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Beliefs about medicines predict refill adherence to inhaled corticosteroids

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Abstract

Objective: Despite the importance of the chronic use of inhaled corticosteroids (ICS) in maintaining asthma control, reported adherence varies between 40% and 60%. The Beliefs about Medicines Questionnaire (BMQ) has been shown to correlate with self-reported adherence. The aim of this study is to investigate whether beliefs about ICS (necessity and concerns), as measured by the BMQ, relate to adherence objectively measured by prescription-refill records. **Methods:** In a cross-sectional study of patients aged 18–45 years who filled at least two ICS prescriptions in 11 community pharmacies in The Netherlands, perceptions of ICS were assessed using the BMQ. Additionally, self-reported adherence was assessed using the Medication Adherence Report Scale. ICS prescription-refill adherence rates for a 12-month period prior to the survey were obtained from automated pharmacy dispensing records. Four attitudinal groups were defined using the necessity and concerns constructs. Statistical tests were used to examine associations between ICS adherence (assessed by subjective self-report and objective pharmacy records), specific beliefs about and attitudes towards ICS, and more general beliefs about pharmaceuticals. **Results:** Questionnaires were returned by 238 patients (51.1%). Both self-reported adherence (r=.38) and adherence by pharmacy records (ρ=0.32) correlated with ICS necessity beliefs and concerns. Patients defined as skeptical, indifferent, ambivalent, or accepting, on the basis of these constructs, differed with respect to both their attitudes towards medicines in general and their adherence to medication. **Conclusions:** Patients' beliefs about ICS correlate not only with adherence by self-report but also with a more objective measure of medication adherence calculated by pharmacy dispensing records. The necessity–concerns constructs offer a potentially useful framework to help clinicians elicit key treatment beliefs influencing adherence to ICS.

Keywords: Patients' beliefs; Self-reported adherence; Prescription-refill adherence; Asthma; Inhaled corticosteroids; Necessity–Concerns Framework; Beliefs about Medicines Questionnaire

Introduction

Appropriate use of inhaled corticosteroids (ICS) has been shown to be beneficial for maintaining disease control in patients with mild to moderate asthma [1,2]. For over a decade, the core pharmacological management of asthma has focused on preventer therapy with ICS [3]. Despite the importance of the regular use of ICS, low adherence rates have repeatedly been reported across studies, with ICS adherence ranging from 40% to 60% [4–7].

The degree of benefit of an appropriate prescription to patients will, to a large extent, depend on how closely patients follow the instructions for use.

Several theoretical models have been developed to explain illness-related behavior, including adherence to treatment. These emphasize the importance of "common-sensical" beliefs about the illness and perceptions of

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personal capacity to follow treatment recommendations [8,9]. When applied to treatment adherence, the explanatory power of theoretical models is likely to be enhanced by considering patients' representations of treatment and adherence [10,11]. To operationalize these treatment representations in relation to medication, specific and general beliefs about medicines are considered [12]. To describe the salient beliefs influencing patients' decisions about taking medicines, Horne and Weinman [11] developed the Necessity–Concerns Framework. This suggests that patients' motivation to start and persist with medication is influenced by the way in which they judge their personal need for the treatment relative to their concerns about potential adverse effects [11]. Deciding that a treatment is necessary is a process of balancing the pros and the cons, influenced by the patients' perceptions of their illness and symptoms experienced relative to expectations [15]. Specific concerns about prescribed medicines are related to more general beliefs (or social representations) about pharmaceuticals as a class of treatment, as well as to the experience or fear of side effects [12]. Adherence behavior is more closely related to specific beliefs than to general beliefs [12].

Both specific and general medication beliefs can be assessed using the Beliefs about Medicines Questionnaire (BMQ) [12]. The BMQ has been validated in patients with various chronic diseases, including asthma [12,13]. Necessity beliefs and concerns, as assessed by the BMQ (the Necessity–Concerns Framework), have been shown to explain nonadherence across a range of illnesses, including rheumatoid arthritis [13], heart failure [14], and asthma [15], and associations have been found uninfluenced by the number of medications used [16].

Patients' self-report is the most common method of assessment used in psychological research, but it is subject to self-presentational and recall biases [11]. It has been applied mostly as a convenient "spot-check" estimate of adherence behavior to grade patients according to their "relative standing on the adherence dimension" [11].

