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Stakeholder-informed prioritisation of HealthTech innovation across chronic respiratory disease: the HERON study

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ABSTRACT

Background Chronic respiratory disease (CRD) is characterised by high symptom burden and frequent emergency admissions, disproportionately affecting disadvantaged populations. Advances in health technology (HealthTech) offer opportunities to improve health outcomes but are most effective when they target the most pressing needs across the CRD pathway. We aimed to develop and apply a stakeholder-informed prioritisation methodology for HealthTech across adult and paediatric CRD.

Methods We used a stakeholder-informed prioritisation methodology designed specifically for HealthTech. National surveys and targeted discussions with people living with CRD, individuals at risk, carers and healthcare professionals identified unmet needs and potential HealthTech solutions. Inductive qualitative content analysis generated a longlist of candidate solution areas, which were mapped against a respiratory technology landscape review to produce evidence summaries of current technological capability. These informed a multistakeholder consensus workshop to identify the top 20 priority HealthTech solution areas for CRD.

Results A total of 314 patients, carers and healthcare professionals contributed through surveys and targeted discussions. Stakeholders identified 741 challenges and 555 potential HealthTech solutions, which were synthesised into 73 candidate solution areas across 16 priority domains. The technology landscape review found that 52/73 (71.2%) solution areas remained unmet and 21/73 (28.8%) were partially met by existing HealthTech; none were considered fully met. A multistakeholder consensus workshop identified the top 20 priority HealthTech solution areas for CRD.

Conclusion This stakeholder-informed HealthTech prioritisation integrates unmet need with current technological capability to inform policy and funding decisions in CRD. The methodology for HealthTech prioritisation can be applied beyond respiratory care.

WHAT IS ALREADY KNOWN ON THIS TOPIC

⇒ HealthTech is increasingly recognised as a driver of improving respiratory care, but innovation remains underfunded relative to disease burden. Prioritisation is needed to ensure limited resources are directed towards HealthTech innovation in areas of greatest unmet need.

WHAT THIS STUDY ADDS

⇒ This study describes a stakeholder-informed HealthTech prioritisation which identifies 20 priority areas for future chronic respiratory disease HealthTech innovation. It also identifies equity, accessibility, usability and sustainability as cross-cutting priorities that stakeholders considered fundamental to successful innovation.

HOW THIS STUDY MIGHT AFFECT RESEARCH, PRACTICE OR POLICY

⇒ HERON provides an inclusive, evidence-informed approach that can help researchers, funders, industry and policymakers direct limited resources towards HealthTech innovations most likely to address stakeholder-defined unmet need and maximise their potential for successful implementation across diverse settings.

INTRODUCTION

Chronic respiratory diseases (CRDs) affect approximately one in five people in the UK. They are the third leading cause of death and result in substantial healthcare utilisation, accounting for over 700 000 hospital admissions and 6 million inpatient bed-days annually.[1] They are also characterised by persistent symptoms, frequent exacerbations and reduced physical functioning, with major impacts on quality of life and day-to-day functioning that are expected to increase as populations age.[2] Respiratory disease also contributes significantly to health inequalities,[3] with marked variation in prevalence, outcomes and healthcare utilisation according to deprivation and geography.[4]

Despite this burden, substantial unmet need remains across prevention, diagnosis, treatment and long-term management of CRDs. Health technology (HealthTech), encompassing diagnostics, artificial intelligence (AI), digital technologies, data systems, wearables and medical devices, is increasingly recognised as an important driver of improvements.

The UK government's 10 Year Health Plan places technological innovation at the centre of delivering National Health Service (NHS) three strategic shifts—from hospital to community, analogue to digital and treatment to prevention—and highlights

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the importance of streamlining the development, evaluation and adoption of technologies to improve patient outcomes, healthcare productivity and sustainability.[5] While these three national priorities make a compelling case for accelerating HealthTech innovation, there is a lack of guidance on how priorities for HealthTech development should be identified. Substantial investment has led to a rapidly expanding respiratory HealthTech landscape, yet innovation is often driven by technological opportunity rather than systematically identified clinical need. As a result, technologies may fail to address the areas of greatest unmet need for patients, clinicians and healthcare systems. Respiratory research and innovation also remain chronically underfunded relative to disease burden,[6] underscoring a need to direct limited resources towards areas with the greatest potential impact.

Stakeholder priority-setting partnerships informed by James Lind Alliance (JLA) methodology[7] have become an established approach for identifying research priorities that matter to patients, carers and clinicians, informing research agendas across numerous clinical specialties including respiratory medicine.[8 9] However, these partnerships were developed primarily to identify unanswered research questions rather than to prioritise HealthTech solutions. HealthTech prioritisation requires additional considerations, including the availability of existing technologies, their maturity and readiness for implementation. To our knowledge, no systematic methodology has been described for stakeholder-informed prioritisation of HealthTech solution areas for CRD.

