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 β-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 β-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 hyperresponsiveness, and inflammation of the airways. In the United States, an estimated 24.6 million people (8.2%) currently have asthma.[1]

The National Asthma Education and Prevention Program (NAEPP) updated clinical guidelines for managing asthma in 2007.[2] 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.[3]

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 β-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.[2] 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.[4,5] Recent surveys show that more than 40% of both adults and children in the United States report uncontrolled asthma.[6,7] 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 β-agonist (SABA) use as a measure of asthma control.[8] In addition, Healthcare Effectiveness and Data and Information Set National Committee for Quality Assurance. measures recommending monitoring medication use have shown improved outcomes.[9] Real-time asthma outreach decreases SABA use.[10] 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.[11] Most current population health strategies have focused on asthma registries to identify patients with high levels of utilization.[12]

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.[13,14] 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.[2]

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,[15] and the Childhood Asthma Control Test has been validated for children between the ages of 4 and 11 years.[16] The Spanish language version of the ACT has also been validated.[17] 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.

FIGURE 1. The Propeller Health sensor attaches to a metered-dose inhaler (MDI) canister, and pairs with smartphone and web applications that present visualized data and trends.

TABLE I. Participant characteristics at baseline

	Routine care	Intervention	Participants, $n_{routine}/n_{intervention}$
Mean age	36.0 y	36.6 y	245/250
Percent aged under 18 y	30.6%	29.6%	245/250
Percent male	42.9%	42.0%	245/250
Mean ACT score—adults	17.7	17.7	200/202
Percent with ACT score >19—adults	43.5%	46.7%	200/202
Mean ACT score—children	19.1	18.6	45/48
Percent with ACT score >19—children	48.9%	54.3%	45/48
Percent from Woodland Healthcare	54.7%	58.8%	235/238
Percent Spanish speaking	4.5%	4.4%	245/250
Percent Hispanic*	26.9%	18.8%	245/250
Percent White	43.7%	49.6%	245/250
Percent other ethnicity	16.7%	20.0%	245/250
Percent unknown ethnicity	12.7%	11.6%	245/250
Percent publically insured	33.1%	32.4%	245/250
Mean BMI	30.5	30.4	188/187
Percent "normal" blood pressure	47.0%	54.1%	219/222
Specialist encounters per 100 patients per year	169.8	129.0	235/238
ED visits per 100 patients per year	4.68	5.04	235/238
IP admissions per 100 patients per year	2.13	0.42	235/238
Mean length of stay for inpatient care in baseline	3.6 d	6.0 d	24/13
Mean utilization cost in baseline per patient per year	$808.34	$572.58	228/218

ACT, Asthma Control Test; *BMI*, body mass index; *ED*, emergency department; *IP*, inpatient.
*$P < .05$.

TABLE II. Numbers of participants beginning and completing monitoring by age, initial asthma control, and study arm

Age	Initial asthma control	Study arm	Started monitoring (n)	Completed monitoring (n)	Completed monitoring (%)
Adult	Uncontrolled	Routine care	102	55	54%
Adult	Uncontrolled	Intervention	97	55	57%
Child	Uncontrolled	Routine care	34	18	53%
Child	Uncontrolled	Intervention	31	15	48%
Adult	Controlled	Routine care	73	37	51%
Adult	Controlled	Intervention	78	52	67%
Child	Controlled	Routine care	36	24	67%
Child	Controlled	Intervention	40	19	47%

Initial asthma control as determined by the Asthma Control Test.
No significant differences were seen between strata, using logistic regression to model completion in each stratum.

Statistical tests

The success of randomization was assessed by comparing baseline characteristics of both study groups using independent samples *t*-tests or Wilcoxon Mann-Whitney tests for continuous variables and χ^2 tests for categorical variables. There was no blinding on arm assignment.

Differences between subgroups in the proportion of participants completing 365 days of monitoring were assessed using logistic regression with completion as the outcome, and separate coefficients for each of the 8 subgroups by age (adult and/or child), initial asthma control (uncontrolled and/or controlled), and study arm (intervention and/or routine care).

