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EDITORIAL

Inhaler devices for asthma: a call for action in a neglected field

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The Brussels Declaration, published in the *European Respiratory Journal* in 2008 [1], recognises the high prevalence of patients with poorly controlled asthma and calls for changes in asthma management across Europe. Prescribing an appropriate inhaler device for asthma, a device that the patient accepts and can handle correctly, is one key element in this process. Inhaler mishandling is very common in real-world clinical practice and can contribute to poor asthma control [2–5].

The International Primary Care Respiratory Group (IPCRG) is committed to identifying reasons for poor asthma control and to promoting interventions to help patients achieve asthma control [6–9]. An international panel of healthcare providers (HCPs), academics and a patient representative was convened under the auspices of IPCRG to discuss and challenge the science behind inhaler therapy, and to propose practical solutions to real-life problems related to inhaler choice and mishandling. The focus was on the problems confronting clinicians in prescribing a suitable inhaler for each individual and those confronting patients in using their inhalers.

Until recently, inhaler therapy and devices have been marginal topics of clinical investigation and research in the field of asthma, mainly confined to a limited circle of experts, and lacking evidence for practical application. Thus, we propose this call for action, given: 1) the importance of inhaler technique for effective inhaled therapy; 2) the critical gaps in knowledge that need still to be addressed; and 3) the lack of solid evidence supporting HCPs in making clinical decisions regarding inhalers for asthma treatment.

CHALLENGES IN ACHIEVING CORRECT INHALER TECHNIQUE

Correct inhaler technique is fundamental for effective inhaled therapy. Errors in inhaler technique are very common [10–13] and can impact drug delivery to the lungs, thereby compromising bronchodilation in the short term and asthma control in the long term, depending on the drug considered [2, 14]. Possible errors include those that are independent of the device (*e.g.* lack of exhalation before inhalation or inhalation through the nose) and those that are device-dependent (*e.g.* improper preparation of the inhaler or inadequate inspiratory flow) [4].

Correct inhaler technique involves some common steps for all inhaler devices (a full exhalation followed by deep inhalation and then breath-hold), but the optimal inhalation pattern differs for different device types [8, 15]. The inhalation with a metered-dose inhaler (MDI) should be slow (4–5 s for adults and 2–3 s for children) [15–17]. By contrast, the inhalation with a dry-powder inhaler (DPI) should be fast and start immediately [14, 15]. Other components of inhalation may influence lung deposition, such as the lung volume at which inspiration begins, inhaled volume, lung volume at which the device is triggered (for MDIs) and duration of apnoea [17]. However, the clinical impact of variations in these components has seldom been evaluated.

Individual characteristics must also be taken into account, as each patient is likely to have their own preferred inhalation profile or abilities naturally more suited to one category of inhaler.

CHALLENGES IN PRESCRIBING EFFECTIVE INHALER THERAPY

Proposals and challenges for making a reasoned choice of the most appropriate device for the individual patient are schematically summarised in table 1. Also outlined in the table are the unmet needs in this field, which represent the reasons for and scope of this call to action.

Choosing the appropriate device

Drug choice is usually the first step in prescribing inhaled therapy for asthma and, together with availability and reimbursement criteria, dictates the inhaler device options. The next two steps, choice of inhaler device type and patient training in use of the inhaler, are hampered by the lack of robust evidence or effective tools to aid HCPs [8].

Patients with severe airway obstruction, as well as young children and the elderly, may be unable to inhale with sufficiently fast acceleration for DPIs [14], for which inspiratory flow is the only driving force. Conversely, a common problem with the use of MDIs is too fast an inhalation [15, 17], which results in difficulty coordinating actuation with inhalation, and increased oropharyngeal impaction. Patients who

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TABLE 1 Summary of proposals and needs to improve inhaler prescribing, patient training, and monitoring

