

Community Pharmacists as Inhaler-Therapy Optimizers in Asthma and COPD: Evidence, Implementation Barriers, Digital Innovation, and Future Models of Care

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ABSTRACT

Asthma and chronic obstructive pulmonary disease (COPD) remain major causes of preventable morbidity, impaired quality of life, healthcare utilization, and premature mortality. Inhaled medicines are central to treatment because they deliver therapy directly to the respiratory tract, but their effectiveness is highly dependent on device selection, inhaler technique, adherence, and the patient's capacity to incorporate treatment into everyday life. Community pharmacists are uniquely positioned to address these modifiable determinants because they are accessible, encounter patients repeatedly, and possess expertise in medicines and medication-use processes. This narrative review synthesizes evidence on the contribution of community pharmacists to inhaler optimization in asthma and COPD, with emphasis on inhaler technique assessment, patient education, adherence support, medication review, device selection, referral, and interprofessional collaboration. The review also examines implementation barriers, including workload, reimbursement, clinical information access, training requirements, scope-of-practice limitations, and variability in health systems. Emerging approaches such as smart inhalers, electronic adherence monitoring, telepharmacy, artificial intelligence-supported inhaler assessment, remote monitoring, and environmentally informed device selection are considered. Evidence from randomized trials and systematic reviews indicates that pharmacist-led interventions can improve inhaler technique and, in selected settings, medication adherence and disease-control outcomes; however, heterogeneity in intervention design and outcome measurement limits conclusions about long-term effects on exacerbations, hospitalizations, mortality, and costs. A sustainable model should therefore move beyond one-time inhaler instruction toward repeated, standardized, patient-centered medication optimization embedded in multidisciplinary respiratory care. Future research should prioritize pragmatic trials, health-economic evaluation, implementation science, digital equity, and standardized clinical outcomes.

KEYWORDS

Community pharmacy; Asthma; Chronic obstructive pulmonary disease; COPD; Inhaler technique; Medication adherence; Pharmaceutical care; Inhaler device selection; Digital health; Telepharmacy; Smart inhalers; Respiratory care

1. Introduction

Asthma and COPD are chronic respiratory conditions with different pathobiological profiles but overlapping challenges in long-term medicine use. Asthma is characterized by variable respiratory symptoms and variable expiratory airflow limitation, commonly associated with airway inflammation and bronchial hyperresponsiveness. COPD is characterized by persistent respiratory symptoms and airflow limitation resulting from abnormalities of the airways and/or alveoli, generally associated with exposure to harmful particles or gases. Both conditions can produce recurrent symptoms and acute worsening, and both require sustained self-management rather than treatment confined to acute episodes [1–6].

Inhaled therapy is a defining component of modern respiratory pharmacotherapy. It permits delivery of bronchodilators, inhaled corticosteroids and other agents to the lungs while limiting systemic exposure. Nevertheless, the existence of an effective medicine does not guarantee effective treatment. The clinical chain can be conceptualized as: appropriate prescribing → appropriate device selection → correct technique

→ regular use → adequate drug delivery → clinical benefit. Failure at any point can undermine the entire therapeutic strategy [7–13].

Inhaler use is particularly vulnerable to human factors. Patients must learn device-specific preparation, inhalation maneuvers, dose activation, breath-holding and maintenance steps. These requirements vary between pressurized metered-dose inhalers (pMDIs), dry-powder inhalers (DPIs), soft-mist inhalers (SMIs), and other systems. Device complexity is further compounded when patients use more than one inhaler with different operating instructions. Repeated evidence shows that inhaler errors remain common even after decades of inhaler availability [7–10,14].

Medication adherence is a second major

determinant of outcome. Non-adherence may be intentional, for example because of concerns about adverse effects or doubts about the need for preventive therapy, or unintentional, for example because of forgetfulness, cost, regimen complexity, or difficulty handling the device. The appropriate intervention therefore depends on the individual barrier rather than on a generic instruction to “take the medicine regularly” [11–15].