Mixed-effects regression models[18] with random intercepts and exchangeable variance-covariance were used to allow a complete analysis of all of the available longitudinal data and maximize statistical power. In addition, mixed-effects models provide valid statistical inferences in the presence of missing data that can be explained by covariates in the regression model (ie, time and study arm). Poisson models were used for counts of SABA use, binomial models for SABA-free days and controlled asthma (ie, ACT > 19), and linear models for average ACTs. All models included the study arm, time (ie, baseline vs study period), and the interaction of time by the study arm. The latter interaction term is the coefficient of primary scientific interest, as recommended for analysis of longitudinal clinical trials.[19]

For example, for daily SABA use the following model was fitted:

$$\log\left(E\left(Y_{ij}\right)\right) = \beta_0 + \beta_1 * S_{ij} + \beta_2 * T_{ij} + \beta_3 * \left(S_{ij} * T_{ij}\right) + \mu_j,$$

where $E(Y_{ij})$ denotes the expected value of the ith daily observation of the outcome for individual j, S_{ij} is a binary indicator for the study arm, T_{ij} is a binary indicator for the study time (where 0 indicates the week 1 baseline period, and 1 indicates the week 2-52 study period), and μ_j is the individual-specific random intercept. The same parameterization was used in the logistic model for SABA-free days.

For ACT scores, a similar model was fitted, with the only difference that the values of T_{ij} were 0 for the ACTs from visit 1 (baseline), and 1 for visits 2-4 (study period).

Covariates were included in sensitivity analyses to determine the effects of specialist care, treatment site, and a targeted pharmacy initiative at MMG. All analyses were performed using Microsoft Excel and R.[20] The ggplot2 R package was used for plotting.[21] The

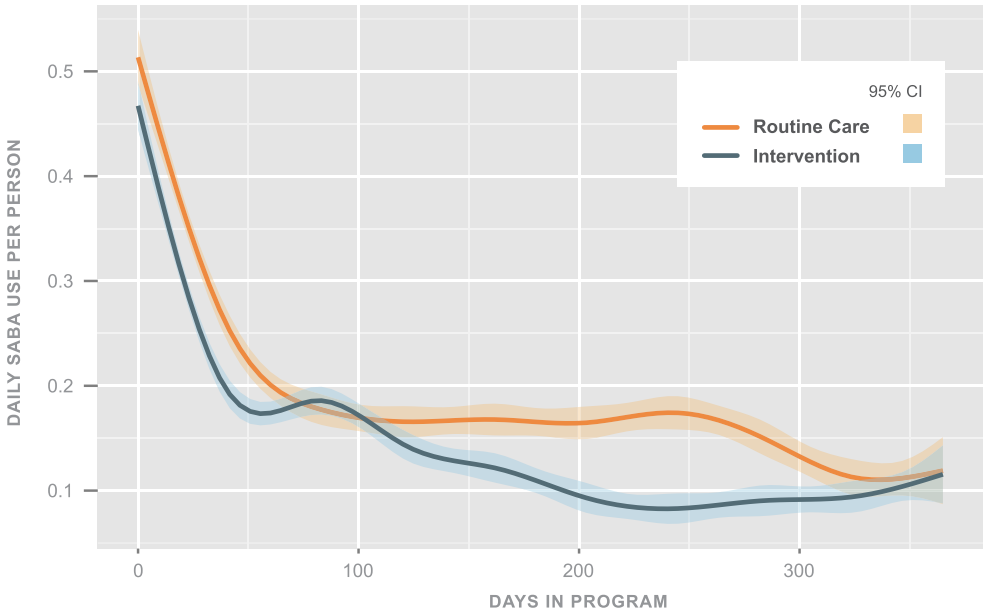

FIGURE 2. All participants: mean daily short-acting β-agonist (SABA) use per person.

