

Improving inhaler technique and adherence in children

Abstract

Inhalers are an essential part of the management of asthma in children and young people, however, technique and adherence are often poor. It is essential to improve these through adequate education and training. This article looks at possible reasons behind errors in inhaler use and strategies health professionals can put in place to remedy these, including repeated education, using multiple training formats, and patient involvement.

KEY WORDS: Inhaler devices · Education · Shared decision-making · Health literacy

Inhalers are the mainstay of treatment for patients with asthma – but just like in adult care, inhaler technique in children is generally poor (Gillette et al, 2016; National Institute for Health and Care Excellence (NICE), 2021).

First-line treatment is to prescribe a short-acting beta 2-agonist (SABA) as a reliever therapy with newly diagnosed asthma (NICE, 2021). A low dose of an inhaled corticosteroid (IHCS) is recommended as the first-line maintenance therapy for children who are symptomatic (NICE, 2021). Despite this, many children are unable to use their inhaler devices effectively and Child (2002) suggests that many have been prescribed devices they cannot use. Some have recently had their devices changed to comply with the NHS Green Plan, swapping their medication to dry powder devices that are hydrofluorocarbon (HFC) free.

There are also many different devices, which can be confusing for patients and the health professionals who prescribe them (Alismail et al, 2016). Each inhaler device has its own set of unique characteristics relating to holding the device, its design and inhalation technology, as well as its specific advantages and disadvantages. One device may have a counter, allowing the patients to see how much medication is left in the canister, and others may not.

Inhaler education is an important aspect of the treatment of asthma. However, poor inhaler technique and poor deposition of the drug in the airways is common among children (Volerman et al, 2021). Studies have shown that only 8–22% of children with asthma use their inhalers correctly (Ferrante et al, 2021).

In a study of 530 children in general practice, 76% were inhaling asthma medication incorrectly (Hagmolen of ten Have et al, 2008). Errors mainly occurred when children used a pressurised metered-dose inhaler (MDI) without a spacer device. The errors increased the longer the child was using the device, reminding us that repeated education is important. Certainly, Capanoglu et al (2015) suggested that repetitive training in using devices contributes to improving inhaler technique. If medication must be adjusted or a new medication started, NICE (2021) recommends that they are seen again after 4–8 weeks. This is an ideal time to support repetitive training.

Gillette et al (2016) suggested that members of the healthcare team should instruct children and their caregivers on the proper use of their inhalation devices at every opportunity. This may also include correcting mistakes and ensuring effective medication delivery, and is in line with global recommendations from GINA (2020). Certainly, all members of the healthcare team should be involved in this process (Kaplan et al, 2020). Axtell et al (2017) suggested that pharmacists providing brief interventions can play a pivotal role in reducing the implications of improper inhaler use.

Leaflets instructing the patient on using the device are included in the packaging. Education can also be delivered by using short video interventions, and these can lead to immediate improvements in children's inhaler techniques (Carpenter et al, 2015). Matsuyama et al (2022) stated that only using one method of providing information (leaflet or video) was insufficient for acquiring proper inhaler techniques. They recommended a combination of two learning materials to enable patients to acquire proper inhaler techniques and subsequently improve their asthma control, although their study participants were college students not children (Matsuyama et al, 2022).

Volerman et al (2021) suggest that teaching inhaler technique should involve demonstrating each step for effective use and the cleaning procedures to ensure that the devices continue to work effectively. This must be individualised for each device, such as a metered-

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dose inhaler, Turbuhalers and Easyhaler devices. There are many resources to enable us to do that such as Asthma + Lung UK videos (see further information at the end of this article).

Metered-dose inhalers and spacer devices

MDIs are considered more challenging to use than most other devices (Lenney et al, 2000). Spacer devices are helpful tools that attach to the mouthpieces of pressurised metered-dose inhalers (pMDIs) and minimise coordination difficulties, reduce oropharyngeal deposition and increasing lung deposition (De Benedictis and Selvaggio, 2003; Newman, 2004). Volerman et al (2020) suggest that effective use of MDIs can be supported with spacers and valved holding chambers and masks.