To address this gap, we have modified JLA methodology to apply a prioritisation approach designed specifically for HealthTech. Health Technology for Chronic Respiratory Disease: Exploring and Mapping Unmet Needs (HERON) aimed to extend conventional prioritisation methods by combining perspectives from patients, carers and healthcare professionals with structured evidence summaries describing existing HealthTech solutions and their maturity, supporting participants to prioritise unmet needs and potential future solutions within the context of current technological capability.

METHODS

Study design

HERON was a national stakeholder partnership that developed and applied a modified HealthTech prioritisation methodology, informed by JLA principles[7] and a previous similar approach to prioritising technology for women's health led by our team.[10] HERON retained the four core principles of JLA methodology,[7] including equal involvement of patients, carers and clinicians; inclusivity; transparency; and commitment to the evidence base, while adapting the methodology to address the additional considerations required for prioritising HealthTech innovation.

An overview of HERON methodology is shown in figure 1. The project comprised several linked components:

1. Co-developed stakeholder surveys and targeted discussions to identify unmet needs and potential HealthTech solutions.
2. Qualitative content analysis to develop a longlist of candidate unmet needs and HealthTech solutions.
3. A CRD technology landscape review mapping candidate solutions against the longlist and preparation of evidence summaries describing existing HealthTech solutions and the extent to which identified needs were considered met.
4. A multistakeholder consensus prioritisation workshop and final refinement of the 20 prioritised HealthTech solution areas.

The CRD technology landscape review underpinning the evidence summaries will be updated and reported separately. Methods are reported in accordance with the Reporting Guideline for Priority Setting of Health Research.[11] Project steering

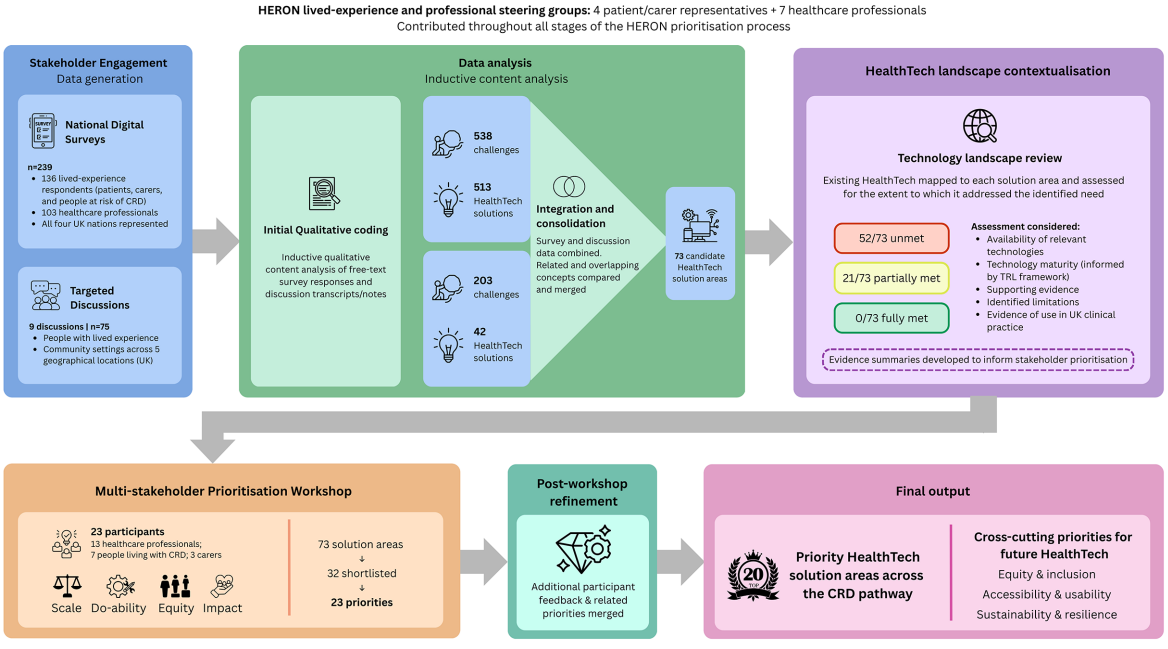


Figure 1 Summary of Health Technology for Chronic Respiratory Disease: Exploring and Mapping Unmet Needs (HERON) study methodology and data flow through each stage of the prioritisation process.

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groups and prioritisation scope are described below, followed by sections which describe each of the four stages in detail.

Project steering groups

Lived experience and healthcare professional steering groups were established at the start of the project and contributed to refining the study scope; developing, piloting and disseminating the surveys; facilitating targeted outreach sessions; sense-checking and refinement of data analysis; planning of the prioritisation workshop; and finalising the top 20 HealthTech solutions wording. Representatives from both steering groups also participated in the final prioritisation workshop. The steering groups comprised four patient/carer representatives and seven healthcare professionals from across England, Scotland and Northern Ireland. Several people were from minority ethnic backgrounds. The lived experience steering group represented different ages, genders and a range of CRDs. Professional roles included GPs, a specialist respiratory pharmacist, physiotherapist, nurse specialists and consultant respiratory and integrated care physicians, providing expertise across the respiratory pathway.