TABLE III. Mean daily SABA use

	Study arm	n	Mean daily SABA use per person, baseline period	Mean daily SABA use per person, study period	Change from baseline to study period	*P* value comparing change in routine care vs intervention	
Whole population	Routine care	245	0.50	0.19	−0.31		
	Intervention	250	0.55	0.14	−0.41	<.001	***
Initially uncontrolled	Routine care	136	0.71	0.25	−0.46		
	Intervention	128	0.79	0.19	−0.60	<.001	***
Adults, initially uncontrolled	Routine care	113	0.78	0.27	−0.51		
	Intervention	106	0.81	0.19	−0.62	.004	**
Children, initially uncontrolled	Routine care	23	0.34	0.13	−0.21		
	Intervention	22	0.70	0.17	−0.53	.02	*
Initially controlled	Routine care	109	0.24	0.11	−0.13		
	Intervention	118	0.27	0.09	−0.18	.002	**
Adults, initially controlled	Routine care	87	0.22	0.10	−0.12		
	Intervention	93	0.25	0.09	−0.16	.001	**
Children, initially controlled	Routine care	22	0.33	0.13	−0.20		
	Intervention	25	0.33	0.08	−0.25	.57	

SABA, Short-acting β-agonist.
Initial asthma control as determined by the Asthma Control Test.
Baseline period is study week 1. Study period is study weeks 2-52.
The *P* value comparing change in routine care vs intervention corresponds to the time by study arm coefficient of a mixed-effects Poisson regression.
*$P < .05$.
**$P < .01$.
***$P < .001$.

lme4[22] and lmerTest[23] packages were used for random effect modeling. A 2-tailed significance level of .05 was used.

RESULTS

The study recruited 495 participants from the WHC and MMG units of Dignity Health between April 2012 and June 2013. Recruitment began with an invitation letter sent to individuals using an asthma registry and through community outreach efforts. This approach was slow to yield participants and recruitment switched to referral from providers, usually specialists, after 4 months. Inclusion criteria included a current diagnosis of asthma and a minimum age of 5 years. Patients with significant comorbidities (eg, chronic obstructive pulmonary disease) were excluded: this was fewer than 25 individuals.

Participants were assigned to intervention or routine care arms using a Taves Adaptive Covariate Randomization

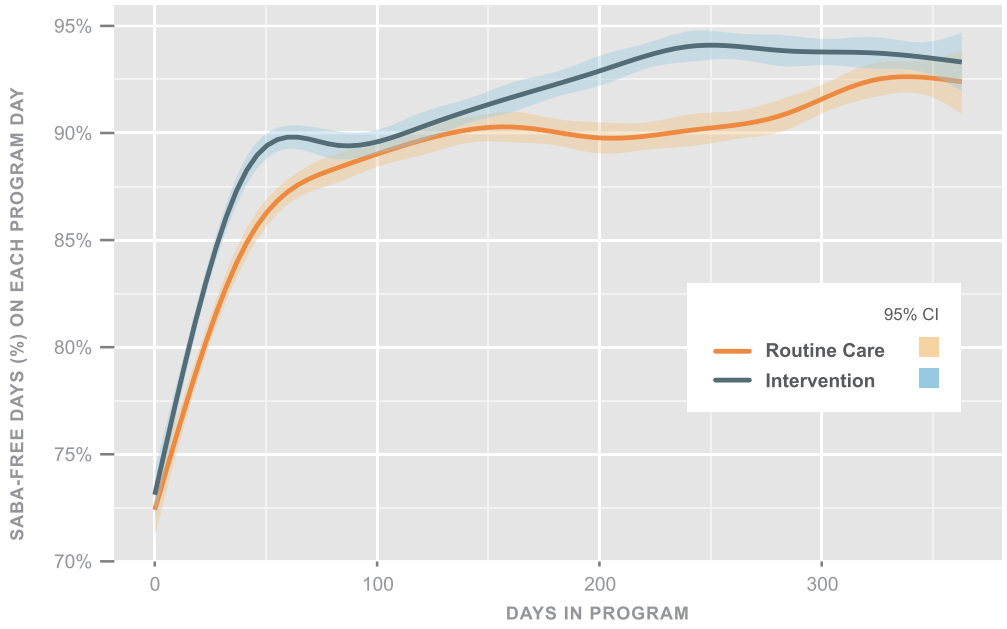

FIGURE 3. All participants: short-acting β-agonist (SABA)-free days.

