

Patterns and determinants of compliance with inhaled steroids in adults with asthma

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BACKGROUND: Patient compliance with inhaled corticosteroids (ICS) in asthma is considered to be suboptimal.

OBJECTIVES: To describe the patterns of compliance with ICS and identify factors determining the compliance to ICS in adults with asthma.

METHODS: Based on a review of the literature and interviews with asthmatic patients who require the regular use of ICS, potential determinants of compliance to ICS were identified. Questionnaires related to these determinants were then administered to a cohort of patients from three subspecialty clinics, including two from university-affiliated centres. Patients with mild-to-moderate asthma who were 15 years of age and older and required (from the physician's point of view) ICS as maintenance medication because of persistent asthma were included in the study. Patients were followed for a period of 12 weeks. Compliance was measured using electronic devices.

RESULTS: Data from 124 patients (51 men; mean age 47±15 years; mean prescribed daily dose of ICS [fluticasone propionate] 643±385 µg) were analyzed. On average, the patients took 72±24% of their prescription. Four patterns of compliance were observed and are described: 1A – regular compliance (n=29); 1B – irregular compliance (n=37); 2A – regular noncompliance (n=24); and 2B – irregular noncompliance (n=34). Among the potential predictors of noncompliance, age was the only significant predictor (compliance increased with increasing age). There was no difference in asthma control between compliant and noncompliant patients.

CONCLUSION: Compliance to ICS in patients with asthma is often suboptimal and difficult to predict. The observations suggest that some asthmatics may be overtreated with ICS.

Key Words: Asthma; Compliance; Inhaled corticosteroids

Compliance is usually defined as the extent to which a person's behaviour (in terms of taking medication, following diets or executing lifestyle changes) coincides with medical or health recommendations (1). In studying compliance, clinicians and researchers must assume that the diagnosis is correct and the recommendations are appropriate, effective and manageable by the patient (2). The most recent guidelines (3) regarding the management of asthma emphasized the avoidance of triggering environmental agents and the use of anti-inflammatory medication in patients with persistent symptoms. Inhaled corticosteroids (ICS) represent the mainstay

Habitudes et facteurs d eterminants dans la fid elit e des adultes asthmatiques   leur corticoth erapie par inhalation

HISTORIQUE : Dans l'asthme, la fid elit e des patients   leur corticoth erapie par inhalation (CTI) est g en eralement jug ee insatisfaisante.

OBJECTIFS : D ecrire les habitudes des patients quant   la fid elit e   leur CTI et identifier les facteurs de l'observance th erapeutique chez les adultes asthmatiques.

M ETHODES : Sur la base d'une revue de litt erature et d'entrevues r ealis ees aupr es de patients asthmatiques qui ont r eguli erement recours   la CTI, certains facteurs potentiels de l'observance th erapeutique vis- -vis de la CTI ont  t e identifi es. Des questionnaires portant sur ces facteurs ont ensuite  t e administr es   une cohorte de patients provenant de trois cliniques sp ecialis ees, y compris deux centres universitaires. Les patients atteints d'un asthme de l eger   mod er e  g es de 15 ans et plus qui n ecessitaient (du point de vue du m edecin) une CTI en traitement d'entretien   cause d'un asthme persistant ont  t e inclus dans l' tude. Les patients ont  t e suivis pendant une p eriod e de 12 semaines. L'observance th erapeutique a  t e mesur ee au moyen d'instruments  lectroniques.

R ESULTATS : Les donn ees provenant de 124 patients (51 hommes;  ge moyen 47±15 ans; devant prendre en moyenne 643±385 µg de CTI par jour (propionate de fluticasone) ont  t e analys ees. En moyenne, les patients prenaient 72±24 % de la dose prescrite. On a observ e et d ecrit quatre types d'observance th erapeutique : 1A – observance r eguli ere (n = 29); 1B – observance irr eguli ere (n = 37); 2A – non-observance r eguli ere (n = 24) et 2B – non-observance irr eguli ere (n = 34). Parmi les facteurs potentiels de non-observance th erapeutique, l' age a  t e le seul facteur de pr evisibilit e significatif (l'observance augmentait avec l' age). On n'a not e aucune diff erence quant au contr ole de l'asthme entre les patients fid eles   leur traitement et ceux qui ne l' etaient pas.

