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Understanding beliefs about inhaled medication in patients with persistent asthma: a cross-sectional analysis of the INSPIRERS studies

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Key words

Asthma; beliefs; treatment adherence; illness perceptions; attitudes; real-world data.

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Impact statement

This study emphasizes the importance of patients' beliefs regarding asthma medications. Although the perception is mainly positive, comprehending patients' viewpoints enables targeted interventions that are crucial for enhancing patient outcomes.

Summary

Background. *Identifying factors influencing adherence, such as patients' beliefs about medication, is essential for effective asthma management. This study aims to assess and gain insight into the beliefs of patients with asthma regarding inhaled medication.* ***Methods.*** *This is a secondary analysis of the INSPIRERS studies. Patients aged ≥ 13 y.o., with persistent asthma and a prescription for inhaled controller were recruited from 60 primary and secondary care centers in Portugal from 2017 to 2020. Demographic and clinical characteristics were collected in a face-to-face visit. The Specific-Beliefs about Medicine Questionnaire was administered 1-week later by telephone interview. Mann-Whitney U and Kruskal-Wallis tests were used to explore relations between patients' beliefs and characteristics.* ***Results.*** *A total of 552 participants (mean 32.8 ± 17.3 y.o.; 64.5% female) were analyzed. The Necessity score (Median 19 [p25-p75 16,22]) was significantly higher than the Concerns score (15 [16,22], $p < 0.001$), resulting in a positive Necessity-Concern differential (Median 4 [0,7]). Acceptance (high necessity, low concerns) characterized 61% of participants, while 19% were ambivalent (high necessity, high concerns). Adolescents exhibited lower Necessity (Median 16 vs 20; $p < 0.001$) and Concerns scores (Median 11 vs 15; $p = 0.002$) than adults. In primary care setting, patients had significantly lower Necessity (Median 18 vs 19; $p = 0.027$) and Concerns (Median 14 vs 15; $p = 0.05$) compared to the secondary care.* ***Conclusions.*** *A predominantly positive perception of inhaled asthma medication necessity was found, although ambivalence or indifference exists in about 1/5 of patients. Our findings highlight the importance of personalized approaches to address beliefs and optimize patient education.*

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Introduction

Asthma is a chronic respiratory disease that affects approximately 262 million people worldwide (1). It is a major noncommunicable disease that is associated with premature death and reduced quality of life, ranking 24th among the leading causes of years lived with disability. Asthma also represents a significant source of global economic burden, which can be reduced through strategies to improve access and adherence to evidence-based therapies (1, 2).

Adherence to inhaled controller medication is critical for effectively managing patients with asthma (3). However, adherence rates reported are highly variable, ranging from 2-63% (4, 5). Medication adherence has been described as particularly diminished in adolescents (6). Non-adherence to asthma therapy at any age leads to poor disease control, increasing the risk for asthma exacerbations, reducing quality of life, and raising healthcare utilization, resulting in high healthcare costs (4, 5, 7-10). Therefore, identifying and understanding the factors that contribute to poor adherence is essential for effective asthma management.

Adherence to long-term treatments for chronic diseases such as asthma is influenced by several factors that need to be considered when addressing adherence. These factors include not only social and economic aspects, the health care system, and the disease itself, but also patient-related characteristics. These include the patient's knowledge, expectations, perceptions, attitudes and beliefs (4). It is known that patients' beliefs and concerns about asthma and asthma medications are related to their medication-taking behavior and adherence to treatment (3-5, 11-13). Patients may have specific beliefs about the need for treatment to maintain the disease controlled, but also concerns about the adverse effects of adherence to such medications (14, 15). Patient's motivation to adhere to chronic medication is influenced by the balance between what they perceive to be a personal need or concern (15).

The Beliefs about Medicine Questionnaire-Specific (BMQ-Specific) is a commonly used patient-reported outcome measure to assess beliefs about medicines and has been shown to relate to non-adherence in patients with chronic illnesses, including asthma (16). Using the BMQ-Specific, previous studies have shown that patients' beliefs and concerns can be used to define different attitudinal groups associated with different levels of medication adherence (17, 18). Thus, understanding patients' beliefs about their inhaled medication is key to shared decision-making and to improving adherence. With this knowledge, healthcare professionals can intervene more effectively (12).

