):1159–1183. doi:10.1016/j.chest.2023.08.014

20. Palmblad M, Tiplady B. Electronic diaries and questionnaires: designing user interfaces that are easy for all patients to use. *Qual Life Res.* 2004;13(7):1199–1207. doi:10.1023/B:QURE.0000037501.92374.e1
21. U.S. Department of Health & Human Services AS for P. System Usability Scale (SUS) [Internet]. 2013 [cited March 11, 2018]. Available from: /how-to-and-tools/methods/system-usability-scale.html. Accessed February 18, 2025.
22. Doyle L, McCabe C, Keogh B, Brady A, McCann M. An overview of the qualitative descriptive design within nursing research. *J Res Nurs.* 2020;25(5):443–455. doi:10.1177/1744987119880234
23. Sandelowski M. What's in a name? Qualitative description revisited. *Res Nurs Health.* 2010;33(1):77–84. doi:10.1002/nur.20362
24. Braun V, Clarke V. Using thematic analysis in psychology. *Qual Res Psychol.* 2006;3(2):77–101. doi:10.1191/1478088706qp063oa
25. Leis JA, Shojania KG. A primer on PDSA: executing plan–do–study–act cycles in practice, not just in name. *BMJ Qual Saf.* 2017;26(7):572–577. doi:10.1136/bmjqs-2016-006245
26. Davies A, Mueller J, Hennings J, Caress AL, Jay C. Recommendations for developing support tools with people suffering from chronic obstructive pulmonary disease: co-design and pilot testing of a mobile health prototype. *JMIR Hum Factors.* 2020;7(2):e16289. doi:10.2196/16289
27. Naranjo-Rojas A, Perula-de Torres LÁ, Cruz-Mosquera FE, Molina-Recio G. Usability of a mobile application for the clinical follow-up of patients with chronic obstructive pulmonary disease and home oxygen therapy. *Int J Med Inform.* 2023;175:105089. doi:10.1016/j.ijmedinf.2023.105089
28. Ghaben SJ, Mat Ludin AF, Mohamad Ali N, Singh DKA. User-centred design of ChestCare: mHealth app for pulmonary rehabilitation for patients with COPD; a mixed-methods sequential approach. *Dig Health.* 2025;11:20552076241307476. doi:10.1177/20552076241307476
29. Lenferink A, Brusse-Keizer MGJ, van der Palen J, Effing TW. Personalizing self-management Interventions in COPD – Looking beyond one-size-fits-all. *Int J Chron Obstruct Pulmon Dis.* 2025;20:65–68. doi:10.2147/COPD.S511278
30. Park SK, Bang CH, Lee SH. Evaluating the effect of a smartphone app-based self-management program for people with COPD: a randomized controlled trial. *Appl Nurs Res.* 2020;52:151231. doi:10.1016/j.apnr.2020.151231
31. Taylor A, Cushing A, Dow M, et al. Long-term usage and improved clinical outcomes with adoption of a COPD digital support service: key findings from the RECEIVER trial. *COPD.* 2023;18:1301–1318. doi:10.2147/COPD.S409116
32. Scott IA, Scuffham P, Gupta D, Harch TM, Borch J, Richards B. Going digital: a narrative overview of the effects, quality and utility of mobile apps in chronic disease self-management. *Aust Health Rev.* 2020;44(1):62–82. doi:10.1071/AH18064
33. Carini E, Villani L, Pezzullo AM, et al. The impact of digital patient portals on health outcomes, system efficiency, and patient attitudes: updated systematic literature review. *J Med Internet Res.* 2021;23(9):e26189. doi:10.2196/26189
34. Nielsen J, Landauer T. A mathematical model of the finding of usability problems. In: *Amsterdam.* Netherlands; 1993.

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