Community pharmacists can intervene across this pathway. Their accessibility, repeated contact during dispensing, knowledge of medicines, and increasing involvement in chronic disease management create opportunities for inhaler assessment, teach-back education, medication review, adherence support, device counseling and referral. Evidence from pharmacist-led trials and systematic reviews suggests clinically relevant improvements in inhaler technique and medication-related outcomes, although the magnitude and durability of benefit vary among studies [21–33].

This review reframes community pharmacy inhaler optimization as a longitudinal clinical service rather than a single educational encounter. It synthesizes evidence on the clinical rationale, pharmacist activities, device-specific considerations, adherence support, implementation barriers, digital innovation, environmental sustainability, and research priorities relevant to asthma and COPD care.

2. Review Approach and Scope

This manuscript is a structured narrative review. The source material was reorganized and substantially rewritten around clinically relevant themes: disease burden, inhaled therapy, device selection, inhaler technique, adherence, pharmacist-led interventions, implementation barriers, digital health, sustainability, and research priorities. Peer-reviewed literature, major respiratory guidelines, systematic reviews, randomized

controlled trials, and authoritative institutional reports were considered. Priority was given to evidence directly addressing asthma, COPD, inhaler use, pharmaceutical care, community pharmacy, adherence, digital inhaler technologies, and implementation of pharmacist services.

3. Clinical Burden of Asthma and COPD

Asthma and COPD generate substantial clinical and societal burden. Global analyses demonstrate that chronic respiratory diseases account for large numbers of deaths, disability-adjusted life-years, healthcare encounters, and productivity losses [3,4]. Asthma affects people across the life course and can cause recurrent symptoms, activity limitation, sleep disturbance and acute exacerbations. COPD is strongly associated with cumulative exposure to tobacco smoke and other pollutants and is characterized by persistent symptoms, progressive functional impairment in many patients, and recurrent exacerbations [1,2,5,6].

The burden is unevenly distributed. Resource constraints, medication affordability, environmental exposure, health literacy, limited specialist access, and inconsistent continuity of care can make long-term disease control more difficult. Community pharmacies may be particularly valuable in such environments because they can provide medication-focused care close to where patients live and obtain their medicines [17,18].

Disease control also depends on recognizing the distinction between preventive and reliever treatment. In asthma, contemporary guideline strategies emphasize anti-inflammatory treatment and caution against reliance on short-acting bronchodilator therapy alone [1]. In COPD, treatment selection is individualized according to symptoms, exacerbation history, airflow limitation, comorbidities and patient factors [2].

Pharmacists should therefore avoid treating inhaler technique as an isolated technical skill; it is part of a broader process of medication

optimization and disease self-management.

4. Inhaled Therapy and the Drug-Device-Patient Interface

Inhaled administration offers a pharmacological advantage by placing the active substance near the target organ. However, pulmonary deposition depends on formulation, particle characteristics, device mechanics and the patient's inspiratory maneuver [16,34–38]. Consequently, the same medicine may behave differently when delivered through different devices, and the “best” device is not necessarily the most sophisticated or newest product.

Device selection should account for inspiratory flow, hand-breath coordination, dexterity, cognition, vision, physical limitations, previous experience, regimen complexity and patient preference [34–39]. Current guidance increasingly supports individualized device selection rather than device-neutral prescribing. If a patient cannot reliably perform the required maneuver, changing to a suitable device may be more effective than repeatedly escalating therapy or blaming the patient for poor control.

pMDIs generally require coordination between actuation and inhalation. Spacers can reduce coordination requirements and may improve lung deposition. DPIs are breath-actuated but require adequate inspiratory effort and correct dose preparation. SMIs generate a slow-moving aerosol and may reduce some coordination demands, although correct preparation and use remain essential [34–40]. Nebulizers can have a role in selected circumstances but involve additional equipment, time and maintenance.

The drug-device-patient relationship therefore provides an important clinical niche for pharmacists. During dispensing, the pharmacist can identify whether the patient understands the device, whether the prescribed device matches practical capabilities, whether multiple devices are creating confusion, and whether the patient needs a physician or respiratory specialist review.