TABLE IV. SABA-free days

	Study arm	n	Mean percentage of SABA-free days, baseline period	Mean percentage of SABA-free days, study period	Change from baseline to study period	*P* value comparing changes in intervention vs routine care	
Whole population	Routine care	245	72%	89%	+17%		
	Intervention	250	70%	91%	+21%	.002	**
Initially uncontrolled	Routine care	136	63%	86%	+23%		
	Intervention	128	60%	88%	+28%	.02	*
Adults, initially uncontrolled	Routine care	113	60%	84%	+24%		
	Intervention	106	58%	88%	+30%	.07	
Children, initially uncontrolled	Routine care	23	79%	91%	+12%		
	Intervention	22	71%	90%	+19%	.50	
Initially controlled	Routine care	109	83%	93%	+10%		
	Intervention	118	82%	94%	+12%	.02	*
Adults, initially controlled	Routine care	87	83%	93%	+10%		
	Intervention	93	83%	94%	+11%	.12	
Children, initially controlled	Routine care	22	84%	91%	+7%		
	Intervention	25	78%	91%	+13%	.09	

SABA, Short-acting β-agonist.
Initial asthma control as determined by the Asthma Control Test.
Baseline period is study week 1. Study period is weeks 2-52.
The *P* value comparing change in routine care vs intervention corresponds to the time by study arm coefficient of a mixed-effects logistic regression.
*$P < .05$.
**$P < .01$.

Technique[24] with 3 stratification factors: age (adult and/or child), insurance status (public and/or private), and baseline ACT score (>19, ≤19). Baseline characteristics are summarized in Table I. The routine care arm had a significantly higher proportion of participants identified as Hispanic ($P = .031$), but no other significant differences between the arms at baseline were found.

ACT scores for both the baseline visit and at least 1 follow-up visit were provided by 81.0% of participants, and 38.1% completed all 4 ACTs. Table II shows numbers of participants beginning and completing 365 days of monitoring by age, initial control, and study arm. No significant differences in completion were seen between subgroups. Consent was withdrawn by 47 participants (20 routine care; 27 intervention group).

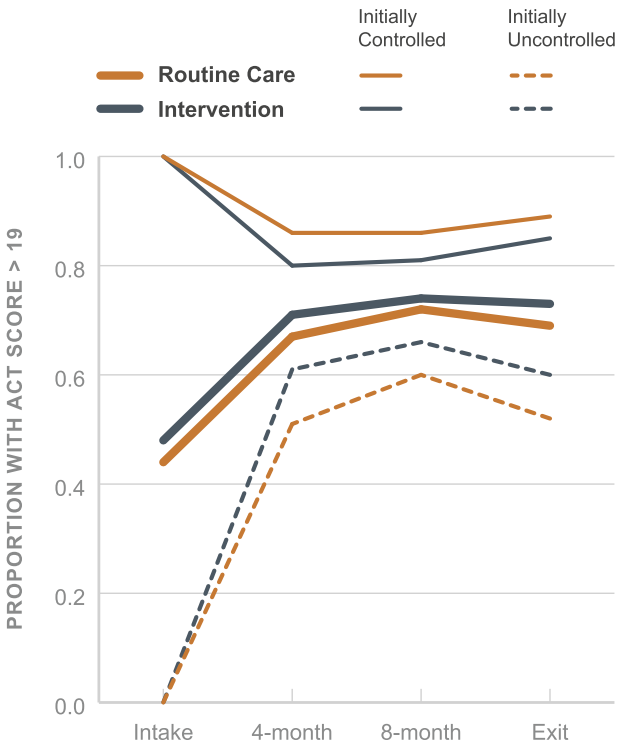

FIGURE 4. All participants: proportions with Asthma Control Test (ACT) score > 19.

