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DuoResp[®] Spiromax[®] adherence, satisfaction and ease of use: findings from a multi-country observational study in patients with asthma and COPD in Europe (SPRINT)

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ABSTRACT

Objective: Adherence and inhaler technique are often suboptimal in asthma and chronic obstructive pulmonary disease (COPD). New inhalers have been developed to improve these determinants of treatment effectiveness. We assessed treatment adherence, satisfaction, and ease of use of DuoResp[®] Spiromax[®] among SPRINT study participants.

Methods: The Phase IV SPRINT study was conducted in 10 European countries. Asthma and COPD patients were receiving a fixed-dose combination of inhaled corticosteroid (ICS) and long-acting β_2 -agonist (LABA), delivered via various inhalers including DuoResp Spiromax. DuoResp Spiromax users self-assessed adherence using the 8-item Morisky Medication Adherence Scale (MMAS-8[®]), and ease of use and satisfaction using 10-point scales, during a single physician's office visit.

Results: Of 1661 (asthma: $n = 1101$; COPD: $n = 560$) SPRINT study participants, 342 (asthma: $n = 235$; COPD: $n = 107$) received DuoResp Spiromax prior to inclusion. Overall, 72.5% of DuoResp Spiromax users reported medium or high adherence (MMAS-8 score ≥ 6). Mean (standard deviation [SD]) satisfaction score for DuoResp Spiromax was 8.9 (1.6). Almost all (98.8%) DuoResp Spiromax users were at least satisfied with their inhaler; 85.4% were very satisfied. Mean (SD) ease of use score for DuoResp Spiromax was 9.1 (1.3).

Conclusions: Asthma and COPD patients using DuoResp Spiromax reported moderate-to-high medication adherence, were very satisfied with their inhaler and found it easy to use.

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Introduction

Asthma and chronic obstructive pulmonary disease (COPD) are chronic pulmonary diseases of significant concern worldwide, owing to their high prevalence and substantial clinical and economic burden (1,2). Inhaled medications are central to the management of asthma and COPD, as advocated by treatment guidelines (3,4). Inhalers can generally be classified as pressurized metered-dose inhalers (pMDIs) and dry-powder inhalers (DPIs), and there are numerous

drug-inhaler combinations available. pMDIs require coordination with actuation of the inhaler, so that the patient needs to press down the canister and inhale the medication simultaneously. DPIs are breath-actuated, which precludes the need to coordinate actuation with inhalation and, therefore, may potentially be easier to use (5).

Despite the efficacy of inhaled medications, there is considerable room for improvement in the management of asthma and COPD, and management is not only reliant on the medications themselves but also

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on their effective delivery using inhalers. Non-adherence to treatment in asthma and COPD represents a significant challenge, with adherence rates varying widely from 40% to 78% in patients with asthma and from 40% to 60% in patients with COPD (6,7). As with treatments, patients should be involved in the choice of inhaler as several studies have reported a positive relationship between patient satisfaction with their inhaler device and treatment adherence (8,9). It is important that patients use their inhaler device correctly to achieve maximum clinical benefit; however, it is estimated that 50–90% of patients fail to use their inhaler correctly (10). One important contributor to patient satisfaction and preference is operational use, including ease of learning to use and cleaning the inhaler (11,12).

A combination of inhaled corticosteroid (ICS) and long-acting β_2 -agonist (LABA) is a widely used treatment option for patients with asthma and persistent symptoms and/or exacerbations despite low-dose ICS, and patients with moderate-to-very-severe COPD and exacerbations and/or associated features of asthma (3,4). Several ICS/LABA fixed-dose combination (FDC) inhalers are commercially available in Europe for the delivery of maintenance therapies for asthma and/or COPD. DuoResp[®] Spiromax[®] is a budesonide/formoterol combination treatment alternative to the existing Symbicort Turbuhaler, which contains the same active substances but a different DPI mechanism (13). In the present Phase IV, observational study (the SPRINT study), we obtained a cross-sectional overview of patient-reported adherence to, satisfaction with, and ease of use of DuoResp Spiromax among patients with asthma and COPD in real-world clinical practice.

