

Patient Portal Use in the Management of Asthma and COPD: A Systematic Review of Quality-of-Care Outcomes.

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Abstract

Background: Patient portals offer access to patient health information and are used to support self-management and facilitate care-coordination in people with chronic diseases. Previous studies have reported some benefits from patient portal on chronic respiratory disease care, but an up-to-date evidence review is required.

Objective: To systematically synthesise evidence on the impacts of patient portals on adult asthma and Chronic Obstructive Pulmonary Disease (COPD) outcomes across six quality-of-care domains (effectiveness, patient-centeredness, equity, efficiency, safety and timeliness).

Methods: We searched five databases (Medline/Pubmed, Embase, PsycINFO, CINAHL, and Google Scholar) for quantitative evaluations published up to January 2025 (CRD42022316044). The Newcastle Ottawa Scale and Cochrane Risk of Bias-2 tool were used for quality assessments and results were narratively synthesised.

Results: We identified 3838 studies and included 18 papers published between 2007 – 2024. Most studies were on asthma (asthma=15, COPD=2, both=1) and were primarily of medium or low quality. Effectiveness and patient-centredness were the most studied outcomes with 13 studies each. Eight studies were on equity, six on efficiency, five on safety and four on timeliness. Evidence on effectiveness varied with some improvements in disease control and preventative practices, but no mortality benefits. Regarding patient-centredness, although good satisfactions rates were noted, engagement and sustained use were low. Equity impacts varied with a notable exclusion of participants with digital access barriers, whereas modest efficiency benefits were reported with improvements in care-delivery processes. Limited but positive reports regarding safety, and some improvements in time to care were also noted. Although some positive effects were noted across various quality outcomes, we were unable to draw strong conclusions given the high risk of bias across most included studies.

Conclusions: Patient portals may provide some benefits in chronic respiratory disease management, but more methodologically robust studies are needed to increase certainty of evidence and identify specific beneficial pathways and functions. Clinical Trial: PROSPERO(CRD42022316044)

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Abstract

Background

Patient portals offer access to patient health information and are used to support self-management and facilitate care-coordination in people with chronic diseases. Previous studies have reported some benefits from patient portal on chronic respiratory disease care, but an up-to-date evidence review is required.

Objectives

To systematically synthesise evidence on the impacts of patient portals on adult asthma and Chronic Obstructive Pulmonary Disease (COPD) outcomes across six quality-of-care domains (effectiveness, patient-centeredness, equity, efficiency, safety and timeliness).

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Results

We identified 3838 studies and included 18 papers published between 2007 – 2024. Most studies were on asthma (asthma=15, COPD=2, both=1) and were primarily of medium or low quality. Effectiveness and patient-centredness were the most studied outcomes with 13 studies each. Eight studies were on equity, six on efficiency, five on safety and four on timeliness. Evidence on effectiveness varied with some improvements in disease control and preventative practices, but no mortality benefits. Regarding patient-centredness, although good satisfactions rates were noted, engagement and sustained use were low. Equity impacts varied with a notable exclusion of participants with digital access barriers, whereas modest efficiency benefits were reported with improvements in care-delivery processes. Limited but positive reports regarding safety, and some improvements in time to care were also noted. Although some positive effects were noted across various quality outcomes, we were unable to draw strong conclusions given the high risk of bias across most included studies.

Conclusions

Patient portals may provide some benefits in chronic respiratory disease management, but more methodologically robust studies are needed to increase certainty of evidence and identify specific beneficial pathways and functions.

What is already known on this topic: Patient portals may support self-care in asthma and COPD, but a comprehensive evaluation of impacts of these portals on quality of care is lacking.

What this study adds: This systematic review found limited evidence on the impacts of patient portals across the IOM domains of care in asthma and COPD. While a few studies reported positive outcomes—such as improved preventive practices and short-term gains in quality of life—challenges related to sustained patient engagement and equity were noted. Safety reports were generally positive and some studies indicated improved timeliness in completing certain operational tasks. However, the evidence remains inconclusive due to heterogenous endpoints, weak methodological quality and variable effects across studies.

How this study might affect research, practice or policy: These findings provide some evidence for the use of online portals for asthma and COPD care. Further research would help to establish whether these digital interventions yield tangible improvements across core clinical and patient outcomes measures.

Background

Chronic respiratory diseases, including asthma and Chronic Obstructive Pulmonary Disease (COPD) affect approximately 450 million people worldwide.¹ Asthma prevalence in the UK ranks among the highest globally, with up to 8 million people living with an asthma diagnosis and it causes three deaths each day.^{2,3} Likewise, nearly three million people in the UK live with COPD and it is the second most common cause of emergency hospitalisation.⁴ The estimated economic burden of asthma to the UK economy is £3 billion and an additional £1.9 billion attributed to COPD, with impacts on health service demand, resource utilisation and productivity losses.⁵ However, respiratory care remains sub-optimal with a national audit data showing that a majority of patients in England and Wales experienced critical gaps in one or more aspects of evidence-based care.⁶

Digital services linked to Electronic Health Records (EHRs), such as patient portals that allow patient access to their health information and facilitate patient-provider communication, may bridge some of these gaps by empowering patients to take a more active role in care decisions.⁷ The respiratory disease literature highlights some patient portal benefits, but the outcomes measures vary, and they are often reported alongside broader digital health interventions. One review identified improved clinical symptoms, medication adherence and reduced emergency visits in patients using portals for asthma and other health conditions, but focused on children only.⁸ Another review identified benefits of remote self-management in asthma—such as enhanced access, convenience, and continuity of care—but did not distinguish the specific contributions of patient portals from other digital tools.⁹ Similar improvements are noted in a recent Cochrane review, but this study also did not isolate the effects of patient portals from other digital interventions.¹⁰ There are also some benefits of wider mobile health applications on aspects of COPD care such as exacerbation management and quality of life impacts, although this evidence remains inconclusive.¹¹ Therefore, there is a lack of comprehensive evaluation of the impacts of patient portals specific to asthma and COPD within clearly defined quality criteria.

The Institute of Medicine (IOM) framework provides a structured approach to understand quality of care of health services and it has been previously used for assessment of digital health interventions across domains of effectiveness, safety, patient-centeredness, efficiency, timeliness and equity impact.¹²⁻¹⁴ Effectiveness is defined as delivery of evidence-based care

with improvements in health outcomes. Safety relates to safeguards against errors and adverse events, while promoting a patient-centered approach that addresses individual needs. Efficient utilisation of economic, human and technical resources are also included, with considerations regarding the timeliness of care and improvements in avoidable disparities in service provision.¹² This review aims to synthesise available evidence on the use of patient portals and asthma and COPD management using the IOM framework as a comprehensive model evaluating impacts across key quality of care aspects.

METHODS

Search strategy

We followed the Preferred Reporting Items for Systematic Reviews and Meta-analyses (PRISMA) reporting guidelines, and the study protocol was registered with the International Prospective Register of Systematic Reviews (PROSPERO) (CRD42022316044). The search strategy included electronic searches of key databases Medline/Pubmed, Embase, PsycINFO, Current Index to Nursing and Allied Health Literature (CINAHL), and Google Scholar in January 2025 using keywords and the Medical Subject Headings (MeSH) terms from the National Library of Medicine. The bibliographies of included studies were also screened. Key search terms and their combinations are detailed in **Supplementary file (Table 1)**.

Eligibility criteria

There is no single definition of a patient portal so we used a pragmatic approach to broadly define patient portals as online tools linked to provider EHRs that offer patients access to their personal health information and enable care coordination using functions such as record views, prescription requests, communication options, appointment booking etc.¹⁵⁻¹⁷ Our preliminary search identified interventions offering key functions central to our definition, although not distinctly EHR connected. Therefore, to capture all relevant evidence, we expanded our definition to include portals if they linked patient data with clinical teams and vice versa alongside other patient-facing functions.

To focus on services that provide comprehensive self-management support, technologies that lacked any form of health record integration such as standalone symptom trackers, medication reminder tools, symptom alert systems etc. were excluded. Comparators included usual care or other forms of self-management interventions, and we only included quantitative evidence on

adults with asthma and COPD. The full inclusion exclusion criteria is detailed in **Table 1**.

Table 1: Study inclusion and exclusion criteria used.

Inclusion Criteria	Exclusion Criteria
<ul style="list-style-type: none"> • All quantitative study designs, including randomised controlled trials, cluster randomised trials, quasi-experimental, case-control, cohort studies etc • Studies including adults (≥ 17 years) with a diagnosis of asthma or COPD • Studies in English • All available studies published to date 	<ul style="list-style-type: none"> • Studies that do not include primary empirical data • Services that are not linked to Electronic Health Records (EHRs), or those that provide non-EHR services such as appointment/instruction reminders, telemonitoring tools, online educational platforms, as well as applications that rely on self-monitoring and self-recording of symptoms • Full text not available

Outcomes were categorised using the IOM quality of care framework across domains related to effectiveness (e.g. disease and symptom management, medication use, activity limitation, lung function etc.), patient-centeredness (e.g., indicators of self-management, knowledge, quality of life, satisfaction etc.), equity impacts (e.g., socio-economic outcomes, or other determinants of health), efficiency (e.g., economic outputs, streamlined administrative tasks etc.), safety related to both patient health and technology (e.g., adverse events, privacy, security etc.) and timeliness (e.g., time to care, information exchange timeliness etc.).