CONCLUSION : L'observance th erapeutique   l'endroit de la CTI chez les patients asthmatiques est souvent suboptimale et difficile   pr edire. Selon les observations, certains asthmatiques recevraient trop de CTI.

of anti-inflammatory therapy for asthma. Evidence of the effectiveness of ICS in reducing bronchial hyperresponsiveness and in improving asthma-related symptoms, control of the disease and quality of life has accumulated (4-7). Most trials include highly selected patients within the framework of study protocols; however, daily practice suggests that compliance with ICS is usually suboptimal.

Several factors have been proposed to explain the gap between the treatment prescribed and the actual use of the medication (2,8). These factors include the complexity of the treatment regimen, lack of knowledge regarding the drug indications

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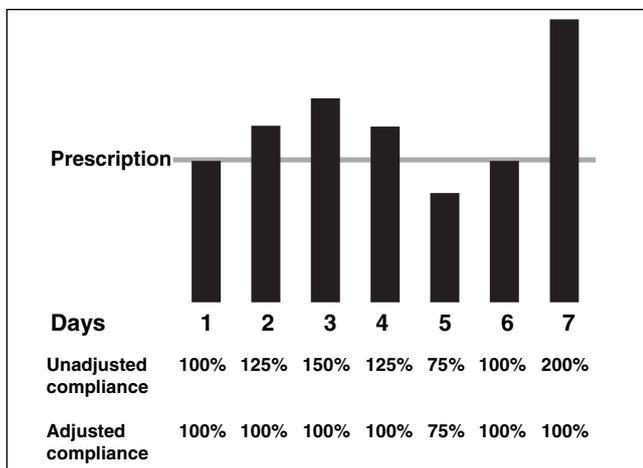


Figure 1) Analysis of compliance. In this example, compliance is examined over a seven-day period. The unadjusted compliance index is the mean of (inhaled/prescribed) \times 100% (or 125%, in this example). The daily variation in inhaled corticosteroid use is the SD of the unadjusted compliance index, and is called the regularity index (41%). To prevent adherence scores from being artificially elevated by including excess usage, the adjusted data consist of no more than the maximum number of puffs prescribed on a given day. The adjusted compliance index is then computed as the mean value for (inhaled/prescribed) \times 100% (96% in this example)

and mechanisms of action, steroid phobia and other psychological factors that remain ill-defined. However, most studies (2) that have investigated compliance to inhaled medication have been limited because the usual techniques for measuring drugs in biological fluids are only applicable to oral or parenteral drugs. Electronic recording mechanisms have recently been developed to overcome this problem. The objectives of the present study were to describe the patterns of compliance to ICS in adults with asthma using objective measures of drug compliance and to identify the factors that determined compliance to treatment.

PATIENTS AND METHODS

Patients

All subjects included in the study fulfilled the American Thoracic Society diagnostic criteria for asthma (9). Eligible patients were 15 years of age or older with mild-to-moderate asthma requiring (from the physician's point of view) ICS as maintenance medication because of persistent asthma for a period of at least 12 consecutive weeks. The investigators did not interfere in the choice of drug therapy to satisfy the inclusion criteria of the study. The prescription was left to the treating physician in agreement with the patient's preference. Therefore, study patients taking dry powder ICS or an inhaler combining ICS and long-acting beta-agonists, those on oral steroids or dependent on someone else for drug administration were excluded.