Methods

Study design and participants

The SPRINT study was a Phase IV, real-world, multi-national, observational, prospective study performed between May 2015 and April 2017 at 140 centers in Croatia, Denmark, Ireland, Italy, The Netherlands, Norway, Portugal, Spain, Sweden, and the UK. Independent Ethics Committee approval in each country was obtained if required. The study was conducted according to the principles of the Declaration of Helsinki, regulations applicable to observational studies and Good Clinical Practice.

The primary study objective was to assess the proportion of patients with asthma or COPD receiving an ICS/LABA FDC twice daily who achieved disease control, and these results are reported separately. The

secondary and exploratory study objectives, presented here, were to obtain a cross-sectional overview of patient-reported adherence to, satisfaction with, and ease of use of DuoResp Spiromax among patients in real-world clinical practice.

Patients

Patients with asthma were required to be aged ≥ 18 years and have a diagnosis of persistent asthma in accordance with the GINA report. Patients with COPD were required to be aged ≥ 40 years and/or be a current or former smoker with a smoking history of ≥ 10 pack-years smoking, and have a diagnosis of COPD in accordance with the GOLD report. Patients were eligible for inclusion if they had received a stable dose (no change in dose by $>50\%$ in the last 3 months) of ICS/LABA FDC, administered twice daily via a variety of DPI devices, including DuoResp Spiromax, for the 3 months prior to enrollment in accordance with its approved indication and Summary of Product Characteristics (SPC). Patients had to be willing and able to provide written informed consent and complete the questionnaires, agree to participate in the study, and to disclose any medical events to the treating physician. The only exclusion criterion was current or planned enrollment in an interventional study (patients were allowed to participate in other observational or case-control studies).

Assessments

There were no treatment groups or interventions to which patients were randomized. All treatment decisions were at the sole discretion of participating physicians, reflected current standard of care and were guided by the local SPC of the respective ICS/LABA FDC and GINA or GOLD reports available in advance of the study. Data were collected in a routine setting on a single occasion during an otherwise normal visit to a physician's office or clinic. Participating physicians did not perform any additional medical procedures, other than those that are part of normal routine clinical practice. Data were collected for the whole population of patients receiving any ICS/LABA FDC, and additional parameters were also assessed for patients using DuoResp Spiromax.

Demographic and clinical characteristics (including medical history, previous and concomitant respiratory medications, number of exacerbations in the previous year, and healthcare utilization in the past 3 months) were collected from the patients' medical records by

the participating investigational centers. Patient-reported adherence to ICS/LABA FDC was assessed using the Morisky Medication Adherence Scale (MMAS-8[®]), an 8-item instrument to measure adherence (14–16). Adherence was classified based on MMAS-8 score as high (score = 8), medium ($6 \leq \text{score} < 8$), or low (score < 6). Among patients using DuoResp Spiromax, satisfaction with the inhaler and patient-perceived ease of use were assessed using questionnaires with 10-point scales. Satisfaction was classified based on the score on the 10-point scale as follows: not satisfied (1–3); satisfied (4–7); very satisfied (8–10). Ease of use was determined using five questions: 1) How easy is it to use your inhaler?; 2) How easy is it to clean your inhaler?; 3) How easy is it to use your inhaler during situations that require rescue/reliever treatment? (among patients who reported that they used their inhaler for rescue/reliever treatment); 4) How easy was it to learn to use your inhaler?; and 5) Do you find it easy to know how many doses are left in your inhaler? Ease of use questions were evaluated on the basis of the following scale: 1 (not at all easy) to 10 (extremely easy).

Statistical analysis

For the SPRINT study, a target sample size of approximately 792 patients with asthma and 648 patients with COPD was planned. Of these, it was estimated that 10% of the enrolled patients were being treated with DuoResp Spiromax (approximately 80 patients with asthma and 65 patients with COPD). All data were summarized descriptively. Dichotomous or categorical variables are presented as the number and percentage of each category, and continuous variables are presented as the number of available observations, mean (standard deviation [SD]) or median (25th and 75th percentiles), depending on the distribution. The relationship between patient adherence and satisfaction with the device and ease of use was investigated using Spearman correlation, with an alpha level of 0.05 for the correlation test. No imputations were made for missing data. Statistical analyses were conducted using R, version 3.1.3 or later.

