Original Research
Phone-Based Teach-To-Goal Inhaler Education Program for Medicare Advantage Beneficiaries With COPD

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Running Head: Medicare Advantage Inhaler Education Intervention

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Abbreviations: Chronic Obstructive Lung/Pulmonary Disease (COPD); Health Maintenance Organization (HMO); Medicare Advantage (MA); Metered-Dose Inhaler (MDI); Percentage Points (PP); Preferred Provider Organization (PPO); Standard Deviation (s.d); Teach-to-Goal (TTG); Value-Based Insurance Design (VBID)

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ABSTRACT

Background: Individuals with chronic obstructive lung disease (COPD) rely on inhaler-based medications to treat and control symptoms. Most patients do not use correct technique. Teach-to-goal (TTG) inhaler education programs have been found to improve inhaler technique. There is limited understanding as to whether TTG inhaler education is effective when delivered over the phone.

Research Question: What was the effect of a phone-based TTG inhaler technique education program among Medicare Advantage beneficiaries with COPD?

Study Design and Methods: Beneficiaries with a diagnosis of COPD within the prior two years, who had filled at least one maintenance inhaler at least once in the prior year, had a VBID plan, and received the inhaler education component of the COPD intervention program were evaluated. Inhaler technique was measured by validated checklists; patients self-reported technique.

Results: Of 1876 patients analyzed, n=13 used more than one inhaler. At the initial assessment, 39.4% of participants were using their inhalers incorrectly. By the end of the first education session, the percentage of participants that were using their inhaler incorrectly decreased to 6.9%.

Interpretation: A phone-based TTG inhaler education program offered by a large national health plan demonstrated improvements in inhaler technique across different inhaler devices and sub-populations. The multiple-session approach was likely critical for longer-term retention of correct technique, though further study is needed to confirm this. Some sub-group populations are also at greater risk for baseline inhaler misuse and/or post-training inhaler misuse indicating a need for further evaluation of how to tailor inhaler education by individuals' needs.

BACKGROUND

Individuals with chronic obstructive lung disease (COPD) often rely on medications to treat and control symptoms delivered through respiratory inhaler devices.[1] While the medications are efficacious when delivered to the lung, the majority of patients do not use correct technique,[2–11] limiting real-world effectiveness.[12] There are numerous types of devices that require different numbers and types of steps, which is further complicated when patients are prescribed more than one inhaler device.[10,12–14]

To address inhaler misuse, clinical guidelines recommend assessing and teaching inhaler education at all healthcare encounters.[1] However, patients often do not receive inhaler education or receive inadequate instruction due to lack of clinician knowledge, time, or use of ineffective strategies in clinical settings.[12,15] Consequences of inhaler misuse and inadequate adherence include decreased symptom control, increased risk of exacerbations, increased acute care utilization and even death.[10–12,16,17] Opportunities to provide education outside of traditional clinical settings could increase delivery of guideline-recommended care and improve outcomes for individuals with COPD.

One innovative approach is to incorporate educational sessions through an insurance-based program. The Centers for Medicare and Medicaid Services offered value-based insurance design (VBID) programs that allowed health plans to offer innovative benefits.[18] In 2020, Humana introduced a VBID program for their Medicare Advantage (MA) members with COPD.[19] The program was comprised of a medication management program including a phone-based adaptation of the 'teach-to-goal' (TTG) inhaler education approach and cost-mitigation through reduced cost sharing for maintenance inhalers.[19] The TTG method is an educational strategy to

teach correct inhaler technique using the teach-back approach.[2,3] The method begins with the patient demonstrating their inhaler use and followed by the educator iteratively correcting their technique through rounds of demonstration and verbal instruction paired with patients' 'teachback' until correct inhaler technique is demonstrated.[4] The TTG approach has been shown to be more effective in improving inhaler technique compared to less intensive intervention strategies such as a single-set of verbal and written step-by-step instructions.[5] This is in part due to the "testing effect,"—a cognitive psychology phenomenon whereby memory is enhanced through the act of retrieving information while learning.[20] Teachback, the primary technique used in the TTG method, has been endorsed as a patient safety standard by the National Quality Forum for informed consent.[21] More recently, teachback is now recommended for inhaler teaching in the COPD clinical guidelines.[13,22]

In this study we evaluated the effectiveness of the VBID program's phone-based TTG inhaler education on inhaler technique during the program's first year.