The existing literature describing the beliefs about medicines in patients with asthma is heterogeneous, often with small sample sizes and mostly recruited from a single setting (17-20). A recent study conducted in a large real-world adult population from the United States and five European countries concluded that, in line with previous studies, higher perceived necessity and lower concerns about medication were associated with better adherence in patients with asthma (21). It should be noted that Portugal was not included in this study and, to our knowledge, there is no real-world data available on the beliefs of Portuguese patients with asthma. While previous studies have explored the beliefs about medication in adults (14, 15, 17, 18, 21) and, to a lesser extent, in adolescents (19, 22), no studies have compared these beliefs in the two age groups.

The aim of this study is to assess and gain insight into the beliefs of adolescent and adult patients with asthma regarding inhaled medication.

Materials and methods

Study design

This study presents a secondary, cross-sectional analysis of four prospective multicenter observational studies conducted as part of the Inspirers project. The project aimed to improve adherence to asthma inhalers among patients with persistent asthma (23). Between November 2017 and October 2020, patients were recruited from 60 primary and secondary (allergy, pulmonology and pediatric) care centers in Portugal using convenience sampling. This study was conducted in accordance with the Declaration of Helsinki and corresponding ethical standards. The study protocol was approved by the ethics committees of all participating centers. Written informed consent was provided by all participants and/or legal representatives prior to enrolment in the study. Adolescents also signed a written informed assent. The study is reported according to STROBE (Strengthening the Reporting of Observational Studies in Epidemiology) guidelines (24).

Population

Patients were included in the analysis if they had a previous medical diagnosis of persistent asthma, were at least 13 years old (13-17 years adolescents; ≥ 18 years adults) and had an active prescription for inhaled controller medication for asthma. All inhaled controller treatments were permitted, and no changes were made to any prescribed medication in relation to participation in these studies. Exclusion criteria included a diagnosis of a chronic lung disease other than asthma or any other significant chronic condition that could potentially interfere with the study's objectives.

Data collection

During the initial face-to-face visit, data were collected from both physicians and patients. Socio-demographic data (age, gender, education level, marital status, current occupation, civil parish, postal code) and clinical data (weight, height, smoking habits, age of asthma diagnosis, exacerbations) were collected from patients. Additionally, socioeconomic level was defined as the Portuguese Ecological Deprivation Index (EDI), extracted from the patient residence information (civil parish/postcode), and categorized

into 5 quintiles (Q1 = least deprived to Q5 = most deprived) (25). Information on the healthcare setting (primary, secondary) was obtained based on the center where the patients were recruited. Two questionnaires were used to assess asthma control: the Global Initiative for Asthma (GINA) assessment of symptoms control (3), completed by the physician, and the Control of Allergic Rhinitis and Asthma Test (CARAT) (26), completed by the patient. CARAT is a widely used self-administered questionnaire in clinical practice and research, adapted in over 27 languages (26). This questionnaire contains 10 questions, each rated on a 4-point Likert scale, with a total score ranging from 0 to 30 points. A score > 24 indicates good disease control (27). In addition, physicians also reported on the patients' current asthma treatment.

Approximately one week later, a telephone interview was conducted to administer the BMQ-Specific, the Morisky Medication Adherence Scale (MMAS-4) and a 1-100 numerical scale simulating a Visual analogue scale (VAS) of adherence to inhaled controller medication (28-30).

The study used the Portuguese version of the BMQ-Specific questionnaire to measure specific beliefs about inhaled medication (29). This patient-reported outcome measure had been previously applied by telephone (31). The BMQ-Specific consists of two subscales: Specific-Necessity and Specific-Concerns. The Necessity subscale contains five items and the Concerns subscale contains six items. Participants rated each item on a 5-point Likert scale, resulting in a total score ranging from 5 to 25 for the Necessity sub-scale and 6 to 30 in the Concerns subscale. A necessity-concerns differential was calculated by subtracting the Concerns subscale scores from the Necessity subscale scores, such that higher differential scores indicate higher perceived necessity and/or lower concerns, thereby representing lower likelihood of intentional non-adherence (29). Four attitudinal groups can be distinguished: skeptical (low necessity, high concerns), indifferent (low necessity, low concerns), ambivalent (high necessity, high concerns) and accepting (high necessity, low concerns) (17). Using Cronbach's alpha coefficient, the internal consistency of the total BMQ-Specific in this study was 0.723, while Cronbach's alphas for the Necessity and Concerns subscales were 0.779 and 0.719, respectively.