Prioritisation scope

CRDs share common clinical care pathways across prevention, diagnosis, long-term management and monitoring, with overlapping symptom experiences such as cough and breathlessness and disease trajectories characterised by exacerbations and progressive deterioration. Recognising these shared features, HERON adopted a disease-agnostic approach. Conditions within scope included asthma, chronic obstructive pulmonary disease (COPD), bronchiectasis, interstitial lung diseases (including pulmonary fibrosis), cystic fibrosis, breathing pattern disorder, unexplained breathlessness and other chronic respiratory conditions. Lung cancer, sleep apnoea, lung infections not associated with CRD and breathlessness primarily attributable to a non-respiratory cause were excluded because these follow distinct clinical pathways and would require different HealthTech priorities.

To identify unmet needs and potential HealthTech solutions across the respiratory pathway and including all ages, HERON engaged not only people living with established CRD and their carers, but also individuals at increased risk of developing CRD, individuals undergoing diagnostic assessment, and parents or carers of children with CRD.

Co-developed stakeholder surveys and targeted discussions to identify unmet needs and potential HealthTech solutions

Two complementary digital surveys were co-developed with the steering groups: one for people with lived experience (or their carers, and those at-risk) and one for professionals involved in the care of those with CRD across all professional backgrounds and healthcare settings. Surveys were designed to minimise respondent burden through simple language, minimal demographic information, limited mandatory questions and predominantly free-text responses to encourage unrestricted idea generation. Participants were invited to describe up to three important challenges and suggest how technology might address each. Illustrative examples were provided to stimulate thinking while encouraging participants to identify any challenge or solution they considered important, irrespective of whether relevant technology already existed.

For lived experience respondents in England who provided a postcode, neighbourhood-level socioeconomic deprivation was estimated using their Index of Multiple Deprivation (IMD) 2019 decile. Survey questions are reproduced in online supplemental 1A/B.

To achieve broad representation across UK nations, stakeholder groups and healthcare settings, the survey was disseminated through national patient organisations, professional societies, and clinical and research networks, including Asthma+Lung UK, Action for Pulmonary Fibrosis, the Primary Care Respiratory Society, the Centre for Applied Research Innovation and Impact (CARRii), NHS Research Scotland and National Institute for Health and Care Research (NIHR) public involvement networks. Additional informal dissemination used steering group networks, social media and posters with QR codes displayed in NHS clinical settings.

Recognising that online surveys may exclude populations experiencing the greatest health inequalities and limit opportunities for in-depth exploration of perspectives,[12] targeted community group discussions were planned as a complementary engagement method and conducted alongside national survey dissemination. These were intended to provide an additional route for participation for people who might be less likely or able to engage through a digital survey. Clinical and patient support groups were identified via steering group contacts or direct invitation, to broaden geographical and stakeholder representation. Where possible, discussions were conducted in community settings serving individuals at greater risk of digital exclusion, including older populations in areas of greater socio-economic deprivation and people experiencing homelessness. Online sessions were offered where remote engagement was more appropriate. A HERON researcher facilitated conversations with individuals or groups using a discussion guide aligned with the survey domains. Sessions were audio-recorded and professionally transcribed where consent was provided or otherwise summarised using detailed written notes. Individual demographic data were not collected during targeted discussions to minimise participant burden and keep participation minimally intrusive.

Qualitative content analysis to develop a longlist of candidate unmet needs and potential HealthTech solutions

Free-text survey responses and discussion transcripts/notes were initially reviewed as separate data sources before being collated and analysed using inductive qualitative content analysis.[13] Responses were coded line-by-line to identify underlying unmet needs and proposed HealthTech solutions. Codes were iteratively compared across the data sources and consolidated into concepts representing common unmet needs, with duplicate or overlapping responses merged. Working definitions were developed throughout the analysis to ensure consistent interpretation and application, with discrepancies resolved through discussion and consensus. This process generated a longlist of unmet needs linked to potential HealthTech solutions. To support the subsequent prioritisation exercise, the longlist was organised into thematic domains reflecting stages of the CRD pathway. Throughout this process, steering groups provided iterative feedback to refine the wording and interpretation of emerging themes.