Results

Study population

A total of 1138 patients with asthma and 596 patients with COPD were enrolled in the study. Eighty-two patients did not meet eligibility criteria and were not included in the analysis. In all cases, the major protocol deviations were related to the informed consent. The full

analysis set comprised 1101 patients with asthma and 560 with COPD. Of these, 342 patients (asthma: $n = 235$; COPD: $n = 107$) were receiving ICS/LABA FDC treatment with DuoResp Spiromax, while 1319 (asthma: $n = 866$; COPD: $n = 453$) were receiving other treatments ($p = 0.316$). Patients receiving treatments other than DuoResp Spiromax were significantly older than patients receiving DuoResp Spiromax (59.8 years vs. 56.3 years, respectively; $p = 0.002$), but there was no gender imbalance between DuoResp Spiromax and other treatments. The demographics and clinical characteristics at baseline of patients with asthma and COPD who were receiving treatment with DuoResp Spiromax are presented in [Table 1](#). As expected, patients with asthma were significantly younger than those with COPD at baseline (50.6 years vs. 68.7 years, respectively; $p < 0.001$). There was also an imbalance in gender, with 43.4% of asthma patients being male compared with 62.6% of COPD patients ($p = 0.001$). Data on previous treatments received by patients in these cohorts are provided in [Table 2](#).

Treatment adherence

There was no difference in median (25th percentile, 75th percentile) MMAS-8 score among DuoResp Spiromax users (pooled asthma and COPD $N = 337$) compared with patients receiving other treatments (7 [5.8, 8] vs. 7 [5.9, 8]; $p = \text{NS}$). Among DuoResp Spiromax users, median MMAS-8 scores for patients with asthma and COPD were 7 (5.8, 8) and 7.8 (6, 8), respectively ($p = 0.008$) ([Supplementary Table S1](#)). Overall, 72.5% of all DuoResp Spiromax users reported medium or high adherence (MMAS-8 score ≥ 6 ; [Figure 1](#)). The corresponding proportions were 69.3% of patients with asthma and 79.6% of patients with COPD, with a numerically higher proportion of patients with COPD versus those with asthma reporting high adherence (MMAS-8 score = 8: 48.5% versus 33.8%, respectively; [Figure 1](#)).

Inhaler satisfaction

Among all DuoResp Spiromax users (pooled), mean (SD) satisfaction score out of 10 was 8.9 (1.6); mean (SD) values among those with asthma and COPD were 9 (1.5) and 8.6 (1.8), respectively ([Supplementary Table S2](#)). Nearly all DuoResp Spiromax users (98.8%) were at least satisfied with DuoResp Spiromax inhaler, with 85.4% of patients being very satisfied ([Figure 2](#)). Similar proportions of satisfaction with DuoResp Spiromax inhaler were seen among patients with asthma and COPD ($p = \text{NS}$) ([Figure 2](#)).

Table 1. Demographic and clinical characteristics of SPRINT study participants receiving treatment with DuoResp Spiromax.

	Asthma (n = 235)	COPD (n = 107)	Total (N = 342)	p-Value
Gender, n (%)				
Male	102 (43.4)	67 (62.6)	169 (49.4)	0.001
Age at study visit				
Mean (SD)	50.6 (17.5)	68.7 (8.9)	56.3 (17.5)	< 0.001
BMI				
Mean (SD)	27.7 (6.3)	28.2 (5.3)	27.9 (6)	0.135
Data unavailable	25	6	31	
Years since disease diagnosis				
Median (P25, P75)	8 (2, 17)	6 (4, 10.8)	7 (2.2, 15)	0.160
Data unavailable	3	1	4	
FEV ₁ , L				
Mean (SD)	2.7 (1.0)	1.4 (0.5)	2.2 (1.1)	< 0.001
Data unavailable	43	7	50	
FEV ₁ , % predicted				
Mean (SD)	84.3 (24.2)	54.4 (17.5)	73.9 (26.3)	< 0.001
Data unavailable	55	11	66	
Asthma severity, n (%)				
Mild	49 (20.9)	Not applicable	Not applicable	Not applicable
Moderate	149 (63.4)			
Severe	37 (15.7)			
COPD severity, n (%)				
Mild	Not applicable	4 (3.7)	Not applicable	Not applicable
Moderate		49 (45.8)		
Severe		47 (43.9)		
Very severe		7 (6.5)		
Duration (months) of use of the patient's current FDC				
Median (P25, P75)	8.7 (4.8, 14.2)	10.2 (4.9, 15.5)	9.2 (4.9, 14.9)	0.318
Data unavailable	32	12	44	

Abbreviations: BMI, body mass index; COPD, chronic obstructive pulmonary disease; FDC, fixed-dose combination; FEV₁, forced expiratory volume in 1 s; NA, not applicable; P25, 25th percentile; P75, 75th percentile; SD, standard deviation.