The MMAS-4 consists of four questions with yes (0) or no (1) response. The item scores are summed to determine three levels of adherence: 0 (high adherence), 1-2 (medium adherence), and 3-4 (low adherence) (32, 33). Additionally, patients reported their global adherence to asthma control inhalers during the previous week using a VAS, ranging from 0 (worst) to 100 (best). The VAS scores were grouped into three categories: low (0-50 mm), medium (51-80 mm) and high (81-100 mm). These categories are commonly used to differentiate adherence groups (30, 34, 35).

Statistical analysis

Descriptive statistics were used to characterize the sociodemographic and clinical characteristics of the sample and the BMQ-specific scores. Absolute and relative frequencies were used to characterize categorical variables. Means and standard deviation (SD) or medians and 25^{th}-75^{th} percentiles (p25-p75) were used, according to data distribution, to characterize the continuous variables. Normality of each variable was investigated with Kolmogorov-Smirnov tests and visual analysis of histograms. To explore relations between beliefs (necessity, concerns, necessity-concerns differential) and sociodemographic and clinical characteristics, Mann-Whitney U tests and Kruskal-Wallis tests were used. The level of significance considered was 0.05. Statistical analyses were performed using IBM SPSS Statistics V.29.0 (IBM Corporation, Armonk, New York, USA).

Results

Participants

A total of 589 participants were included in the study, but 37 did not answer the 1-week telephone interview and had no BMQ-Specific data. The analysis was conducted on 552 participants with asthma with a mean (±SD) age of 32.8 ± 17.3 (range 13-82) years old. Sixty-four percent (n = 356) of participants were women. About 41.7% (n = 230) of patients lived in deprived areas. Regarding healthcare setting, most patients (n = 426; 77.2%) were recruited in secondary care. According to the GINA assessment of symptom control, almost half of the participants had well-controlled asthma (n = 273; 49.5%) and about 51.4% (n = 284) had at least one exacerbation in the last year. **Table I** summarizes the socio-demographic and clinical characteristics of the participants.

Beliefs about inhaled medication

The median Necessity score (19 [16,22]) was significantly higher than the median Concerns score (15 [12,18], $p < 0.001$). The Necessity-Concerns differential was positive, with a median score of 4 [0,7]. Overall, patients had a high perception of the necessity of inhaled medication. Specifically, 94% of patients agreed that the inhaler protects them from getting worse, and 74% believed that their health depends on medication (**figure 1A**). However, almost half of the patients reported being worried about long term effects of medication (48%) and becoming too dependent on the inhaler (42%) (**figure 1B**). **Figure 1** shows the frequency of participants agreeing with the items of both BMQ subscales.

The patients were categorized in four groups for attitudinal analysis, as shown in **figure 2**. Most patients (61%; n = 338) demonstrated acceptance of their inhaled medication (high necessity, low concerns) and 19% (n = 261) exhibited ambivalence, reporting high necessity and high concerns regarding their inhaler. Only 3% of participants belonged to the skeptical group (low necessity, high concerns), while 17% of participants were indifferent towards their medication (low necessity, low concerns). In the

Table I *- Socio-demographic and clinical characteristics of the participants (n = 552).*

