

Smart Inhalers and the Future of Respiratory Health Management

By Cassandra
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Smart inhalers are part of a new wave of digital technology designed to improve the management of lung diseases.



Smart inhalers are quickly emerging as one of the most visible areas of pharmaceutical engagement in digital health.¹ A growing number of companies are embracing the use of this digital technology to enhance the management of lung diseases such as asthma and COPD, as well as improve the effectiveness of the prescribed medications.

These monitoring devices attach to the user's inhaler and should ideally be able to monitor adherence, accurately record the time each dose is taken, store data, not interfere with the dose of delivered medication, and provide access to data so that it can be downloaded to a personal computer.² Benefits range from improving medication adherence to reducing hospital admissions, which makes smart inhalers the next wave of respiratory care technology to improve patient outcomes.

On the Market

Presently, there are a number of new technologies available on the healthcare market designed to improve respiratory health management and therapeutic compliance. [Propeller Health](#) (Madison, Wisc) has entered this market with a new FDA-approved mobile platform intended to measure and monitor when patients take their medication. The Propeller system has a combination of mobile applications, sensors that attach to the prescribed asthma inhaler, and a comprehensive analytics system that helps patients keep track of their medication use.³

Essentially, the user snaps the Propeller sensor on the inhaler, and the sensors of the new system streamline the data collection process by intercepting the signal and collecting objective data about symptoms and medication use on the patient's smartphone as well as the company server.³ The patient's healthcare provider receives the collected data in dashboards, and physicians can ask data-driven questions based on the gathered information.

According to Chris Hogg, COO of Propeller Health, "With all the new data, physicians and providers can understand each user better and help direct patient care."

David Van Sickle, CEO of Propeller Health, said, "Propeller Health markets an FDA-cleared digital health system

designed to help patients and their physicians better understand asthma and COPD, and improve symptoms and outcomes. Patients appreciate the smart medication reminders, personal insights, and automated communication with their doctors about what's happening between visits.”

The features and benefits of the Propeller system have resulted in improved disease control and a greater than 70% reduction in rescue inhaler use, on average, across diverse clinical settings, patient populations, and studies, according to Van Sickle.

Also, he noted that Propeller has been used by patients with asthma or COPD in over 35 commercial programs across the United States, including major healthcare systems, payers, and employers.

Meanwhile, [AstraZeneca](#) has partnered with [Adherium Limited](#), a New Zealand company that manufactures a line of medical devices under the name Smartinhaler. These “smart” attachments connect to a range of inhalers and are designed to increase medication adherence.¹ The features include a touch screen display for management, alerts to remind the user to take his or her medication, and essentially enable the patient to track the date and time of medication usage.⁴ AstraZeneca will incorporate Adherium products into global patient support programs for patients with asthma and COPD.

“The devices track the date and time of patient use and transmit audio and visual reminders to the patient when they miss a critical dose of preventative medication,” Adherium explained in a news release. “The devices automatically transmit the data using the SmartinhalerLive wireless communications software to a smartphone app, home monitoring hub, or PC, and then to the company’s cloud-based servers.”

Doug Wilson, PhD, chairman of Adherium, said, “By providing objective and accurate data on a patient’s medication usage, we can now for the first time develop treatment plans tailored to each patient, and in doing so dramatically improve their quality of life.”

“The use of smart technology solutions to improve outcomes for patients is an important aspect of future care, particularly as it relates to respiratory medicines,” said Chris Blango, vice president US Medical Affairs, Respiratory, AstraZeneca. “As part of our ongoing efforts, AstraZeneca is excited to be supporting a company that is delivering devices to independent investigators who are testing the impact of technology on medication adherence and outcomes.”

Another available device is the Smart-inhaler from Auckland-based Nexus 6. The device was developed to measure adherence with inhaled asthma medications. The microcomputer tracks how often someone is using their asthma medication and reminds the user when he or she forgets.