A method that is widely applied in epidemiology to assess adherence is the use of pharmacy records, which have shown to be a reliable source of current drug exposure as estimated in a home inventory [17,18].

Pharmacy records assist in evaluating patients' medication-taking behavior [19,20] and are informative on the proportion of patients who are most likely to be nonadherent as a consequence of insufficient filling of prescriptions [21].

There is, in addition to self-reported measures, a need for the investigation of objective indicators of medication use in relation to patients' beliefs about medicines in order to identify and, in the future, effectively address barriers to effective self-management. Therefore, the aim of this study is to determine whether patients' beliefs correlate with objective indicators of ICS use retrieved from pharmacy dispensing records in a community population.

Method

Patients

A cross-sectional study, in which patients aged 18–45 years who were filling ICS prescriptions in 11 pharmacies in The Netherlands were selected, was performed. These patients' automated prescription records from 1 January 2001 until 28 February 2005 were available. Patients who filled at least two ICS prescriptions, of which at least one was filled in the 6 months before 1 March 2005, were eligible for inclusion in the study. Since the majority of patients in The Netherlands are registered at only one community pharmacy, independently of prescriber, pharmacy records are virtually complete with regard to prescription drugs [22].

Exclusion criteria

Patients were excluded if they were known to have moved away from the pharmacy, as well as if they were terminally ill or apparently suffering from serious comorbidity. These patients were identified by the pharmacists and excluded from the study population.

Procedure

A random selection of eligible patients was performed in order to attain a manageable workload per pharmacy. The questionnaire, along with a prestamped addressed return envelope and an accompanying letter describing the research and requesting for their participation, was mailed to the patients by their pharmacists. Questionnaires were labeled with the study ID of the patient; names and addresses of patients were not marked on the questionnaire. Patients could contact their pharmacist if they had any difficulty completing the questionnaire. All patients received a reminder 3 weeks after the sending of the questionnaire.

Questionnaires

Patients' beliefs about their inhaled preventer medication and medicines in general and their reported adherence were assessed using BMQ Specific, BMQ General, and the Medication Adherence Report Scale (MARS).

Beliefs about Medicines Questionnaire

The BMQ questionnaire consists of the BMQ Specific, which measures perceptions of specific medicines, and the BMQ General, which measures more general beliefs about medicines [13]. All items are rated on a 5-point Likert scale.

BMQ Specific

The BMQ Specific has been validated for use in patients with asthma who are currently using their

medication. The BMQ Specific comprises two scales: one assessing patients' beliefs about the necessity of preventer medication for maintaining present and future health (Necessity scale), and the other assessing their concerns about the potential adverse consequences of using it (Concerns scale) [13].

Each scale has core items assessing beliefs that have been shown to be common across a range of chronic illness groups (9 for the Necessity scale and 12 for the Concerns scale), of which four items were added for use in patients with asthma [11]. Examples of items from the Necessity scale are "My health, at present, depends on my inhaler" and "My health in the future will depend on my inhaler." An item from the Concerns scale is "I sometimes worry about the long-term effects of my inhaler." Examples of the extended version for patients with asthma are "When I don't have any symptoms, I don't need to use my preventer medication" for the Necessity scale and "I can use as much of this inhaler as I need without having to worry about becoming too dependent on it" for the Concerns scale [11].

Scores for each scale were summed, divided by the total number of items in the scale, and multiplied by 5 to give a scale score ranging from 5 to 25 and a scale midpoint of 15 (Table 1). Higher scores on the scales indicate stronger beliefs in the concepts represented by the scale. A necessity–concerns differential was calculated by subtracting the individuals' concerns scores from the individuals' necessity scores, leading to a range from −20 to 20 (Table 1) [13]. Higher scores on this differential indicate higher perceived necessity and/or lower concerns for the use of ICS. The number of patients agreeing with a particular statement was assessed by categorizing the Likert scale responses as follows: 4 (*agree*) and 5 (*strongly agree*) were considered as agreeing; 1 (*strongly disagree*) and 2 (*disagree*) were considered as not agreeing.

Patients' attitudes towards ICS

The separate Necessity and Concern scales were split at the scale midpoint to create four attitudinal groups: (a) skeptical (low necessity, high concerns); (b) indifferent (low necessity, low concerns); (c) ambivalent (high necessity, high concerns); and (d) accepting (high necessity, low concerns) (Fig. 2).