The intervention group recorded 18.5% fewer SABA uses over the study year than the usual care group (10,208 vs 12,523, respectively), as well as 14.9% fewer days with SABA usage (6508 vs 7651) over a similar number of days of observation (65,570 vs 66,169).

Mean SABA use

In analyses of the entire study population, although patients in the routine care group had a substantial improvement (ie, decreases) in daily SABA use between the first study week and the remainder of the study period (Figure 2; Table III), there was a significantly larger improvement in the intervention group (respectively −0.31 vs −0.41 average SABA uses per person per day; $P < .001$ comparing the 2 decreases; Table III). In week 52, average daily SABA use was 0.12 in the routine care group and 0.09 in the intervention group.

In subgroup analyses (Table III), the intervention group improved significantly more than the routine care group among the following types of patients: initially uncontrolled (adults + children), initially uncontrolled adults, initially uncontrolled children, initially controlled (adults + children), and initially controlled adults.

SABA-free days

In analyses of the entire study population, although patients in the routine care group had a substantial improvement in their proportion of SABA-free days between the first study week and the remainder of the study period (Figure 3; Table IV), there was a significantly larger improvement in the intervention group (respectively +17% vs +21%; $P < .01$ comparing the 2 improvements; Table IV). In week 52, proportion of SABA-free days was 92% in the routine care group and 94% in the intervention group (Figure 3).

In subgroup analyses (Table IV), significantly larger improvements in the intervention group versus routine care were seen in both subgroups after stratifying participants into initially uncontrolled and initially controlled.

Proportions with ACT score > 19

In analyses of the entire study population, similar improvements were seen among patients in the routine care group and intervention group for the proportion of participants with controlled ACT scores (+25 and +24%, respectively, $P = .84$; Figure 4; Table V). At visit 4, the percentage of controlled participants with an ACT > 19 was 69% in the routine care group and 73% in the intervention group (Figure 4).

In subgroup analyses, among initially uncontrolled adults, there was a significantly larger improvement in the intervention group versus routine care (respectively +63% controlled in the study period vs +49%; $P < .05$ comparing the 2 improvements; Figure 5; Table V).

ACT scores

ACT scores were compared separately for adults and children, because different ACT scales are used for each (Figure 5, Table VI). Among initially uncontrolled adults, there was a significantly larger improvement in the intervention group versus routine care (+6.2 and +4.6, respectively, $P < .01$ comparing the 2 improvements; Table VI).

Covariate-adjusted regression models

All results comparing the study arms were unchanged after inclusion of covariates in the mixed-effects regressions.

Exit surveys

Exit surveys were received from 256 (51.7%) participants and 12 Dignity providers. Survey responses showed that 59% of intervention group participants reported learning about new triggers for their asthma. Overall, 86% of adults and 84% of children in the study found Propeller reports useful in learning more about their asthma.

DISCUSSION

Asthma prevalence and costs continue to rise nationally, increasing the importance of tools for improving quality and efficiency. The Propeller Asthma Management Platform provides reports and web-dashboards that display data on frequency, timing, and location of SABA inhaler use to patients and their providers. E-mail notifications or text messages alert individuals and physicians about changes in asthma control based on albuterol use. By receiving alerts and monitoring the reports and web-dashboards, providers are better equipped to identify individuals having acute symptoms and/or persistently uncontrolled symptoms, allowing for earlier changes in asthma treatment or intervention.