Choosing the inhaler
Develop a standard procedure or follow a check-list: 1) choose drug in partnership with patient; 2) from the available inhaler types for that drug, match inhaler to patient, taking into consideration patient device preferences; 3) train and check inhaler technique; and 4) recheck technique at each visit and if symptoms occur
Revisit the choice of drug and inhaler with the patient if symptoms persist
Need for: devices
Devices that are forgiving of poor technique (*e.g.* breath-actuated devices)
''Intelligent'' devices that provide positive feedback to the patient that dose emission has occurred and, ideally, that inhalation is correct
Devices that provide a means of measuring adherence
Need for: instruments/techniques
Instruments/techniques to match patient inspiratory pattern to inhaler device type (*e.g.* based on breathing patterns and lung function)
Inhalation hardware and software to chart inhalation pattern
Need for: improving knowledge on inhalation patterns and flow rates necessary for acceptable and optimal use of inhalers
Need for: tools to trace patients' adherence to treatment
Training the patient
Teach and ascertain correct technique from the start: 1) use the patient's ''language''; 2) repeat and repeat; and 3) know their knowledge level
Explain, demonstrate then physically check technique
Train the patient's relatives too
Provide inhaler training for hospitalised patients before discharge
Provide asthma school: group sessions for patients who find them useful (not all do)
Need for: software or mechanical devices for training inhaler technique
Need to: ''train the trainer''; all HCPs (physicians, nurses, physiotherapists, pharmacists, and receptionists) should be able to provide patient training
Need for: training and equipment so HCPs can use two steps to check inhaler technique: 1) visual evaluation (inexpensive); and 2) electronic evaluation with a device [4] to check for and identify mistake(s) in inhaler technique (expensive)
Maintaining technique
Supply a source of recommended reference material so the patient knows where to go if they have questions: both videos and written material
Demonstrate and teach inhaler technique with each revisit
Instruct patient to bring inhaler to each follow-up visit
Mandatory recheck of technique if asthma not controlled
Need for: use of electronic instructions and reminders
SMS from doctor to patient: film/video on proper technique and reminder when to use inhaler
Pocket computer or desktop reminders
Need for: tools for patients to check their technique and use in self-management

HCP: healthcare provider.

have coordination problems with MDIs but otherwise have an appropriate speed of inhalation may benefit from being prescribed a breath-actuated MDI (BAI) [18], but the use of BAIs can be limited by the available range of drug content. Moreover, although MDIs were the first devices to be studied, poor technique is also a concern with BAIs and DPIs [4, 19, 20].

When choosing the optimal device, it could be useful for clinicians to have a means of mapping the patient's natural inhalation profile and of assessing whether the patient is more likely to master the fast, sharp inhalation required by DPIs or the even, slow inhalation required by pressurised MDIs and BAIs. The yield of devices able to analyse spontaneous inhalation profiles has not yet been assessed. Patient preference is another important issue to consider here. Tools needed at this stage of the consultation include placebo devices and disposable mouthpieces, which can be surprisingly hard to access in some healthcare settings.

Training the patient in inhaler use

A key challenge in many practice situations is the allocation of personnel and time for patient training in inhaler technique, although the upfront investment in time to properly train could later save time, resources and adverse patient impact by preventing uncontrolled asthma because of poor inhaler technique. The conventional wisdom is that training patients to use inhalers is time-consuming. However, in one study, training sessions provided by pharmacists took an average of only 2.5 min and were shown to improve asthma outcomes [21].

The ''trainer'' must know the proper technique, including refinements to optimise inhaler therapy for each device type prescribed. However, the HCPs involved often have not mastered inhalation technique themselves [22, 23] and are not sufficiently aware of handling difficulties with devices other than MDIs [24]. The best person to provide inhaler training (physician, nurse or pharmacist) will vary by practice situation. Another option is to enlist the aid of lay educators (*e.g.* other patients) to provide support and training. In all cases, adequate time and resources must be allotted for the training sessions.

Studies investigating the effectiveness of inhaler training are few, and most compare devices rather than training techniques. In one small study, the best results were achieved if verbal instruction and technique assessment were provided

together with written instructions [10]. In another study, repeated training sessions were identified as being important [21]. Mechanical or computer-based devices to aid in technique training could be useful (and time-saving) additions to one-on-one training sessions [25, 26]. However, their value must not be overestimated, as a substantial proportion of patients still have incorrect inhalation technique despite several training sessions [26].

Incorporating the principles of education theory and addressing different adult learning styles (visual, auditory and kinaesthetic) will likely be useful in future research of training techniques. Moreover, it is important that the focus of training reflects the different challenges presented by each inhaler type. Since many patients inhale too quickly through an MDI, training should focus on achieving a longer inhalation time. For DPIs, the focus of training will vary, as resistance and handling requirements vary among different types of DPI.

Assessing inhaler technique

A visual evaluation by the HCP is subjective but important in assessing inhaler preparation and the mechanics of inhaler handling by the patient. Indeed, in real life, patients make many errors with their usual inhalation device that may negate the benefits observed in clinical trials. A check-list to identify critical errors, which are those comprising treatment efficacy, could be applied here, as outlined by MOLIMARD and LE GROS [19].