Potential predictors of compliance

In a preliminary phase of the study, a comprehensive list of potential determinants of compliance to ICS was generated. These were drawn from a number of sources: a review of the literature on compliance in asthma; consultations with clinicians with extensive experience in evaluating and treating asthmatic patients; and semistructured interviews with patients with asthma. Individual interviews were conducted until five consecutive patients could not contribute any additional items to the list. Whenever possible, a valid questionnaire available from the literature was selected to match each of the elicited potential predictors. All questionnaires

were available both in French and English, either from the literature or, for the French versions, from a translation that followed existing guidelines to preserve equivalence (10). This process involved two translations of the questionnaire from English to French; back-translation of the questionnaire from French to English; comparison of the source and final versions; and pretesting of the French version of the questionnaire using five patients with asthma.

Follow-up study

A cohort of consecutive, unselected patients with asthma was enrolled in a 12-week observational study. During the study period, patients were not supplied with ICS; instead, the participants used their own medication. This time period was selected because it exceeded the expected duration of a regular 120-dose canister of ICS, allowing for the determination of whether the patients refilled their prescription during the observation period. At study entry, a set of questionnaires was administered to evaluate each of the potential predictors of compliance to ICS elicited in the preliminary phase of the study. From this point on, the patients were not contacted at all by the study personnel. They were not asked to maintain an asthma diary because this might have modified their usual behaviour. The patients' compliance to ICS was then measured using electronic inhalation devices (MDILog II, Model MDC-512, Medtrac Technologies Inc, USA). These microprocessor devices accept a metered-dose inhaler mouthpiece and canister, and record the date and time of each inhaler actuation. The time measurement has a 4 min resolution. Up to 1320 actuations can be stored in memory, which exceeded the needs of the present study by far. The data can be downloaded through an external interface onto a personal computer. The patients were only told that the total number of puffs taken over the study period would be recorded. Complete information on the time measurement properties of the device was withheld given the obvious bias introduced by the patient's awareness of medication monitoring (11). The use of the monitoring device fulfilled the suggested criteria of behavioural research (12) and received approval by the ethics committee of the three institutions involved in the study. At the end of the 12-week study period, the Asthma Control Questionnaire (13) and the Self-reported Medication-taking Scale (14) were administered. Finally, the study participants were asked to estimate the proportion of the prescribed doses they had inhaled over the study period.

Statistics

Descriptive statistics: The proportions, means and SD were used to describe the study population. ICS dosage equivalencies were classified into three categories according to the most recent Canadian Asthma Guidelines (3): low dose (fluticasone propionate of 250 μ g/day or less), medium dose (more than 250 μ g/day, up to 500 μ g/day) and high dose (higher than 500 μ g/day). The questionnaires were analyzed according to the methods described previously (13,14).

Analysis of compliance: The data obtained from the first and last days of the study period were excluded. Then, for each day of use, the number of puffs recorded was extracted and the proportion (%) of the prescribed daily dose that was actually inhaled was determined (ie, [inhaled/prescribed] \times 100%). The unadjusted compliance index was defined as the mean of the proportion of the prescribed daily dose that was actually inhaled ([inhaled/prescribed] \times 100%) over the study period. To prevent adherence scores from being artificially elevated by including excess usage, the compliance index was adjusted by recording no more than the maximum number of puffs prescribed on any given day, so that the maximum value for ([inhaled/prescribed] \times 100%) was 100% (Figure 1) (15).

TABLE 1
Potential predictors of compliance to inhaled corticosteroids in adults with asthma

