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ADHERENCE AND ASTHMA CONTROL

Adolescents' inhaled corticosteroid adherence: the importance of treatment perceptions and medication knowledge

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Background: Studies measuring inhaled corticosteroid (ICS) adherence frequently report adherence rates below 50%. Although asthma is common in adolescents, few studies have explored determinants of ICS adherence in adolescents. The objective of this study was to examine adherence and related factors in adolescent ICS users. **Methods:** Adolescent ICS users, aged 12–18 years, were randomly recruited from a sample of 94 community pharmacies belonging to the Utrecht Pharmacy Practice Network for Education and Research to complete an online questionnaire. The survey contained questions on asthma control, self-reported adherence, medication beliefs and medication knowledge. Data were collected between April and August 2013. **Results:** Complete questionnaire data were received from 182 adolescents of which 40% reported to be adherent. Approximately 40% of the participants perceived strong needs, whilst only 10% was highly concerned about adverse effects regarding their ICS use. Good adherence was significantly associated with asthma control (OR: 2.1, 95% CI: 1.1–4.1). Necessity beliefs and sufficient medication knowledge were associated with better adherence ($p < 0.05$). **Conclusion:** Our results suggest that by improving knowledge about asthma treatments and stimulating positive perceptions towards medicines, especially regarding the necessity of medication use, better adherence rates might be achieved.

Keywords

Adherence, adolescence, asthma, inhaled corticosteroids, knowledge, medication beliefs, pharmacy

History

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Introduction

The prevalence of asthma in children and adolescents is approximately 10% [1]. Lack of asthma control places a heavy burden on patients' quality of life; frequent periods with uncontrolled symptoms negatively influence school performance and other daily activities, such as sports [2]. Uncontrolled asthma may be the result of poor adherence to inhaled corticosteroids (ICS), which are used as a maintenance treatment in asthma. Studies measuring ICS adherence frequently report adherence rates below 50% [3].

Patients' motivation to adhere to a certain medication regimen is influenced by their individual needs and concerns regarding treatment. In addition, factors such as the perception of others (family members and peers), self-management and knowledge may influence adherence rates. It has been shown before that parental perceptions towards medication use are an important driver of medication adherence and disease control in asthmatic children using ICS [4–8].

Adolescence is a potentially turbulent life phase associated with many changes, such as development of self-regulatory

behavior and organizational skills, cognitive and psychosocial development and social changes including school life, after-school activities and choosing which peer groups to join [9–11]. This may also have an impact on changing medication intake behavior during this period in life.

Although asthma is common in adolescents, only a few studies have explored determinants of ICS adherence in adolescents. These studies were mainly qualitative in nature and therefore most of these studies had small sample sizes [11–15]. Therefore, it is important to study factors that drive adolescent adherence behavior in order to develop strategies to increase adherence among adolescents. We aimed to study determinants of adherence in order to identify possibilities for improvement and emphasized on factors related to medication beliefs and external influence (contextual factors and socio-demographics).

Materials and methods**Study population and setting**

Adolescents aged 12–18 years who filled at least two ICS prescriptions during the last two years of which at least one prescription was filled during the previous 12 months were randomly recruited a sample of community pharmacies belonging to the Utrecht Pharmacy Practice Network for Education and Research (UPPER), a network consisting of

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approximately 1400 pharmacies that participate in research and traineeships for pharmacy students [16]. Patients were sent an information brochure containing information about the study and the request to complete an online questionnaire. The link referring to the online survey was provided in the information brochure. Patients not willing to participate were also asked to complete a few questions regarding their reasons for non-participation. Data were collected between April and August 2013. The study was approved by and conducted in compliance with the requirements of the UPPER Institutional Review Board of the Division of Pharmacoepidemiology and Clinical Pharmacology, Utrecht University.

Data collection

The online survey contained socio-demographic questions and questions to collect information regarding asthma symptoms, self-reported ICS adherence, patients' perceptions about their ICS use, medication knowledge and influence and support of peers and family members.