Characteristic	
Age (years) M ± SD[a]	32.8 ± 17.3
Age group n (%)	
Adolescent	153 (27.7)
Adult	399 (72.3)
Gender n (%)	
Female	356 (64.5)
Male	196 (35.5)
Educational level n (%)[b]	
No education completed	2 (0.4)
Primary school	36 (6.5)
Lower secondary education	191 (34.6)
Upper secondary education	161 (29.2)
Qualification above high school (but not university)	19 (3.4)
University or higher	134 (24.3)
Other	1 (0.2)
Marital status n (%)[c]	
Single	311 (56.3)
Married/Living as a couple	199 (36.1)
Separated/divorced	30 (5.4)
Widowed	11 (2)
Current occupation n (%)[d]	
Employed	259 (46.9)
Student	211 (38.2)
Unemployed	35 (6.3)
Retired	35 (6.3)
Other	8 (1.4)
Socioeconomic level[e]	
Q1-Q2 (least deprived)	154 (27.9)
Q3	105 (19.0)
Q4-5(most deprived)	230 (41.7)

Characteristic (Continued)	
BMI Kg/m^2, M ± SD[f]	24.8 (5.4)
Smoking Status n (%)[d]	
Never smoker	413 (74.8)
Ex-smoker	94 (17)
Current smoker	41 (7.4)
Setting n (%)	
Secondary care	426 (77.2)
Primary care	126 (22.8)
Age of asthma diagnosis (years) M ± SD[g]	16.5 ± 15.1
GINA assessment of symptom control n (%)[h]	
Well controlled	273 (49.5)
Partly controlled	173 (31.3)
Uncontrolled	101 (18.3)
CARAT n(%)	
Controlled	147 (26.6)
Uncontrolled	405 (73.4)
Exacerbations in the last year n (%)[i]	
None	253 (45.8)
At least one	284(51.4)
Inhaler prescribed n (%)[d]	
1	190 (34.4)
>1	358 (64.9)
MMAS-4 level n (%)[j]	
High	59 (10.7)
Medium	321 (58.2)
Low	172 (31.2)
VAS adherence level n(%)[k]	
High	241 (43.7)
Medium	150 (27.2)
Low	78 (14.1)

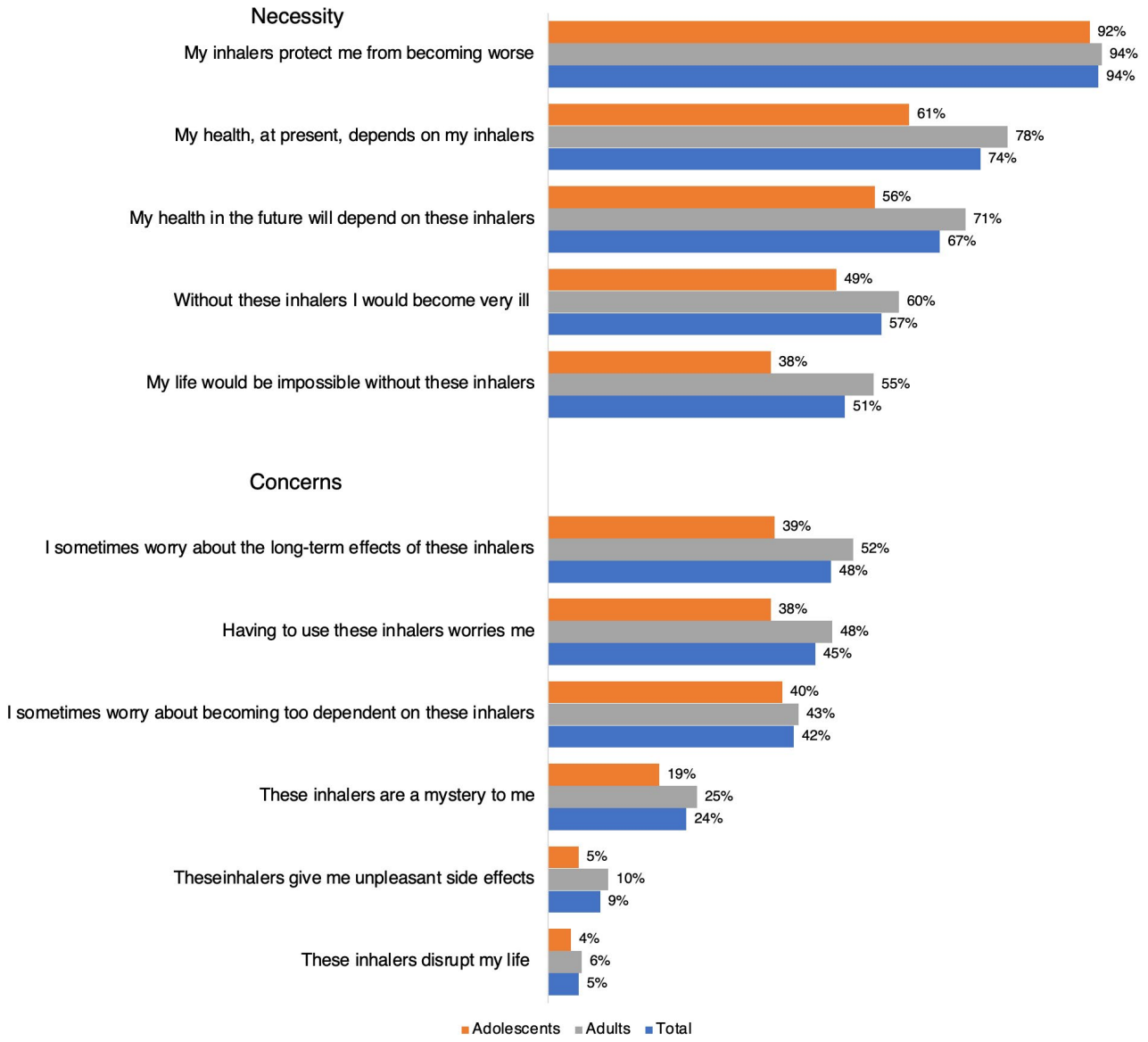
BMI: body mass index; CARAT-T: Control of Allergic Rhinitis and Asthma Test total score; GINA: Global Initiative for Asthma; M: Mean; MMAS-4: Morisky Medication Adherence Scale; SD: Standard Deviation; VAS: Visual analogue scale. [a]6 missing values. [b]7 missing values. [c] 1 missing value. [d]4 missing values. [e]63 missing values; [f]25 missing values. [g]18 missing values. [h]5 missing values. [i]15 missing values. [j]37 missing values. [k]83 missing values.