Note: Patients were eligible for the study if they had received a stable dose of ICS/LABA FDC for the 3 months prior to enrollment. One COPD patient who had received treatment for 12 weeks was accepted onto the study by the sponsor.

Table 2. Previous treatments received by SPRINT study participants receiving treatment with DuoResp Spiromax.

	Asthma (n = 215)	COPD (n = 98)	Total (N = 313)	p-Value
Previous asthma/COPD treatment, n (%)				
None	76 (35.3)	23 (23.5)	99 (31.6)	< 0.001
ICS monotherapy	33 (15.3)	2 (2.0)	35 (11.2)	
LABA monotherapy	4 (1.9)	5 (5.1)	9 (2.9)	
FDC (different from current)	84 (39.1)	51 (52)	135 (43.1)	
Long-acting muscarinic antagonists	0 (0)	14 (14.3)	14 (4.5)	
Leukotriene modifier	10 (4.7)	0 (0)	10 (3.2)	
Methylxanthine (theophylline)	0 (0)	0 (0)	0 (0)	
Other	8 (3.7)	3 (3.1)	11 (3.5)	
Not available	20	9	29	

Abbreviations: COPD, chronic obstructive pulmonary disease; FDC, fixed-dose combination; ICS, inhaled corticosteroid; LABA, long-acting β_2 -agonist.

Inhaler ease of use

Patient-reported ease of use of DuoResp Spiromax is reported in Table 3. Among all DuoResp Spiromax users (pooled), mean (SD) ease of use score rated on a 10-point scale was 9.1 (1.3) and mean scores were ≥ 9 for all five ease of use questions. Mean scores for each ease of use question were similar among patients with asthma and COPD ($p = \text{NS}$) (Table 3).

Correlation between adherence and inhalation device

Treatment adherence, as evaluated by MMAS-8 score, was significantly and independently correlated with both inhaler satisfaction ($p = 0.001$) and ease of use

($p < 0.001$) among pooled patients with asthma or COPD receiving treatment with DuoResp Spiromax (Table 4).

Discussion

Effective management of asthma and COPD to control symptoms and reduce exacerbations requires medication adherence (3,4). However, nonadherence to treatment and incorrect inhaler technique have been widely reported in patients with asthma and COPD (6,7,10). In SPRINT, we investigated patient-reported adherence to, satisfaction with, and ease of use of DuoResp Spiromax among patients with asthma and COPD from real-world clinical practice.

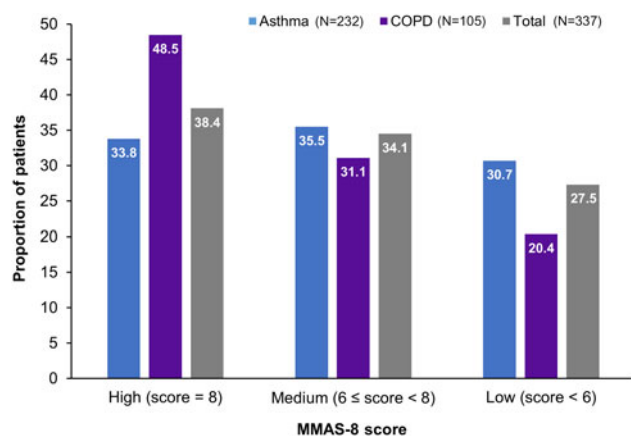


Figure 1. Adherence to ICS/LABA FDC treatment among SPRINT study participants with asthma and COPD receiving treatment with DuoResp Spiromax, as assessed by MMAS-8 score. Data for five patients with asthma and two patients with COPD were unavailable. Abbreviations: COPD, chronic obstructive pulmonary disease; ICS, inhaled corticosteroid; LABA, long-acting β_2 -agonist; MMAS-8, 8-item Morisky Medication Adherence Scale. *Note:* Use of the ©MMAS is protected by US copyright laws. Permission for use is required. A license agreement is available from: Donald E. Morisky, ScD, MSPH, Professor, Department of Community Health Sciences, UCLA School of Public Health, 650 Charles E. Young Drive South, Los Angeles, CA, 90095-1772.