Aerosol science also underscores that pulmonary delivery is influenced by airway

anatomy, inspiratory pattern, particle size, formulation and device characteristics [66–69]. These factors explain why device selection cannot be separated from patient capability. In practice, the pharmacist should treat the inhaler as a drug-delivery system rather than merely as packaging.

5. Inhaler Technique: A Persistent Modifiable Determinant

Incorrect inhaler technique is among the most consistent and preventable contributors to ineffective inhaled therapy. Sanchis and colleagues reviewed 144 studies involving more than 54,000 subjects and showed that incorrect technique remained common over several decades [7]. Subsequent literature has reinforced the observation that critical errors can affect clinical outcomes in asthma and COPD [8–10,41].

Common pMDI errors include failure to shake when required, inadequate exhalation, poor synchronization between actuation and inhalation, excessively rapid or shallow inhalation, and insufficient breath-holding. DPI errors can include incorrect dose preparation, exhaling into the device, inadequate inspiratory effort, and incorrect sequence of steps. SMI users may have difficulty with device preparation, loading and coordination. The exact critical steps differ by device; therefore, generic inhaler counseling is insufficient [9,10,34,40].

Technique should be assessed by direct observation rather than patient confidence or self-report alone. A practical pharmacist assessment can use a validated device-specific checklist. The patient should demonstrate the device, the pharmacist should identify critical errors, demonstrate the correct procedure, and then ask the patient to repeat the technique using teach-back. This sequence creates an immediate feedback loop and allows the pharmacist to verify competence.

Importantly, technique is not static. Skills can

deteriorate after initial instruction, particularly when the patient receives little reinforcement or changes devices. Evidence from community-pharmacy interventions indicates that physical demonstration and repeated follow-up can produce more durable improvement than written instructions alone [42,43]. Therefore, inhaler education should be treated as a recurring clinical activity.

6. Medication Adherence and Persistent Treatment Barriers

Adherence is multidimensional. A patient may intentionally discontinue treatment because symptoms have improved, may avoid corticosteroids because of perceived risk, or may simply forget doses. Conversely, the patient may be motivated but unable to use the device effectively, unable to afford treatment, or overwhelmed by a complex regimen [11–15,44].

Inhaled therapy creates a particular adherence challenge because treatment is often preventive and benefits may not be immediately perceived. Patients may therefore underestimate the value of regular controller therapy. In COPD, multiple inhalers and comorbidities may further increase regimen burden. Meta-analytic evidence indicates that adherence is associated with patient knowledge, socioeconomic factors, cognition, age, regimen complexity and other individual determinants [11].

Pharmacists can address these barriers through refill history review, nonjudgmental interviews, medication synchronization, simplified regimens where clinically appropriate, reminder systems, shared decision-making, education and referral. The intervention should be matched to the cause. For example, a patient who forgets doses may benefit from reminders, whereas a patient who intentionally avoids treatment because of concerns about corticosteroids needs a discussion focused on risk perception, benefits and expectations.

Evidence increasingly supports multidimensional adherence interventions rather than education alone. Reviews of adherence interventions identify reminders, education, motivational approaches, feedback, shared decision-making and regimen simplification as potentially useful components [15,44]. Community pharmacists can combine these approaches with routine dispensing data, creating a practical longitudinal model of adherence support.

Adherence should be understood as a dynamic behavior influenced by the patient, treatment, disease, health system and socioeconomic environment [70,71]. Shared decision-making and patient involvement can improve the alignment between prescribed therapy and the patient's preferences and routines [72].

7. Evidence for Pharmacist-Led Inhaler Optimization

Clinical trials provide direct evidence that pharmacists can improve inhaler-related outcomes. Mehuys and colleagues evaluated a community pharmacist intervention in asthma involving education, inhaler technique assessment and medication counseling and reported improvements in asthma control and related outcomes [21]. Garcia-Cardenas et al. subsequently synthesized evidence from pharmacist interventions and found beneficial effects across several asthma outcomes, although results were not uniform for every measure [22].