adolescents' group, the indifferent group was larger than the ambivalent group (22% *vs* 12%).

Beliefs and patients' characteristics

Table II summarizes the distribution of the Necessity, Concerns and Necessity-Concerns differential scores according to patient characteristics. Adolescents had significantly lower Necessity (Median [p25-75] 15.5 [18,20] *vs* 20 [17,22]; p < 0.001) and Concerns (Median 11 [14,17] *vs* 15 [12,18]; p = 0.002) scores compared to adults. Female patients had significantly higher Necessity scores (19 [16,22] *vs* 19[16,21]; p = 0.037) compared to male patients.

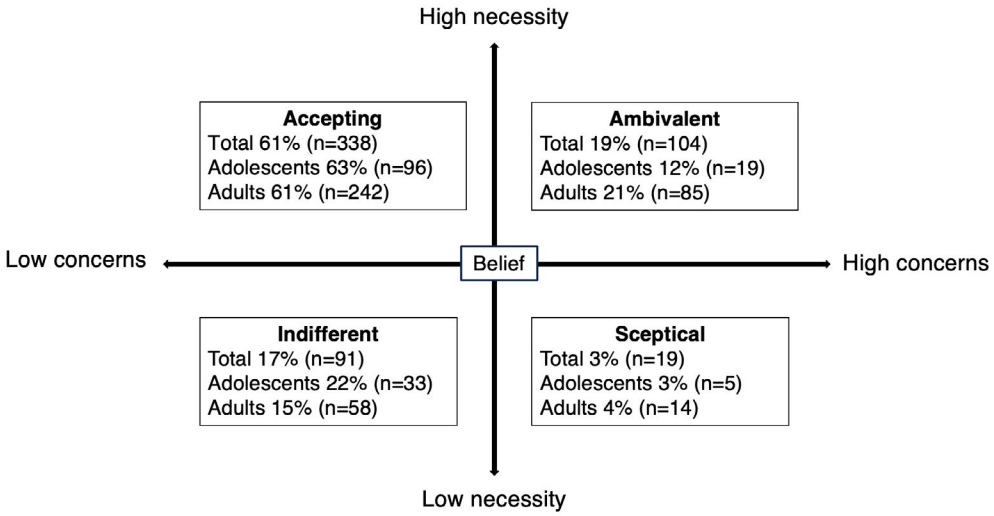
Figure 1 *- Frequency of patients agreeing with Necessity items and Concern items (n = 552).*