Potential predictors	Measure instrument used	Comments/brief description
Sociodemographics	Study-specific questionnaire	Includes sex, age, civil status, level of education, personal or family income, and type of drug insurance plan.
Asthma severity		
Asthma history	Study-specific questionnaire	Includes duration of asthma, smoking status, prior asthma education clinic attendance, previous participation in an asthma study, previous hospitalization for asthma, use of peak flow meter and use of a written action plan.
Pulmonary function	Spirometry (FEV ₁)	Spirometry was performed according to the American Thoracic Society requirements (29).
Asthma control	Asthma Control Questionnaire (ACQ) (13)	The ACQ is a seven-item questionnaire (including spirometry) that measures the adequacy of treatment.
Disease-specific quality of life	Standardized version of the Asthma Quality of Life questionnaire (AQLQ[S]) (30)	The AQLQ(S) is a 32-item self-report questionnaire designed to measure the problems that adults with asthma experience in their day-to-day lives. It is composed of four domains: asthma symptoms, activity limitation, emotional function and environmental exposure.
Knowledge/attitudes toward asthma (31-33)		
Knowledge/attitudes	Same questionnaire as that used by Boulet (31)	Includes 19 items about various aspects of corticosteroids therapy, particularly relating to the perceived modes of action and side effects
Self-control	Self-Control Schedule (34,35)	From Rosenbaum's theory (35): people who succeed in maintaining a health behaviour over an extended period of time can be distinguished from those who failed based upon their relative level of learned resourcefulness. The Self-Control Schedule is a 36-item questionnaire that measures patients' self-control skills.
Psychological factors (21)		
Anxiety	Spielberger's State-Trait Anxiety Inventory (STAI) (36)	The STAI is a self-report scale for measuring state and trait anxiety. The State-Anxiety scale evaluates how respondents feel at this moment. The Trait-Anxiety scale assesses how people generally feel. The current study limited its use to the State-Anxiety scale. Both scales are usually highly correlated under circumstances in which personal adequacy is evaluated (36).
Depression	Symptom Checklist-90 (SCL-90) (37)	The SCL-90 contains 90 items relating to 9 different domains. The current study limited its use of the SCL-90 to the depression (10 items) and hostility (10 items) domains (see below).
Problems with interpersonal relationships	SCL-90 (37)	Problems with interpersonal relationships may represent a reflection of negative attitudes towards asthma and its treatment (including relationships with health care staff).

FEV₁ Forced expiratory volume in 1 s

The cohort of patients was divided according to the adjusted index cut-off of 75% that was arbitrarily selected to define compliers (75% or higher) and noncompliers (less than 75%) (2). The daily variation in ICS use was also examined by computing the SD of the unadjusted compliance index. An SD of the unadjusted compliance index (called the 'regularity index') of less than 50% defined regular users, whereas patients with an SD of 50% or higher were defined as irregular users.

The cohort of patients was thus divided into four groups according to the adjusted compliance and regularity indexes. The 'regular compliers' comprised patients with an adjusted compliance index of 75% or higher and a regularity index of less than 50%. The 'irregular compliers' included those with an adjusted compliance index of 75% or higher and a regularity index of 50% or higher. The 'regular noncompliers' were defined as patients with an adjusted compliance index of less than 75% and a regularity index of less than 50%. The 'irregular noncompliers' were those with an adjusted compliance index of less than 75% and a regularity index of 50% or higher.

Logistic regression analysis was conducted to explain noncompliance using each of the potential predictors as independent variables. The linear correlation between the self-reported compliance and the adjusted index of compliance was also examined.

Sample size: It was anticipated that 50% of the study population would meet the definition of compliance. The authors sought to detect, in univariate logistic regression analyses, an OR of 2.0 or higher for noncompliance, with a power of 85%. With statistical significance set at the 0.05 level, 125 patients were needed (16).

RESULTS

Potential predictors of compliance

Only five patients participated in the preliminary phase of the study that aimed to elicit the potential predictors of compliance to ICS. Their interviews did not result in the identification of any predictor other than those listed from the review of the literature and consultations with clinicians. Table 1 is a summary of the potential predictors of compliance with ICS identified in the preliminary phase of the study. The method of administration and the dosing regimen of ICS were excluded because by virtue of the inclusion criteria of the study and the electronic devices used, all patients were on a twice-daily regimen of inhaled fluticasone propionate delivered through metered-dose inhalers. These potential predictors clustered into four dimensions: sociodemographic; asthma severity; knowledge and attitudes towards asthma and its medication; and psychological variables.

