

## Original Article

# Effectiveness of Population Health Management Using the Propeller Health Asthma Platform: A Randomized Clinical Trial

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**What is already known about this topic?** Current guidelines recommend monitoring of short-acting  $\beta$ -agonist (SABA) use and assessment of asthma control. Excessive SABA use is an indicator of poor asthma control. Electronic monitoring of inhalers has been used primarily to monitor controller medications.

**What does this article add to our knowledge?** Real-time monitoring of SABA use improves patient and physician awareness of asthma symptoms and ability to identify potential triggers.

**How does this study impact current management guidelines?** Real-time telemonitoring of SABA use is another tool that can be added to existing asthma care to improve outcomes. Incorporating telehealth solutions has the potential to improve care delivery.

**BACKGROUND:** Telehealth strategies for asthma have focused primarily on adherence to controller medications.

Telemonitoring of short-acting  $\beta$ -agonist (SABA) focuses on patterns of use and may allow more timely action to avert exacerbations. Studies assessing this approach are lacking.

**OBJECTIVE:** This pragmatic controlled study was designed to measure real-world effectiveness of the Propeller Health Asthma Platform to reduce use of SABA and improve asthma control.

**METHODS:** A total of 495 patients were enrolled in parallel arms (1:1) for 12 months of monitoring SABA use. Intervention group (IG) patients received access to and feedback from the Propeller Health system. Routine care (RC) patients were outfitted with sensors but did not receive feedback. Physicians were able to monitor the status of their patients in the IG and receive proactive notifications.

**RESULTS:** The daily mean number of SABA uses per person decreased by 0.41 for the IG and by 0.31 for RC between the first week and the remainder of the study period ( $P < .001$  for the difference between groups). Similarly, the proportion of SABA-free days increased 21% for the IG and 17% for RC ( $P < .01$  for the difference between groups). Asthma Control Test (ACT) scores were not significantly different between arms in the entire study population, but adults with initially uncontrolled ACT scores showed a significantly larger improvement in the proportion with controlled asthma in IG versus RC (63% controlled in the study period vs 49%, respectively;  $P < .05$  comparing the 2 improvements).

**CONCLUSIONS:** Compared with RC, the study arm monitoring SABA use with the Propeller Health system significantly decreased SABA use, increased SABA-free days, and improved ACT scores (the latter among adults initially lacking asthma control). © 2015 American Academy of Allergy, Asthma & Immunology (J Allergy Clin Immunol Pract 2016; ■: ■-■)

**Key words:** Asthma; Telemedicine; SABA monitoring; Propeller Health

Asthma is a respiratory disease characterized by variable and recurring symptoms, airflow obstruction, bronchial hyper-responsiveness, and inflammation of the airways. In the United States, an estimated 24.6 million people (8.2%) currently have asthma.<sup>1</sup>

The National Asthma Education and Prevention Program (NAEPP) updated clinical guidelines for managing asthma in 2007.<sup>2</sup> Available evidence suggests that most people with asthma can be symptom free if they receive appropriate medical care, use inhaled corticosteroids when prescribed, and modify their environment to reduce or eliminate exposure to allergens and irritants.<sup>3</sup>

The current approach to asthma management includes monitoring symptoms, measuring lung function, encouraging

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*Abbreviations used**ACT*-Asthma Control Test*MMG*-Mercy Medical Group*NAEPP*-National Asthma Education and Prevention Program*RC*-Routine care*SABA*-Short-acting  $\beta$ -agonist*WHC*-Woodland Healthcare

use of medications that control and prevent symptoms, reducing the triggers of asthma, educating the patient, and maintaining a collaborative patient-provider relationship.<sup>2</sup> The 2 main goals of therapy are to minimize current impairment and future risk.

Despite evidence of efficacy in improving outcomes, there is extensive evidence that the NAEPP recommendations are not followed routinely.<sup>4,5</sup> Recent surveys show that more than 40% of both adults and children in the United States report uncontrolled asthma.<sup>6,7</sup> Explanations include not seeking medical attention appropriately, not receiving optimal care when seen, or both. The traditional approach to improving disease outcomes has been by one-on-one physician-patient interactions. Delivery of asthma care continues to be episodic and regular follow-up care, and disease management has been limited in many settings.