Regarding socioeconomic level, patients living in least-deprived regions (had significantly higher Necessity scores (20 [17,23] *vs* 19 [16,21]; p = 0.010) and Necessity-Concerns differential (5 [1,8] *vs* 3 [0,6]; p = 0.04) than those from most deprived regions. Patients recruited in primary care setting had significantly lower median scores for Necessity (18 [16,21] *vs* 19 [17,22]; p = 0.027) and Concerns (14 [11,17] *vs* 15 [12,18], p = 0.05) than those recruited in the secondary care setting.

In terms of disease control, the Necessity and Concerns scores were similar in participants with controlled and uncontrolled asthma, as determined by the GINA assessment of symptom control, CARAT or exacerbations in the last year. Patients prescribed with more than one inhaler had significant higher Necessity scores (Median 20 [17,22] *vs* 19 [16,21]; p = 0.007) compared to those prescribed with only one inhaler.

Figure 2 *- Frequency of patients with asthma in each attitudinal group based on their Necessity and Concerns scores (n = 552).*



When considering the MMAS-4, median Concerns scores were significantly different across the three adherence groups, being higher when adherence was lower. When considering VAS, the Necessity score of patients with higher adherence was significantly higher than patients with the lower adherence (Median 20 [17,22] *vs* 18 [14,21]; p = 0.008).

Discussion and conclusions

This study found that most patients with persistent asthma had a positive Necessity-Concern score differential, indicating that their need for medication outweighed their concerns. This highlights an overall positive perception of the need for inhaled medication among patients with asthma. On the other hand, almost half of the patients showed ambivalence towards their inhaled medication, with high levels of both necessity and concern.

Our findings are consistent with Van Steenis *et al.*, who reported that, on average, patients give a higher importance to the need for their asthma medication than to their concerns (18). Similar to previous studies (21, 36), the most reported concerns about inhaled medication were about their long-term effects, the general use of medication and becoming too dependent on their inhaler.

Looking at the attitudinal groups, the accepting group (61%), consisting of patients with high necessity and low concerns and the ambivalent group (19%), with both high necessity and high concerns, were the most represented. Accepting and ambivalent groups were also the most represented in a study including adults with asthma from 5 European countries (37) and both adolescents and adults with asthma from Spain and France (21).

It was previously described that patients in these two attitudinal groups, holding stronger necessity beliefs, exhibit higher adherence to medication (13, 17, 21). In our study, however, following the accepting group, the indifferent was the one with higher frequency in adolescents (22%). Previous studies have shown that the accepting group is predominant in adults (17, 18, 21), while the indifferent group predominates in adolescents (19, 22). As in previous articles, the proportion of patients in the skeptical group (low necessity, low concerns) was small (3%) (17, 18, 21).

When evaluating patients with asthma, it is essential to address their concerns and educate them to improve their understanding of medication, which can be achieved by demystifying fears and misconceptions (36). Personalized care strategies can help to improve medication-taking behavior and adherence to treatment. Policymakers and health systems together with community-based and patient and public involvement organizations can also play a role in improving asthma health literacy by developing and disseminating linguistically and culturally appropriate materials using different tools (written materials, videos, e-health tools) and outreach strategies (38).