In COPD, the PHARMACOP randomized controlled trial evaluated a structured pharmaceutical-care program delivered through community pharmacies. The intervention addressed medication use, inhaler technique and patient counseling, demonstrating the feasibility of community pharmacy-based COPD management [23]. Khmour and colleagues likewise reported benefits from a clinical pharmacy-led disease and medication management program in COPD [24]. A

systematic review and meta-analysis of pharmacist care in COPD found evidence of reduced hospital admission risk, while effects on quality of life were less consistent [25].

More recent evidence strengthens the case for inhaler-focused interventions. A systematic review and meta-analysis found that pharmacist-led interventions improved inhalation technique and medication adherence, although the adherence effect differed between asthma and COPD subgroups [26]. The INSPIRA pilot cluster-randomized trial found substantially higher odds of achieving correct inhaler technique among patients exposed to a community pharmacist educational intervention [27].

These findings support several conclusions. First, pharmacists can produce measurable changes in technique. Second, education is more effective when it is structured, demonstrative and repeated. Third, the effect on broader clinical outcomes is plausible but more variable. Fourth, service design matters: intervention intensity, follow-up duration, patient selection, collaboration with prescribers, and outcome measurement all influence results [22,25–29].

The evidence base nevertheless has limitations. Studies vary in sample size, device types, intervention content, comparator conditions and follow-up duration. Some rely on surrogate outcomes such as technique scores or knowledge rather than exacerbations and hospitalizations. Many studies are conducted in settings with healthcare systems that differ substantially from one another. Consequently, evidence supports pharmacist involvement but does not justify assuming that every model will produce identical clinical or economic benefits.

8. A Proposed Community Pharmacy Inhaler-Optimization Pathway

A standardized pathway can translate evidence into routine practice. A practical model should contain six linked stages.

Stage 1—Identify: Patients with asthma or COPD can be identified during new prescriptions, repeat dispensing, frequent reliever requests, medication changes, hospital discharge follow-up, or opportunistic screening.

Stage 2—Assess: The pharmacist reviews current inhalers, indications, dose, frequency, refill behavior, adherence barriers, recent symptoms, exacerbation history when available, and device suitability. Disease-control tools such as the Asthma Control Test or COPD Assessment Test can be used when appropriate and within the pharmacist's scope of practice [1,2].

Stage 3—Observe: The patient demonstrates each inhaler. Device-specific critical errors are documented. The pharmacist should distinguish a technique problem from a disease-control problem and avoid making unsupported diagnostic or prescribing decisions.

Stage 4—Teach and confirm: The pharmacist demonstrates the correct method and uses teach-back. Written or video instructions can reinforce the encounter, but they should not replace direct observation where feasible.

Stage 5—Optimize and refer: The pharmacist addresses medication-related problems within legal scope and communicates with the prescriber when treatment, device selection, adverse effects, adherence or disease control require clinical review.

Stage 6—Follow up: Technique and adherence are reassessed at subsequent contacts. Persistent errors trigger repeated education or referral. Digital reminders, electronic monitoring and telepharmacy can be added when suitable.

This pathway shifts the service from a one-time “inhaler demonstration” to continuous medication-use management. It also creates measurable process indicators: proportion assessed, proportion with critical errors, proportion corrected, adherence improvement, referral completion, patient-reported confidence, and longer-term clinical outcomes.

9. Patient Education and Teach-Back

Education is most useful when it is interactive. Merely handing a patient an instruction leaflet assumes that the patient can translate written information into a complex motor sequence. Demonstration followed by patient performance allows the pharmacist to identify misunderstandings immediately [42,43].

Teach-back should not be framed as a test of the patient. The pharmacist can say, in effect, “Please show me how you will use this inhaler at home.” The patient's demonstration reveals whether the instructions were understood. Errors can then be corrected without blame. Communication should use plain language, culturally appropriate examples, and visual aids where helpful.

Health literacy is another important determinant. Patients with limited health literacy may misunderstand the difference between maintenance and reliever medicines, interpret absence of symptoms as absence of disease, or fail to recognize signs requiring urgent assessment [45]. Community pharmacists can mitigate this risk through short explanations, visual demonstrations, repetition, and confirmation of understanding.