Data extraction and quality assessment

Initial title and abstract screening and full text evaluation were carried out independently by two reviewers (SK and AAL) using Covidence software and all conflicts were resolved by discussion. Data extraction and quality assessment was conducted by one reviewer (SK) and checked by a second reviewer (AAL). The extracted data include details of the population recruited, interventions, comparators used and outcomes reported. Only quantitative data were

extracted from mixed-methods studies. Quality assessment was carried out using the original Newcastle-Ottawa Scale (NOS) for cohort studies, and an adapted version from a previous review for cross-sectional studies.^{18,19} For randomised controlled trials, the Cochrane Risk of Bias Tool 2.0 was used.²⁰

Results

The search identified 3838 citations (**Figure 1**). After de-duplication, 3542 articles were retained for abstract screening and three additional papers were identified through backward/forward screening. Subsequently, 44 articles were shortlisted for full-text screening, of which 26 were excluded (16 studies included stand-alone tools, eight were the wrong publication type and two reported irrelevant outcomes). Therefore, a total of 18 papers were included.²¹⁻³⁸

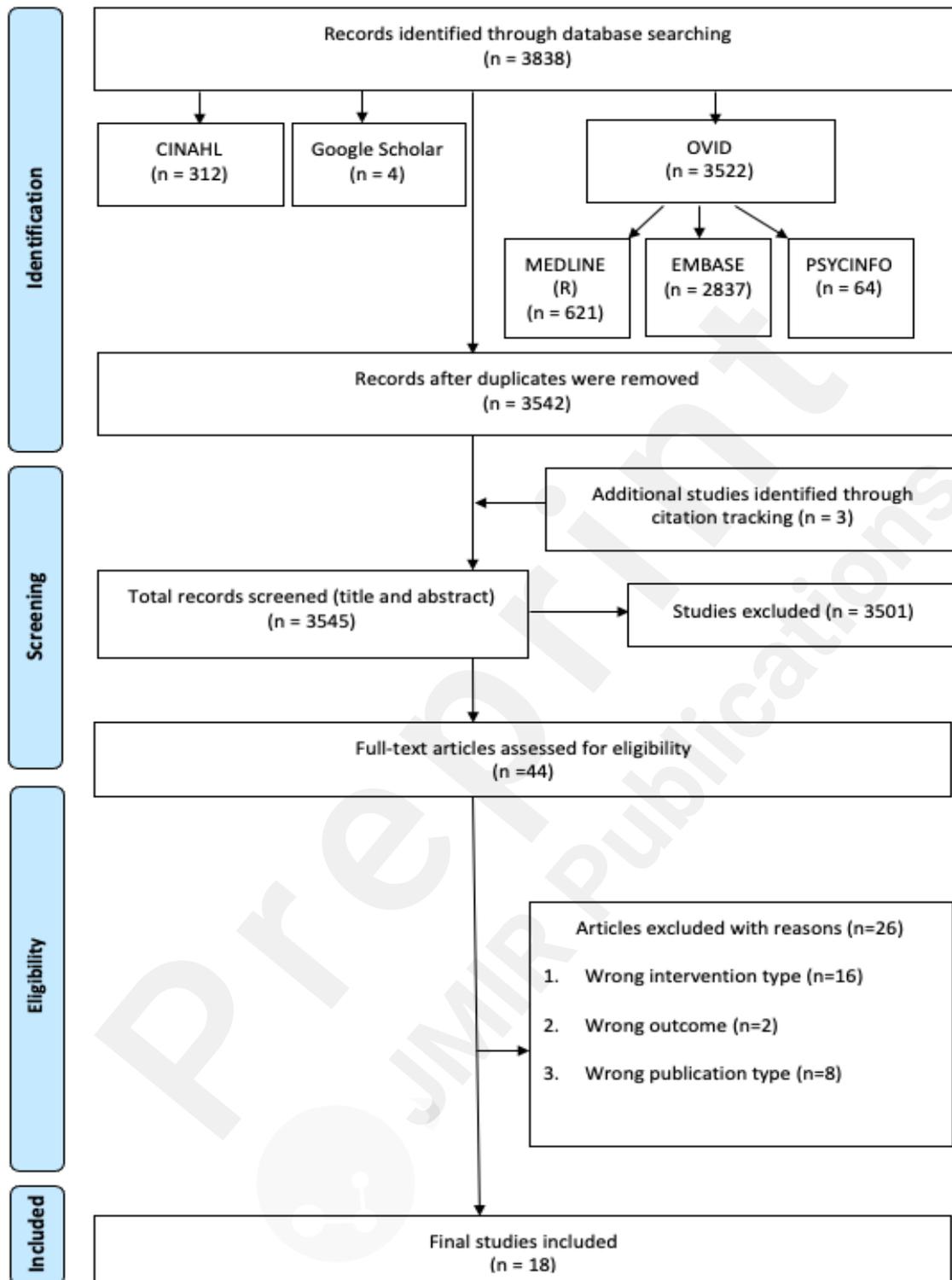


Figure 1: PRISMA flowchart

Description of studies

Of the 18 included papers, 15 investigated asthma and two COPD.^{32,35} One study included both asthma and COPD but did not separate these out.³⁷ Publication years ranged from 2007 to 2024. Eight studies were from the USA,^{21,23–25,29–31,34} three from Canada;^{22,33,36} two from the Netherlands;^{37,38} and one each from Turkey,²⁶ Portugal,²⁷ Australia,²⁸ Spain³² and the UK.³⁵ There were eight Randomised Control Trials (RCT),^{22,24–29,36} three observational studies,^{23,33,35} two feasibility trials,^{30,34} and pilot evaluations;^{21,38} and one cohort trial,³⁰ quasi-experimental study³² and cross-sectional study.³⁷ Details of studies included are in **Table 2**.

In quality assessment, nine out of 18 were rated as high, six moderate and three low risk of bias. All of the RCTs received a risk of high bias rating due to high attrition and missing outcome data. Of the other studies, six were moderate^{30,31,33,34,37,38} and two of poor quality^{21,22} mostly due to absence of a comparator group and lack of assessment of treatment effects against a baseline. **Figure 2** details the quality rating decisions. Risk of bias from missing results was assessed through checks of partially published data and author contact.

Cohort/ Case control studies						Overall risk rating
Author (Year)	Selection (Stars)	Comparability (Stars)	Outcome/Exposure (Stars)	Total		
Acharya, 2017	2/4	0/2	2/3	4		HIGH
Alladina, 2024	2/4	0/2	2/3	4		HIGH
Locallo, 2022	4/4	1/2	3/3	8		LOW
Mammen, 2021	3/4	0/2	3/3	6		MODERATE
Mammen, 2022	2/4	0/2	3/3	5		MODERATE
Martínez Nicolás, 2019	4/4	1/2	3/3	8		LOW
Morita, 2019	3/4	0/2	3/3	6		MODERATE
Rudin, 2019	2/4	0/2	3/3	5		MODERATE
Taylor, 2023	4/4	1/2	3/3	8		LOW
Tossaint-Schoenmakers, 2021	2/4	1/2	2/2	5		MODERATE
Zijp, 2024	3/4	0/2	3/3	6		MODERATE

Randomised control trials						
Author (Year)	D1: Randomisation	D2: Deviations from Interventions	D3: Missing Data	D4: Outcome Measurement	D5: Reporting	Overall risk rating
Ahmed, 2016	Low	Some concerns	High	High	Some concerns	HIGH
Apter, 2019	Low	Some concerns	High	Low	Low	HIGH
Apter, 2020	Low	Some concerns	High	Low	Low	HIGH
Cingi, 2015	Some concerns	High	High	Some concerns	High	HIGH
Cuz-Correia, 2007	Low	Some concerns	High	High	Some concerns	HIGH
Lau, 2015	Low	Some concerns	High	Some concerns	Low	HIGH
To, 2020	High	Some concerns	High	Low	Low	HIGH

Figure 2: risk of bias rating for the included studies, where high= poor quality papers with high risk of bias, moderate=medium risk of bias and low= good quality papers with low risk of bias. The Newcastle-Ottawa Scale (NOS) was used for cohort studies, and an adapted version of the NOS tool was used for cross-sectional studies.^{18,19} For NOS tools, total score <5 =high, 5-6= moderate and >7= low bias risk. The Cochrane Risk of Bias Tool 2.0 was used for randomised control trials where the overall rating was ‘High’ if any domain was rated High, ‘Low’ only if all domains were Low and otherwise ‘Unclear’.²⁰

Participants

Study participants were recruited from a range of settings. Six studies were multicentre collaborations involving primary care practices, specialty clinics, pulmonary/ENT departments, and/or academic hospitals^{23–26,29,33} and three studies were each based in primary care,^{30,31,36} secondary care^{32,35,38} and tertiary-care centres.^{21,22,27} Two studies were community based^{28,37} and one ambulatory care based.³⁴ The sample size ranged from 7 to 909,724 participants.^{30,32}

Participants were predominantly female (55% to 90%).^{24,32} Nine studies reported data on ethnicity,^{23,24,30–34,36} and the number of White participants enrolled ranged from 0.7% to 78.3%^{23,24} whereas, the number of Black/African American participants ranged 9.2% to 76.8%.^{23,24}

Patient portal functions

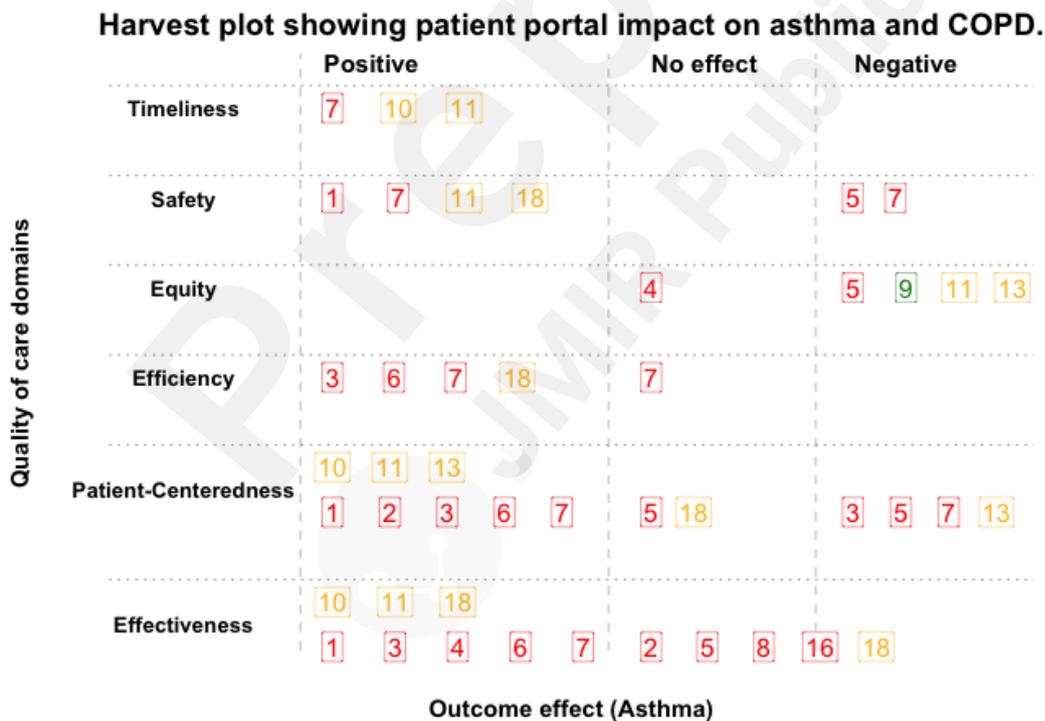
Communication options were included in 13 papers using features such as secure messaging options, email alerts, provider logs, emergency contacts/services etc.^{21–23,26–28,30–33,35,36,38} Functions supporting health and disease monitoring were reported in 12 studies using asthma diaries, logs, journals, immunization records, wireless spirometry etc.^{21,23–27,30,31,33,36,38} Self-management support and educational components using personalised action plans, social forums, training and linked resources were mentioned in 10 papers.^{21–23,27,28,30,31,35,36,38} Seven papers included provider-facing dashboards or decision support tools.^{22,23,27,30,31,35,38} Appointment management options (e.g. review, scheduling and reminders) were reported in five papers^{24,25,28,29,32} and five papers offered visual care indicators using features such as disease trend-chart, traffic-light displays etc.^{23,27,33,36,37} Four articles included medication list/review and repeat prescription order functions.^{24,25,28,29} Medication management tools using inhaler logs and trackers appeared in three papers.^{21,23,26} One study also offered options to customise monitoring schedule via a clinician dashboard.²⁷ Eight out of the 18 papers offered access to provider records which mostly consisted structured data such as lab results, action plan updates, clinical decision support outputs etc.^{24,25,30–33,36,37} Data on quality outcomes related to specific functions were not explored by any of the included studies, restricting identification of effects of individual features.