Technology landscape review to produce summaries of existing HealthTech solutions for each unmet need

A CRD technology landscape review was undertaken to identify existing HealthTech relevant to each stakeholder-defined unmet need and produce evidence summaries for the prioritisation workshop. Searches drew on published literature and innovation sources to identify relevant technologies across a range of

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development stages. For each unmet need, evidence was synthesised into a standardised summary describing: (i) available HealthTech solutions; (ii) key limitations of current technologies; (iii) relevance to UK clinical practice; and (iv) an overall assessment of the extent to which the unmet need was considered addressed by existing HealthTech. Identified technologies were grouped according to their stage of development as early stage (ideas, prototypes or early feasibility studies), clinical research (tested with patients but not yet widely used) or market-ready/implemented (available, distributed or in real-world use), informed by the Technology Readiness Level (TRL) framework.[14 15] A single reviewer (ZO) reviewed the evidence and mapped relevant technologies against each identified stakeholder-defined solution area. Each need was classified as met, partially met or unmet based on the maturity of relevant technologies, strength of supporting evidence, identified limitations and evidence of use within UK clinical practice. The threshold for a need to be considered fully met was deliberately high, requiring evidence of a relevant technological solution in routine use at scale in the UK. These evidence summaries were presented alongside each unmet need during the final prioritisation workshop, enabling participants to consider priorities within the context of the current HealthTech landscape rather than in isolation.

Multistakeholder consensus prioritisation workshop and final refinement of the 20 prioritised HealthTech solution areas

A national multistakeholder prioritisation workshop was convened to achieve consensus on the highest priority HealthTech solution areas. Workshop participants were purposively selected to provide diversity of relevant perspectives rather than to be statistically representative of participants from earlier project stages. The workshop was held in-person to facilitate discussion and collaborative consensus building. Reasonable travel and accommodation expenses were reimbursed, and lived experience contributors were compensated in accordance with NIHR payment guidance.

Before the workshop, participants received a short introductory video to familiarise themselves with the project and workshop materials, together with the full longlist of candidate unmet needs. They also indicated priority domains of greatest interest, which informed allocation to mixed-role discussion tables, balancing lived experience and professional perspectives. Each table received a subset of thematically grouped candidate unmet needs, accompanied by evidence summaries and explanatory material describing the technology review methodology.

An experienced independent facilitator led the workshop, encouraging balanced discussion and equal contribution from all stakeholder groups. Prioritisation of unmet needs/HealthTech solutions was guided by four predefined criteria co-developed with the steering groups:

- Scale (the size of the problem).
- Impact (the potential benefit of addressing the unmet need).
- Do-ability (the feasibility of developing and implementing a HealthTech solution in routine NHS care).
- Equity (the potential to reduce rather than widen health inequalities).

Participants were additionally encouraged to consider:

a. Whether the unmet need was already adequately addressed by existing technologies.
b. Whether it represented a clear opportunity for technology-enabled innovation within respiratory care.

Consensus was achieved through a structured deliberative process. Participants first prioritised needs/solutions within their allocated domains, before rotating across all domains to review priorities selected by other groups, providing a 'legitimacy check' to affirm or challenge decisions, identify overlap and suggest potential merges. Collective comparison of the remaining priorities, including short presentations from each group, was followed by individual reflection and a final 'vote to drop', during which participants could allocate a maximum of one negative vote to any individual priority. Closely related priorities could be merged where participants agreed they represented a common underlying unmet need.

Following provisional agreement at the workshop, the wording of the prioritised HealthTech solution areas was reviewed and circulated to participants to ensure it accurately reflected the consensus reached and to invite further comment or clarification, which was then incorporated into the final shortlist.

Project governance and ethics

Before the project commenced, the HERON project outline and survey materials were reviewed by the Research Governance, Ethics and Assurance Team at the University of Oxford who confirmed that as a priority-setting partnership project, HERON constituted PPIE rather than research, and therefore did not require formal ethics approval. Participation in surveys and discussions was voluntary, with anonymous responses and optional contact details for future involvement. All participants received written information describing the purpose of the project, voluntary participation, data handling and publication of anonymised findings before deciding whether to participate. HERON was conducted in line with established UK standards for public involvement.[16]

RESULTS

Participant contributions and numerical flow through each stage of the HERON prioritisation process are summarised in figure 1.

Co-developed stakeholder surveys and targeted discussions to identify unmet needs and potential HealthTech solutions

Patients, carers and healthcare professionals (n=314) representing all four UK nations contributed through two national digital surveys (June-November 2025) alongside targeted engagement activities (August-December 2025). A total of 239 participants contributed through the national digital surveys (136 lived-experience respondents and 103 healthcare professionals) and a further 75 people with lived experience participated in nine targeted discussions. The discussions took place in Greater Manchester, Norwich, Bristol, Nottingham and Weston-super-Mare, including pulmonary rehabilitation programmes, peer support and singing groups for those experiencing breathlessness and specialist respiratory services supporting people experiencing homelessness.

Detailed respondent characteristics are presented in online supplemental 2A/B. Among lived experience survey respondents (n=136), the majority were living with a CRD (83.1%), most commonly asthma (61.9%), COPD (31.0%) or bronchiectasis (23.0%). Respondents were predominantly female (69.4%), White (92.6%), aged ≥45 years (81.6%) and reported degree-level or higher educational attainment (64.7%). Almost one-third (31.0%) reported living with CRD for more than 20 years. Although responses were received from across all deciles of deprivation, a higher proportion were from less deprived areas: 26.0% respondents were from the most deprived half of areas and 38.0% lived in IMD deciles 9–10.