In this study, the Necessity and Concerns scores were significantly lower in adolescents compared to adults. We did not find studies comparing beliefs among these two age groups, but the scores found in adolescents are consistent with findings in the literature (19, 22). This age group typically shows low levels of concern and necessity, despite taking the responsibility for taking their own medication. It is important to note that adolescence is a unique period of personal development, during which various factors may

Table II *- Beliefs (necessity, concerns, necessity-concern differential) and patient characteristics (n = 552).*

	Necessity	Concerns	Necessity-Concerns differential
Age group			
Adolescents	16 [8,20]*	11 [14,17]*	4 [0,7]
Adults	20 [17,22]	15 [12,18]	4 [0,8]
Gender			
Female	19 [16,22]*	15 [12,18]	4 [0,8]
Male	19 [16,21]	15 [12,18]	3 [0,7]
Socioeconomic level			
Q1-Q2 (least deprived)	20 [17,23]*	15 [12,18]	5 [1,8]*
Q3	19 [17,22]	14 [12,19]	4 [0,9]
Q4-5(most deprived)	19 [16,21]	15 [12,18]	3 [0,6]
Setting			
Secondary care	19 [17,22]	15 [12,18]	4 [0,7]
Primary care	18 [16,21]*	14 [11,17]*	4 [1,7]
GINA			
Well/Partly controlled	19 [16,22]	15 [12,17]	4 [0,8]
Uncontrolled	19 [16,22]	15 [12,19]	4 [0,7]
CARAT			
Controlled	19 [16,21]	14 [12,17]	5[0,8]
Uncontrolled	19 [16,22]	15 [12,19]	4 [0,7]
Exacerbations in the last year			
None	19 [16,22]	15 [12,18]	4 [0,7]
At least one	19 [16,22]	15 [12,18]	4 [0,7]
Inhaler prescribed			
1	19 [16,21]*	15 [12,18]	4 [0,7]
>1	20 [17,22]	15 [12,19]	4 [0,8]
MMAS-4			
High	19 [15,23]	14 [11,18]*	5 [2,7]
Medium	19 [17,22]	14 [12,18]	4 [0,8]
Low	19 [16,22]	16 [13,19]	3 [-1,6]
VAS adherence			
High	20 [17,22]*	15 [12,18]	4 [1,8]
Medium	19 [16,22]	15 [12,18]	4 [-1,7]
Low	18 [14,21]	16 [13,19]	2 [-3,6]

Data are presented as median [p25-p75]. CARAT-T: Control of Allergic Rhinitis and Asthma Test total score; GINA: Global Initiative for Asthma; MMAS-4: Morisky Medication Adherence Scale; VAS: Visual analogue scale. *p < 0.05

influence adherence and disease control (6). As a child grows into adolescence, autonomy and responsibility in taking asthma medication increases over time. By the age of 15 years old, approximately 75% of adolescents with asthma take responsibility for their controller medication (39). In this age group, adherence to asthma treatment may be influenced by factors such as social stigma or parental involvement, in addition to the patients' personal beliefs (40, 41). By showing that there are differences between adult and adolescent beliefs, this study highlights the need for personalized interventions and sheds light on the importance of understanding the unique factors that influence adherence in adolescents.

Women had a greater need for inhaled medication than men, a trend that has been observed in other countries (37). While literature on gender differences in medication adherence is inconclusive, it has been suggested that women may have a better understanding of the disease and therefore adhere to medication more effectively (42). It was found that patients living in least deprived areas had significantly higher Necessity scores. This could be attributed to the fact that these patients have probably easier access to healthcare resources and are more aware of the importance of their medication. But future studies collecting direct socio-economic data (*e.g.*, family income) are needed to validate this preliminary finding. Patients recruited in primary care had significantly lower Necessity and Concern scores, while still maintaining a positive Necessity-Concerns differential. In a previous study comparing beliefs across specialties, no differences were observed for the necessity score, but for the concerns score the results are consistent with our study, with patients recruited by primary care physicians showing lower concerns (21). This may be because primary care settings often deal with less severe or better controlled cases of asthma, where patients may have milder symptoms or more stable conditions. The Portuguese primary care system has been found to manage chronic conditions more effectively than other countries, being among the ones with lowest rates of hospital admission for asthma in the European Union (43). Conversely, patients with more severe or uncontrolled asthma are typically treated in secondary care settings. Patients referred to secondary care settings may have already encountered challenges with asthma management in primary care. This prior experience could impact on their beliefs about medication, potentially leading to higher concerns or a stronger perception of necessity. Although asthma control and associated impact on the patients' daily lives could influence their perceptions of the necessity and concerns regarding medication, there were no differences found in the Necessity and Concerns scores regarding GINA, CARAT scores or exacerbations history.