According to *MobiHealthNews*, additional companies working on smart inhalers include: Gecko Health Innovations, maker of a platform called CareTRx; Cohero Health, which is conducting a pilot with Mount Sinai Hospital; and Opko Health, who bought Israeli startup Inspiro Medical to build its own smart inhaler products.¹

‘Smart’ Benefits

Smart inhaler technology can offer a number of benefits to both the patient and the healthcare provider. The benefits of a device such as the Propeller platform, which collects valuable patient data, is that the sensors aid patients in identifying his or her own patterns. For example, if the patient is aware of triggers, like pollen or temperature, they may be better equipped to avoid preventable hospitalizations. This can lead to improved disease self-management and adherence rates. In addition, the new platform aims to reduce preventable emergency room visits, hospitalizations, and unnecessary suffering by helping patients and their doctors better understand and control their respiratory disease.³

Hogg said, “The data can be used to understand the disease better, including how frequently the patient uses a

rescue inhaler, what the triggers are, and when they happen.”

Van Sickle affirmed this sentiment and said an important benefit of this new technology is that patients can learn new things about themselves and their condition. “With Propeller, each patient receives custom information about their symptoms, triggers, flares, and medication trends over time. This is unique and empowering information,” Van Sickle said. “Propeller’s technology makes it easier for patients to better manage their disease with less effort.”

Smart inhaler technology can also aid in tracking medication use with a variety of unique features. For example, the Nexus Smart-inhaler offers a time stamp that allows investigators to determine when doses were given during the day. Also, this feature allows investigators to conclude if doses were administered so close together that normal dosing would not have been possible.² Another advantage of this device is the capacity to download data, which saves time and avoids errors during the manual transfer of data into a database.

Improving medication adherence is another benefit of smart inhalers. According to reporter Susie Nordqvist, new research shows patients with the smart inhaler are better at managing their condition than those without.⁵ Adherence is important both in clinical and research settings, and poor adherence with asthma management plans and treatment regimens has been associated with poor disease control, an increased risk of hospital admission, and an increased mortality rate.²



While the data on the impact of smart inhalers on medication adherence is encouraging, Satish Misra, MD, cardiology fellow at The Johns Hopkins Hospital and executive editor of *iMedicalApps*, said it is important that these devices prove this in ongoing clinical study.

Misra also said smart inhalers can be a useful tool to help patients manage their medications more effectively as well as play a valuable role in reducing emergency hospital visits. Medication non-adherence is at least a partial contributor to exacerbations, he explained. “Medication non-adherence is a major problem and is one driver of acute presentations to clinics and emergency departments. So the potential is there for this technology to make a meaningful impact.”

The Propeller system is FDA-cleared to predict oncoming exacerbations and help reduce the frequency of symptoms and exacerbations in COPD and asthma, according to Van Sickle. “Acute exacerbations are a leading cause of hospitalization and rehospitalization in asthma and COPD,” he said, adding that information about medication use enables prevention of both admission and readmission.

In trials conducted by Adherium, the inhaler sensor was shown to improve adherence by up to 59% in adults and 180% in children with asthma.¹ An additional study of 220 children between the ages of 6 and 15 years showed that 84% of the young participants with a reminder inhaler took their medication, compared to 30% without the technology.⁵ Garth Sutherland, CEO of Nexus 6, explains, “There is a real need for this type of technology, in particular, doctors don’t have visibility on how patients are using their medication.”

The unique features of smart inhalers may also offer benefits for healthcare providers, according to Misra. “First, it could provide useful information when titrating medications and help us avoid uptitrating medications when the problem was really that our patients were in fact not taking their medications,” he explained. In addition, Misra said tracking use of rescue inhalers may also provide a foundation for systems that deliver early interventions at the first signs of exacerbation or improve titration of controller therapies for pulmonary diseases.

Van Sickle also believes electronic inhalers can aid healthcare providers by giving them new perspectives into their

patients' behaviors and outcomes. "Electronic inhalers open a new window on chronic disease as it's managed day-to-day: real-time and objective information about how patients are doing in their daily life," he said. "We think of this information as a new respiratory 'vital sign' for the doctor to assess each patient's level of risk and impairment."