BMQ General

The BMQ General comprises a General Harm scale and a General Overuse scale assessing beliefs about pharmaceuticals as a class of treatment [10]. The General Harm scale assesses beliefs about the intrinsic nature of medicines and the degree to which they are perceived as harmful addictive poisons that should be avoided if possible. The General Overuse scale represents beliefs about the use of medicines and whether they are overprescribed by clinicians. Each scale comprises four items, and scores for each scale were summed, resulting in a range from 4 to 20 (Table 1). Higher scores indicate a more negative orientation towards medicines in general [13].

Self-reported adherence (MARS)

The five-item MARS asks respondents to rate the frequency with which they engage in each of the five types of nonadherent behavior (e.g., deciding to miss a dose, forgetting to take a dose). All items are rated on a 5-point scale (where 5=*never*, 4=*rarely*, 3=*sometimes*, 2=*often*, and 1=*very often*). Scores for each of the five items are summed to give a total score ranging from 5 to 25 (Table 1), where higher scores indicate higher levels of self-reported adherence. The scales can be used to grade patients according to their "relative standing on the adherence dimension" rather than as an exact measure of when and how patients took their medicines [13].

Medication use

Automated pharmacy records for eligible patients were available for up to 5 years. Prescription-refill records of 1 year before the survey were used to calculate a Continuous Measure of Medication Acquisition (CMA) [20]. The days' supply were summed and divided by the total number of days from the beginning to the end of the time period, multiplied by 100%. We defined time period as the number of days between the last prescription fill date and the first prescription fill date in the year before the survey. It is possible to observe CMA values that exceed 100% as patients may fill their prescriptions before the due date. CMA could not be calculated for

Table 1
Scores on the BMQ Specific (comprising the Necessity and Concerns scales), BMQ General, and MARS for the total sample (N=233)

Scales of the questionnaire	Range of score	Cronbach's α	Mean score	S.D.	% Scoring above the scale midpoint
Necessity	5 to 25	.81	15.6	3.5	53.6
Concerns	5 to 25	.77	14.9	2.9	42.9
Harm	4 to 20	.66	9.96	2.4	16.5
Overuse	4 to 20	.68	11.12	2.7	34.9
MARS	5 to 25	.81	19.4	4.4	79.0
BMQ Specific (Necessity–Concerns)	−20 to 20	–	0.71	4.7	52.4

patients with only one prescription in the year before the survey [23–27]. The number of ICS prescriptions filled was assessed.

Analysis

Scores for the BMQ Specific, BMQ General, and MARS, and adherence by pharmacy records were analyzed on a continuous scale. Correlations between beliefs, self-reported adherence (bivariate Pearson correlation coefficient), and adherence by pharmacy dispensing records (Spearman's rank–order correlation) were calculated.

In comparing patient attitudes, an analysis of variance (ANOVA) comparison of multiple groups (Bonferroni test) and nonparametric multiple independent-samples tests (Kruskal–Wallis test) were performed.

Statistical analyses were carried out with the SPSS 12.0 for Windows statistical software package (SPSS Inc., Chicago, IL, USA).

Results

Participants

Eight hundred three patients aged 18–45 years who filled at least two prescriptions for ICS during the past 5 years were eligible to participate in the study. Of these patients, a random sample was taken per pharmacy. From 458 patients who were sent a questionnaire, 238 patients (51.1%) responded. After the exclusion of 1.1% of questionnaires with >10% missing responses, the questionnaires of 233 patients (50.9%) were analyzed (Fig. 1).

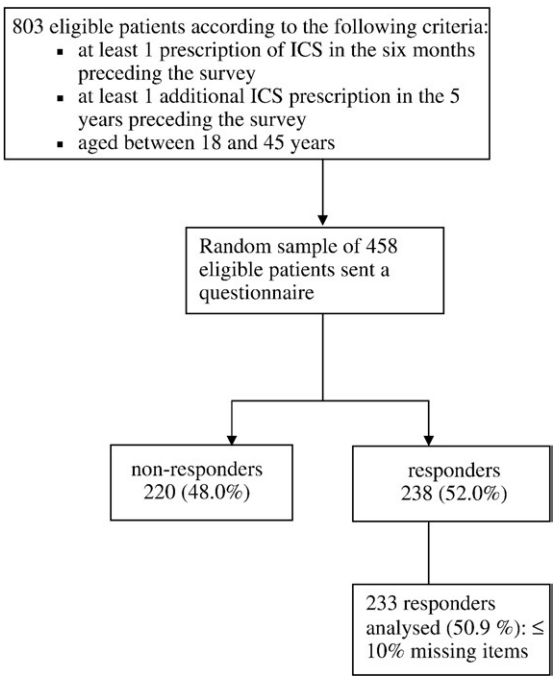

Fig. 1. Flowchart showing patient participation throughout the study.