The asthma guidelines (NICE, 2021) recommend that all patients using pMDI are prescribed a spacer device as they are more effective. Certainly, an MDI-spacer is just as effective as a nebuliser as both deliver salbutamol equally to preschool children (Hamza et al, 2022). The new digital applications on smartphones to support the use of MDIs and inspiratory flow alongside traditional verbal counselling has been shown to improve their asthma control (Behroozet al, 2020; Ferrante et al, 2021; Tony et al, 2021). Tony et al (2022),

in their study comparing verbal counselling versus advanced counselling (using acoustic Flo-tone training device and its smartphone application with traditional verbal counselling), found a significant improvement in the number of inhalation technique mistakes compared to using traditional verbal counselling alone. Sportel et al (2020) suggested that it is the immediacy of the smart feedback that leads to improvement in therapy adherence and inhalation technique.

Health literacy

Health literacy can be considered as a patient’s ability to understand the basic health information and services needed to make appropriate health decisions about their care. Health literacy in children is described as the skills, commitments, and knowledge that enable a person to process health information and instigate health-promoting decisions and actions (Bröder et al, 2017). For patients with asthma, this is something we need to consider as they try to manage their disease. Certainly, we know that inadequate literacy is linked with poor health outcomes (Rosas-Salazar et al, 2012; Federman et al, 2014). Thai and George (2010) suggest that asthma educators are uniquely prepared to evaluate health literacy and to develop individualised training programmes. Despite this, Tzeng et al (2018)

Key Points

- As many children are unable to use their inhaler devices effectively and some have recently had their devices changed to dry powder devices it is important to ensure that they are prescribed the right device and provided with adequate training.
- The variety of devices can be confusing for patients and families but also for healthcare professionals. It is therefore important that the healthcare team remains up to date and able to support training at every opportunity.
- In children using a pressurised metered-dose inhaler, fewer errors were found when they used spacer devices.
- Repeated education is important as errors would increase over time. If medication is adjusted or a new medication started it is recommended that children are seen again after 4–8 weeks.
- The use of multiple methods of providing information and training has been found to improve inhaler technique.
- A shared-care approach and comprehensive patient education, including device training, can improve outcomes. It is important to facilitate choice but also to ensure a match between patient and device at the outset of treatment to help lead to better adherence.

CPD

- Define health literacy in the context of asthma.
- How can health literacy be assessed and improved in children?
- What strategies can help improve technique and adherence?

suggest that children's health literacy is still not completely understood and there needs to be more research in the topic.

When recommending an inhaler device, it is therefore important to identify and support children and parents or carers with low health literacy. They may have their own perceptions and preferences about certain devices, so shared decision making is therefore helpful (Muscat et al, 2021). Often, the prescribing decision about the device is made by the prescriber and is affected by local or national guidelines and cost. Hsiao et al (2022) suggest that this decision process is one way and can lead to reduced satisfaction and non-

Further information

- A helpful resource for patient education about the demonstration of inhaler devices from Asthma + Lung UK: <https://tinyurl.com/5n6d3pv5>
- You can also register with MIMS as a health professional to access their visual inhaler guide: <https://www.mims.co.uk/respiratory-visual-guide>
- Also see the pocket guide to inhaler technique from the Greater and Clyde NHS Trust: <https://www.nhsggc.org.uk/media/245983/respiratory-inhaler-tech-guide-final-1606.pdf>
- A visual guide for optimising asthma reviews (NHS England): <https://s40639.pcdn.co/wp-content/uploads/Asthma-Visual-Guide-V1.5.2.pdf>

adherence. Giving children the choice as to what device they prefer will, ultimately, lead to better adherence. Kaplan and Price (2018) suggest that a shared-care approach and comprehensive patient education, including device training, can improve outcomes but that not all children are able to use their inhalers correctly. They highlight the point that some devices are unsuitable for certain patients. It is therefore important to facilitate choice but also to ensure a match between patient and device at the outset of treatment. Dijk (2017), in their doctorate thesis, suggests that there are a huge range of different inhaler devices and preferences which can be affected by the age, gender and education level of the patient. They highlight the point that it is difficult to predict which inhaler device is best suited for which child but that it should be their choice. Van Boven et al (2023) suggest that if we are being holistic about choice, then this should be about the device and the dosing regimen should be a part of the shared decision-making process. Ultimately, despite the large number of devices, there is no ideal device that fits all patients, so a personalised approach needs to be considered (Cataldo et al, 2022). This personal approach needs to be used for the education about inhaler devices.

Boise and Rotellas' (2015) systematic review of asthma training recommends that the education should be device-specific, patient-centred, and repeated at frequent intervals. They suggest that healthcare professionals must frequently reassess patient understanding and ability about their asthma inhalers, which will ultimately increase their therapeutic outcomes (Boise and Rotellas, 2015).