STUDY DESIGN AND METHODS

Overview of the VBID Program

Humana's VBID program was available to all eligible MA beneficiaries with COPD on participating plans, though some beneficiaries were randomly selected for invitation to enroll in the program.[19] Beneficiaries were eligible for the program if they had a diagnosis of COPD in the prior two years, had filled at least one inhaler (short-acting or maintenance) at least once in the prior year, had a VBID plan, and had low medication adherence (<80%). Patients were excluded from the program if enrolled in Medicare Part D Low-Income Subsidy program, were in the coverage gap phase of their drug plan, on hospice, had end-stage renal disease, or obtained

their primary care at certain Humana subsidiary locations. Patients were included in the program but excluded from analysis when beneficiaries were contractually obligated to be excluded from research, were not continuously enrolled 6 months pre- and 3 months post-program, and/or if there were missing data. Below, we provided a brief overview of the VBID medication management portion of the program; additional enrollment, randomization, and cost-sharing reduction information is available in Agarwal 2024.[19]

Medication management intervention

Enrollees received up to three telephone calls from Humana pharmacists for medication management. During the first call, the pharmacist checked eligibility, explained the program, assessed the enrollee's overall treatment plan and gaps in management, and relayed refill needs to the prescriber including connecting them to a pharmacy if requested. If the enrollee already had access to their inhaler at the time of the initial call, the Humana pharmacist administered TTG education. Otherwise, the Humana pharmacist would schedule a later call to administer the first TTG education session after the enrollee received their inhaler. All enrollees would receive a second TTG education session at least 60 days after their first education session.

Teach-to-Goal (TTG) inhaler education

The TTG education sessions were provided over the phone by Humana-employed pharmacists trained in TTG methodology. An initial 'train the trainer' training session occurred in December 2019. The TTG method breaks down the technique for each inhaler into a standardized checklist of 10–17 separate steps, depending on the inhaler [see **e-Figure 1** in Supplemental Material].

The traditional 'in-person' TTG approach was adapted to a phone-based approach for this program to facilitate broad-scale dissemination. Humana's telephonic adaptation of TTG adhered to the following order of events for each inhaler the beneficiary used: 1) pharmacist assessed the beneficiary's inhaler technique pre-education by requesting the client verbally report the steps they would take to use the inhaler; 2) pharmacist provided verbal step-by-step inhaler-specific instruction; 3) pharmacist re-assessed the beneficiary's inhaler technique after the first training by requesting the beneficiary to describe each step of using their inhaler again (post-training 1 assessment); 4) pharmacist provided verbal inhaler instructions again if needed; 5) if instruction was repeated, the pharmacist conducts another assessment of the beneficiary's inhaler use by having the beneficiary report the steps they would take to use their inhaler (post-training 2 assessment). All these steps were completed in a single education session (i.e., one phone call). All program participants received two education sessions (two phone calls) [**Figure 1**].[7]

Data Collection and Outcomes

The TTG pharmacists recorded program participation, inhaler types, assessment scores and dates in a single documentation tool, RxConsult. For each education session we had one pretraining score and the beneficiary's highest post training assessment score. We utilized assessment scores to construct the primary and secondary outcomes. Participant's age, sex, race, dual-eligibility status, eligibility for the Medicare Part D Low-Income Subsidy, primary residence (for classifying participants' US census geographic region and ZIP-code level population density) and plan type were obtained from Medicare administration data. We constructed comorbidity data using medical claims.

The primary outcome was the difference in the percentage of participants misusing their inhaler(s) before and after the first inhaler education session (session one pre-training assessment score minus session one post-training assessment score). We classified misuse as conducting less than 75% of steps correctly, as done in prior TTG studies.[3–9] "Overall misuse" was evaluated at the member-inhaler level and hence averaged.

A secondary outcome was the difference in the percentage of participants misusing their inhaler(s) before the first inhaler education session and before the second education session. This measure told us the extent to which the inhaler education information was retained between visits. We also calculated the average number of steps conducted correctly.