The American Thoracic Society guidelines recommend that providers monitor the frequency of short-acting  $\beta$ -agonist (SABA) use as a measure of asthma control.<sup>8</sup> In addition, Healthcare Effectiveness and Data and Information Set National Committee for Quality Assurance measures recommending monitoring medication use have shown improved outcomes.<sup>9</sup> Real-time asthma outreach decreases SABA use.<sup>10</sup> Monitoring SABA use can inform clinical decisions, guide medication adjustments, and identify patterns indicating deterioration in advance of exacerbations requiring acute medical attention. By using a secure, electronic dashboard, care teams can monitor the status of their patients and receive alerts about individuals who are decompensating, enabling earlier intervention. Previous patient reminder systems demonstrated increased patient medication adherence, but none have documented improved clinical outcomes.<sup>11</sup> Most current population health strategies have focused on asthma registries to identify patients with high levels of utilization.<sup>12</sup>

This randomized controlled study evaluated the effectiveness of the Propeller Health Platform for asthma management in a real-world outpatient clinic setting to assess the contribution to asthma control as measured by participants' SABA use and the Asthma Control Test (ACT).

## METHODS

Propeller Health incorporates a telehealth solution using an FDA-cleared sensor, mobile apps, predictive analytics, and feedback to help patients and providers better understand and control asthma and other respiratory disease.<sup>13,14</sup> The Propeller sensor objectively monitors use of inhaled medications, capturing date, time, and number of uses (Figure 1). Actuations that occurred within a 2-minute span were counted as a single event, with counts of events accumulated per day. The sensor transmits the information via Bluetooth to a paired smartphone, which records the location of the event and securely uploads these data to remote servers. The platform facilitates appropriate patient self-management by providing a data-driven assessment of asthma control and personalized

educational guidance based on observed morbidity and national guidelines.<sup>2</sup>

Participants were enrolled in parallel arms (1:1) on a rolling basis between April 2012 and June 2013 for 12 months of monitoring SABA use to factor for seasonal variations in asthma symptoms. Only intervention patients received access to and feedback from the electronic Propeller Health system. Data from intervention patients were accessible by authorized Dignity Health providers through a secure online dashboard and electronic notifications. Data from patients receiving routine care were not provided to patients or their health care providers.

The Dignity Health Institutional Review Board (IRB) reviewed and approved this study. The trial is registered at <http://clinicaltrials.gov/show/NCT01509183>.

## Study environment

Woodland Healthcare (WHC) and Mercy Medical Group (MMG) are 2 health units of Dignity Health located in Yolo and Sacramento Counties of California's Central Valley. The implementation of a population health model at both facilities coincided with the study. In addition, MMG introduced a pharmacy flag model alerting providers on patient request of a third SABA refill. Referral to the study was primarily through the Allergy Clinic at both locations.

## Measures

The primary endpoint was reduction in SABA use. SABA inhaler uses during the first week provided a baseline before any Propeller reports for individuals in the intervention group. For each participant on each day, we tracked the number of SABA inhaler uses. This information was used to classify each day as SABA free (ie, no SABA use) or not. Participants received the Propeller sensor at intake with instructions on how to attach the sensor on their SABA inhaler, sync the sensor to their communication device, and recharge the sensor. More than half (routine care 54.7%; intervention 57.2%) continued to monitor their SABA use for the full 365 days of the study, whereas 12.7% of participants (routine care 10.6%; intervention 14.8%) stopped monitoring within 1 month. Mean days of monitoring were 271 for the routine care group and 263 for the intervention group.

We also measured improvement in ACT scores and the proportion of individuals with controlled asthma. All participants took the ACT electronically during intake, and this score became the individual ACT baseline. Follow-up ACTs were completed at 4 months, 8 months, and exit. Chart audits provided 81 scores performed during office visits to replace missing values. The standard ACT has been validated for use with subjects at least 12 years of age,<sup>15</sup> and the Childhood Asthma Control Test has been validated for children between the ages of 4 and 11 years.<sup>16</sup> The Spanish language version of the ACT has also been validated.<sup>17</sup> For all versions of the ACT, higher scores are associated with greater asthma control.

Participant surveys addressed questions of how the information in Propeller was used, learning about asthma, and interaction with providers. Provider surveys asked providers with at least 1 patient in the intervention group to assess usefulness of the Propeller system and provide information on how the system was used.

Not all subjects were monitored for the entire 365-day term of the study, and this attrition both affected the extent of the intervention and resulted in monotonically missing SABA use data.

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