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Healthcare professional respondents (n=103) included GPs, practice nurses, respiratory specialist nurses, consultants, pharmacists, physiologists and a range of other allied health professionals and roles across primary, secondary, specialist and community care settings. Approximately two-thirds (66.1%) had more than 10 years' experience caring for people with CRD.

Qualitative content analysis to develop a longlist of candidate unmet needs and potential HealthTech solutions

Survey responses generated 538 challenges and 513 suggested HealthTech solutions. Targeted discussions generated a further 203 challenges and 42 solutions. Data from both sources were subsequently collated and analysed together, with overlapping and related concepts consolidated into 73 potential HealthTech solutions. These were then organised into 16 priority domains spanning the CRD pathway from prevention and early identification through diagnosis, treatment, long-term management and psychosocial support. Online supplemental 3 summarises these priority domains, and online supplemental 4 presents the complete list of stakeholder-informed potential HealthTech solutions grouped by priority domain.

Across all domains, stakeholders consistently identified cross-cutting priorities relating to equity, accessibility, usability, sustainability and future development. These principles were considered relevant to all future HealthTech solutions irrespective of the specific clinical problem and are summarised in box 1.

Technology landscape review to produce summaries of existing HealthTech solutions for each unmet need

The CRD technology landscape review informed evidence summaries for each of the 73 stakeholder-defined HealthTech solution areas. Based on these summaries, 52/73 (71.2%) solution areas were considered unmet, while the remaining 21/73 (28.8%) were considered partially met; no solution area was considered fully met by currently available HealthTech. Technology landscape review assessments for all 73 solution areas are presented in online supplemental 4.

Multi-stakeholder consensus prioritisation workshop and final refinement of the 20 prioritised HealthTech solution areas

The consensus prioritisation workshop was a full-day event in March 2026 and involved 23 participants (13 healthcare professionals, seven people living with CRD and three carers). Participants represented a range of professional roles, respiratory conditions, ages, ethnic backgrounds and UK regions and were allocated across priority domain discussion groups to maximise diversity (online supplemental 5A/B).

Following initial prioritisation and cross-group legitimacy check of the 73 long-listed HealthTech solution areas, 32 were taken forward for final consideration. The workshop reached consensus on 23 priority HealthTech solution areas. Following postworkshop participant feedback, several closely related priorities were merged and reworded where they represented a common underlying unmet need, resulting in the final top 20 prioritised HealthTech solution areas.

The outcome for all 73 HealthTech solutions is presented in online supplemental 4. The final 20 prioritised HealthTech solution areas are presented in table 1 and summarised visually according to their position within the CRD pathway in figure 2.

Box 1 Cross-cutting stakeholder priorities relevant to all future respiratory HealthTech solutions

Equity and inclusion
- ⇒ Proposed solutions should explicitly address digital inclusion and avoid exacerbating existing inequalities in access to care, for example, by offering non-digital alternatives and additional support or options for those with low digital literacy or limited confidence.
- ⇒ Patient-facing tools should incorporate inclusive features such as language translation and accessibility options for patients with disabilities (eg, language interpretation in online peer support spaces, keyboard navigation and colour contrast).

Accessibility and usability
- ⇒ Digital solutions should require low-burden, user-centred design that is intuitive regardless of digital confidence or educational background.
- ⇒ Medical devices and medication delivery systems should be designed to accommodate patients with physical or cognitive limitations.

Sustainability and resilience
- ⇒ Environmental sustainability should be explicitly considered during development of all technologies.
- ⇒ Consideration should also be given to the financial burden and required infrastructure needed for patient use (eg, electricity, internet connectivity and digital hardware costs), with appropriate system-level safeguards to prevent interruption of care (eg, power cuts or service disruptions).

Research and future development
- ⇒ Where possible, and with appropriate data security and governance measures in place, health technologies should include the potential for users to optionally contribute their data for future development and improvement of the technology.
- ⇒ Users should also be made aware of relevant research participation opportunities.

DISCUSSION

This study describes a methodology for stakeholder-informed prioritisation of HealthTech innovation across a care pathway and demonstrates its application in CRD. Combining national stakeholder engagement with a respiratory HealthTech landscape review, HERON identified 20 priority opportunities for future innovation. The study also identified cross-cutting principles relating to equity, accessibility, usability and sustainability that stakeholders considered fundamental to successful HealthTech innovation. Together, these findings provide a structured approach to guiding HealthTech innovation towards areas of greatest unmet need while reflecting the priorities of those who develop, deliver and use respiratory care.