Table 2
Baseline characteristics of the study population (*N*=233)

Female gender (%)	67.0
Age in years (mean±S.D.)	36.2±6.3
Age [*n* (%)]	
20–24 years	20 (8.6)
25–29 years	19 (8.2)
30–34 years	39 (16.7)
35–39 years	61 (26.2)
40–45 years	94 (40.3)
Total number of ICS prescriptions during the observation period (*n*=222)[a]	
Mean±S.D.	11.6±7.8
Range	2–51
% Adherence by pharmacy records during the year prior to the survey (*n*=222)[a]	
Mean±S.D.	73.4±38.6
Median	70.5

[a] For 11 patients, CMA could not be calculated.

Medication beliefs

Almost half of the sample (46.4%) had doubts about the personal need for the preventer inhaler (scores below the scale midpoint), and 42.9% reported concerns about potential adverse effects (scores above the scale midpoint) (Table 1).

The mean necessity–concerns differential was 0.7 (±4.7) and ranged from −1.7 to 3.5. About half of the sample (47.6%) had necessity scores that were lower than concerns scores (negative values for the necessity–concerns differential) (Table 1).

About one third (34.9%) of the patients thought that doctors overprescribed medicines, and 16.5% thought of medications in general as harmful (scores greater than the scale midpoint).

Statements on the Concerns scale express possible barriers to the continuous use of ICS. Examples of the prevalence of concerns in this sample include the following: "This inhaler gives me unpleasant side effects" (14.6%), "I can use as much of this inhaler as I need without having to worry about becoming too dependent on it" (20.6%), "I sometimes worry about becoming too dependent on my inhaler" (24.9%), and "I sometimes worry about the long-term effects of my inhaler" (44.6%).

The proportion of patients agreeing with the following two items in the Necessity scale, "I should keep using my inhaler even when I don't have symptoms" (59.2%) and "When I don't have any symptoms, I don't need to use my preventer medication" (30.9%), illustrate how symptom perceptions influence patients' perceptions of medication necessity.

Moreover, approximately one third (30.9%) of the patients agreed or strongly agreed with this statement, "When I don't have any symptoms, I don't need to use my preventer medication/this inhaler." Patients who endorsed this belief were significantly more negatively oriented towards medication in general and had a lower reported adherence. Scores on the BMQ General Harm scale were

Table 3
Pearson correlation coefficients between different constructs of the questionnaire (BMQ Specific, BMQ General, and MARS) for the total sample (N=233) and for patients with available adherence by pharmacy records (N=222)

	(1) BMQ Specific	(2) Necessity	(3) Concerns	(4) Harm	(5) Overuse	(6) MARS
(1) BMQ Specific						
(2) Necessity	.78 **					
(3) Concerns	−.67 **	−.06				
(4) Harm	−.41 **	−.19 **	.42 **			
(5) Overuse	−.31 **	−.09	.39 **	.59 **		
(6) MARS	.38 **	.35 **	−.19 **	−.28 **	−.20 **	
(7) Adherence by pharmacy records (Spearman's rank–order correlation) (N=222)	.32 **	.37 **	−.07	−.16 *	−.07	.46 **

* Significant at .05 level (two tailed, P<.05).
** Significant at .01 level (two tailed, P<.01).

11.1±2.5 for those agreeing versus 9.2±2.2 for those not agreeing, and scores on the BMQ General Overuse scale were 11.9±2.6 for those agreeing versus 10.5±2.7 for those not agreeing. MARS scores were 20.9±3.7 for those agreeing and 17.0±4.5 for those not agreeing. The total number of ICS prescriptions filled was significantly lower (7.7±5.3) for those agreeing than for patients who disagreed (13.2±7.7) with the statement (P<.001).