The Propeller intervention was implemented for adults and children aged 5 and above, with and without initial asthma control, English and Spanish speaking, and both privately and publically insured. Within this diverse population, SABA use and SABA-free days were significantly improved compared with routine care. Asthma control improved consistent with a decrease in SABA use. Adults who began the study without asthma

TABLE V. Percentage of participants with controlled asthma

	Study arm	N	Percentage with controlled asthma, baseline period	Percentage with controlled asthma, study period	Change from baseline to study period	*P* value comparing changes in intervention vs routine care	
Whole population	Routine care	245	44%	69%	+25%		
	Intervention	250	48%	72%	+24%	.84	
Initially uncontrolled	Routine care	136	0%	54%	+54%		
	Intervention	128	0%	62%	+62%	.13	
Adults, initially uncontrolled	Routine care	113	0%	49%	+49%		
	Intervention	106	0%	63%	+63%	.02	*
Children, initially uncontrolled	Routine care	23	0%	71%	+71%		
	Intervention	22	0%	59%	+59%	.32	
Initially controlled	Routine care	109	100%	87%	−13%		
	Intervention	118	100%	82%	−18%	.24	
Adults, initially controlled	Routine care	87	100%	86%	−14%		
	Intervention	93	100%	83%	−17%	.52	
Children, initially controlled	Routine care	22	100%	89%	−11%		
	Intervention	25	100%	77%	−23%	.10	

Asthma control as determined by the Asthma Control Test.
Baseline period is visit 1 (enrollment). Study period is visits 2-4.
The *P* value comparing change in routine care vs intervention corresponds to the time by study arm coefficient of a mixed-effects logistic regression.
*$P < .05$.

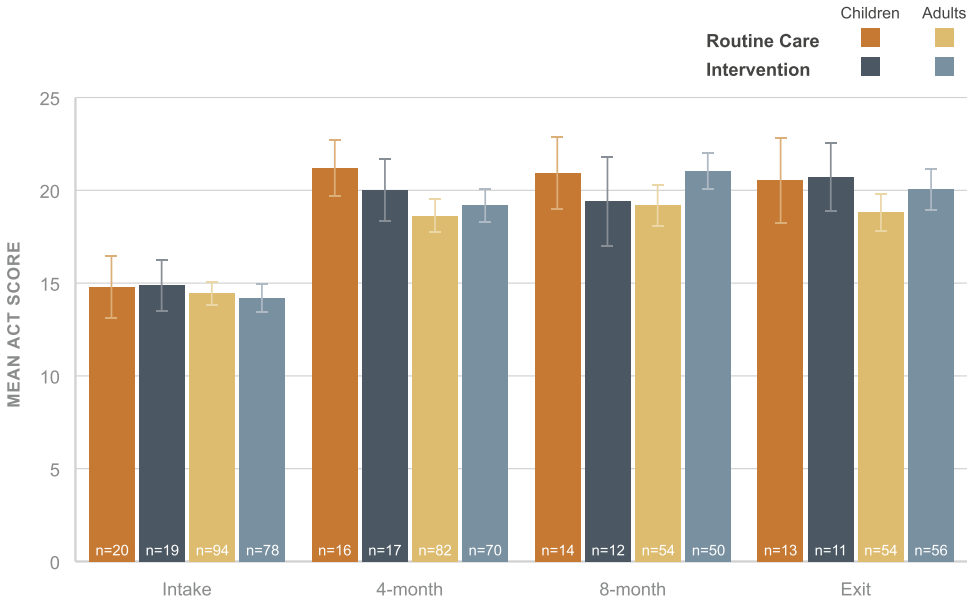

FIGURE 5. Mean ACT scores for adults and children with initially uncontrolled ACTs.

control and were receiving the Propeller intervention had significantly greater improvement compared with routine care.

Limitations

The Propeller Asthma Management Platform was just one of multiple coincident efforts to improve asthma care, including implementation of an asthma registry, emphasis on ACT testing, monitoring of SABA refills, and referral to specialty care. All patients in the study continued to receive routine care by their physicians, and were seen to receive higher levels of outpatient care compared with national averages. In addition, electronic monitoring cannot be divorced from the Hawthorne effect[25] as routine-care-group subjects may have changed their health behaviors as a result of being in an unblinded study using