Regarding enrollee characteristics, we constructed the following demographic variables for each participant: age (categorical: younger than 65, 65–69, 70–74, 75–79, and 80 or older); sex (binary); race (White, Black, other, and unknown); U.S. census region of enrollee's residence (Northeast, Midwest, South, and East); whether the enrollee's residence ZIP code was in an urban, suburban, or rural area based on Rural-Urban Continuum Codes; enrollee's health insurance plan type (Health Maintenance Organization [HMO], Preferred Provider Organization [PPO], or other) and enrollee's eligibility for Medicaid or the Medicare Part D Low-Income Subsidy. These characteristics were measured as of the date of the participant's second assessment. Participants' clinical characteristics were constructed using medical claims in the six months before their first education assessment and measured using the Charlson comorbidity index.

Finally, we obtained COPD Assessment Test (CAT) data for patients at both educational sessions.

Statistical Analysis

The analysis included 1,876 of the 2,440 education program participants. Participants were excluded if they were missing education session dates and scores, had non-logical assessment scores suggestive of assessor error in inputting the data (e.g., scores greater than 100%), or were contractually required to be omitted from research (see **e-Table 1** in Supplemental Material). We also required participants to have been continuously enrolled in the medical plan for six months before and three months after their second assessment to ensure we could measure utilization before and after the program.

We identified the proportion of participants with assessment scores indicating inhaler misuse. We calculated the difference in proportions between assessments and identified statistical significance using two-way t-tests. Statistical significance was determined by P-values < 0.05.

We performed subgroup analyses to estimate whether there were differences in outcomes by age, race (white and non-white), medical plan type (HMO and PPO), and number of comorbidities.

We conducted a sensitivity analysis to address concerns regarding data quality. There was evidence that a data recording issue may have caused a non-trivial proportion of post-training assessment scores to override pretraining assessment scores. The sensitivity analysis replaced the pretraining scores from the first session with the pretraining scores from the second session. Our rationale for this approach is that the pretraining scores from the second session were either similar or better than the true pretraining scores of the first session but likely smaller than the

first session's post-training scores. Prior studies where follow-up assessment occurred showed that significant improvements in technique found immediately after the first educational session were no longer present within a month.[4,5]

Analyses were performed using SAS Enterprise Guide, version 8.3. This study was granted exemption from an Institutional Review Board review by the Humana Healthcare Research Human Subject Protection Office.

RESULTS

Enrollee Characteristics

Of 1876 unique participants eligible for inclusion in the analysis between January 1 and December 31, 2020, 68% (n=1276) were targeted for enrollment and received program outreach, while 32% (n=600) self-enrolled in the TTG program. Of 1876 patients enrolled, 13 (<1%) used more than one inhaler (n=1889 inhaler evaluations). Of 1876 patients analyzed, 13 (<1%) used more than one inhaler (n=1889 inhaler evaluations). The mean age was 73 years, most were women (56%), White (87%), living in the South (75%), and in urban (76%) settings. Most participants were in HMO plans (82%). Participants had on average (mean) 1.65 comorbidities, with the most common comorbidities other than COPD being peripheral vascular disease (14%) and renal disease (13%). The most common inhaler type was Ellipta (52%) [**Table 1**].

Inhaler Technique

At the initial assessment, 39.4% of participants were using their inhalers incorrectly [**Table 2**]. This varied by inhaler type, with several inhaler device types being misused by about half of participants: MDI (49.2%), Handihaler (52.2%), or Respimat inhalers (52.2%). By the end of the first education session, the percentage of participants that were using their inhaler incorrectly decreased from 39.4% to 6.9%, with the largest improvements occurring among the MDI (6.8%), Handihaler (4.3%), and Respimat inhalers (7.0%) (Table 2).

Comparing the pretraining scores from the first and second education sessions (the two sessions were about 60 days apart), there was a moderate decrease in inhaler misuse over time. For example, there was an overall decrease in the percentage of participants misusing their inhaler of about 3.8 percentage points, from 39.4% at the first session to 35.6% at the second session. There were notable reductions in misuse among Handihaler (52.2% to 41.3%), Diskus (39.4% to 27.1%), and MDI (49.2% to 38.1%) inhaler users with reductions of ten percentage points or more between the first and second session, though only MDI saw significant differences between the first and second session [**Table 2**].

Analyses of the average assessment scores showed similar results. The average initial assessment score was 75.7 out of 100, increasing to 90.9 at the end of the first session and 93.1 at the end of the second session [see **e-Table 2** in Supplemental Material].