This study has several strengths. HERON has adopted a well-established JLA methodology and adapted it for HealthTech prioritisation, using national stakeholder engagement across the respiratory community and different care pathways rather than individual diseases. Deliberate efforts were made to broaden participation and include groups at risk of digital exclusion through targeted discussions conducted alongside the digital surveys. Notwithstanding, several limitations should be acknowledged. Despite these efforts, participants may not fully represent all stakeholder groups, and as individual demographic information was not systematically collected during targeted

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Table 1 Top 20 HealthTech solutions for unmet needs in chronic respiratory disease

Top 20 HealthTech solution	Expanded description
Screening and proactive case-finding tools to identify people at risk earlier	Screening and proactive case-finding tools, including personalised risk assessments based on multisource data, through annual or opportunistic screening, and community-based checks to identify people at risk earlier.
Triage and pathway tools to guide timely diagnostic escalation	Triage and pathway tools to guide timely diagnostic escalation from primary care or community settings, ensuring patients are sent for the right tests, imaging or specialist input earlier.
Accurate diagnostic tools available in primary/community settings with real-time feedback and guided interpretation	More modern and quality-controlled diagnostic tools that are accurate and consistently available in primary and community settings, alongside or with integrated tools to guide performing and interpreting diagnostic tests, including real-time feedback and AI interpretation support to maximise quality of lung function and imaging analysis.
Digital reporting and communication systems to improve diagnostic turnaround	Faster diagnostic turnaround through digital reporting and communication systems, reducing delays in test interpretation, result sharing and onward referral.
Patient-informed training and resources for healthcare professionals around diagnosis	Training and resources for healthcare professionals including lived-experience content and condition-specific information, to improve understanding and support respectful communication.
Patient-facing medication, dose monitoring and reminder tools	Patient-facing tools that support regular use of preventer medication, help keep track of treatment over time and highlight when medication may be being missed or over-used. Dose monitoring features could show how much medication remains and provide low-supply alerts, helping to avoid ineffective use of empty inhalers and reducing wastage.
Patient-held tools for symptom monitoring, reporting, self-management and education to help recognise and respond to exacerbations and support continuity of care	Tools that enable patients to monitor and report symptoms, recognise exacerbations and triggers, understand and follow personalised action plans, apply airway clearance techniques, use equipment correctly, and know when to self-manage or seek help. These should support continuity of care by allowing key clinical information, symptom records and management plans to travel with the patient across settings.
Tools to identify and monitor exacerbation triggers	Tools to identify and monitor triggers that increase the risk of respiratory exacerbations, such as real-time or linked monitoring (eg, air quality, pollen), enabling pro-active action to reduce exposure or adjust treatments such as increasing inhaled medication dose.
Tools for individuals to reduce trigger exposure	Tools to reduce individual exposure to triggers that increase the risk of exacerbations. Examples could include air purifiers, breathing filters or masks.
On-demand specialist support and virtual care to identify and manage acute and chronic deterioration	On-demand specialist access, including direct communication routes, virtual ward/multi-disciplinary team (MDT) input, and remote (video/telehealth) consultations and monitoring to prevent and respond to both acute and chronic deterioration during long waits between routine appointments. This would allow symptom progression and deterioration to be tracked, shared and acted on promptly and allow assessment and management at home during exacerbations or post-discharge.
Tools to strengthen patient voice and lived experience in clinical interactions	Tools that reinforce patient voice in clinical interactions, including supporting clinicians to listen to patient-reported changes, recognise lived experience, and improve understanding of the social and psychological impact of lung disease.
Tools to identify and prioritise higher-risk patients for routine review	Pre-review engagement and prioritisation tools, using simple questionnaires, symptom scores or lung function measurements to identify higher-risk patients, prioritise reviews, and focus appointments where they are most needed in both primary and specialist care.
Tools to maintain correct inhaler technique	Inhaler technique support and feedback tools, enabling patients and clinicians to assess, maintain and correct inhaler technique over time, including during remote or infrequent reviews.
Inhaler delivery devices that are easier for people with diverse needs and abilities	Accessible and low-effort inhaler delivery devices, accommodating children, older adults, and people with visual or dexterity impairments to use their inhalers with confidence, including automated or assisted options.
Tools and resources to support breathlessness management, including breathlessness-related anxiety	Tools and resources to support patients and carers in recognising and managing breathlessness and breathlessness-related anxiety, including guided breathing, relaxation, mindfulness, reassurance and calming strategies. These should include techniques to improve confidence and function in daily activities, reduce panic and help people understand when symptoms are anxiety-related versus physical deterioration.
Oxygen systems that are reliable, light, unobtrusive, comfortable and convenient to use, both at home and on the move	Patient-centred oxygen systems that are reliable, light, unobtrusive, comfortable and convenient to use, both at home and on the move, with safe and intuitive flow control, smart monitoring and alerts, and improved tubing design. This should include solutions that reduce cost burden and ensure reliable, uninterrupted access.
Integrated exercise monitoring and digital education to support safe and effective exercise	Integrated exercise monitoring and digital education that combines real-time feedback (eg, heart rate, oxygen levels, activity tracking) with clear guidance to help people interpret breathlessness and fatigue, pace themselves appropriately, avoid over-exertion and exercise safely with confidence.
Tools to support managing cough and sputum clearance	Tools to support managing cough and sputum clearance, including access to appropriate devices and guidance to clear sputum safely and reduce feelings of chest tightness.
Digitally delivered rehabilitation and physiotherapy, including ongoing support after programme completion	Digitally delivered rehabilitation and physiotherapy, providing guided, safe exercise through apps and video-supported sessions to improve access and reduce delays. These should support continuation of care after rehabilitation programmes, through ongoing guidance, monitoring, and re-engagement when needed.
Tools to connect patients to services, care pathways, peer/community support and research opportunities	Tools that connect patients and carers to local services, care pathways, peer/community support and research/study participation opportunities, improving awareness of available help, enabling access or self-referral, and providing safe spaces to share experiences and reduce isolation.

