

New advances in inhaler sensors can help answer decades long inhaler technique issues

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Chronic lung diseases such as asthma affect over 35 million Americans and its prevalence has increased drastically in the past fifteen years [1]. According to the Centers for Disease Control and Prevention, 1 in 13 people in the United States alone suffer from asthma, with 8.3 percent of children diagnosed [2,3]. Metered Dose Inhalers (MDIs) are the most commonly prescribed medication for the treatment of asthma and chronic lung diseases. However, almost 90% of patients use their inhalers incorrectly resulting in suboptimal medication delivery to the lungs [4-7] which in turn leads to poor asthma control, missed school days, work days and adverse health outcomes (exacerbations, emergency department visits, hospitalizations) [7-9].

To tackle this issue, patients need to be frequently educated on correct inhaler use technique. Prior studies have shown that misuse of inhalers reduce drastically when coached on the correct use. Both in-person and virtual techniques have proven useful in improving patient's technique of using inhalers [10]. But in busy clinics, this teaching aspect is often overlooked. It is also difficult to assess the inhaler technique objectively by just observing the patient's inhaler use [11]. New digital technologies can help both patients and physicians to answer this. We partnered with local startup Cognita Labs to pilot their smart inhaler attachment CapMedic that quantifies inhaler use technique and coaches patients for correct use. CapMedic is an interesting and engaging tool that attaches to the commonly used MDIs and guides patients using *live* interactive audio-visual cues to help them use their inhalers regularly and correctly every time. The device reminds patients of inhaler use steps such as inhaler shaking, upright positioning, coordination while actuating, deep inhalation as well as breath-hold at the end of inhalation, all critical for sufficient lung deposition of aerosol medication [11, 12]. In a prior pilot study using CapMedic, the device was able to detect 60% more inhaler use errors than observation alone due to the quantified nature of the data [11], and thus, training with CapMedic ensures that patients do not miss critical use errors during education. In our in-clinic pilot study, we are seeing about 2.5x improvements in inhaler technique when patients are guided by CapMedic.

Inhaler training is currently also a billable service and is reimbursed through **94664** code for each training session. The session may also include a review of inhaler technique, another crucial aspect to understand which step patients have difficulty in and a simple, "Show me how you use your inhaler at home" can clarify issues with patient's adherence and competence in using inhalers. Understandably, in the busy clinic environment, adoption of a new service may slow down the clinical workflow. Thus, a research of the various inhaler training options would be prudent in deciding the optimal solution for a particular clinic/hospital setting. For example, A video-based virtual inhaler training would reduce staff time in teaching inhaler technique and patients can view and learn in the waiting room *on their own*. The CapMedic device can be used in a similar way in the clinic environment using disposable empty MDIs (obtained with the device) and a set of video and pamphlet-based tutorials. The patient learns with the practice disposable MDI in the waiting room and the HCP can download a report at the end of the session for review of quantified improvement in inhaler technique. This automated workflow minimizes staff time in teaching while providing critical education.

Current inhaler devices remain woefully inadequate in ensuring effective dosage for every use. New digital technologies such as CapMedic can bridge the gap between inhalers and patient behavior.

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