With regard to subgroups, while misuse significantly decreased across all subgroups post versus pre-training, some subgroups had higher baseline misuse and/or had greater decreases in misuse (**Table 3**). For instance, inhaler misuse was greater among younger beneficiaries (44.1%)

compared to older beneficiaries (38.8%) misused pretraining, but lower post-training (6.6% vs. 7.0%, respectively). White beneficiaries had lower inhaler misuse pre- and post-training compared to non-white beneficiaries (37.9 vs. 49.4; 6.6 vs. 9.5%). Differences were not seen among those with low or high levels of comorbidities pre- or post-training.

Sensitivity analysis

Results of the sensitivity analysis were similar to those from the primary analysis (**Table 4**). After replacing the pretraining assessment scores from session one with the pretraining assessment scores from session two, the percentage of participants misusing their inhalers decreased slightly. The improvement in inhaler use between the pre- and post-scores during session one also decreased slightly, as expected, due to the pre-scores at the second session being higher than the initial assessment scores.

DISCUSSION

We found that patients improved their inhaler technique across all inhaler types through the two-session phone-based TTG inhaler education program. Importantly, the second education session was likely critical for longer term technique since initial improvements in inhaler technique seen after the first education session were not consistently maintained prior to the second session. Additionally, some sub-groups had higher levels of baseline inhaler misuse, though all subgroups showed decreased misuse post-education. These findings further support the use of TTG inhaler education which now aligns with more recent COPD guidelines that suggest the use of 'teach-back' as an effective strategy.[1,13,22]

It is notable that this phone adaptation of a traditionally in-person TTG educational strategy was still effective, despite lack of visualization by the educator or the beneficiary. Without visualization by the educator of the beneficiaries' baseline or post-training inhaler technique, it is possible that they provided correct actions without being able to conduct the steps correctly. Importantly, a direct-to-patient adaptative learning module called 'virtual' TTG that does not have a live educator, but rather the individual uses a learning module to test their knowledge and learn correct technique,[6,27] has been shown to be non-inferior to in-person TTG.[7] Future non-inferiority studies are needed to test in-person TTG compared to phone-based TTG to determine whether phone-based TTG is as robust and effective as TTG for improving visualized inhaler technique and clinical outcomes. If phone-based TTG is as effective this could allow for clinicians, health systems, and health plans to scale this approach to a larger group of individuals with COPD.

With respect to overall levels of misuse, the proportion of patients misusing inhalers decreased significantly between the pretraining and post-training assessments within the first session from one-third to one-half misusing to less than 10% for all inhalers. These results validate previous findings that after a single TTG educational session, inhaler misuse decreases for most individuals.[5,8,9] Also notable was the need for a second educational session due to levels of misuse rising again across inhaler types between the first and second sessions. While the precise level of "dosing" or number of educational sessions needed for long-term effectiveness is unknown, even one session has been found to reduce short-term acute care utilization,[4,5] and multiple sessions have been found to improve adherence,[9,19] quality of life,[9] and self-efficacy,[9] in addition to inhaler technique.[8,9]

Importantly, while improvements were seen across devices, not all inhalers had the same degree of effectiveness with TTG. We observed heterogeneous outcomes with Handihaler, MDI and Respimat inhaler users demonstrating the most significant improvements. These groups experienced nearly 50 percentage point reductions in the proportion of misusers between the post-training and pretraining assessments within the first session, respectively. This contrasts with the Inhub and Ellipta inhaler users that demonstrated smaller, but still meaningful reductions in the first session. This heterogeneity is unsurprising because prior studies have found that some inhalers are more difficult to use and learn to use than others.[4,5,10,11,14,17,24,25] Further, not all subgroups had the same baseline level of misuse or, in some cases equivalent responses to the TTG education. Due to the large study cohort, these findings are novel and may shed light for identifying at risk groups and groups that may benefit more than others from the education. For instance, younger beneficiaries had more baseline misuse but less misuse after TTG compared to the older beneficiaries. Specifically, younger beneficiaries qualified for Medicare due to disability as opposed to being age-based. Further research is needed to learn if adjustments in the inhaler education are needed to accommodate different beneficiaries' needs. While more than one educational session is necessary for most individuals, the largest improvements in inhaler use were concentrated in the first TTG session. This is not surprising as some individuals retained the education from the first session dampening the potential effect seen both in this study and in prior studies.[5,8,9] However, despite less of an effect, there was still substantial improvement after the second session. It is still not known, however, whether two sessions are adequate and what the ideal intervals should be. Future studies are needed to evaluate longer term sustainability of the multi-session education and effects on clinical outcomes.