Education should also include safe-use messages: adherence to the prescribed regimen, device cleaning, storage, dose counters, spacer use where appropriate, recognition of worsening symptoms, and when to seek medical attention. Pharmacists should not substitute general counseling for individualized medical assessment when symptoms are worsening or treatment appears inadequate.

10. Interprofessional Collaboration and Referral

Community pharmacy inhaler optimization should complement, not replace, physician and respiratory-specialist care. Pharmacists are particularly well positioned to identify medication-use problems and communicate actionable information to prescribers. Collaborative relationships are associated with clearer role definitions, better communication

and greater acceptance of pharmacist contributions [19,20,46].

Referral triggers can include frequent reliever use, suspected uncontrolled asthma, recurrent exacerbations, significant adverse effects, inability to use any suitable device, suspected incorrect diagnosis, deterioration in respiratory status, or a need for prescription modification outside the pharmacist's authority. A standardized referral form can improve the quality of communication by recording the identified problem, device used, observed errors, adherence concerns and requested clinical review.

Formal collaborative practice agreements may enable pharmacists to undertake defined medication-management activities in jurisdictions where legislation permits [19,47]. However, expanded authority should be accompanied by competency standards, evidence-based protocols, documentation, audit and professional accountability. The aim is coordinated care rather than replacement of another profession.

11. Implementation Barriers in Community Pharmacy

The effectiveness of a clinical service depends on its ability to operate within real-world pharmacy systems. Several barriers recur across healthcare settings.

11.1 Workforce and workflow. High dispensing volumes can leave little time for structured counseling. A respiratory service requires private consultation space, documentation and follow-up. Appointment-based reviews, workflow redesign and pharmacy-technician support may improve feasibility [17,18,48].

11.2 Training. Pharmacists need current knowledge of asthma and COPD guidelines, inhaler devices, inspiratory requirements, adherence science, communication and referral. Training should include hands-on device demonstration rather than theoretical instruction alone [9,34].

11.3 Reimbursement. A service that depends entirely on unpaid pharmacist time may be difficult to sustain. Payment models can include medication-management fees, chronic-disease programs, insurer reimbursement, employer-supported services, or integration into publicly funded primary care [49,50].

11.4 Access to clinical information. Pharmacists may lack spirometry results, exacerbation history, current treatment rationale or complete medication records. Shared electronic health records and secure communication pathways can improve the safety of pharmacist interventions.

11.5 Scope of practice and regulation. The authority to change therapy differs substantially between jurisdictions. The service model must therefore be designed around local law and professional standards.

11.6 Patient acceptance and privacy. Patients may welcome accessible pharmacist support but may be reluctant to discuss symptoms in a busy retail environment. Private consultation areas and clear explanations of the pharmacist's clinical role can improve acceptance.

Implementation science should be used to evaluate these barriers systematically. A program that works in a research setting but cannot be integrated into routine workflow has limited population-level value.

Implementation research can provide a formal framework for evaluating adoption, feasibility, fidelity, sustainability and equity [73]. Such evaluation is particularly important when services are transferred from research pharmacies to routine community settings. Reporting should also be transparent about the review and intervention-development process, with appropriate use of established reporting frameworks where applicable [74,75].

12. Digital Health, Smart Inhalers, and Artificial Intelligence

Digital technologies are extending the pharmacist's ability to observe and support medication use between visits. Smart inhalers

and electronic monitoring systems can record dose timing, missed doses, and patterns of reliever use. These data may reveal behavior that cannot be captured by self-report or refill history alone [51–56].

Recent evidence suggests that patient-facing digital inhalers can improve asthma control and may reduce severe exacerbations in selected populations, although device failures, connectivity problems and privacy issues remain relevant [55]. Feedback-enhanced electronic monitoring may be particularly valuable because passive data collection is less likely to change behavior than monitoring combined with actionable feedback [56].

Remote monitoring can also reduce geographic barriers. Telepharmacy allows pharmacists to conduct video-based inhaler assessments, medication counseling and follow-up. It may be especially useful for rural patients, people with mobility limitations, and patients who live far from respiratory specialists [57,58].