Self-reported and prescription-refill adherence

The mean score of self-reported adherence assessed by MARS was 19.4 (±4.4). Scores on the MARS scale showed a skewed distribution, with 79% scoring above the scale midpoint (Table 1).

To investigate the correlation between beliefs and prescription-refill adherence and to identify barriers for nonadherence, the selection of a heterogeneous population with variable medication-taking behaviors was necessary. Our inclusion criteria were therefore directed towards attaining variable prescription-refill patterns. The mean adherence calculated by pharmacy dispensing records was 73.4% (±38.6%) and also showed a skewed distribution (Table 2). For 11 patients, refill adherence could not be calculated as they filled only one prescription within the year prior to the survey.

Intercorrelations between BMQ and self-reported adherence

A moderate significant correlation between the BMQ Specific necessity–concerns differential and MARS was found (r=.38). The BMQ Specific Necessity scale and MARS were both negatively correlated with the General Harm scale and the General Overuse scale. However, the Concerns scale was positively correlated with both the General Harm and the General Overuse scales (Table 3).

Adherence by pharmacy records correlated (Spearman's rank–order correlation) with the necessity–concerns differential (ρ=0.32) and with MARS (ρ=0.46) (Table 3).

Relations between ICS attitudes and adherence

Both the mean self-reported adherence scores and the adherence rates by pharmacy records were highest for the accepting (n=69) and ambivalent (n=56) groups, while they were lowest for the indifferent (n=64) and skeptical groups (n=44) (Fig. 2).

An ANOVA comparison of multiple groups (Bonferroni) indicated that self-reported adherence differed significantly between groups. Specifically, the ICS accepting group had reported adherence that was significantly higher than those for both the indifferent group (P<.001) and the skeptical group (P<.001).

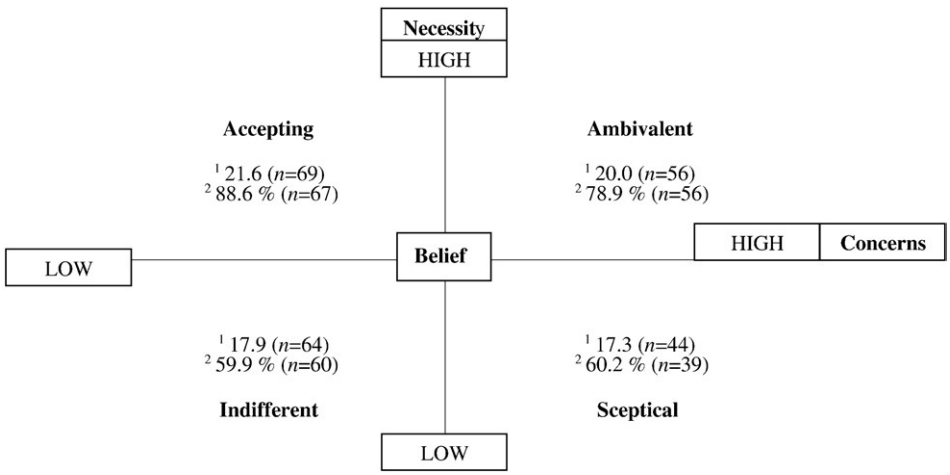

Fig. 2. Preventer medication belief groups and self-reported adherence (MARS) (1: N=233), adherence by pharmacy records (2: n=222), and the number of patients in each group (in parentheses).

A Kruskal–Wallis test indicated that the mean adherence by pharmacy records differed significantly between the attitudinal groups ($P<.001$). The ICS accepting group and the ambivalent group had adherence by pharmacy data that were significantly higher (ANOVA Bonferroni) than those for the indifferent group ($P<.001$ for both) and the skeptical group ($P<.001$ for both). Thus, the accepting and ambivalent groups did not differ with respect to adherence (both measures). Patients in the ambivalent group more often agree with statements that reflect their view on the harmfulness of drugs in general (10.6±2.2 vs. 8.8±2.2 for the accepting group; Bonferroni, $P<.05$). Moreover, ambivalent patients have higher overuse scores (11.7±2.3 vs. 10.3±2.8 for the accepting group; Bonferroni, $P<.05$).