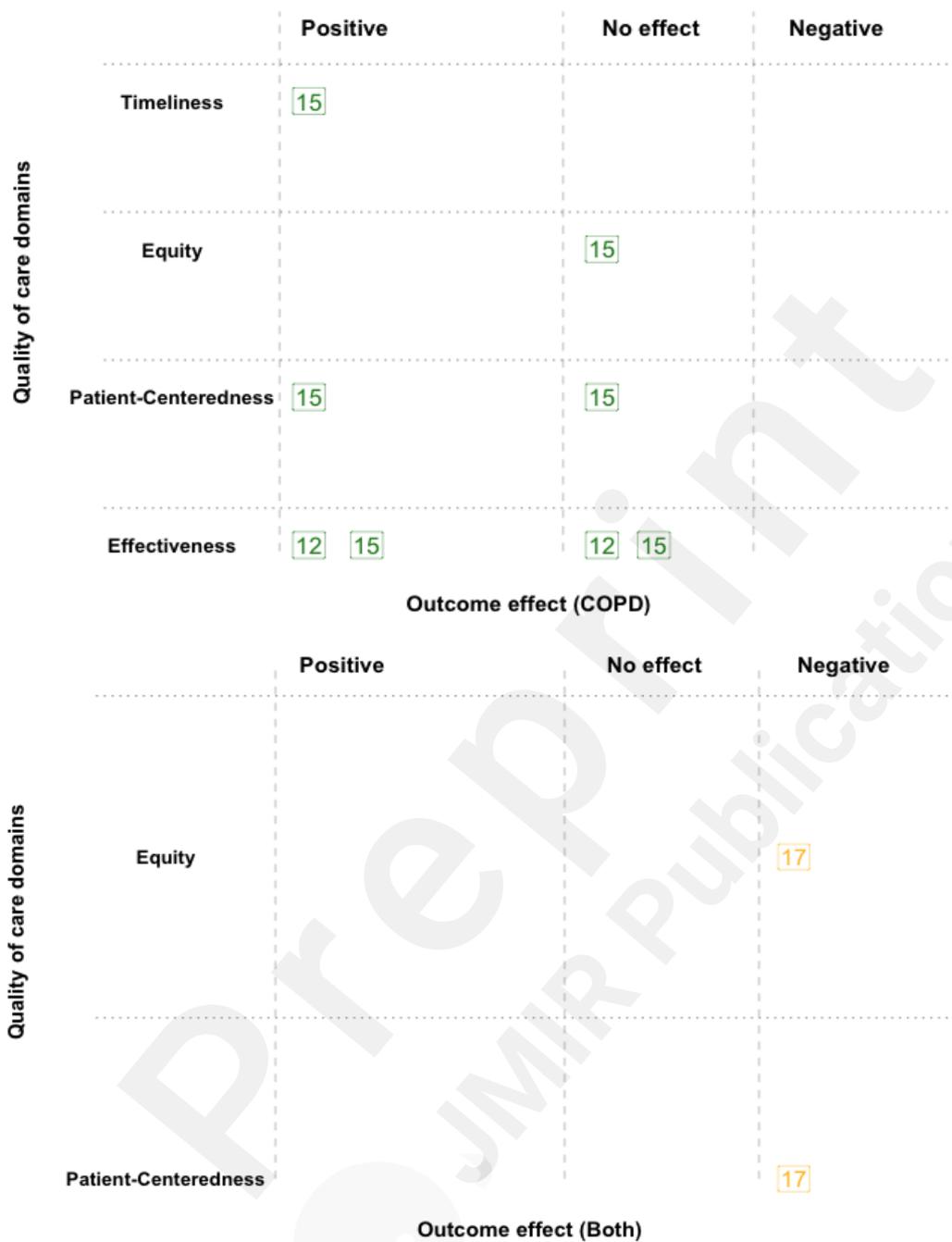
Comparators

Comparators were patients receiving regular care;^{22,36} portal access but without home visits;^{24,25} paper diaries and other web-based tools/ educational material;²⁶⁻²⁸ non-users of the intervention³⁵ and English vs. Spanish language speakers.²⁹

Outcomes

There were differing numbers of studies across different quality domains: effectiveness (13 studies), patient-centredness (13 studies), equity (8 studies), efficiency (6 studies), safety (5 studies), and timeliness (4 studies). Details of the outcomes are presented in **Table 3** and **Figure 3** shows a harvest plot with intervention effects.





Studies: 1.Acharya, 2017, 2.Ahmed, 2016, 3.Alladina, 2024, 4.Apter, 2019, 5.Apter, 2020, 6. Cingi, 2015, 7.Cruz-Correia, 2007, 8.Lau, 2015, 9.Localio, 2022, 10.Mammen, 2021, 11.Mammen, 2022, 12.MartinezNicolas, 2019, 13..Morita, 2019, 14.Rudin, 2019, 15.Taylor, 2023, 16.To, 2020, 17.Tossaint-Schoenmakers, 2021, 18.Zijp, 2024

Note: Outcome effects were categorised as ‘Positive’, ‘No effect’ and ‘Negative’ related to the specific domain and their indicators. Multiple outcomes of the same category were counted once and studies with different outcome results were recorded separately. The box colour represents risk of bias rating where red= high risk of bias, yellow=medium and green= low risk of bias.

Figure 3: Harvest plot showing quality-of-care impacts of patient portals in asthma and COPD.

1. Effectiveness

Asthma

Eight out of the 13 studies on asthma found evidence of improvements in at least one of the indicators of effectiveness.^{21,23,24,26,27,30,31,38} Five studies showed either no difference in disease control,^{22,25,28} symptom management,²⁸ healthcare service use,^{28,36} or small, non-significant gains in Asthma Control Questionnaire (ACQ) scores and rescue medication use.³⁸ Among the studies with positive effects, improved disease control was frequently noted with a modest increase in well-controlled asthma (27.8% intervention vs. 23.3% control) and clinically significant improvements (0.5-point ACQ reduction in 25% intervention group) at 12 months follow-up,²⁴ although a subsequent paper by the same group found that disease control improvements were unrelated to portal usage rates.²⁵ In other studies, a 1.5-fold improvement in ACQ scores at follow-up was noted (2.1 baseline vs. 1.3 post-intervention).³⁸ There were also improvements in guideline-based care (43.3% at baseline vs. 86.7% at 6-months) and an inverse correlation between baseline disease control and symptom improvements ($r = -0.82$, $P < .001$), suggesting that patients with the poorest asthma control could benefit more from the intervention.³¹ In Cingi et al. (2015), the intervention group had better disease control rates (49% vs. 27%) and greater mean Asthma Control Test (ACT) score improvements (6 point vs. 2 point) than controls.²⁶

Assessment of medication and healthcare service use showed some evidence of improvements in medication adherence rates (45.6% at baseline to 85.3% post-intervention) (11), greater medicine requests and more preventive healthcare visits.³⁰ There were also reports of reduced inhaler use and fewer unplanned follow-up visits suggesting better asthma outcomes in the intervention group compared to controls (10.9% vs. 32.1%).²⁶ Reductions in hospital visits were also noted in a majority of provider reports (> 60%) in Acharya et al. (2017).²¹ Hospitalisation rate reduction at 12 months follow-up was greater among patients who received training in portal use alongside home visits than patients with no home visit support.²⁴

COPD

In the two COPD studies, reductions in the monthly hospitalisation trend, emergency visits and outpatient appointments post intervention (slope change -4.38, -5.08 and -0.004 per 10,000

patients/month respectively).³² A greater mean change in annual hospital admission days (1.21 vs. 0.62), and occupied bed days (8.12 vs. 3.38) were reported in intervention vs. control, suggesting more effective disease management.³⁵ However, there was no survival benefits as the difference in the 12-month mortality rates were non-significant (16.9% intervention vs. 24.1% control, $P = .215$).³²

2. Patient-centeredness

Asthma

Out of the 13 papers reporting on patient centeredness, eight asthma papers showed positive effects such as high patient satisfaction,^{21,23,26,27,30,31,33} but issues related to adherence and engagement were also identified. Satisfaction rates were as high as 93.9% in Mammen et al. (2021) and a median satisfaction score of 4.0 out of 6 in Cingi et al. (2015).^{26,30} Some studies showed patients rated patient portals better than usual care or paper diaries,^{27,31} but sustained use was a notable issue with a drop in usage within the first month.²⁷ Similar issues with long-term engagement were also reported by Morita et al. (2019) with just over half of participants (57.7%) using the tool at week 45, even though 65.2% trusted the intervention.³³ Alladina et al. (2024) also reported that despite 66% of patients recommending the application and nearly half (49%) rating it as excellent, overall usage rates remained low.²³ In Apter et al. (2020), most patients (62%) expressed low confidence that patient portals would improve provider communication²⁵