This study had several limitations. First, we cannot draw causal inferences from these results because the TTG education was delivered in combination with the cost-savings component of the VBID program. Likewise, we were unable to identify a valid control group against which to compare changes in inhaler misuse over time. Therefore, we can only infer associative conclusions based on these results. Further, given the pragmatic implementation of this program, real-world data capture was challenging, and complete accuracy was not likely. For instance, there were data capture issues for inhaler technique scores, but an exact number of patients for whom this was an issue was not known. Also, this led to nearly one-quarter of participants whose data were not analyzed. In addition, the program targeted patients with fill-related adherence of less than 80% based on days covered. Therefore, this approach may limit the generalizability of our findings to broader populations, as adherence behaviors in other groups may respond differently to the intervention. Additionally, individuals received the program via two different pathways, namely being invited into the VBID program or receiving the TTG training through an independent pathway. Individuals may have responded differently to the program depending on their method of joining the program. Finally, this was a real-world program whereby pharmacists were trained on the phone-based TTG approach but could have altered their educational strategy without being able to observe or measure these adjustments.

Despite these limitations, the effects of this phone-based TTG program are congruent with prior studies of in-person, video-based, and video-module based TTG inhaler education studies,[3–7,9,9] which all show that use of TTG inhaler education is effective. The results from this study demonstrating the effectiveness of TTG and our prior work demonstrating improved medication

adherence[19] could have greater implications for supporting additional medication management programs for patients with COPD. This pharmacist-led phone-based education could be readily adapted and disseminated across other payers and/or health care settings.

CONCLUSION

A phone-based adaptation of a 'teach-to-goal' inhaler education program offered by a large national health plan demonstrated improvements in inhaler technique across different types of inhaler devices and among different sub-populations. The multiple session approach was likely critical for longer term retention of correct technique, though further study is needed to confirm this. Some sub-group populations are also at greater risk for baseline inhaler misuse and/or post-training inhaler misuse indicating a need for further evaluation of how to tailor inhaler education by individuals' needs.

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Table 1: Enrollee Characteristics

Category	N	%
N	1876	
Demographics		
Age, mean years as of index (s.d.)	73.14 (7.40)	
Age category, n(%)		
Less than 65 years old	208	11%
65-69	351	19%
70-74	494	26%
75-79	465	25%
80-84	249	13%
85+	109	6%
Male	823	44%
Geographic region, n (%)		
Northeast	79	4%
Midwest	159	8%
South	1407	75%
West	231	12%
Population Density, n (%)		
Urban	1419	76%
Suburban	335	18%
Rural	80	4%
Unknown	42	2%
Race, n(%)		
White	1637	87%
Black	181	10%
Other	38	2%
Unknown	20	1%
Part D Low-Income Subsidy or Dual Eligible	122	7%
Medical Plan Type		
Health Maintenance Organization (HMO)	1532	82%
Preferred Provider Organization (PPO)	353	19%
Other	2	0%
Clinical Characteristics, mean (s.d.)		
Charlson Comorbidity Index	1.65 (1.79)	
COPD Assessment Test (CAT) Symptom Category (measured during session 1)		
Low (score 0-9)	463	25%
Medium (10-20)	872	46%
High (21-30)	463	25%
Very high (31-40)	86	5%
Inhaler type		
Diskus	33	2%
Ellipta	976	52%
Handihaler	46	2%
Inhub	354	19%

Metered-dose	323	17%
Respimat	157	8%

Notes: s.d. = standard deviation

Table 2. Percentage of patient-inhaler combinations with assessment scores less than 75% indicating improper inhaler use, overall and by inhaler category