AI, artificial intelligence.

discussions, we cannot determine the extent to which these activities broadened the range of demographic groups represented. Findings are likely to be most applicable within the UK healthcare context. The HealthTech landscape review represents a snapshot of a rapidly evolving field. HERON's disease-agnostic approach prioritised shared healthcare functions and unmet needs upstream of individual product development, meaning that the resulting priorities are likely to remain relevant despite continuing technological advances. However, technologies developed in response may subsequently require disease-specific

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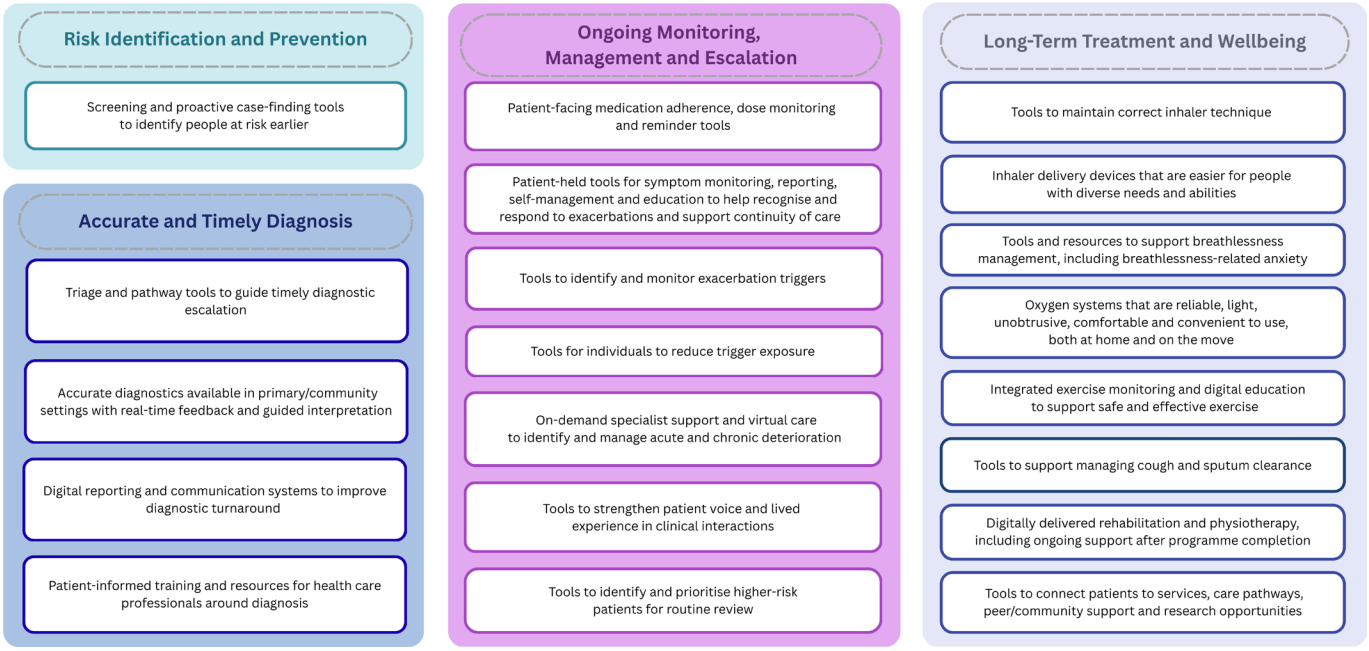


Figure 2 Top 20 HealthTech solutions for unmet needs in chronic respiratory disease. These have been grouped by place within the CRD pathway. CRD, chronic respiratory disease.

intended uses, validation and regulatory evidence depending on their function and target population.