Insurance Coverage

According to Van Sickle, the recent creation of the Chronic Care Management (CCM) code by the Centers for Medicare and Medicaid Services (CMS) is providing ways for organizations to be reimbursed for managing chronic conditions through technology like Propeller. "Effective January 2015, CMS has begun reimbursing qualified practices for non-face-to-face monitoring of patients with chronic diseases that suffer from two or more diseases, making it relevant to many asthma and COPD patients," Van Sickle explains.

A CMS news release⁶ noted that Medicare pays separately under the Medicare Physician Fee Schedule under American Medical Association Current Procedural Terminology code 99490 for non-face-to-face care coordination services administered to Medicare beneficiaries with multiple chronic conditions (which includes asthma and COPD). The chronic care management service is comprised of a variety of elements, such as structured recording of patient health information, access to care management services, and coordinating and sharing patient information with practitioners and providers.

With this recent development, it may be easier for patients to have smart inhaler technology paid for by their insurance provider in the future. "This is an important new pathway for digital health reimbursement," Van Sickle said.

A Revolution in Lung Disease Treatment

Smart inhaler technology may revolutionize the treatment of asthma and other lung diseases, and in the future, similar technology may also be useful for patients with other medical conditions. Amy Chan, PhD, student and researcher at Auckland University, said, "Reminders might be helpful for things like people taking regular medication, such as heart medications, or possibly with blood pressure medications or diabetic medications."

Van Sickle also believes this new technology can be used to treat other types of conditions. "Passively collected information, combined with patient-reported outcomes, will become increasingly important in clinically-integrated, financially-accountable care," Van Sickle said. "Digital health resets expectations for acceptable outcomes and provides individualized guidance to accomplish those goals."

Misra echoed a similar sentiment and said the technology should be readily transferable to other pulmonary diseases. However, the "benefit in other health conditions will be dependent on what the challenges are in the management of each condition as well as the availability of effective interventions," Misra added. "The technology should follow an understanding of the needs and challenges faced by patients with a particular health condition."

Juan Carlos Molina, director of external communications for GlaxoSmithKline (GSK), a multinational pharmaceutical company also working with biosensors and mobile health platforms, said GSK's work with this technology is currently helping the company better understand a number of disease areas.

"We continue to explore different device and platform technologies that may help to improve patient adherence and compliance with our medicines and inhalers, and smart inhalers are part of that effort," Molina said. "Wearable or remote biosensors and smart mobile health platforms provide the opportunity to get highly detailed and accurate



The user snaps the Propeller Sensor on the inhaler and it tracks usage

monitoring of a patient's physiology and behavior, information that may improve our understanding of asthma and COPD and a patient's response to medication."

With such a complex problem as medication nonadherence, management resources such as smart inhalers can help address part of the problem by supporting patients with tools to help the user manage their medication as well as their condition. **RT**

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References

1. Comstock, Jonah. "AstraZeneca Invests \$3M in NZ Smart Inhaler Maker Adherium." www.mobihealthnews.com. MobiHealthNews, 19 Aug. 2015. Web. 11 Sept. 2015.
2. Burgess SW, Wilson SS, Cooper DM, Sly PD, Devadason SG. In vitro evaluation of an asthma dosing device: the smart-inhaler. *Respir Med*. 2006;100(5):841-5.
3. Knutsen, Rebecca Mayer. "Mobile Technology Is Poised to Improve Respiratory Health Management." www.advanceweb.com. Advance Healthcare Network, n.d. Web. 11 Sept. 2015.
4. Misra, Satish, MD. "AstraZeneca Embracing Smart Inhalers for Asthma Tracking & Medication Adherence." www.imedicalapps.com. IMedicalApps, 21 Aug. 2015. Web. 11 Sept. 2015.
5. Nordqvist, Susie. "Smart Inhaler Means Never Forgetting." www.3news.co.nz. 3 News, 21 Jan. 2015. Web. 11 Sept. 2015.
6. Department of Health and Human Services: Centers for Medicare and Medicaid Services. "Chronic Care Management Services." May 2015. Accessed [here](#).