Five papers showed modest but variable Quality of Life (QoL) improvements.^{22,25,30,31,38} Zjip et al. (2024) used the EuroQol questionnaire incorporating a visual analogue scale and found a non-significant QoL increase from 53.5 (± 17.5) to 67.4 (± 18.9) points ($d = 0.56$; $P = .06$) (18).³⁸ The Mini Asthma-Related Quality of Life Questionnaire (AQLQ) was used by all other studies. Ahmed et al. (2016) reported short-term QoL improvements at three months in the intervention group only (mean AQLQ change = 0.67, 95% CI 0.36 to 0.98), but not at six and nine months,²² and Apter et al. (2020) found no QoL change at 12 months.²⁵ Asthma related QoL improvements was strongly related to asthma control ($r = 0.80$, $P < .001$), but not with lung function measured using FEV1%_{pred} ($r = 0.087$, $P = .648$).³¹ Also, there was a 1.91 point (SD 1.53) mean QoL improvement ($P = .016$), evenly distributed across all questionnaire domains.³⁰ Ahmed et al. (2016) reported improvements in depression (Patient Health Questionnaire PHQ-9, mean change -0.27, 95% CI -0.37 to -0.18) linked to QoL gains.²²

Zjip et al. (2024) also showed perceived self-management, as measured by Perceived Control of Asthma Questionnaire (PCAQ) remained unchanged post intervention suggesting that the platform did not influence patient self-management perceptions (21.4 to 21.6; $d=0.06$; $P=.84$).³⁸

COPD

In COPD, Taylor et al. (2023) showed health-related QoL was stable over time and symptom burden remained unchanged. Engagement was higher in patients experiencing more disease exacerbations, with an average of four self-managed exacerbations annually compared to the overall group average of two.³⁵

Evidence related to asthma or COPD showed presence of respiratory disease was not significantly associated self-efficacy and the outcomes for the two respiratory conditions were not presented separately.³⁷

3. Equity Impacts

Equity related analyses found that nearly half of the papers excluded participants without access to technology or the internet,^{23,27,28,31,33,34,36,38} and two papers explicitly focused on younger age groups below 40 years or 45 years.^{30,31} Two papers recruited purposeful samples of participants from areas of high deprivation,^{24,25} and one reported on portal use difference by language.²⁹

Asthma

Six out of eight papers reported asthma related sub-group differences in patient portal access and use.^{24,25,29,31,33,34} One showed greater lung function improvements (FEV1%_{predicted}) among smokers, males, and participants with high school education or less.³¹ In terms of compliance, females and participants with minimum bachelor's degree had higher questionnaire completion rates showing better engagement; while age, clinical characteristics, and ethnicity were unrelated.³⁴ Spanish speakers, particularly those with lower literacy were less likely to use patient portals than English speakers (56% vs.42%; low-literacy groups= 69% vs. 49%) and reported more barriers (76% vs. 25%). However, nearly a quarter in both groups reported

they would use the internet more if they had more knowledge or had access (English vs. Spanish speakers= 25% vs. 26% and 25% vs. 23% respectively), highlighting access barrier issues among all participants.²⁹ In contrast, Apter et al. (2019) found no significant differential benefit from the patient portal with home visit across any patient subgroups, including participants with different primary languages (Spanish vs. English).²⁴ Limited access and personal choice were reported as factors influencing technology engagement, as patients with chronic illness or prior hospitalisations were found less likely to use the portal.²⁵ Morita et al. (2019) showed older age (≥ 50 years) was associated with higher portal use and though only half of all participants reported smartphone ownership and use (55.2%), it was not related to technology use.³³

COPD

One COPD paper by Taylor et al. (2023) showed no subgroup differences in patient portal use between participants from socioeconomically deprived and non-deprived areas.³⁵

Tossaint-Schoenmakers et al. (2021) showed lower portal usability in those with asthma or COPD compared to those without a chronic disease ($b = -3.630$, $P = .02$) and among those with higher education and age,³⁷ suggesting the need for adaptive implementation strategies.

4. Efficiency

Six papers reported on efficiency and four showed positive impacts on asthma care,^{23,26,27,35} with a noted benefit in streamlining tasks as well as communication.³⁵ 44% of participants in Alladina et al.(2024) reported improved disease related discussions with their care providers communication and 37% agreed it helped their appointment run more smoothly.²³ In terms of task completion, the feasibility of internet diary entry was rated similar to paper diaries, while lung-function monitoring was faster (median 2 minutes).^{27 26}

Economic evaluation using descriptive metrics showed a mean cost of the patient portal of US \$186.52 per participant over six months and an average nursing time of approximately 45 minutes per visit.^{30,31} However, these findings were from studies conducted in the USA only.

5. Safety

Five papers included safety reports and all were on asthma. Four reported positive effects with no safety related concerns noted by the participants, or by the group involved in technology implementation.^{21,27,30,38} There were also no adverse events reported in Zijp et al. (2024).³⁸ Privacy concerns were reported by 16% of participants in Apter et al. (2020) and Cruz-Correia et al. (2007) noted internet connectivity issues were most frequently reported.^{25,27}

6. Timeliness

Asthma

Four papers reported on timeliness and three demonstrated positive effects in asthma care.^{27,30,31} Functions such as remote symptom logs facilitated timely care and patients received 100% response from care providers to follow-up requests.³⁰ Cruz-Correia et al. (2007) showed patient portals reduced symptom reporting delays and eliminated bulk entry errors attributed to paper-based tools.²⁷

COPD

Taylor et al. (2023) reported on time to adverse events in COPD and found that patient portal group went longer without COPD/respiratory related hospitalisation or death compared to controls without patient portal access (335 days vs 155 days), with a 26% lower risk in the intervention group (hazard ratio 0.74, $P=.047$).³⁵

DISCUSSION

Main findings

This systematic review found limited evidence and a lack of high-quality studies on quality-of-care impacts of patient portals on COPD and asthma. Evidence on effectiveness was inconsistent with some increases in disease control, medication adherence and preventive service use, but limited evidence on long-term health benefits and survival. Findings related to patient centredness revealed high satisfaction and some quality-of-life gains, but low levels of engagement. We also identified noted barriers to use and exclusion of participants experiencing digital health disparities.

Comparison with existing literature

These findings are in line with a previous review which found benefits of patient portal in asthma symptom management, medication adherence and reduced emergency visits.⁸ However, inconsistencies in clinical improvements in other areas and variability across other end points reported make it difficult to draw robust conclusions. Although we also noted benefits in some markers of effectiveness such as improved provider-care and greater symptom reductions in those with poorest baseline control, these advantages coincided with co-support strategies such as home visits and portal use training. Facilitation strategies such as structured onboarding, technical support along with provider encouragement are established best practices in patient portal implementation and drivers of sustained engagement,^{16,39} and our findings indicate they remain crucial.

The evidence on patient centredness varied, but patient portal satisfaction was generally high. However, varied impacts on self-management ability were noted and attrition rate remained high in both short-term (i.e., one month) and long-term follow-up. These patterns suggest an initial positive patient response to patient portals but challenges with continued engagement, which could be due to reasons such as lack of motivation or usability issues, which need to be further investigated.^{40,41} In asthma, QoL improvements were limited to the short term and not sustained over longer periods, but it remained unchanged in COPD. As asthma presents with more episodic symptoms that can improve rapidly with improved care (e.g. rescue medication use reminders), technology may offer certain benefits which may fade as engagement drops. In contrast, COPD is more progressive and persistent, therefore, technology may only yield modest benefits in quality of life changes.⁴²

In terms of equity, we found a notable exclusion of individuals with low technology literacy and access, reinforcing the evidence of under representation of certain disadvantaged population in digital health studies, which is a known concern.⁴³ Exclusion of certain user groups may bias the study findings and over-inflate the effectiveness of these interventions. Although few of the studies we reviewed recruited a purposeful sample of marginalised groups, and reported some access inequalities and usage barriers, these issues unequivocally affected both disadvantaged and non-disadvantaged populations. Therefore, disparities in digital health may persist across diverse populations and they require concerted efforts to improve accessibility and engagement.⁴⁴

Notably, one paper showed lower patient portal usability among individuals with respiratory disease and with higher education.³⁷ Though people with a higher disease burden are more likely to use technology to manage their health,⁴⁵ we found that clinical need alone does not drive uptake and education does not guarantee digital competency. This complexity is recognised in the literature which recognises the influence of multiple factors including technology exposure, personal motivation and support availability on digital access, literacy and skills required to effectively engage with healthcare technologies.^{46,47} Therefore, the need to involve participants from different background at every stage from research through to delivery and to co-produce interventions with them remains key to ensure technological solutions are equitable and truly responsive to the needs of different user groups.

Regarding safety domain, limited evidence showed patient portals were generally considered safe with some reports of privacy concerns in asthma. Previous reviews highlight that security and privacy are key barriers restricting successful uptake of interventions providing EHR access, but we could not find strong evidence to support this.^{8,48,49} However, most of the studies included in this review were of medium to low methodological quality with multiple pilot trails and small-scale studies, so the observed lack of association may be due to study limitations instead of an actual absence of safety concerns.

Strengths and limitations

This study systematically synthesises diverse evidence from studies using varied quantitative methods, endpoints, and geographical contexts. Due to heterogeneity, meta-analysis was not feasible, so a narrative synthesis was conducted. All included studies were published post-2007, likely reflecting the broader adoption of patient portals from 2006, initially in primary care and outpatient settings.¹⁶ As portals increasingly support chronic disease management, especially for asthma and COPD, more evidence is expected. Also, most studies focused on asthma, with few on COPD—possibly due to asthma's episodic nature and suitability for self-management, whereas COPD often involves complex, multimorbid presentations requiring direct clinical support. Significant variation in portal design and functionality also limits generalisability of findings.

Implications for research, practice and policy

The recent NHS long-term plan offer opportunities to integrate respiratory-care specific functions within national digital health platforms such as the NHS App, which may mitigate some of the access and engagement barriers we noted.⁵⁰ For example, patients in England are already able to view test results, access care advice (including those specific to respiratory symptoms), and manage medication list through the NHS App. Therefore, facilitation efforts enabling wider use of national digital portals may offer some of the asthma and COPD specific benefits while supporting coordinated management of multiple-health conditions. As a precursor to this, further methodologically robust studies using defined quality indicators are necessary to allow a more transparent evaluation of comparable outcomes. Future research using mixed-methods approach would facilitate a more comprehensive understanding of measurable effects and their contextual factors. This could include studies mapping specific functions to clinical outcomes and those with a longer follow-up period. Data collection approaches also need to be intersectional, recruiting a wide range of patient characteristics and across key quality domains to identify user groups that would most benefit from digital tools.