The latest GINA guidelines recommend using a single inhaler for both maintenance and reliever therapy in adolescents and adults, containing long-acting beta$_2$ agonist (LABA) and low-dose inhaled corticosteroid (ICS) (3). This approach is more effective than using separate inhalers for maintenance and reliver therapy. This study

found that patients prescribed with more than one inhaler had significantly higher Necessity scores than patients using only one inhaler. Although, in our analysis, it is not specified what kind of inhaler is used (short-acting beta$_2$ agonist (SABA) or ICS/LABA or other) and future studies could clarify this link. It might be the case that patients with asthma may be more aware of the necessity of medication when treatment regimens are more complex or when their asthma is more severe. However, complexity of treatment can also impact patient adherence. Healthcare professionals should address this topic and aim to simplify treatment regimens, by following the most recent guidelines.

Previous studies have shown that, while patients with strong beliefs about necessity of medication are more likely to be completely adherent, patients who have higher levels of concern are more likely to have lower adherence to medication (13, 14, 44, 45). The notably higher Necessity scores observed in individuals classified as highly adherent by the VAS align with previous research. Horne *et al.* reported that patients with strong necessity beliefs were 1.7 times more likely to exhibit adherence to asthma medication (13). However, regarding concerns, we were able to find differences using MMA but not the VAS on medication adherence. This may be explained by the simplicity of the self-reported questionnaires used in our study in comparison with more complex patient-reported outcome measures, such as the eight item Morisky Medication Adherence Scale and the Medication Adherence Rating Scale, that try to identify the circumstances/situations related to adherence behavior (44). It is known that self-reported questionnaires may also lead to overestimation of true adherence by respondents. This can also be attributed to the telephone application of questionnaires, which differed from the data collection strategy in previous studies (mostly, self-report in paper versions). In paper self-reports respondents typically have a greater sense of anonymity and may feel less pressure to provide socially desirable responses.

Our study holds several strengths that should be acknowledged. Firstly, it is a multicenter investigation that enrolled participants across various age groups, including and comparing both adults and adolescents with asthma, which is not found in previous articles. Secondly, the inclusion of a large and diverse sample recruited from both primary and secondary care settings in real-world practice enhances the prominence of this study, providing insights into the beliefs of patients encountered in routine clinical practice. The use of a validated tool, such as the BMQ-Specific allows for a multifaceted evaluation of patients' beliefs. This study has also some limitations that should be acknowledged. The study included a large percentage of patients with self-reported uncontrolled asthma (assessed with CARAT), and concerns and beliefs about medication may be perceived differently by this group. Therefore, the findings from this analysis may not be directly applicable to individuals who have good asthma control. Nevertheless, it should be noted that the studied population was obtained through a convenience sample, which may limit the generalizability of the results, as it only includes patients seeking medical care, who therefore may have higher concerns or poorer disease control. Future analysis could include a consecutive patient sample and investigate the role of disease duration and severity. Another limitation can be the fact that beliefs were collected through telephone interview, which may introduce bias, as respondents may provide socially desirable or inaccurate information unconsciously In addition, this is a cross-sectional analysis, which can be limiting given that beliefs about treatment and adherence patterns are subject to evolution over time. Our study may not fully capture the dynamic nature of these factors and their interplay, but it can be done in future research through longitudinal investigations.

This study contributes to the understanding of patients' beliefs about inhaled medication for asthma in a large, real-world population in Portugal. A predominantly positive perception of inhaled asthma medication necessity was found, although ambivalence or indifference exist in about 1/5 of patients. By addressing age-specific disparities and considering patient-related factors, the findings pave the way for targeted interventions and improved patient outcomes in asthma care. Future research should include longitudinal analysis and adherence objective measures to provide a more dynamic understanding of medication adherence, treatment beliefs, and asthma control over time.

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Contributions

AMP, RuAl, RiAm, JAF, CJ: conceptualization. CN, AMC, AMP, JAF, CJ: data collection. CN, CJ: formal analysis. CN: writing – original draft. All authors: writing – review & editing.

Conflict of interests

The authors declare that they have no conflict of interests.

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