However, digital interventions can reproduce inequities when patients lack smartphones, broadband, digital literacy, or confidence with technology.

Artificial intelligence has potential roles in predicting exacerbations, identifying adherence patterns, processing patient-reported outcomes, and assessing inhaler technique using computer vision [59–61]. These applications should be viewed as decision-support tools rather than autonomous replacements for clinical judgment. False alerts, algorithmic bias, privacy concerns and unclear accountability may undermine trust if governance is weak.

A pharmacist-centered digital model could integrate dispensing data, smart-inhaler information, patient-reported symptoms and clinician records into a risk dashboard. The pharmacist could then prioritize patients for intervention. Such a system would change the pharmacist's role from reactive counseling to proactive identification of medication-use risk.

Digital respiratory care should be aligned with

broader health-system principles for responsible digital transformation, including interoperability, privacy, patient-centered design and equitable access [76].

13. Environmental Sustainability and Inhaler Selection

Respiratory care increasingly recognizes the environmental footprint of inhaler devices. Some pMDIs use propellants with substantial greenhouse-gas impacts, whereas many DPIs and SMIs have different environmental profiles [62–64]. Recent reviews emphasize that sustainability should be evaluated across the full life cycle, including manufacturing, transport, use and disposal [65].

Community pharmacists can contribute to environmentally responsible care by minimizing unnecessary medicine waste, educating patients about appropriate disposal, and discussing device options within the treatment plan. However, environmental preference should never override clinical effectiveness, patient ability, adherence or disease control. A device with a lower theoretical carbon footprint is not a sustainable choice if the patient cannot use it correctly and experiences avoidable exacerbations.

The appropriate principle is therefore “clinical optimization first, environmental optimization within safe clinical boundaries.” Better asthma control itself may reduce reliance on reliever medicines and unnecessary healthcare utilization. Device choice should be individualized and shared with the patient and prescriber [36,64,65].

14. Research Gaps and Future Priorities

The existing evidence supports pharmacist involvement but leaves several questions unanswered.

First, more pragmatic trials are needed. Many studies are relatively short and focus on technique or adherence rather than exacerbations, hospitalizations, emergency visits, quality of life and mortality. Long-term follow-up is necessary to determine whether early technique improvement translates into

durable clinical benefit.

Second, intervention components should be standardized sufficiently to permit comparison. Studies should clearly define the educational method, number of contacts, device-specific assessment tool, follow-up schedule, pharmacist training and referral process.

Third, economic evaluation should become routine. Policymakers need information about pharmacist time, training, technology costs, avoided healthcare utilization and patient outcomes. Cost-effectiveness should be evaluated from healthcare-system and societal perspectives [49,50].

Fourth, research should address underserved populations. Rural communities, older adults, people with low health literacy, economically disadvantaged patients and those with multiple chronic conditions may face distinctive barriers. Digital interventions should explicitly evaluate digital equity.

Fifth, future studies should evaluate integration with electronic health records and smart-inhaler data. Research should determine whether algorithm-supported risk identification improves outcomes beyond conventional pharmacist follow-up.

Finally, implementation science should accompany clinical effectiveness research. Important outcomes include adoption, fidelity, feasibility, acceptability, sustainability, equity and cost. A clinically effective intervention that cannot be implemented at scale is unlikely to produce meaningful population benefit.

Future evidence syntheses should use transparent reporting and appropriate methodological standards. PRISMA 2020 and PRISMA-ScR are useful reporting frameworks when systematic or scoping review methods are undertaken [74,75]. Recommendations generated from future evidence should also communicate certainty and implementation considerations explicitly [73,76].

15. Practical Model for Journal and Health-System Implementation

A scalable respiratory pharmacy service can be organized around five operational pillars: competency, workflow, measurement, collaboration and technology.

Competency requires standardized training and periodic assessment. Workflow requires a defined consultation pathway that fits dispensing operations. Measurement requires a small set of clinically meaningful indicators. Collaboration requires clear referral and communication procedures. Technology should support, rather than complicate, these processes.