TABLE 2
Baseline clinical characteristics of the patients with asthma (n=124)

Sociodemographic	
Sex distribution (M:F)	51:73
Age, years (mean ± SD)	47±15
Level of education, years (mean ± SD)	13±4
Public drug insurance plan (%)	44
Asthma history/severity	
Time since the diagnosis of asthma, years (mean ± SD)	20±14
Written action plan (%)	36
Prior asthma education clinic attendance (%)	67
Previous participation in an asthma study (%)	21
FEV ₁ (% predicted; mean ± SD)	78±21
Inhaled steroids	
Daily dose of fluticasone propionate, µg (mean ± SD)	643±385
Daily dose of fluticasone*	
Low dose ≤250 µg/day, n (%)	27 (22)
Medium dose 251 µg/day to 500 µg/day, n (%)	55 (44)
High dose >500 µg/day, n (%)	42 (34)
Long-acting beta-agonists, n (%)	8 (6) [†]
Antileukotrienes, n (%)	24 (19)
Asthma Quality of Life Questionnaire – Standardized (mean ± SD) [‡]	
Asthma symptoms	4.9±1.3
Activity limitation	5.3±1.1
Emotional function	5.5±1.2
Environmental exposure	5.0±1.3
Asthma Control Questionnaire (mean ± SD) [§]	1.8±1.2
Knowledge about asthma (mean ± SD) [¶]	2.8±0.6
Psychological profile	
State-Trait Anxiety Inventory (mean ± SD)**	32.6±9.7
Symptom Checklist-90 ^{††}	
T score (mean ± SD)	56.3±10.3
T scores ≥63, n (%)	38 (31)

*Inhaled corticosteroid (ICS) dosage equivalencies were classified into three categories according to the most recent Canadian Asthma Guidelines (3);

[†]This small proportion is attributed to the fact that patients taking an inhaler combining ICS and long-acting beta-agonists were excluded from the study;

[‡]Asthma Quality of Life Questionnaire (30) results are reported per domain on a 7-point scale, ranging from 1 – worst possible score to 7 – best possible score;

[§]Asthma Control Questionnaire (13) results are reported on a 6-point scale, ranging from 6 – worst possible score to 0 – best possible score;

[¶]Knowledge about asthma was measured using a 19-item questionnaire about various aspects of corticosteroid therapy, particularly relating to the perceived modes of action and side effects (31); 0 – worst possible score;

4 – best possible score; **State-Trait Anxiety Inventory (36) scores range from 20 (the lowest level of anxiety) to 80 (the highest level of anxiety). Normal scores range from 32 to 47 (36);

^{††}Symptom Checklist-90 – depression (37): T scores of 63 or higher define 'depressive syndrome profile'. F Female; FEV₁ Forced expiratory volume in 1 s; M Male

Follow-up study

Patients: One hundred thirty-four patients participated in the follow-up study. Ten were excluded because of defective electronic devices. Table 2 is a summary of the baseline clinical characteristics of the 124 patients who contributed to the analysis. No difference was observed in the patients' baseline characteristics across the study centres (Quebec City: n=60; Saguenay: n=49; Montreal: n=15).

Patterns of compliance: Including the excess doses, the patients took an average of 98±50% (range 5% to 327%) of the prescribed medication daily. Excluding the doses in excess of the prescription, the mean adjusted compliance index was

72±24% (range 3% to 100%). On average, the patients were aware of their compliance behaviour (Self-reported Medication-taking Scale: compliers 2.9±1.1 [of 4 points] versus noncompliers 1.9±1.1; P<0.0001). The self-recorded compliance (88±24%; range 0% to 100%) was usually higher than the measured indexes of compliance. The correlation between the adjusted compliance index and the self-reported compliance was moderate (r=0.52, P=0.0001). Of note, 21% of the patients disposed of the content of their inhaler the day before the follow-up visit.

Four patterns of compliance were observed and are described (Figure 2): 1A – regular compliance (n=29; mean adjusted compliance index 91%; mean regularity index 36%); 1B – irregular compliance (n=37; mean adjusted compliance index 90%; mean regularity index 99%); 2A – regular non-compliance (n=24; mean adjusted compliance index 49%; mean regularity index 33%); and 2B – irregular noncompliance (n=34; mean adjusted compliance index 51%; mean regularity index 124%). From visual inspection of the compliance histograms, no patient had a period of complete or partial compliance followed by a period of complete noncompliance, a pattern that would have been compatible with nonrefilling of the ICS prescription.