TABLE VI. ACT scores

	Study arm	n	Mean ACT score, baseline period	Mean ACT score, study period	Change from baseline to study period	*P* value comparing changes in intervention vs routine care
Adults, initially uncontrolled	Routine care	113	14.2	18.8	+4.6	
	Intervention	106	13.8	20.0	+6.2	.009 *
Children, initially uncontrolled	Routine care	23	15.0	21.0	+6.0	
	Intervention	22	15.1	20.0	+4.9	.40
Adults, initially controlled	Routine care	87	22.2	21.9	−0.3	
	Intervention	93	22.1	22.2	+0.1	.45
Children, initially controlled	Routine care	22	23.3	22.7	−0.6	
	Intervention	25	21.6	21.4	−0.2	.71

ACT, Asthma Control Test.
Initial asthma control as determined by ACT.
Baseline period is visit 1 (enrollment). Study period is visits 2-4.
The *P* value comparing change in routine care vs intervention corresponds to the time by study arm coefficient of a mixed-effects linear regression.
Results shown only separately for adults and children, due to different ACT scales for each.
*$P < .01$.

a monitoring device. These factors may explain the reduction of SABA use and subsequent improvement in asthma control for the routine care group. However, statistically significantly greater improvements were seen for the intervention group relative to the control group, and this effect was unchanged by adjustment for the coincident efforts to improve asthma care in multivariable regression. The study did not track controller medications, so proportions with prescriptions for controller medications, controller medication adherence, and education about controller medication use were not measured during the study.

In addition, there was a learning curve for providers as they began to use the Propeller Health information in the absence of predeveloped protocols. The physician dashboard for remote monitoring may have been underutilized because it was not incorporated within the Dignity Health EMR system. Children in the study received reports and feedback in the same format as did adults. These factors may have limited the benefit in the intervention group.

Finally, attrition was higher than expected in both arms. Propeller technology deployed early in the study had limited battery life and syncing challenges that may have limited the potential benefit of monitoring. We also believe that patients may have become less diligent regarding sensor maintenance as their asthma control improved. Additional features and enhancements released since this trial began include extending battery life, monitoring controller medication adherence, and increasing capability for parents to track children's medication use.

Interpretation

The Propeller Asthma Management system was launched in 2010, providing a new tool to improve asthma care. Real-time data on SABA use deliver information allowing patients and providers to identify triggers and incipient exacerbations, and to determine if management plans are working. Research on the system is limited, but studies have shown decreases in SABA use associated with the Propeller system.[13,14]

Decreases in SABA use were observed immediately in this study, with both intervention and routine care participants seeing reductions by the second week and corresponding increases in the proportion of SABA-free days, with continued reduction in SABA use throughout the study. The improvements for the routine care group were not anticipated, but may have been the result of a variety of factors including the implementation of a population health model and increased ACT testing. Recruitment based on provider referral may also have resulted in attracting participants who were near the beginning of an increasing level of care, and the average participant had more than 1.6 specialist encounters during the study period. These factors would have affected both the intervention and routine care groups, but participants receiving the Propeller intervention had significantly greater gains in mean SABA use and the proportion of SABA-free days.

Electronic monitoring of inhaler use has been found to yield more accurate information than does self-reporting,[26] and the Propeller Health system delivers this information in real time. The availability of accurate information on SABA use has implications for treatment burden, clinician prescribing practices, and cost. Informal feedback from primary care providers indicated that Propeller information was used to identify patients to refer to specialists for more intense management, and this type of stratification evolved as a valuable use of the system. As the study progressed, providers found that they were able to use Propeller information to track patient progress without the need for office visits as long as patients maintained their sensors. Combining this system with monitoring of controller medication adherence may improve asthma control further.

CONCLUSIONS

The Propeller Health Asthma Platform provides a comprehensive tool for monitoring and feedback. Patients using this tool had greater improvement in SABA-free days and greater reductions in SABA use than did patients in the routine care arm, whereas adults with initially uncontrolled asthma using this tool had greater improvements in ACT scores. We believe that there is potential for improved care and efficiency to be delivered via telehealth.

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