Inhaler	N	Session One			Session Two			Session 1 v. Session 2 Pretraining score difference (p.p.); *P* value
		Pretraining Assessment (%)	Post Training Assessment (%)	Diff (p.p.); *P* value	Pretraining Assessment (%)	Post Training Assessment (%)	Diff (p.p.); *P* value	
Overall	1889*	39.4	6.9	-32.5; <0.001	35.6	5.1	-30.5; <0.001	-3.8; 0.02
Diskus	33	39.4	9.1	-30.3; 0.01	27.3	6.1	-21.2; 0.05	-12.1; 0.43
Ellipta	976	35.8	6.1	-29.6; <0.001	34.2	4.3	-29.9; <0.001	-1.6; 0.51
Handihaler	46	52.2	4.3	-47.8; <0.001	41.3	10.9	-30.4; <0.001	-10.9; 0.40
Inhub	354	33.1	9.3	-23.7; <0.001	32.5	4.2	-28.2; <0.001	-0.6; 0.94
MDI	323	49.2	6.8	-42.4; <0.001	38.1	7.7	-30.3; <0.001	-11.1; 0.01
Respimat	157	52.2	7.0	-45.2; <0.001	46.5	5.1	-41.4; <0.001	-5.7; 0.37

pp = percentage points; MDI = metered-dose inhaler; *n=1889 represents patient-inhaler level data (1876 unique patients with 13 using more than one inhaler)

Table 3. Percentage of patient-inhaler combinations with assessment scores less than 75% indicating improper inhaler use by subgroup category

	n	Session One			Session Two		
		Pre-training Assessment	Post Training Assessment	Diff (p.p.); *P* value	Pre-training Assessment	Post Training Assessment	Diff (p.p.); *P* value
Age							
<65 years	211	44.1	6.6	-37.4; <0.001	37.9	3.8	-34.1; <0.001
65+ years	1678	38.8	7.0	-31.8; <0.001	35.3	5.3	-30.0; <0.001
Race							
White	1648	37.9	6.6	-31.4; <0.001	34.2	5.2	-29.1; <0.001
Non-white	241	49.4	9.5	-39.8; <0.001	45.2	5.0	-40.2; <0.001
Comorbidities							
1 or less	1167	39.8	7.0	-32.7; <0.001	32.6	4.5	-28.1; <0.001
More than 1	722	38.8	6.8	-32.0; <0.001	40.4	6.1	-34.3; <0.001

Table 4. Percentage of patient-inhaler combinations with assessment scores less than 75% indicating improper inhaler use by overall and inhaler group, replacing session 1 scores

Inhaler	n	Session One			Session Two		
		Pre-training Assessment	Post Training Assessment	Diff (p.p.); *P* value	Pre-training Assessment	Post Training Assessment	Diff (p.p.); *P* Value
Overall	1889*	35.6	6.9	-28.7; <0.001	35.6	5.1	-30.5; <0.001
Diskus	33	27.3	9.1	-18.2; 0.11	27.3	6.1	-21.2; 0.05
Ellipta	976	34.2	6.1	-28.1; <0.001	34.2	4.3	-29.9; <0.001
Handihaler	46	41.3	4.3	-37.0; <0.001	41.3	10.9	-30.4; <0.001
Inhub	354	32.5	9.3	-23.2; <0.001	32.5	4.2	-28.2; <0.001
MDI	323	38.1	6.8	-31.3; <0.001	38.1	7.7	-30.3; <0.001
Respimat	157	46.5	7.0	-39.5; <0.001	46.5	5.1	-41.4; <0.001
pp = percentage points; MDI = metered-dose inhaler; *n=1889 represents patient-inhaler level data (1876 unique patients with 13 using more than one inhaler)							

Figure Legend

Figure 1. Teach to Goal Education Process

Supplementary Material

e-Figure 1. Example Inhaler Checklist for Phone-Based Teach-To-Goal

Enter Program Info Here

Member/Patient/Participant Name: _____
Member/Patient/participant ID: _____
Pharmacist Initials: _____
Date: ____ / ____ / ____
Clinical Consultation: 1 or 2 (Please circle)

MDI WITH SPACER INHALATION TECHNIQUE CHECKLIST
Trained assessor to read to member: Please show me exactly* how you use your MDI with spacer at home
*If using actual medicine (not placebo) the patient should mimic use (i.e., do not take repeated doses of actual medicine)