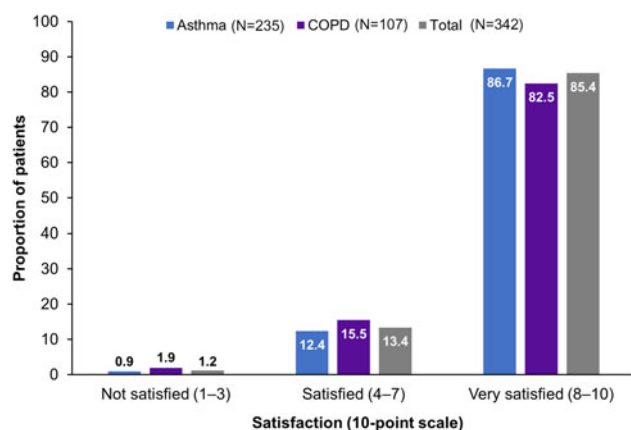


Figure 2. Patient satisfaction with the DuoResp Spiromax inhaler, self-assessed on a 10-point scale. Data for two patients with asthma and four patients with COPD were unavailable. Abbreviations: COPD, chronic obstructive pulmonary disease.

We assessed medication adherence using the MMAS-8 score, a reliable and validated 8-item instrument (14–16). Mean MMAS-8 score among all DuoResp Spiromax was within the medium adherence classification, and most users reported moderate or high adherence to treatment. No difference was observed in median MMAS-8 score between DuoResp Spiromax patients and those receiving other treatments. A higher proportion of patients with COPD versus patients with asthma reported high adherence,

Table 3. Patient-reported ease of use of the DuoResp Spiromax inhaler, self-assessed on a 10-point scale.

	Asthma (n = 235)	COPD (n = 107)	Total (N = 342)	p-Value
1. How easy is it to use your inhaler?				
Mean (SD)	9.2 (1.3)	9.1 (1.3)	9.1 (1.3)	0.404
Not available	3	0	3	
2. How easy is it to clean your inhaler?				
Mean (SD)	9 (1.5)	9 (1.4)	9 (1.5)	0.751
Not available	11	1	12	
3. How easy is it to use your inhaler during situations that require rescue/reliever treatment?*				
Mean (SD)	9 (1.4)	9.2 (1.4)	9.1 (1.4)	0.243
Not available	135*	62*	200*	
4. How easy was it to learn to use your inhaler?				
Mean (SD)	9.2 (1.5)	9.1 (1.2)	9.2 (1.4)	0.191
Not available	7	0	7	
5. Do you find it easy to know how many doses are left in your inhaler?				
Mean (SD)	9.3 (1.5)	9.2 (1.4)	9.2 (1.5)	0.169
Not available	6	1	7	

*Only patients who reported that they used their inhaler for rescue/reliever treatment were included for this question.

Abbreviations: COPD, chronic obstructive pulmonary disease; SD, standard deviation.

Table 4. Correlation of inhaler satisfaction and ease of use with adherence to treatment among SPRINT study participants with asthma and COPD receiving treatment with DuoResp Spiromax.

MMAS-8 adherence	Total (N = 342)	p-Value*
MMAS-8 score and inhaler satisfaction		
Spearman correlation	0.166	0.001†
MMAS-8 score and ease of use		
Spearman correlation	0.186	<0.001†

*For hypothesis contrast, null hypothesis was correlation = 0 and alternative hypothesis was correlation > 0.

†p Values for Spearman correlation could not be computed exact due to ties.

Abbreviations: COPD, chronic obstructive pulmonary disease; MMAS-8, 8-item Morisky Medication Adherence Scale.

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which is a good indication of inhaler ease of use in an elderly COPD population of SPRINT study (mean age = 70 years). The association between adherence to asthma and COPD therapy and clinical outcomes varies in the literature. However, generally, high adherence is associated with better symptom control (17–19) in patients with asthma, and reduced exacerbation rates in patients with asthma and COPD (20–22). High adherence has also been associated with lower mortality rates compared with lower adherence in patients with COPD (22), and regular use of ICS is associated with a decreased risk of death from asthma (23). Although we did not determine the impact of medication adherence on asthma control in this analysis, the MMAS-8 score has previously been shown to be valid for predicting health outcomes in patients with asthma. In a cross-sectional study of 208 patients

with asthma, the odds of asthma control increased by 1.7 times (odds ratio: 1.65, $p=0.027$) as MMAS-8-assessed adherence improved from low to medium or from medium to high (24). In addition, patients with high and medium adherence had improved quality of life compared with patients with low adherence (24).