Within the compliant and noncompliant groups, regular and irregular users did not demonstrate any differences. Among the potential predictors of noncompliance listed in Table 1, only age reached statistical significance, with compliance increasing with increasing age (OR for noncompliance for one-year increments in age 0.95; 95% CI 0.93 to 0.98). No differences in asthma-specific quality of life or asthma control were detected between compliant and noncompliant patients, both at baseline and at the 12-week follow-up (Table 3). In a similar analysis comparing regular and irregular users of ICS, no differences in asthma-specific quality of life or asthma control were detected between the two groups, both at baseline and at the 12-week follow-up (Table 3).

DISCUSSION

Although complete information on the time measurement properties of the device was withheld, it is probable that the use of electronic devices increased the patients' compliance to ICS. In addition, our patients were recruited from specialty clinics and approximately 20% had previously participated in an asthma study. This suggests that they were not 'typical' asthma patients. For both reasons, our data may overestimate patients' usual compliance. Notwithstanding this situation, the results of our study indicate that compliance to ICS in asthma is generally suboptimal, at least in mild-to-moderate asthma.

Compliance to ICS is a complex phenomenon that is difficult to predict. Among the potential predictors of noncompliance, only age reached statistical significance, with compliance increasing with increasing age. Because the full spectrum of asthma severity was not equally represented in the study population, this may have hindered finding asthma severity as a predictive factor for compliance.

We relied entirely on the validity of compliance measurement through an electronic device. Several investigators (17-19) have reported on the validity of such devices, often with conflicting results. In a pilot study, we found that the MDILog II (Model MDC-512) accurately recorded the date and time of inhaler actuations (unpublished data). The fact that 21% of the patients disposed of the contents of their inhaler the day