A minimum dataset might include disease category, inhaler/device type, critical technique errors, adherence concern, intervention delivered, referral made, follow-up date, and outcome. For research purposes, additional outcomes could include validated disease-control scores, exacerbations, healthcare utilization, patient-reported confidence, quality of life and costs.

A stepped-care model may be appropriate: brief assessment during routine dispensing for low-risk patients; structured pharmacist review for patients with errors or adherence problems; and rapid referral for patients with suspected poor disease control or clinical deterioration. This model can help allocate pharmacist time according to risk.

The long-term objective is not to make community pharmacists miniature respiratory specialists. It is to ensure that every patient receiving inhaled therapy has access to competent medication-use support and that medication-related problems are detected early and communicated to the appropriate clinician.

At the policy level, pharmacist-led respiratory services should be linked with broader noncommunicable-disease strategies rather than implemented as isolated pharmacy programs [80]. This can support integration with primary care, prevention, digital health and public-

health priorities.

16. Conclusion

Inhaled therapy is effective only when the medicine, device and patient are appropriately aligned. Persistent errors in inhaler technique, inconsistent adherence, unsuitable device selection and fragmented follow-up can undermine otherwise evidence-based treatment for asthma and COPD. Community pharmacists are well positioned to address these problems because of their accessibility, medication expertise and repeated contact with patients.

Current evidence supports pharmacist-led interventions for improving inhaler technique and medication-related outcomes, with growing evidence for broader benefits in asthma and COPD management. However, the heterogeneity of interventions and limited long-term outcome data mean that pharmacist services should be implemented with outcome measurement rather than assumed to be

effective by default.

The next generation of respiratory pharmacy should combine standardized face-to-face technique assessment with repeated follow-up, shared decision-making, interprofessional communication and appropriate digital support. Smart inhalers, remote monitoring and artificial intelligence may increase the reach and precision of these services, while environmental sustainability should inform—without overriding—clinical device selection.

A patient-centered, longitudinal model that connects community pharmacy with primary care and respiratory services offers a practical pathway for converting inhaler expertise into measurable improvements in respiratory health. Future research should focus on long-term clinical outcomes, cost-effectiveness, implementation, equity and responsible use of digital technologies.

Table 1. Proposed community-pharmacy inhaler-optimization pathway

Stage	Core activity	Key pharmacist output	Escalation trigger
1. Identify	Target patients during dispensing, new prescriptions, repeat reliever requests or discharge follow-up.	Patient selected for review.	Frequent reliever use, repeated exacerbations, high-risk history.
2. Assess	Review medicines, device, adherence, symptoms and available clinical information.	Medication-use problem list.	Suspected uncontrolled disease or treatment-related concern.
3. Observe	Patient demonstrates every inhaler; device-specific errors documented.	Critical-error checklist.	No suitable device or persistent inability to use device.
4. Teach	Demonstration plus teach-back; written/video reinforcement.	Verified technique and patient confidence.	Technique remains unsafe after retraining.
5. Optimize/refer	Resolve pharmacist-manageable problems; communicate with prescriber when therapy requires review.	Action plan/referral record.	Clinical deterioration, adverse effects or prescribing issue.
6. Follow up	Reassess technique, adherence and outcomes at subsequent contacts.	Longitudinal outcome record.	Persistent problems requiring multidisciplinary review.

Table 2. Major implementation barriers and practical responses

Barrier	Effect on service	Potential response
Workload and staffing	Clinical review competes with dispensing.	Appointment-based reviews, workflow redesign and technician support.
Training variability	Inconsistent technique assessment and counseling.	Competency-based inhaler training with periodic reassessment.
Reimbursement	Unpaid clinical time threatens sustainability.	Defined clinical-service payment or chronic-disease funding.
Limited clinical information	Incomplete assessment and weak continuity.	Shared records and secure pharmacist–prescriber communication.
Regulatory restrictions	Pharmacist cannot modify therapy in some systems.	Protocols and collaborative practice within local law.
Digital inequity	Technology may exclude vulnerable patients.	Offer non-digital alternatives and assess digital literacy.
Privacy	Patients may avoid counseling in open retail areas.	Private consultation space and clear data-governance procedures.

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