Patient satisfaction can be defined as the patient's evaluation of the process of taking the medication or using the device, and corresponding outcomes associated with these activities (25). The importance of patient satisfaction with the inhalation device is increasingly recognized as a key factor in driving adherence to inhaled treatment regimens, and hence clinical outcomes in asthma and COPD (26). In the SPRINT study, satisfaction with the DuoResp Spiromax inhaler was very high, and patients were almost universally satisfied with their inhaler, with the majority of patients being very satisfied. No differences were observed between asthma and COPD patients in terms of inhaler satisfaction. Due to the nature of the CRF used for this study, no patient satisfaction data were collected for treatments other than DuoResp Spiromax, and we are not able to draw any conclusions regarding any differences between devices. However, these findings support the high levels of satisfaction observed with DuoResp Spiromax in the ASSET (A Spiromax Safety and Efficacy Trial) randomized clinical trial (13,27), and supplement the findings of a Phase IV observational study in patients with asthma or COPD in German clinical practice, which demonstrated that patient satisfaction seen in clinical trials is replicated in a real-world setting (28).

DuoResp Spiromax scored highly for all five components of ease of use questions, including overall ease of use, learning to use the inhaler, and knowing how many doses remain in the inhaler, with no significant differences observed between asthma and COPD patients. As with patient satisfaction, we are not able to draw comparisons in ease of use between DuoResp Spiromax and other inhalers due to a lack of data. Nevertheless, important conclusions can tentatively be drawn. Ease of use and convenience are domains that contribute both to the overall assessment of patient satisfaction (25,29) and to clinical outcomes. For inhaled therapies, to achieve optimal therapeutic efficacy the drug particles must reach the peripheral airways in the lungs (30). Errors in inhaler technique can impact drug delivery and therefore contribute to suboptimal clinical outcomes (31). Poor inhaler technique may result from challenges in achieving mastery of the inhalation device and/or inadequate training in its use (27). It is estimated that 50–90% of patients

with asthma or COPD do not use their inhalers correctly (10). Additionally, as physicians often do not review whether patients are using their inhalers correctly (32,33), it is critical that patients find the inhaler easy to use during the initial learning phase and long-term use.

There is growing interest in the association between medication adherence, inhaler satisfaction, and ease of use. High levels of patient-reported satisfaction with asthma and COPD inhaler devices have been shown to be associated with higher treatment adherence (8,9). In the SPRINT study, statistically significant correlations between adherence to DuoResp Spiromax and patient satisfaction with and ease of use of the device were observed, even though average satisfaction, ease of use and adherence scores were typically all very high. In view of previous reports that patients' satisfaction with their inhaler appears to have a positive influence on treatment outcomes, including improvements in quality of life, and fewer exacerbations and hospital visits (8,9,29), further study is warranted to assess the reliability of these correlation findings and better understand the relationships between these variables.

The levels of adherence and high patient satisfaction and ease of use scores observed in the SPRINT study may be reflective of the attributes of the DuoResp Spiromax inhaler. Spiromax is a breath-actuated, multi-dose, DPI which was developed to provide high-dose consistency with maximal ease-of-use for patients. Many of the maneuvers required for correct inhalation are device-specific, and as such errors should be assessed against device-specific checklists (27). Spiromax is ready for actuation after the single step of opening the cap and, therefore, has the theoretical advantage of being more intuitive and easier to use (13,34). Inhaler-naïve, healthy volunteers were able to demonstrate higher levels of device mastery with Spiromax, compared with Easyhaler and Turbuhaler, and reported that they found Spiromax to be the easiest inhaler to use of the three (34,35). Furthermore, the Spiromax inhaler has been shown to be easy for healthcare professionals to learn how to use correctly (36), which may reduce the provider time burden of patient education and training in device use.