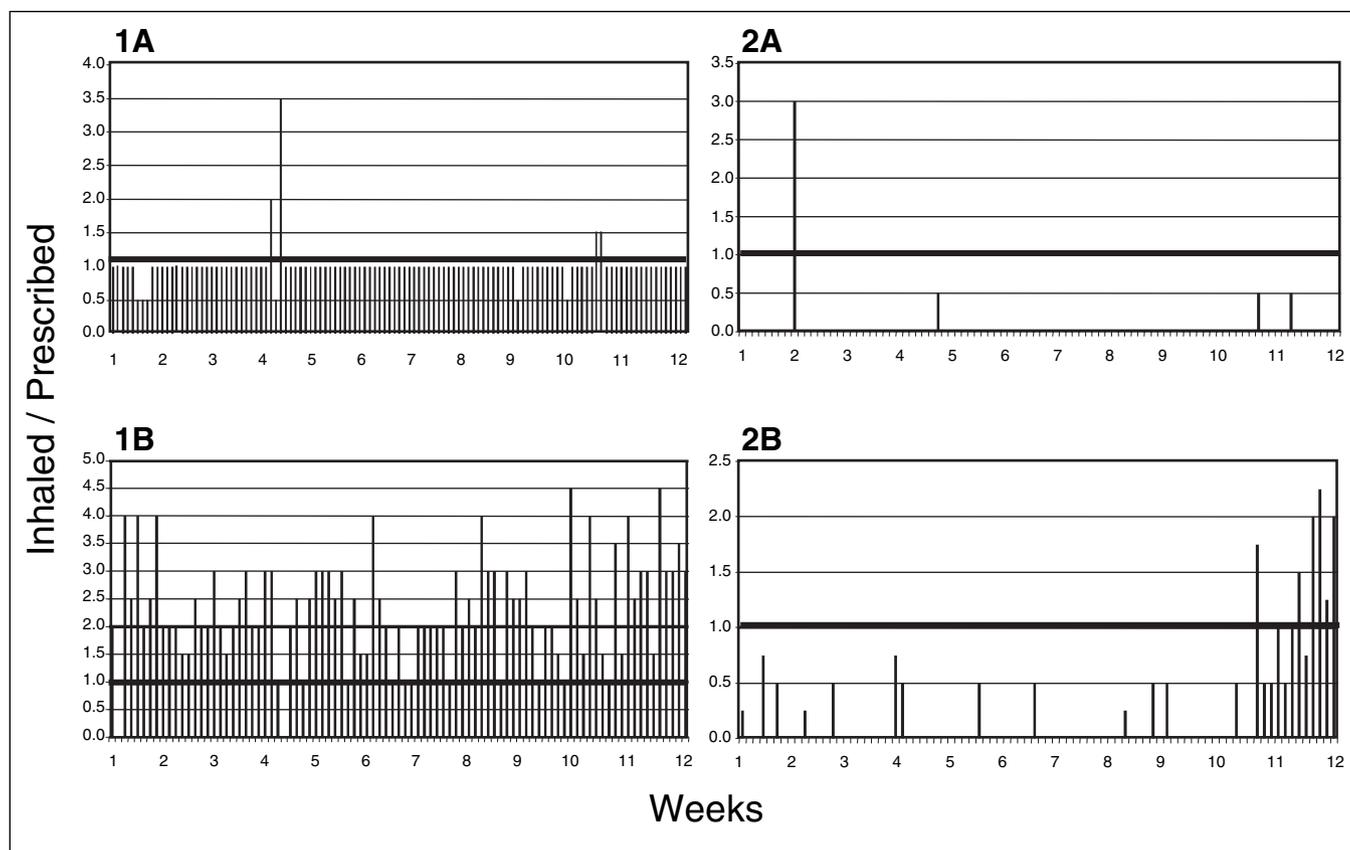


Figure 2) Patterns of compliance. Selected examples are provided. **1A** Regular compliance (adjusted compliance index 97%; regularity index 28%); **1B** Irregular compliance (adjusted compliance index 99%; regularity index 92%); **2A** Regular noncompliance (adjusted compliance index 3%; regularity index 32%); and **2B** Irregular noncompliance (adjusted compliance index 19%; regularity index 50%)

TABLE 3
Quality of life and asthma control at the 12-week follow-up between compliers and noncompliers, and between regular and irregular users

	Asthma Quality of Life Questionnaire scores				Asthma Control Questionnaire scores
	Activity limitation	Asthma symptoms	Emotional function	Environmental exposure	
Compliers (n=66)					
Score at baseline	5.2±1.2	4.9±1.3	5.4±1.2	5.0±1.3	1.9±1.3
Score at 12 weeks	5.4±1.3	5.3±1.3	5.8±1.2	5.4±1.3	1.5±1.2
Change in score	0.3±0.8	0.5±1.0	0.4±0.9	0.4±1.1	-0.4±0.8
Noncompliers (n=58)					
Score at baseline	5.5±1.1	5.0±1.3	5.6±1.2	4.9±1.3	1.6±1.0
Score at 12 weeks	5.8±1.0	5.5±1.1	6.0±1.0	5.4±1.2	1.3±1.0
Change in score	0.4±1.0	0.5±1.3	0.4±1.0	0.5±1.1	-0.3±1.0
Regular users (n=53)					
Score at baseline	5.5±1.1	5.2±1.2	5.7±1.2	5.2±1.3	1.6±1.1
Score at 12 weeks	5.7±1.2	5.6±1.2	6.1±1.0	5.6±1.3	1.3±1.1
Change in score	0.2±0.7	0.5±0.9	0.4±0.9	0.4±0.8	-0.3±0.7
Irregular users (n=71)					
Score at baseline	5.2±1.1	4.8±1.3	5.3±1.3	4.7±1.3	1.9±1.2
Score at 12 weeks	5.5±1.1	5.3±1.3	5.8±1.1	5.3±1.2	1.6±1.1
Change in score	0.3±1.1	0.5±1.3	0.5±1.1	0.6±1.3	-0.3±1.1

All scores are reported as mean ± SD. None of the comparisons in scores between compliers versus noncompliers and between regular versus irregular users was significant

before the follow-up visit indicated that many remained unaware of the time measurement properties of the devices throughout the study.