Conclusions

Although inhalers are the mainstay of treatment for patients with asthma, inhaler technique is generally poor (Gillette et al, 2016; NICE, 2021). Many children are unable to use their inhaler devices effectively or are even prescribed devices they cannot use (Child, 2002). There are also many different devices, which is challenging for health professionals who prescribe these (Alismail et al, 2016). Each inhaler device has its own set of unique characteristics relating to holding the device, its design and inhalation technology, as well as its specific advantages and disadvantages.

It is important to offer education that is device-specific, child-centered, and repeated at frequent intervals (Boise and Rotellas, 2015). As health professionals we need to keep up to date with new devices so we can support children with asthma and their families. **JFCH**

Conflicts of interest: None declared

- Alismail A, Song CA, Terry MH, Daher N, Almutairi WA, Lo T. Diverse Inhaler Devices: A Big Challenge for Health-Care Professionals. *Respir Care*. 2016 May;61(5):593–9. doi: 10.4187/respcare.04293
- Asthma and Lung UK (2021) Inhaler videos. <https://tinyurl.com/5n6d3pv5> (accessed 6 September 2024)
- Axtell S, Haines S, Fairclough J. Effectiveness of Various Methods of Teaching Proper Inhaler Technique. *J Pharm Pract*. 2017 Apr;30(2):195–201. doi: 10.1177/0897190016628961