Among the strengths of the SPRINT study is the large-scope observational study design, which included patients with asthma and COPD from 10 European countries. In SPRINT, patients with all levels of education were included. Thus, the study represented real-world clinical practice across multiple European countries. The observational study design can,

however, also be considered a limitation as it is subject to confounders and potential bias. Because this report describes the secondary and exploratory study objectives of the study and is designed to supplement the primary publication of clinical outcomes, some methodological deficiencies are clear. Due to the design of the CRF, satisfaction and ease of use data were not collated for inhalers other than DuoResp Spiromax. This precludes our ability to make comparisons with other inhalers, and we are only able to report satisfaction and ease of use of DuoResp Spiromax in isolation, without being able to put this into the context of other devices. Furthermore, although the MMAS-8 scale is a validated instrument (14–16), allowing us to report adherence data with some confidence, the scales used for collation of satisfaction and ease of use were not similarly validated. Again, this is because of the exploratory nature of these assessments, but limits the certainty with which these data should be interpreted. Other limitations of the study include the lack of assessment of patient education or training in the devices being studied, as these were the patients' current devices that they had been using for at least 3 months prior to study conduct, and the fact that treatment adherence, inhaler satisfaction, and ease of use were self-reported by patients, and so are subject to recall bias. Furthermore, patients may be subject to social desirability bias, resulting in overestimation of true adherence by selecting questionnaire responses that they believe to be appropriate and acceptable (37). Despite these limitations, we feel that the data presented herein represent an important adjunct to the primary clinical data published previously, adding to our understanding of DuoResp Spiromax use in a real-world population and from the perspective of the patient.

Conclusions

Adult patients with asthma and COPD using DuoResp Spiromax reported moderate-to-high treatment adherence. The majority were very satisfied with their inhaler and found it easy to use, supporting the high levels of satisfaction seen previously. Treatment adherence was significantly correlated with both inhaler satisfaction and ease of use among patients with asthma or COPD receiving treatment with DuoResp Spiromax. The observed high satisfaction with and adherence to DuoResp Spiromax is indicative of potential for improved clinical outcomes. In view of the limitations of this study, particularly it

having been conducted in a single visit and over a short duration, further investigation is warranted.

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Declaration of interests

Job van der Palen, Isa Cerveri, Chelo Gonzalez and Vibeke Backer and declare no conflicts of interest.

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Oliver Patino and Guilherme Safioti are employees of Teva Pharmaceuticals.

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Supplementary Material

Supplementary Table 1. Adherence to ICS/LABA treatment among SPRINT study participants with asthma and COPD receiving treatment with DuoResp Spiromax, and with ACT or CAT score (as appropriate) available, as assessed by MMAS-8[®] score and adherence classification

	Asthma (n = 235)	COPD (n = 107)	Total (N = 342)	p-value
MMAS-8 score				
Median (P25, P75)	7 (5.8, 8)	7.8 (6, 8)	7 (5.8, 8)	0.008
<i>Data unavailable</i>	7	4	11	
MMAS-8 adherence classification, n (%)				
High (score = 8)	77 (33.8)	50 (48.5)	127 (38.4)	0.027
Medium (6 ≤ score < 8)	81 (35.5)	32 (31.1)	113 (34.1)	
Low	70 (30.7)	21 (20.4)	91 (27.5)	
<i>Data unavailable</i>	7	4	11	

COPD, chronic obstructive pulmonary disease; ICS, inhaled corticosteroid; MMAS-8, 8-item Morisky Medication Adherence Scale; P25, 25th percentile; P75, 75th percentile; SD, standard deviation

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Supplementary Table 2. Patient satisfaction with the DuoResp Spiromax inhaler, self-assessed on a 10-point scale

	Asthma (n = 235)	COPD (n = 107)	Total (N = 342)	p-value
Patient satisfaction score				
Mean (SD)	9 (1.5)	8.6 (1.8)	8.9 (1.6)	0.057
Data unavailable	2	4	6	
Satisfaction classification, n (%)				
Not satisfied (1–3)	2 (0.9)	2 (1.9)	4 (1.2)	0.451
Satisfied (4–7)	29 (12.4)	16 (15.5)	45 (13.4)	
Very satisfied (8–10)	202 (86.7)	85 (82.5)	287 (85.4)	
Data unavailable	2	4	6	

COPD, chronic obstructive pulmonary disease; SD, standard deviation