Comparison with other studies

Overall, our results on compliance are in agreement with previous smaller studies in which electronic devices were employed to

monitor compliance. Spector et al (20) found that the per cent of appropriate use ranged from 4.3% to 94.8%, with only three of 19 patients using the medication appropriately on at least 70% of the days. Underusage greatly exceeded overusage, which could be appropriate in case of asthma exacerbations. Younger patients more frequently underused the aerosol than did the older subjects, which was also confirmed in the present findings.

Other researchers have investigated reasons for noncompliance with asthma therapy, including social and economic factors. Bosley et al (21) reported that depression and interpersonal difficulties were among the factors that could discriminate compliers from noncompliers. However, the model they developed could correctly classify only 74% of the patients as either compliers or noncompliers. Apter et al (22) examined adherence to twice-daily inhaled steroid regimens in relation to sociodemographics, asthma severity and health locus of control in adults with moderate to severe asthma. Although this study appears similar to the present study, there were several key methodological differences. In Apter et al's study, the sample size was small (n=50) and the observation period was only six weeks; as well, it was unclear who provided the medication to the patient and the patients were aware of the time measurement properties of the electronic devices. Up to four excess inhalations per day were allowed in the calculation of compliance. Ad hoc questionnaires were used to measure knowledge and attitudes towards ICS without prior validation. Surprisingly, several of the predictors of adherence were measured only at the end of the six-week adherence-measurement period. In univariate regression analyses, the authors found that the factors associated with poor adherence included a low level of education, poor patient-clinician communication, low income and minority status. The differences observed between Apter et al's study and the current study may arise from any or all of the methodological issues described.

What are the consequences of poor ICS compliance in asthma?

In children with asthma, a strong relationship between poor corticosteroid adherence and exacerbations of asthma has been reported (23). In adults with asthma, the evidence is less compelling. Although we did not record data on asthma exacerbations during the study period, no differences in scores on the Asthma Control and the Asthma Quality of Life questionnaires were detected between the adult compliers and noncompliers either at baseline or at the 12-week follow-up. This may result from the inability of both questionnaires to detect small but clinically significant differences. Another explanation would be that, on average, our patients were indeed 'overtreated', so that the control of asthma could be obtained with lower doses of ICS such as those taken by the noncompliers. In these patients, occasional symptoms may elicit medication-taking

behaviours. This phenomenon of "intelligent non-adherence" (24) is often promoted in asthma education clinics, where it is recommended that patients tailor their dose of ICS according to the self-perceived control of the disease (3).

What if poor compliance is a real issue?

A number of strategies have been developed to enhance patient compliance with asthma medication. These include: educating the patient; educating the patient's support group; providing cues and reminders; simplifying the treatment regimen; and providing comprehensive programs to foster compliance (8). There is little evidence to support the effectiveness of these strategies. Asthma patients who participated in a formal self-management program demonstrated only partial adherence to self-treatment guidelines (25). Similarly, there were no differences detected between compliers and noncompliers in the proportion of patients who had attended an asthma education clinic. It is a common belief that patient compliance with ICS may be enhanced by a combination treatment with a beta-agonist. However, Bosley et al (26) could not confirm this hypothesis in a study of 72 patients.

Noncompliance in asthma may take several forms. Patients may fail to adhere to recommendations related to asthma trigger avoidance (27) or peak flow measurements (28). Determinants of noncompliance to nonpharmacological interventions may also differ from those of drug therapy. In addition, noncompliance to inhaled medication may have a bearing on the results and proper interpretation of clinical trials. Thus, clinicians remain challenged in their efforts to improve their assessment of asthma severity, the need for medication and compliance to anti-inflammatory therapy in patients who really need it on a regular basis.

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