Examples of currently available tools to objectively check and maintain the correct inhalation pattern include the Aerosol Inhalation Monitor (Vitalograph Ltd, Buckingham, UK) and 2Tone Trainer (Canday Medical Ltd, Newmarket, UK) for MDIs, and the In-Check Dial (Clement Clarke International, Harlow, UK) for DPIs [25, 26]. The Turbuhaler whistle (AstraZeneca International, London, UK) and Novolizer inhaler (MEDA Pharma GmbH & Co. KG, Bad Homburg, Germany) provide feedback about inhalation rate. These tools can provide an objective evaluation of the inhalation profile but cannot assess the patient's preparation and handling of their device.

CHALLENGES IN HELPING PATIENTS TO MAINTAIN PROPER TECHNIQUE

Other clinical challenges include helping patients to maintain inhaler technique once learned and stay motivated to continue regular therapy for asthma when recommended. Written or online supporting information is useful. Moreover, practical technology for patients to self-assess technique would be of value (*e.g.* a feedback mechanism built into the inhaler device to confirm correct inhalation).

In one study, elderly patients' perceptions of their inhaler skills correlated poorly with their actual performance [27]. Thus, if patients are not aware that their technique is inadequate and do not associate their symptoms with poor inhaler technique, they may miss an opportunity to ask for guidance from a HCP, or conclude that the medication is not effective and reduce their adherence to treatment. These possibilities support the recommendation of asthma guidelines for regular reassessments of inhaler technique [28]. Moreover, preliminary evidence suggests that repeated instructions in inhaler technique improve adherence to therapy and asthma outcomes [21, 29]. Pharmacists are well positioned to work with patients, as they often have frequent patient contact. Indeed, in the Australian healthcare setting, a pharmacist-delivered asthma care programme improved asthma control [30].

Adherence to inhaled corticosteroid therapy for asthma is consistently poor when evaluated in real-life settings [2, 31]. Regularly eliciting and addressing patients' preferences for medication and inhaler type over time could be helpful in improving their adherence to treatment [13]. The use of currently available technologies, such as SMS messages [32] or Internet social networks, particularly popular amongst young people, could be of help in instituting reminder systems (table 1).

RESEARCH QUESTIONS AND NEEDS SPECIFIC TO INHALER THERAPY

Some of the proposals above and listed in table 1 could be instituted immediately. For others, further research or device development is needed. There are several fundamental unanswered questions requiring further research. 1) To what extent are clinical outcomes affected by lung deposition *per se* (amount and distribution) and its determinants (device preparation and inhalation profile), improved inhaler technique, and adherence to therapy in real life? 2) How can we measure adherence in real life while avoiding the effects of clinical trial intervention? 3) Does improved adherence in real life lead to better outcomes? 4) For real-world patients with asthma, how do different inhaler devices compare in terms of clinical efficacy and tolerance, ease of use, time required for education, acceptance, patients' preferences, and adherence? 5) Are adherence and inhalation technique better if patients choose their own devices or device choice is individually tailored to spontaneous inhalation profile? 6) Can improved inhaler devices (*e.g.* recording the time and correctness of an inhalation) improve asthma control?

In addition, the recently published IPCRG statement of research needs lists the following research questions [9]. 1) How can good and poor inhaler technique be identified, and what is the best strategy for ensuring good inhaler technique? 2) What is the most cost-effective approach to inhaler devices? 3) What strategies are needed to counteract the taboos associated with inhaler usage in some countries?

CONCLUSIONS

The success of the Finnish Asthma Programme demonstrates that a comprehensive approach to management can improve asthma outcomes [33]. Our knowledge of pharmacological interventions in well-defined patient populations is substantial. The need to translate this knowledge into improved care of individual patients in real-life settings by individual clinicians is rightly attracting greater academic attention. Knowledge gaps in the design and performance of inhalers, the practice of prescribing inhalers, patient preferences, and issues around inhaler technique, all of which are fundamental and critical aspects of asthma management, remain substantial and must be addressed.

An effective, individualised clinician–patient partnership is particularly important for instituting and maintaining therapy of a chronic disease such as asthma. Combining this partnership with present and future technology may offer the best

potential for further advances, but the science is lagging, and academic study must gain momentum.

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STATEMENT OF INTEREST

Statements of interest for all authors can be found at www.erj.ersjournals.com/site/misc/statements.xhtml

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