CONCLUSION

This systematic review found that the evidence on patient portal use in management of asthma and COPD is weak. Positive findings from few studies suggest that portals can be effective in improving certain aspects of care in asthma (e.g. preventative service use) and COPD (e.g. reduced hospitalisations) with some efficiency benefits (e.g. streamlined tasks). However, if online tools such as patient portals are to play a greater role in supporting self-management and quality of care, more robust studies on impacts are required.

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Table 2: Key characteristics of the included studies.

AUTHOR, DATE (COUNTRY)	STUDY DETAILS a. DESIGN b. SETTING c. DATA COLLECTION PERIOD	CONDITION TYPE	EXCLUSION CRITERIA	NUMBER OF PARTICIPANTS INCLUDED	POPULATION DEMOGRAPHY (AGE, SEX)*	DHI NAME/ FUNCTION	COMPARATOR
Acharya, 2017 (USA)	a. Pilot evaluation b. Tertiary care (regional trauma centre and partner clinical practices) c. 12 months-quaterly collection	ASTHMA	Not stated	N= 116 (Healthcare providers= 36 Patients=68 IT personnel= 12)	Patients only Age range: 18-44 years Sex (n) <i>Females:</i> 23, <i>Males:</i> 45 (Described as 1:2 ratio of female: male)	Pro-care framework • Journal entry • Asthma diary • Peak flow chart • Notification • Action plan • Inhaler log • Call 911	Not stated
Ahmed, 2016 (Canada)	a. Pilot RCT b. Tertiary care(pulmonary clinics located in 2 tertiary hospitals) c.3, 6 and 9 months	ASTHMA	COPD, serious medical conditions (e.g. lung cancer) or severe mobility restrictions)	N=100 (Intervention=49 Control= 51)	Age (n, %) <i>0-39 years=</i> Intervention: (20, 43%), Control: (14,27%) <i>40-49 years=</i> Intervention: (10, 21%), Control: (13, 25%) <i>50-59 years=</i> Intervention: (12, 26%), Control: (15, 29%) <i>>60 years=</i> Intervention: (5, 11%), Control: (9,18%) Sex (n, %) <i>Females:</i> Intervention: 32 (68%), Control: 33 (65%)	My Asthma Portal (MAP) •Personal health information •Access educational resources •Monitor and receive feedback on self-management (color-coding, email alerts) •Communication with nurse case manager •For nurse case manager communication log and alerts regarding new participants, action plan issues, or	Usual care (Written action plan, regular pulmonologist care, education and follow up from asthma nurse but not MAP access)

AUTHOR, DATE (COUNTRY)	STUDY DETAILS a. DESIGN b. SETTING c. DATA COLLECTION PERIOD	CONDITION TYPE	EXCLUSION CRITERIA	NUMBER OF PARTICIPANTS INCLUDED	POPULATION DEMOGRAPHY (AGE, SEX)*	DHI NAME/ FUNCTION	COMPARATOR
Alladina, 2024 (USA)	a. Observational study b. Multi-centre (a community allergy practice and a pulmonology practice at an academic hospital) c. 7 months	ASTHMA	Diagnosis of chronic obstructive pulmonary disease or other non-asthma pulmonary disease and those without a smartphone with internet access (operating system iOS 13 or newer/iPhone 8 or newer or Android operating system 8 or newer)	N=157(patients=152, healthcare providers=5)	Patients only Age (Mean): 38.7 years, SD=16.4 Sex (n, %) <i>Females</i> : 93(78%)	medication changes Amaze™ digital platform •Symptom log and trends • Trigger log • Medication use tracker • Emergency visit log • Patient-provider communication • Air quality updates • Appointment booking and view • Personalised asthma plans • Educational resources •Provider facing dashboard for asthma control review and guidance	Not stated

AUTHOR, DATE (COUNTRY)	STUDY DETAILS a. DESIGN b. SETTING c. DATA COLLECTION PERIOD	CONDITION TYPE	EXCLUSION CRITERIA	NUMBER OF PARTICIPANTS INCLUDED	POPULATION DEMOGRAPHY (AGE, SEX)*	DHI NAME/ FUNCTION	COMPARATOR
Apter, 2019 (USA)	<p>a. RCT, Observational study</p> <p>b. Multi-centre (outpatient family medicine practices, 2 general internal medicine, 2 pulmonary medicine, 1 allergy-immunology of academic medical center, and 1 primary care practice serving mainly Spanish-speaking patients)</p> <p>c. 12 months</p>	ASTHMA	Participants with severe psychiatric or cognitive problems or had used the portal more than 3 times	N= 301 (Half the participants randomized to receive four community health worker home visits, each 20-30mins long)	<p>Age: 18 years and older</p> <p>Sex (n, %) <i>Females:</i> Intervention=136 (90.1%), Control=134 (89.3%)</p>	<p>Epic MyChart portal</p> <p>Patients were trained on:</p> <ul style="list-style-type: none"> • Reviewing upcoming appointments •Scheduling appointments •Reviewing medication lists •Locating laboratory results •Locating immunization records •Requesting prescription refills • Messaging (Full list of portal functions not described) 	Usual care plus portal training/ access without home visits
Apter, 2020 (USA)	<p>a. RCT, Observational study</p> <p>b. Multi-centre (4</p>	ASTHMA	Participants with severe psychiatric or cognitive problems or had	N= 301 (Half the participants randomized to receive four community	<p>Age: 18 years and older</p> <p>Sex: Not stated</p>	<p>Epic MyChart portal</p> <p>Patients were trained on:</p> <ul style="list-style-type: none"> • Reviewing upcoming 	Usual care plus portal training/ access without home visits

AUTHOR, DATE (COUNTRY)	STUDY DETAILS a. DESIGN b. SETTING c. DATA COLLECTION PERIOD	CONDITION TYPE	EXCLUSION CRITERIA	NUMBER OF PARTICIPANTS INCLUDED	POPULATION DEMOGRAPHY (AGE, SEX)*	DHI NAME/ FUNCTION	COMPARATOR
	primary care, 3 asthma speciality clinics and 1 service for mostly Latino/Hispanic patients) c. 12 months		used the portal more than 3 times	health worker home visits, each 20-30mins long)		appointments •Scheduling appointments •Reviewing medication lists •Locating laboratory results •Locating immunization records •Requesting prescription refills • Messaging (Full list of portal functions not described)	
Cingi, 2015 (Turkey)	a. RCT, Clinical trial b. Multi-centre (Pulmonary and ENT departments of university and training hospitals) c. 6 months (June 2013 - December 2013)	ASTHMA	Pregnant, breast-feeding, and unable to provide consent	N=89 (Intervention=60, control=29) Also,12 clinicians (6 ENT specialists and 6 chest specialist) matched with the patients recruited	Age Mean \pm SD (range): 32.0 \pm 3.7 years (25.0 to 41.0 years) Sex (n) <i>Females:</i> Intervention=30, control=17 <i>Males:</i> Intervention=30, control=12	Physician On call Patient Engagement Trial (POPET) • Health Status log: overall health and status update • Messaging • Medicine Tracking • Questionnaire Completion • Communications and educational content shared by the physician (Separate functions for patients and clinicians)	Application with limited functionalities
Cruz-Correia, 2007	a. RCT, Exploratory trial	ASTHMA	Severe psychiatric,	N=21	Age Mean \pm SD (range): 29 \pm 10 years (18 to 62	Portal for Assessment & Self-Management of	Paper asthma diary and action

AUTHOR, DATE (COUNTRY)	STUDY DETAILS a. DESIGN b. SETTING c. DATA COLLECTION PERIOD	CONDITION TYPE	EXCLUSION CRITERIA	NUMBER OF PARTICIPANTS INCLUDED	POPULATION DEMOGRAPHY (AGE, SEX)*	DHI NAME/ FUNCTION	COMPARATOR
(Portugal)	b. Tertiary care (Immuno-allergology outpatient clinic of a hospital) c. 8 weeks		neurological, oncologic or immunologic disease, unable to use the Internet during the study period		years) Sex n(%) <i>Females</i> =5 (71%), <i>Males</i> =6 (29 %)	Asthma (P'ASMA) <ul style="list-style-type: none"> • Symptom and exacerbation logs • Lung function log (PEF, FEV₁) • Feedback •Trend charts and asthma-control score •Education library •Messaging •Automated e-mail alerts For clinicians: <ul style="list-style-type: none"> • Longitudinal monitoring and GINA control data view •Customisable monitoring schedule (which variables, how often) 	plan
Lau, 2015 (Australia)	a. RCT b. Community setting c. 12 months	ASTHMA	Younger than 18years, not living in Australia, without a doctor diagnosis of asthma, no access to internet, enrolled in other Healthy.me trials	N=153 (Intervention=56, control=97)	Age Mean (SD): Intervention=46years(14), Control=41years (14) Sex n(%) <i>Females</i> : Intervention=44(79%), Control=81 (84%)	Healthy.me <ul style="list-style-type: none"> • Asthma education • Appointment booking • Social communication spaces • PHR access to record test results, health status, medication list and adherence • Reminders • Patient-specific care 	Static webpage with links to patient websites that provided educational information on asthma

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						pathways	
Localio, 2022 (USA)	a. RCT b. Multi-centre(2 family medicine, 2 general internal medicine, 2 pulmonary, and 1 allergy-immunology outpatient practices) c. 12 months	ASTHMA	Participants with severe psychiatric or cognitive problems or had used the portal more than 3 times	N= 301 (Half the participants randomized to receive four community health worker home visits, each 20-30mins long)	Age Median (range):Overall=51 years (18-87) ,English=50 years (18–84), Spanish = 53 years (24–87) Sex n(%) <i>Females:</i> Overall = 270 (90%),English = 223 (90%), Spanish = 47 (90%)	Epic MyChart portal Patients were trained on: • Reviewing upcoming appointments •Scheduling appointments •Reviewing medication lists •Locating laboratory results •Locating immunization records •Requesting prescription refills • Messaging (Full list of portal functions not described)	English speaking vs. Spanish speaking users
Mammen, 2021 (USA)	a. Feasibility trial, Mixed methods b. Primary Care c. 3 months	ASTHMA	Age restricted to 18-40 years and patients with confounding comorbidities (e.g. heart failure chronic obstructive pulmonary disease, cystic fibrosis), pregnant	N=7	Age Mean (SD): 29.5 years (5.22) Sex n (%) <i>Females</i> (%): 6 (86%)	Technology Enabled Asthma Management System (TEAMS) • Remote symptom monitoring • Smartphone telemedicine visits • Nurse-led self-management training • EMR based clinical decision support	Not stated