A notable finding was that stakeholders consistently prioritised functions and models of care rather than specific technologies. Priorities centred on earlier diagnosis, proactive disease management, self-management, rehabilitation and integrated, community-based care, while remaining largely technology-agnostic. These findings align with other UK respiratory priority-setting initiatives, including the JLA Breathlessness Priority Setting Partnership[17] and the Asthma+Lung UK Lung Research Grand Challenges,[18] which similarly identified earlier diagnosis, prevention, person-centred care, rehabilitation and reducing inequalities as major research priorities for improving respiratory health. There is also notable concordance with disease-specific research priorities and evidence gaps identified in clinical guidance across asthma, COPD, bronchiectasis and interstitial lung disease, including around technology-enabled diagnosis, monitoring and self-management, airway clearance and rehabilitation.[19–22] The alignment across these independent initiatives, despite their differing scope and approaches, suggests that these areas represent shared and persistent unmet needs across the respiratory community. HERON complements these initiatives by extending beyond disease-specific research questions to identify shared needs across CRDs and translate them into a stakeholder-informed approach for HealthTech innovation, identifying where technological development has the greatest potential to improve respiratory care.

Stakeholders also identified equity, accessibility, usability and sustainability as cross-cutting principles relevant across HealthTech priorities (box 1). These findings are particularly pertinent in respiratory care, where digital exclusion and variation in digital literacy risk limiting the benefits of HealthTech and further widening existing health inequalities.[3 12]

Although our technology review identified a diverse respiratory HealthTech landscape, many needs remained only partially addressed and comparatively few technologies had progressed to widespread implementation or routine clinical use. This highlights a persistent gap between technological development and real-world uptake, reinforcing that innovation activity alone does not necessarily translate into meaningful improvements in care.[23 24] These observations align with sociotechnical frameworks in implementation science which recognise that successful implementation of digital health depends on the alignment of technological, organisational and wider-system factors.[25 26] HERON supports this perspective and shifts it upstream by demonstrating that these considerations should inform how HealthTech priorities are identified, technologies are designed and innovations are evaluated from the outset. This approach is complementary to the LifeArc Target Product Profile for a simple lung test,[27] which translates stakeholder priorities into product specifications for a specific diagnostic challenge; whereas HERON provides a broader upstream methodology for identifying and prioritising HealthTech opportunities across the respiratory care pathway.

The implications of HERON extend beyond individual technologies to the wider respiratory innovation ecosystem. Meaningful improvements in respiratory care will require investment not only in technology development but also in co-design, inclusive innovation, implementation science, interoperability and pragmatic real-world evaluation. This aligns with both national respiratory priorities calling for coordinated investment across research, innovation, implementation and healthcare infrastructure[28] and industry perspectives identifying evidence generation and NHS adoption pathways as major barriers to successful HealthTech innovation.[29] HERON provides a practical roadmap for addressing these challenges by identifying where to focus target product profiles and future collaborative technology development, including co-design involving patients, clinicians and industry. The priorities can also be used to inform research funding calls, guide innovators towards areas of greatest unmet

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need and support evaluation through platform-based studies. Such greater coordination at system level need not preclude commercial competition between individual technologies but may help focus innovation towards areas of greatest unmet need while reducing unnecessary duplication. Together, these findings suggest that successful respiratory HealthTech requires a coordinated systems approach that grounds technological innovation in the priorities of patients, carers and clinicians while aligning it with organisational and wider health system contexts.

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Contributors GNH conceived the idea for the study. The methodology was developed by ZO, SP, GNH, HFA, MW and PJT. ZO, SP, MW, GNH and HFA designed the surveys. ZO and SP undertook stakeholder engagement and data collection. NWR, ZO and SP designed the literature search strategy and undertook the technology landscape searches. ZO and SP undertook the quantitative and content analyses, supported by MW and HFA. LW, FM, CC, GR and JS contributed as steering group members and participated in the prioritisation workshop. SP prepared the initial manuscript draft, which was revised and redrafted by HFA, ZO and MW. All authors contributed to interpretation of the findings, critically revised the manuscript for important intellectual content, approved the final version for submission and agree to be accountable for all aspects of the work. HFA had full access to all study data and is the guarantor of the study. The study design, methodology, analyses, interpretation and conclusions were independently developed and verified by the authors, who take full responsibility for the accuracy and integrity of the work. The University of Oxford ChatGPT Edu workspace (GPT-5.5, OpenAI) was used during manuscript preparation to assist with language refinement, manuscript organisation and editorial suggestions.

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Ethics approval This study involved human participants, but before the project commenced, the HERON project outline and survey materials were reviewed by the Research Governance, Ethics and Assurance Team at the University of Oxford who confirmed that as a priority-setting partnership project, HERON constituted PPIE rather than research and therefore did not require formal ethics approval. Participants gave informed consent to participate in the study before taking part.

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Data availability statement Data are available upon reasonable request. The research team hold anonymised data from the surveys in addition to that published in the supplemental material, but as it was collected for the purposes of research prioritisation, we are unable to share it unless for this specific purpose. Requests for access can be directed to the corresponding author.

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