	Pre		Post 1		Post 2		Post 3	
	Wrong	Correct	Wrong	Correct	Wrong	Correct	Wrong	Correct
1. Reports removing cap of inhaler and spacer	☐₀	☐₁	☐₀	☐₁	☐₀	☐₁	☐₀	☐₁
2. Reports attaching inhaler to the back of spacer	☐₀	☐₁	☐₀	☐₁	☐₀	☐₁	☐₀	☐₁
3. Reports shaking inhaler up and down	☐₀	☐₁	☐₀	☐₁	☐₀	☐₁	☐₀	☐₁
4. Reports breathing out fully before putting spacer up to mouth	☐₀	☐₁	☐₀	☐₁	☐₀	☐₁	☐₀	☐₁
5. Reports when breathing out fully (step #4), does so away from spacer	☐₀	☐₁	☐₀	☐₁	☐₀	☐₁	☐₀	☐₁
6. Reports bringing spacer up to mouth and closes lips around mouthpiece	☐₀	☐₁	☐₀	☐₁	☐₀	☐₁	☐₀	☐₁
7. Reports activating inhaler by pressing down on canister ONE time	☐₀	☐₁	☐₀	☐₁	☐₀	☐₁	☐₀	☐₁
8. Reports taking a SLOW, DEEP breath to fill lungs with medicine, without hearing a whistle sound	☐₀	☐₁	☐₀	☐₁	☐₀	☐₁	☐₀	☐₁
9. Reports holding breath for at least 5 seconds or as long as comfortable (with or without spacer in mouth)	☐₀	☐₁	☐₀	☐₁	☐₀	☐₁	☐₀	☐₁
10. Reports removing spacer from mouth before breathing normally	☐₀	☐₁	☐₀	☐₁	☐₀	☐₁	☐₀	☐₁
11. Reports breathing normally for at least 30 to 60 seconds	☐₀	☐₁	☐₀	☐₁	☐₀	☐₁	☐₀	☐₁
12. Reports repeating for a second puff (if prescribed)	☐₀	☐₁	☐₀	☐₁	☐₀	☐₁	☐₀	☐₁
Member's Score:	___/12		___/12		___/12		___/12	

Score the participant's performance by assigning 1 point to each correct reported step and adding across the 12 steps. If score is less than 12, demonstrate to the participant appropriate technique and repeat inhaler assessment.

Comments:_____

e-Table 1. Attrition Table

Inclusion Criteria	Members Excluded		Members Remaining	
	n	%	n	%
Total interactions in RxConsult			104,621	
Interactions not missing dates	102,181	97.7%	2,440	2.3%
Standard research exclusions (contractually obligated to exclude certain populations from research, e.g., Administrative Services Only plans, residents of U.S. territories)	102,199	97.7%	2,422	2.3%
Participant Age 18-90	102,235	97.7%	2,386	2.3%
Nonmissing LOB	102,245	97.7%	2,376	2.3%
Continuous enrollment for at least 6 months before index date	102,321	97.8%	2,300	2.2%
Continuous enrollment for at least 3 months after index date	102,348	97.8%	2,273	2.2%
Missing covariates (age, sex, geography)	102,348	97.8%	2,273	2.2%
Exclude if pre or post scores > 100%	102,348	97.8%	2,273	2.2%
Exclude if both scores are NA (for pre & post for both coachings)	102,405	97.9%	2,216	2.1%
Exclude if both pre and post scores are zero for singular call	102,431	97.9%	2,190	2.1%
Has two calls for the same inhaler	102,560	98.0%	2,061	2.0%
first and second calls are different dates	102,745	98.2%	1,876	1.8%

e-Table 2. Average assessment scores, overall and by inhaler type

Inhaler	n	Pretraining Assessment	Post Training Assessment	Diff	*P* Value	Pretraining Assessment	Post Training Assessment	Diff	*P* Value
Overall	1889	75.72	90.85	15.12	0.00	78.67	93.08	14.41	<0.001
Diskus	33	77.58	92.42	14.85	0.01	83.94	90.91	6.97	0.25
Ellipta	976	77.73	91.65	13.92	0.00	79.24	93.50	14.27	<0.001
Handihaler	46	67.97	91.74	23.77	0.00	76.38	91.59	15.21	<0.001
Inhub	354	79.35	89.93	10.58	0.00	81.55	93.73	12.18	<0.001
MDI	323	71.06	89.24	18.18	0.00	76.72	92.00	15.28	<0.001
Respimat	157	66.53	90.64	24.10	0.00	72.27	92.11	19.84	<0.001
pp = percentage points; MDI = metered-dose inhaler; *n=1889 represents patient-inhaler level data (1876 unique patients with 13 using more than one inhaler)									