AUTHOR, DATE (COUNTRY)	STUDY DETAILS a. DESIGN b. SETTING c. DATA COLLECTION PERIOD	CONDITION TYPE	EXCLUSION CRITERIA	NUMBER OF PARTICIPANTS INCLUDED	POPULATION DEMOGRAPHY (AGE, SEX)*	DHI NAME/ FUNCTION	COMPARATOR
			women			software	
Mammen, 2022 (USA)	a. Cohort study, Mixed methods b. Primary Care c. 6 months	ASTHMA	Without smartphone ownership, disease comorbidities and age range restricted to 18-44 years and others excluded.	N=35 (Patients=30, healthcare providers=5)	Age Mean (SD): Patients=32.97years(6.33), Providers=36.50years(15.33) Sex n (%) <i>Females:</i> Patients=19 (63.3%), Providers=4(100%)	Technology Enabled Asthma Management System (TEAMS) <ul style="list-style-type: none">• Remote symptom monitoring• Smartphone telemedicine visits• Nurse-led self-management training• EMR based clinical decision support software	Not stated
Martínez Nicolás, 2019 (Spain)	a. Quasi-experimental interrupted time-series secondary Care c. 4 years 8 months (April 2012- December 2016)	COPD	Patients who did not receive treatment at the study sites	N= 909,724	Age Mean: 42 years Sex (%) <i>Females</i> = 55%	An Electronic Patient Portal (EPP) <ul style="list-style-type: none">• View/ modify their patient profiles• Schedule / manage appointments• Medical record view• Message healthcare staff• Videoconference with medical staff• Upload personal diagnostics	Not stated
Morita, 2019 (Canada)	a. Secondary observational analysis	ASTHMA (well-somewhat-well-	Diagnosis of other chronic lung disease (e.g.	N=138	Age Mean (SD)= 45.3years (15.8) Sex (%)	Breathe <ul style="list-style-type: none">•Risk-reduction messaging	Not stated

AUTHOR, DATE (COUNTRY)	STUDY DETAILS a. DESIGN b. SETTING c. DATA COLLECTION PERIOD	CONDITION TYPE	EXCLUSION CRITERIA	NUMBER OF PARTICIPANTS INCLUDED	POPULATION DEMOGRAPHY (AGE, SEX)*	DHI NAME/ FUNCTION	COMPARATOR
	b. Multi-centre(6 primary care and 2 asthma specialty clinics) c. 12 months	controlled)	cystic fibrosis, chronic obstructive lung disease or bronchiectasis), without familiarity with and access to a mobile smartphone, laptop and desktop computer		Females= 72.5%	<ul style="list-style-type: none"> •Display of environmental conditions •Daily and weekly symptom assessment •Real-time access to personalised asthma action plan and medication use • Reminders and alerts •Historical data review •Disease journal 	
Rudin, 2019 (USA)	a. Feasibility trial b. Ambulatory Care c. 25 weeks	ASTHMA	Cognitive impairment, non-regular use of a smart phone	N=32 (Patients= 26, Health care professionals=6)	Patients only Age Mean (SD)= 54 years(16) Sex N(%) Females= 19(73%), Males= 7(27%)	An mhealth App and Practice Model <ul style="list-style-type: none"> • Symptom check and notifications • Patient's review of symptoms on app • Clinician's review of symptoms within the EHR 	Not stated
Taylor, 2023 (UK)	a. Prospective observational cohort study b. Secondary Care c. 1 year 11 months (September 2019 - August 2021)	COPD	Lack of capacity for consent and communication barrier, without daily access to a smartphone, tablet or computer with internet access	N=498 (Intervention=83 , control=415)	Age Mean(SD): Intervention= 64.4year(9.3), Control= 64.6years (9.1) Sex (%) Females: Intervention=63.9%, Control=63.%	Lenus COPD support service <ul style="list-style-type: none"> • Patient application to enter Patient Reported Outcomes (PRO) with further self-management support website • Clinician dashboard where structured data from EHRs, PROs, 	Non-user of the intervention

AUTHOR, DATE (COUNTRY)	STUDY DETAILS a. DESIGN b. SETTING c. DATA COLLECTION PERIOD	CONDITION TYPE	EXCLUSION CRITERIA	NUMBER OF PARTICIPANTS INCLUDED	POPULATION DEMOGRAPHY (AGE, SEX)*	DHI NAME/ FUNCTION	COMPARATOR
						wearables, and home non-invasive ventilation machines are displayed • Asynchronous messaging	
To, 2020 (Canada)	a. RCT b. Primary Care c. 3 years	ASTHMA	Diagnosis of other chronic lung disease (e.g. cystic fibrosis, chronic obstructive lung disease or bronchiectasis), without familiarity with and access to a mobile smartphone, laptop and desktop computer	N=677 (Intervention=132, internal control= 149, external control=396)	Age Mean (SD): Breathe vs. non-breathe= 46.5years (15.74) vs. 46.5years (15.65), Breathe vs. population control= 44.9years (15.72) vs. 44.9years (15.72) Sex (%) <i>Females:</i> Breathe vs. non-breathe= 71.0% vs. 71.87%, <i>Breathe vs. population control= 72.7% vs. 72.7%</i>	Breathe •Risk-reduction messaging •Display of environmental conditions •Daily and weekly symptom assessment •Real-time access to personalised asthma action plan •Reminders and alerts •Historical data review •Disease journal	Receiving “equivalent quality” of asthma care
Tossaint-Schoenmakers, 2021 (Netherlands)	a. Cross-sectional b. Community setting c. 7 months (December 2019 - July 2020)	ASTHMA OR COPD	Not stated	N=748	Age Mean(SD): 52.8years (16.4) Sex n(%) <i>Females:</i> 428 (57.2%), <i>Males:</i> 314 (42.0%)	Web-based portal • Blood-test results • Information regarding the test, outcomes and action plan • Visual support using traffic light colours to indicate whether the outcome is within the normal range	Not stated
Zijp, 2024	a. Pilot study	ASTHMA	Respiratory	N=18(Patients=	Age Mean (range):	Astmakompas	Not stated

AUTHOR, DATE (COUNTRY)	STUDY DETAILS a. DESIGN b. SETTING c. DATA COLLECTION PERIOD	CONDITION TYPE	EXCLUSION CRITERIA	NUMBER OF PARTICIPANTS INCLUDED	POPULATION DEMOGRAPHY (AGE, SEX)*	DHI NAME/ FUNCTION	COMPARATOR
(Netherlands)	b. Secondary Care c. 12 weeks	(Uncontrolled)	disease other than asthma or a non-reversible airway obstruction and not having access to smartphone or internet	14, providers=4)	Patients=47.6 years (21–71), Providers=44 years (32–59) Sex n(%) <i>Females:</i> Patients=10 (71.4%), Providers=4 (100%)	<ul style="list-style-type: none"> •Asthma monitoring for patients using an app with wireless spirometer •Patient-provider communication •HCP facing portal to view patient data and monitor asthma control • Disease alerts for healthcare professionals • Digital action plan and guidance on asthma management 	

Where: EHR= Electronic Health Records, IT= Information Technology, MAP= My Asthma Portal, P'ASMA= Portal for Assessment & Self-Management of Asthma, POPET= Physician On call Patient Engagement Trial, PRO= Patient Reported Outcomes, RCT= Randomised control trials, TEAMS= Technology Enabled Asthma Management System.

*= Additional population demography indicators where available is presented as Supplementary File, Table 2.

Table 3: Key study outcomes across the IOM quality of care domains.

	AUTHOR, DATE	EFFECTIVENESS	PATIENT-CENTEREDNESS	EFFICIENCY	EQUITY IMPACT	SAFETY	TIMELINESS
1	Acharya, 2017	Healthcare service use: 83% of healthcare providers reported that the use of the Pro-Care application reduced the number of office visits for patients by over 60%.	Self-Management: Majority of patients strongly agreed that the real-time feedback was very useful in managing their asthma condition. Most patients found the application helpful in keeping track of their prescribed action plans. Satisfaction: Majority of patients found application to be successful in asthma management.	Not stated	Not stated	Security: The IT group reported no instances of instability or unavailability during the evaluation period.	Not stated
2	Ahmed, 2016	Disease control: No significant between-group differences over time in asthma control status.	QoL Between baseline and 3 month only intervention group showed a significant improvement in MAQLQ score (mean change 0.67, 95% CI 0.36 to 0.98). No significant differences between 3 - 6 months (mean change -0.01, 95% CI -0.35 to 0.32) and 6-9 months (mean change -0.12, 95% CI -0.46 to 0.22) for the intervention group. Also,	Not stated	Not stated	Not stated	Not stated

	AUTHOR, DATE	EFFECTIVENESS	PATIENT-CENTEREDNESS	EFFICIENCY	EQUITY IMPACT	SAFETY	TIMELINESS
			<p>no significant differences over time for the control group and between two groups.</p> <p>MAQLQ significantly associated with improvement in depression PHQ (mean change -0.27 95% CI -0.37 to -0.18 for 5 unit change), self-efficacy (mean change 0.24, 95% CI 0.16 to 0.32) and ACT score (mean change -0.25, 95% CI -0.30 to -0.20).</p>				
3	Alladina, 2024	<p>Disease control: Asthma status was consistent and reported as 'good' in >69% of daily entries. 14% of patients experienced asthma exacerbations.</p> <p>Medication Use: 76% of patients reporting "bad" asthma status used quick relief/rescue medication.</p>	<p>Satisfaction: 66% of patients were satisfied or very satisfied with the app. 49% rated the app "excellent," 30% "good. 71% of HCP reported the app as "very easy" to implement and 29% reported the app "moderately" or "slightly" helped patient management.</p> <p>Recommendation: 66% would likely or very likely recommend the app.</p>	<p>Streamline of communication and appointments: 44% felt the app helped discuss asthma with care professionals; 37% said it made appointments smoother.</p>	Not stated	Not stated	Not stated