Discussion

In addition to previous studies, we have shown that not only self-reported adherence but also adherence by prescription-refill records correlated with patients' beliefs about ICS (necessity and concerns). Our findings show that the Necessity–Concerns Framework provides an insight into not only patients' intentions to take medication but also their actual medication-taking behavior. Nonadherence to ICS, as assessed using pharmacy records, was associated with patients' evaluation of their personal need for ICS relative to their concerns about potential adverse effects.

All four attitudinal types that we defined using the BMQ Specific necessity and concerns constructs differed with respect to patients' beliefs about medicines in general and with respect to medication-taking behaviors reflected by self-report and prescription-refill data. Both adherence measures were highest for the accepting group and the ambivalent group, while they were lowest for the indifferent group and the skeptical group. Similar findings were obtained in the study of self-reported adherence to antidepressant medication by Aikens et al. [28].

In accordance with previous studies [11–13] and as predicted by theoretical models [10], we found that patients with a more negative orientation towards medicines in general (higher scores on the General Harm and the General Overuse scales) had more negative attitudes towards ICS.

Patients who participated in the studies by Horne and Weinman [11,13] and Horne et al. [12] were recruited in the United Kingdom, as opposed to our study where patients were recruited in community pharmacies in The Netherlands. A study of Horne and Weinman [13] with patients recruited in an (United Kingdom) outpatient clinic of consultant respiratory physicians reported a mean necessity–concerns differential of 3.9 (±4.6) as opposed to 0.7 (±4.7) in the present study, possibly indicating a more skeptical attitude towards ICS in our (Dutch) population. The United Kingdom sample might be different from the Dutch sample with regard to symptom severity, duration of disease [12], and comorbidity, which can influence patients' perspective on the benefit of taking ICS. In the present study, a more heterogeneous population was included. Despite this, we obtained similar findings on intercorrelations as in previous studies [11–13], confirming that the BMQ can also be used in a Dutch setting.

The associations found in this study and in previous studies [11,13,15,28–30] indicate a relation between beliefs and medication adherence. Causal relations cannot be deduced from these findings and might be quite complex, as beliefs can influence medication use and vice versa. Behavior change is a dynamic process and is influenced by a variety of factors. At a certain moment, people can be aware that a problem exists and think about changing; however, they have not yet committed themselves to a plan of action [31]. This is illustrated by the fact that the current perceived necessity of preventer therapy might be the same for some patients, but their actions might be different (different MARS or prescription-refill adherence). Moreover, beliefs about medicines can be affected by both positive and negative experiences with ICS preventer medication. Notwithstanding all that, we describe the variation of beliefs and behaviors within this population and give insights into specific patients' views on necessity and concerns.

It might be useful to increase our understanding of patients' beliefs and their determinants by acquiring prospective information on beliefs but also on clinical information, in addition to prescription data, especially in new users of medication. A patient with intermittent asthma might, for example, appropriately use ICS intermittently [3]. By analyzing comedication as a proxy for disease severity or comorbidity at the time of the study [32], progress in time can be assessed in order to gain insight into the appropriateness of low (prescription refill) adherence.

Clinical implications

Optimum self-management and adherence are often difficult to achieve for patients suffering from chronic diseases. Asthma programs are rarely driven by theory but tend to be principally information based and instructional, with only a few studies incorporating techniques to address barriers (e.g., patients' beliefs, expectations, and preferences in effective self-management) [33,34].

This study showed that patient perceptions of their personal need for ICS, relative to their concerns about potential adverse, were related to prescription refill as a proxy for medication-taking behavior. Eliciting patients' perceptions about ICS necessity and concerns about ICS adverse effects should be an integral part of prescribing related consultations. Prescribers need to take account of the fact that many patients may be skeptical about the net benefits of ICS and recognize that this is often related to general negative attitudes towards pharmaceuticals. Interventions to facilitate adherence are likely to be more effective if they also take account of these general beliefs and patients' concerns [35].

Patients with lower perceived needs could benefit from education on the rationale of maintenance treatment. It might be beneficial to explore whether these patients view their asthma as a chronic disease or whether these patients view their asthma only as an acute episodic disease associated with the occurrence of symptoms [35,36].

Although few studies have targeted patients' cognitions, those that did so appear to be effective in improving patients' adherence [37] and functional outcome [38]. Our findings suggest that the Necessity–Concerns Framework is a potentially useful method for operationalizing key medication beliefs influencing adherence and could be incorporated into theory-based interventions that take account of patient perspectives to facilitate informed choice and appropriate adherence.

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