- Boise E, Rotella M. ABCs of asthma inhaler and device training. *Int Forum Allergy Rhinol*. 2015 Sep;5 Suppl 1:S71-5. doi:10.1002/alr.21605
- Bröder J, Okan O, Bauer U, Bruland D, Schlupp S, Bollweg TM, Saboga-Nunes L, Bond E, Sorensen K, Bitzer EM, Jordan S, Domanska O, Firnges C, Carvalho GS, Bittlingmayer UH, Levin-Zamir D, Pelikan J, Sahrai D, Lenz A, Wahl P, Thomas M, Kessl F, Pinheiro P. Health literacy in childhood and youth: a systematic review of definitions and models. *BMC Public Health*. 2017 Apr 26;17(1):361. doi:10.1186/s12889-017-4267-y. Erratum in: *BMC Public Health*. 2017 May 9;17(1):419. doi:10.1186/s12889-017-4365-x
- Cataldo D, Hanon S, Peché RV, Schuermans DJ, Degryse JM, De Wulf IA, Elinck K, Leys MH, Rummens PL, Derom E. How to Choose the Right Inhaler Using a Patient-Centric Approach? *Adv Ther*. 2022 Mar;39(3):1149-1163. doi:10.1007/s12325-021-02034-9
- Carpenter DM, Lee C, Blalock SJ, Weaver M, Reuland D, Coyne-Beasley T, Mooneyham R, Loughlin C, Geryk LL, Sleath BL. Using videos to teach children inhaler technique: a pilot randomized controlled trial. *J Asthma*. 2015 Feb;52(1):81-7. doi:10.3109/02770903.2014.944983
- Child F, Davies S, Clayton S, Fryer AA, Lenney W. Inhaler devices for asthma: do we follow the guidelines? *Arch Dis Child*. 2002 Mar;86(3):176-9. doi:10.1136/adc.86.3.176
- De Benedictis FM, Selvaggio D. Use of inhaler devices in pediatric asthma. *Paediatr Drugs*. 2003;5(9):629-38. doi:10.2165/00148581-200305090-00005
- Federman AD, Wolf MS, Sofianou A, O'Connor R, Martynenko M, Halm EA, Leventhal H, Wisnivesky JP. Asthma outcomes are poor among older adults with low health literacy. *J Asthma*. 2014 Mar;51(2):162-7. doi:10.3109/02770903.2013.852202
- Ferrante G, Licari A, Marseglia GL, La Grutta S. Digital health interventions in children with asthma. *Clin Exp Allergy*. 2021 Feb;51(2):212-220. doi:10.1111/cea.13793
- Gillette C, Rockich-Winston N, Kuhn JA, Flesher S, Shepherd M. Inhaler Technique in Children With Asthma: A Systematic Review. *Acad Pediatr*. 2016 Sep-Oct;16(7):605-15. doi:10.1016/j.acap.2016.04.006
- Global Initiative for Asthma. 2020 GINA main report. <https://ginasthma.org/gina-reports/> (accessed 6 September 2024)
- Hagmolen of ten Have W, van de Berg NJ, Bindels PJ, van Aalderen WM, van der Palen J. Assessment of inhalation technique in children in general practice: increased risk of incorrect performance with new device. *J Asthma*. 2008 Jan-Feb;45(1):67-71. doi:10.1080/02770900701815834
- Hamza MB, Harkan AI. Spacers versus Nebulizers in Treatment of Acute Asthma A Prospective Randomized Study in Preschool Children. *Egyptian Journal of Hospital Medicine*. 2022;88(1):2996-2999
- Hsiao YH, Tseng CM, Sheu CC, Wang HY, Ko HK, Su KC, Tao CW, Tsai MJ, Chen YF. Shared Decision-Making Facilitates Inhaler Choice in Patients with Newly-Diagnosed Chronic Obstructive Pulmonary Disease: A Multicenter Prospective Study. *Int J Chron Obstruct Pulmon Dis*. 2022 Sep 2;17:2067-2078. doi:10.2147/COPD.S376547
- Kaplan A, van Boven JFM, Ryan D, Tsiligianni I, Bosnic-Anticevich S; REG Adherence Working Group. GINA 2020: Potential Impacts, Opportunities, and Challenges for Primary Care. *J Allergy Clin Immunol Pract*. 2021 Apr;9(4):1516-1519. doi:10.1016/j.jaip.2020.12.035
- Kaplan A, Price D. Matching Inhaler Devices with Patients: The Role of the Primary Care Physician. *Can Respir J*. 2018 May 23;2018:9473051. doi:10.1155/2018/9473051
- Lenney J, Innes JA, Crompton GK. Inappropriate inhaler use: assessment of use and patient preference of seven inhalation devices. *EDICI. Respir Med*. 2000 May;94(5):496-500. doi:10.1053/rmed.1999.0767
- Matsuyama T, Machida K, Hamu A, Takagi K, Momi H, Higashimoto I, Inoue H. Effects of instructional materials on the proper techniques of inhaler device use. *Respir Investig*. 2022 Sep;60(5):633-639. doi:10.1016/j.resinv.2022.04.010
- Muscat DM, Shepherd HL, Nutbeam D, Trevena L, McCaffery KJ. Health Literacy and Shared Decision-making: Exploring the Relationship to Enable Meaningful Patient Engagement in Healthcare. *J Gen Intern Med*. 2021 Feb;36(2):521-524. doi:10.1007/s11606-020-05912-0
- Newman SP. Spacer devices for metered-dose inhalers. *Clinical Pharmacokinetics*. 2004;43:349-360
- Rosas-Salazar C, Apter AJ, Canino G, Celedón JC. Health literacy and asthma. *J Allergy Clin Immunol*. 2012 Apr;129(4):935-42. doi:10.1016/j.jaci.2012.01.040
- Sportel ET, Oude Wolcherink MJ, van der Palen J, Lenferink A, Thio BJ, Movig KLL, Brusse-Keizer MGJ. Does immediate smart feedback on therapy adherence and inhalation technique improve asthma control in children with uncontrolled asthma? A study protocol of the IMAGINE I study. *Trials*. 2020 Sep 17;21(1):801. doi:10.1186/s13063-020-04694-4
- Thai AL, George M. The Effects of Health Literacy on Asthma Self-management. *Journal of Asthma & Allergy Educators*. 2010;1(2):50-55. doi:10.1177/2150129710368850
- Tony SM, Abdelrahman MA, Osama H, Elgendy MO, Abdelrahim MEA. The Effect of Adding a Training Device and Smartphone Application to Traditional Verbal Counseling in Asthmatic Children. *Pulm Ther*. 2021 Dec;7(2):549-562. doi:10.1007/s41030-021-00176-3
- Tzeng YF, Chiang BL, Chen YH, Gau BS. Health literacy in children with asthma: A systematic review. *Pediatr Neonatol*. 2018 Oct;59(5):429-438. doi:10.1016/j.pedneo.2017.12.001
- van Boven JFM, Achterbosch M. Once- or Twice-Daily Inhaler Therapy for Optimal Adherence: "No-Brainer" or Shared Decision? *J Allergy Clin Immunol Pract*. 2023 Jul;11(7):2094-2095. doi:10.1016/j.jaip.2023.05.006
- van Dijk L. Patients in control, the future key in choosing an eligible inhaler device? The feasibility of shared decision making in the choice of the inhaler device (Doctoral dissertation). 2017
- Volerman A, Balachandran U, Siros M, Akel M, Press VG. Mask use with spacers/valved holding chambers and metered-dose inhalers among children with asthma. *Annals of the American Thoracic Society*. 2021;18(1):17-22