	AUTHOR, DATE	EFFECTIVENESS	PATIENT-CENTEREDNESS	EFFICIENCY	EQUITY IMPACT	SAFETY	TIMELINESS
			<p>Engagement: 47% did not use the asthma plan, 52% skipped appointment scheduling, 57% skipped education, and 65% did not message the clinic.</p>				
4	Apter, 2019	<p>Disease Control: <i>Intervention:</i> 27.8% (42 patients) achieved asthma control (ACQ \leq 1.5) at 12 months. <i>Control:</i> 23.3% (35 patients) achieved asthma control at 12 months.</p> <p><i>Intervention:</i> 25% (37 patients) had a clinically important improvement (0.5-point reduction in ACQ). <i>Control:</i> No patients had clinically important improvement.</p> <p>Healthcare service use: Only hospitalisations showed statistically significant improvements in the intervention group at 12 months (-0.53, 95% CI= -1.08 to -0.024).</p>	Not stated	Not stated	<p>Intervention benefit: Spanish as the primary language and trust on the internet and the patient portal for clinical information were possible effect modifiers, but these subgroups did not prove to have different benefits for the portal plus home visit intervention.</p>	Not stated	Not Stated

	AUTHOR, DATE	EFFECTIVENESS	PATIENT-CENTEREDNESS	EFFICIENCY	EQUITY IMPACT	SAFETY	TIMELINESS
5	Apter, 2020	Disease control: No association between portal usage rates and asthma control at 12 months compared with baseline.	QoL: No association between portal usage rates and asthma quality of life at 12 months compared with baseline. Satisfaction: 62% had little confidence that the portal could improve communication with their doctor.	Not stated	Portal use: Patients with chronic diseases or past hospitalisations were less likely to use the portal, but it was unrelated to asthma severity. 50% of potential participants had computer access, but some chose not to use the portal.	Privacy: 16% expressed concerns about portal confidentiality.	Not stated
6	Cingi, 2015	Disease control: 49% of intervention group achieved a well-controlled ACT score (>19) compared to 27% in the control group ($P < .05$). Median ACT improvement of 6.0 points in the intervention group compared to 2.0 points in the control group. Healthcare service use =10.9% of intervention group had unplanned follow-up visits compared to 32.1% of control group (P for difference= 0.015,	Satisfaction: Median intervention satisfaction score of 4.0 (range 3.0-5.0, on a 6-point scale).	Streamline of communication: 86% of communications were between 8:00 AM and 6:00 PM (within working hours).	Not stated	Not stated	Not stated

	AUTHOR, DATE	EFFECTIVENESS	PATIENT-CENTEREDNESS	EFFICIENCY	EQUITY IMPACT	SAFETY	TIMELINESS
		<p>$z = -2.438$).</p> <p>Patients who used the intervention felt less impaired in their activities, used less rescue inhaler medications, and more felt their asthma to be under control.</p>					
7	Cruz-Correia, 2007	<p>Disease Control: More participants in the intervention group believed the platform could improve their asthma control (73% vs. 50%), treatment adherence (64% vs. 53%) and asthma care (80% vs. 69%) in the intervention vs. paper diary group.</p>	<p>Satisfaction: More patients rated the intervention as very useful compared to the paper diary ($P=.038$). Viewing previous data was considered much easier with the Internet tool than with paper ($P=.038$). Overall, 92% were very interested in using the intervention in the future vs. 12% for paper tools ($P=.002$).</p> <p>Adherence dropped after the second visit specially after week 1 and 4. Paper diary showed higher recorded adherence ($P<.001$), but likely</p>	<p>Streamline of tasks: The median time to complete both internet and paper diaries was similar (3 minutes per entry; $P=.675$).</p> <p>PEF/FEV1 monitoring took less time (median 2 minutes; $P=.028$ for internet and $P=.036$ for paper).</p>	Not stated	<p>Safety report: No safety concerns reported. Authors conclude the technology was considered safe.</p> <p>Issues related to internet connection (n=9), user interface (n=5), system errors (n=3) and question interpretation (n=2) were reported.</p>	<p>Reporting Timeline: Paper tools lacked timeliness; users often delayed entries (some admitted bulk-filling days later).</p>

	AUTHOR, DATE	EFFECTIVENESS	PATIENT-CENTEREDNESS	EFFICIENCY	EQUITY IMPACT	SAFETY	TIMELINESS
			overestimated.				
8	Lau, 2015	<p>Disease control/symptom management: The intervention did not show a significant effect on severe asthma exacerbations, inadequately controlled asthma, possession of an up-to-date written AAP, utilisation of AAP, or days lost from work or study.</p> <p>Healthcare Service use: No significant effects of the intervention on visits to healthcare professionals.</p>	Not stated	Not stated	Not stated	Not stated	Not stated
9	Localio, 2022	Not stated	Not stated	Not stated	<p>Portal use: 42% (n=102) of English speakers did not use portal vs. 56% (n=29) of Spanish speakers (Pearson chi-squared = 3.84, $P=.05$). 49% (n = 32) of low-literacy English speakers did not use the portal vs. 69% (n = 18) of low-literacy Spanish speakers (Pearson chi-</p>	Not stated	Not stated

	AUTHOR, DATE	EFFECTIVENESS	PATIENT-CENTEREDNESS	EFFICIENCY	EQUITY IMPACT	SAFETY	TIMELINESS
					<p>squared= 10.4, $P=.02$). 25% of English-speaking participants reported barriers to portal use, compared to 76% of Spanish-speaking respondents.</p> <p>Access and knowledge: In response to “I would use the internet more if... 25% of English speakers (out of 182 respondents) and 26% of Spanish speakers (out of 43 respondents) selected “I knew more/learned how”</p> <p>25% of English speakers (n=182) and 23% of Spanish speakers selected “ I had access”</p>		
10	Mammen, 2021	Disease control: 1.5 (SD 1.02) point mean ACQ improvement in asthma control $P=.007$, CI= 0.59-2.51) at 3-month follow-up. Significant	QoL: 1.91 (SD 1.53) point mean improvement ($P=.016$, CI = 0.50–3.31) evenly distributed across all domains (symptoms, activity limitations,	Economic evaluation: \$186.52 per person. Nursing time: 44.47	Not stated	Not stated	Time to care: 100% care provider response to follow-up, and home symptom

	AUTHOR, DATE	EFFECTIVENESS	PATIENT-CENTEREDNESS	EFFICIENCY	EQUITY IMPACT	SAFETY	TIMELINESS
		<p>improvements were seen in morning symptoms, nighttime wakening, activity limitations and shortness of breath, with greatest effects on reductions in wheezing with mean 1.87 (SD 1.34) ($P=.011$, CI= 0.61–3.10).</p> <p>14.86% (SD 19.4) mean increase in FEV1%_{pred} ($P=.089$, CI= -3.09–32.80)</p> <p>Health service use: Preventive healthcare utilisation increased significantly (1.86 visits/year vs. 0.29/year prior, CI 0.67–2.47, $P=.005$).</p> <p>Medication use: Increased prescriptions for controller medications (9.29 prescriptions/year vs. 1.57 prescriptions/year, CI 4.85–10.58, $P=.001$).</p>	<p>emotional functioning, and environmental stimuli).</p> <p>Satisfaction: 93.9%</p>	minutes/visit.			monitoring facilitated timely care.
11	Mammen, 2022	Disease control: 80% participants had uncontrolled asthma at baseline and at 6months,	QoL: Improvement in QoL was strongly associated with improved control ($r = 0.80$, P	Economic evaluation: \$186.52 per person over the 6-	Wider health determinants: Improvements in FEV1% _{pred} were	Technical issues: 93.2% visits showed no disruptive	Time to care: 38% of visits occurred after-hours or on

	AUTHOR, DATE	EFFECTIVENESS	PATIENT-CENTEREDNESS	EFFICIENCY	EQUITY IMPACT	SAFETY	TIMELINESS
		<p>80% had well-controlled asthma. Patients with worse asthma control at baseline benefited the most from the intervention, with a strong correlation between baseline ACQ and symptom improvement ($r = -0.82, P < .001$).</p> <p>FEV1%_{pred} increased by 4.2%</p> <p>Medication use: Adherence increased from 45.58% to 85.29% (CI = 14.79–64.62).</p> <p>Guideline-based care: HCP adherence to the guideline based therapy increased from 43.3% at baseline (CI = 22.11–64.55) to 86.7%.</p>	<p>$< .001$), but not with FEV1%_{pred} ($r = 0.087, P = .648$).</p> <p>Satisfaction: 95.7% acceptability. 29/30 patients and all providers indicated intervention worked better than usual care.</p>	month period.	<p>greatest for smokers (+10.27% vs. non-smokers +0.68%, CI = 1.72-17.45), males (+11.27% vs. females +0.11%, CI = 3.62-18.72), and those with high-school education or less (+7.94% vs. any college education -0.071%, CI = 0.20-15.82).</p> <p>No other significant differences in intervention effects based on gender, smoking status, education, race/ethnicity, or presence of comorbid mental illness.</p>	technical issues.	weekends.
12	Martínez Nicolás, 2019	<p>Health service use: For COPD group, there was a significant decline in slope for any hospitalizations per 10,000 patients per month (before EEP=1.33, standard error; SE= 0.3 , $P < .001$ vs. after =-4.38</p>	Not stated	Not stated	Not stated	Not stated	Not stated

	AUTHOR, DATE	EFFECTIVENESS	PATIENT-CENTEREDNESS	EFFICIENCY	EQUITY IMPACT	SAFETY	TIMELINESS
		SE=0.66, $P<.001$), and emergency department use (before=2.27, SE=0.45, $P<.001$ vs. after= -5.08, SE=1.26, $p<0.001$) and any outpatient service use (before=0.02, SE=0.0002, $P<.001$ vs. after= -0.004, SE= .001, $P<.001$), but no change in 30-day hospital readmissions (before=0.33, SD=0.10 $P<.05$ vs. After= -1.07, SD=0.59).					
13	Morita, 2019	Not stated	<p>Satisfaction:63.8% (74/116) of patients agreed or strongly agreed that the intervention was helpful in the management of their asthma.</p> <p>65.2% (75/115) of patients were confident that the intervention was correct when it presented the patient's asthma action plan zone of control.</p> <p>49.6% (58/117) of participants agreed or strongly agreed that they</p>	Not stated	<p>Use: Age (≥ 50 years) was associated with higher utilisation.</p> <p>55.2% (76/138) of participants had a smartphone and reported being comfortable or very comfortable with its use but post-hoc analysis did not find an association between platform utilisation and having a smartphone.</p>	Not stated	Not stated

	AUTHOR, DATE	EFFECTIVENESS	PATIENT-CENTEREDNESS	EFFICIENCY	EQUITY IMPACT	SAFETY	TIMELINESS
			<p>would continue to use the intervention after the study.</p> <p>The platform scored 71.1 (SD 19.9) on the standardised System Usability Scale (SUS) at 12 months indicating good usability.</p> <p>Engagement: Declined use within the first 4 week. 67.5% (83/123) of the participants used the platform weekly initially and only 57.7% (71/123) used the platform in week 45.</p>				
14	Rudin, 2019	Not stated	<p>Engagement: On average 25% of all questionnaires had results severe enough to qualify for a call back from a nurse; however, 77% declined at least one option for call back.</p>	Not stated	<p>Programme Completion: Female patients had significantly higher weekly questionnaire completion rates compared to males (88 vs. 73%, $P = .02$).</p> <p>Patients with a bachelor's degree level or higher completed significantly more</p>	Not stated	Not stated

	AUTHOR, DATE	EFFECTIVENESS	PATIENT-CENTEREDNESS	EFFICIENCY	EQUITY IMPACT	SAFETY	TIMELINESS
					<p>questionnaires compared to those with lower education (94 vs. 74%, $P<.01$).</p> <p>Clinical characteristics, age, and ethnicity were not significantly associated with questionnaire completion.</p>		
15	Taylor, 2023	<p>Health service use: Reduction in annual COPD or respiratory-related admissions (mean change=1.21days in intervention group vs 0.62 days in control and bed occupied days (mean change= 8.12 days in intervention group vs 3.38 days in control).</p> <p>Mortality: Lower 12-month mortality rate in intervention vs. control (16.9% vs. 24.1%), but this difference was not statistically significant ($P=.215$).</p>	<p>QoL: Health-related QoL(measured via EQ-5D visual analogue scale) remained broadly stable over the course of the study.</p> <p>Disease burden: Symptom burden (measured via COPD assessment test) also showed no significant change during the study period.</p> <p>Self-management: Median self-managed exacerbations was 2 per year for intervention group with a higher median exacerbation of 4</p>	Not stated	<p>Use: 77% of participants were sustained use. Subgroup analysis of participants resident in more socioeconomically deprived postcode areas revealed equivalent utilisation to rest of the cohort.</p>	Not stated	<p>Time to adverse events: Median time to first COPD/respiratory-related admission or death was longer in the intervention cohort (335 days vs. 155 days; unadjusted hazard ratio= 0.740, CI 0.550-0.996,$P=.047$).</p>

	AUTHOR, DATE	EFFECTIVENESS	PATIENT-CENTEREDNESS	EFFICIENCY	EQUITY IMPACT	SAFETY	TIMELINESS
			per year in patients with the highest application utilisation.				
16	To, 2020	Health service use: No significant differences between the Breathe group, non-Breathe group, and population controls in hospitalisations, ED visits, physician office visits.	Not stated	Not stated		Not stated	Not stated
17	Tossaint-Schoenmakers, 2021	Not stated	Self-efficacy: Higher education levels were associated with lower self-efficacy in managing health $P < .10$ ($b = -3.521$, 95% CI -6.469 to -0.572 ; $P = .02$)	Not stated	Use: Higher age and high education were associated with a decreased usability: respectively, $b = -.094$, 95% CI -0.1147 to -0.042 ($P < .001$); and $b = -2.512$, 95% CI -4.791 to -0.232 ($P = .03$). Patients with asthma or COPD scoring significantly lower compared with those without a chronic disease ($b = -3.630$, 95% CI -6.545 to -0.715 ; $P = .02$).	Not stated	Not stated

	AUTHOR, DATE	EFFECTIVENESS	PATIENT-CENTEREDNESS	EFFICIENCY	EQUITY IMPACT	SAFETY	TIMELINESS
18	Zijp, 2024	<p>Disease control: Asthma control improved post-intervention (ACQ-6-score: baseline $\mu=2.1$, $SD=1.3$; post-intervention $\mu=1.3$, $SD=1.0$; $t=2.61$, $P=.02$, $d=0.70$)</p> <p>Medication use: No significant change in rescue medication use (Last week additional medication: baseline $\mu=2.0$, $SD=1.5$; post-intervention $\mu=1.4$, $SD=1.1$; $t=-1.63$, $P=.10$, $d=-0.06$)</p>	<p>QoL: No significant changes in asthma-related quality of life trends RIQMON-10-Score: $\mu=22.6$, $SD=6.9$; post-intervention $\mu=18.9$, $SD=7.7$; $t=1.70$, $P=.11$, $d=0.46$. EQ-5D-5L- Score: $\mu=1.8$, $SD=0.7$; post-intervention $\mu=1.6$, $SD=0.6$; $t=1.75$, $P=.10$, $d=0.47$. VAS-QoL score: baseline $\mu=53.5$, $SD=17.5$; post-intervention $\mu=67.4$, $SD=18.9$; $t=-2.08$, $P=.06$, $d=0.56$.</p> <p>Self-management: Perceived ability to manage asthma remained stable with no significant change ($P=.84$) (PACQ-score: baseline $\mu=21.4$, $SD=2.7$; post-intervention $\mu=21.6$, $SD=5.0$; $t=-0.231$, $d=0.06$).</p>	<p>Economic evaluation: Indirect costs showed no significant change iPCQ-score: baseline $\mu=34.8$, $SD=54.7$; post-intervention $\mu=22.8$, $SD=53.3$; $t=1.057$, $P=.33$, $d=0.37$. iMCQ-score: baseline $\mu=4.6$, $SD=3.7$; post-intervention $\mu=2.9$, $SD=3.0$; $t=1.52$, $P=.15$, $d=0.41$.</p>	Not stated	<p>Adverse events: No adverse events reported by patients or providers.</p>	Not stated

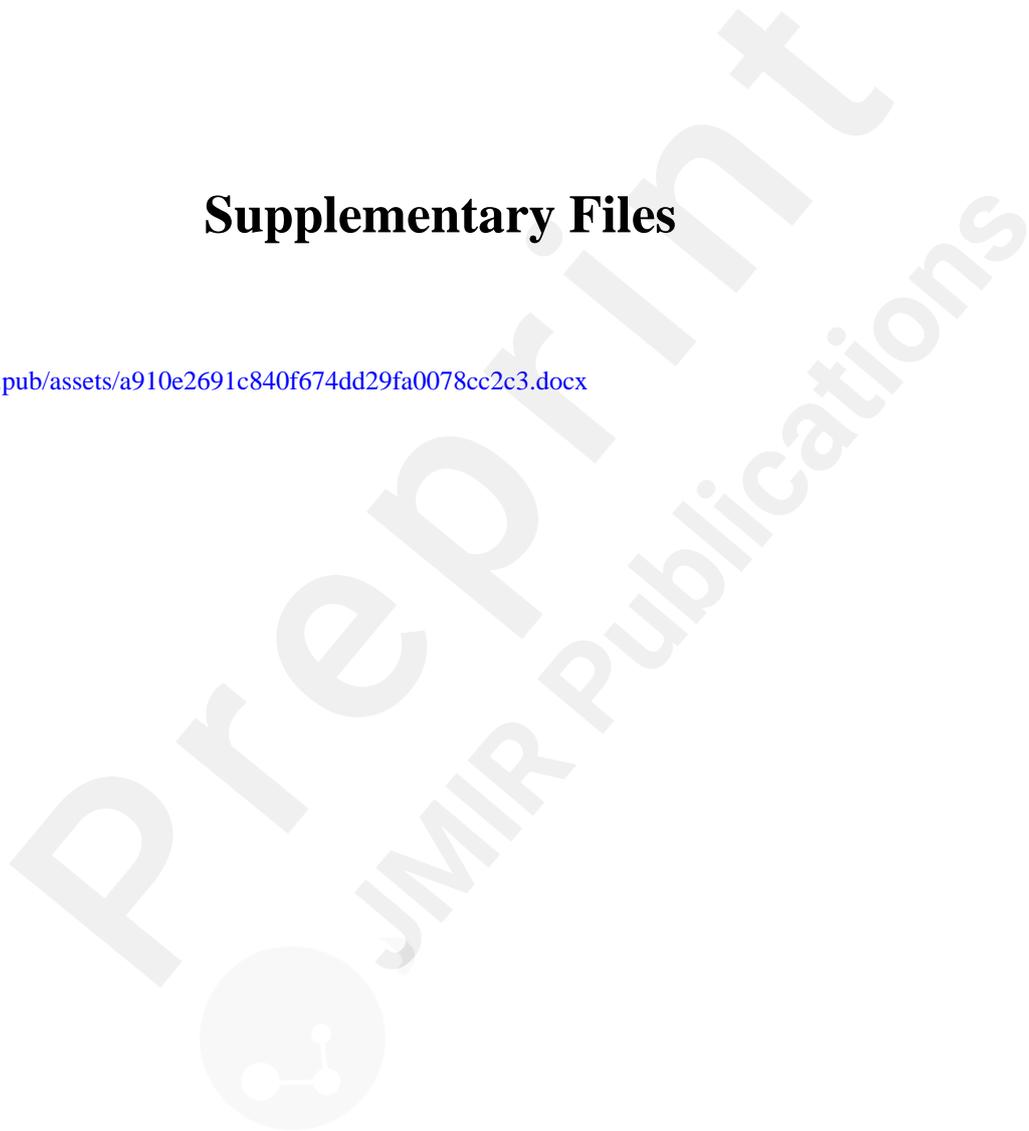
AAP = Asthma Action Plan, ACQ = Asthma Control Questionnaire, ACT = Asthma Control Test , COPD= Chronic Obstructive Pulmonary Disease, CI=

Confidence Interval, EQ-5D-5L= EuroQol five-dimension questionnaire 5 levels, FEV₁ = Forced Expiratory Volume in 1 second, FEV1%_{pred} = Forced Expiratory Volume in 1 second percentage predicted, HCP= Healthcare Providers, iMCQ= iMTA Medical Consumption Questionnaire, IT= Information Technology, MAQLQ= Mini-Asthma Quality of Life Questionnaire, PCAQ= Perceived Control of Asthma Questionnaire, PHQ-9= Patient Health Questionnaire, QoL= Quality of Life, RIQMON-10= Respiratory Illness Questionnaire-Monitoring 10, SD= Standard Deviation, SE= Standard Error, SUS= System Usability Scale, VAS= Visual Analogue Scale.

Supplementary Files

Untitled.

URL: <http://asset.jmir.pub/assets/a910e2691c840f674dd29fa0078cc2c3.docx>



CONSORT (or other) checklists

PRISMA checklist.

URL: <http://asset.jmir.pub/assets/2038890089cef806ffafb4704f39cf72.pdf>