Definition of outcome – adherence

Self-reported ICS adherence was assessed by using the 5-item Medication Adherence Report Scale (MARS) [17] comprising five questions on medication intake behavior, in this study specifically referring to ICS use. These five questions included: forgetting to take medication, altering the dose, deciding to miss a dose, taking less than instructed and deciding not to take medication for a while. The MARS is a self-reporting measurement scale which shows good psychometric properties and has widely used before, also in patients with asthma [18]. All MARS-items are measured on a 5-point Likert scale. Menckeborg et al. [8]. showed that the MARS is a satisfactory screening tool for non-adherence among adult ICS users, irrespective of the chosen cut-off point. There is no gold standard for dichotomizing the MARS and opinions regarding the chosen cut-off differ [19]. A higher cut-off score is recommended to exclude social desirability bias; therefore, in this study, the MARS was dichotomized by using a cut-off point for the sum-score of 23. Patients with scores of 23 and higher were considered to be highly adherent. We performed a sensitivity analysis using different cut-off scores (MARS scores 21 and 25) and use of these different cut-offs did not influence our results (data not shown).

Definition of main determinants

Patients' perceptions about their ICS were assessed with the Beliefs about Medicines Questionnaire-specific (BMQ) [20]. This questionnaire measures perceived necessity of and concerns about a specific drug used by the respondent. The questionnaire consists of two subscales: a necessity scale (5 items) and a concerns scale (5 items). All items are measured on a 5-point Likert scale and higher BMQ scores indicate a stronger belief in the concepts presented by the subscale (concerns or needs). Scores above the scale midpoint (>15) were considered as strong beliefs. Patients were also classified into four different categories regarding their attitude about ICS: accepting (high necessity and low concerns),

ambivalent (high necessity and high concerns), skeptical (high concerns and low necessity) and indifferent (low concerns and low necessity) users [8].

Current asthma control was defined using the 6-item Asthma Control Questionnaire (ACQ), which can be used to differentiate between well-controlled and not well-controlled asthma. An ACQ score <0.75 was considered "well-controlled asthma" and scores ≥ 0.75 were considered as "not well-controlled asthma" [21].

Knowledge about asthma medication use and disease was scored by using 10 questions on medication use (e.g. *Prednisolone decreases acute shortness of breath symptoms within 15 minutes* or *Antibiotics are important for the treatment of asthma*) also used in previous studies [7,22]. Scores $\geq 70\%$ were considered as good knowledge on asthma medication use.

Data analysis

Five groups of determinants were studied in relation to ICS adherence: (1) general characteristics (gender, age, education, religion), (2) disease-related factors (asthma control, hospitalization), (3) medication related (oral steroid use, chronic medication use), (4) perception (medication beliefs and knowledge) and (5) external support (peer or family involvement). Odds ratios and their corresponding 95% confidence intervals were calculated. First, univariate analysis was performed to study individual determinants of adherence and second, multivariate analysis was performed to assess the independence of the associated factors. Covariates that were significant in the univariate analysis at a *p* value less than 0.1 were included in the multivariate logistic regression model. All analyses were performed using IBM SPSS for Windows, version 20.0 (IBM Corp, Armonk, NY).

Results

Response and study population

In total, 1725 adolescents were selected from 94 community pharmacies in the Netherlands and requested for their participation. Based on the sent invitation, 210 adolescents (12.2%) visited the online survey. Of these patients, 26 adolescents actively declined participation. Main reasons for not willing to participate were not using the indicated medication (ICS) anymore or participating being considered too time-consuming. For 182 adolescents, questionnaires were complete and they were therefore included in the study indicating a response rate of 10.6%. Non-responder analysis showed no differences in mean age, gender and asthma medication use between adolescents that participated in the study compared to non-responders based on information from pharmacy records (data not shown).

The general characteristics of this population are shown in Table 1: 44.5% of the participants are males, mean age was 15.0 years, the majority of the population was of Dutch origin and 60.9% was higher educated (higher general secondary or pre-university education). The majority of the population had a physician diagnosis of asthma (84.6%), other indications for ICS use were asthma-like symptoms, such as wheezing and chest tightness.

Table 1. Characteristics of study population ($n = 182$).

Characteristics	% (n)
Male gender	44.5 (81)
Age, mean (SD)	15.0 (2.0)
Dutch ethnicity ^a	95.6 (174)
Education	
Primary school (last year)	13.7 (25)
Vocational	24.2 (44)
Higher general secondary/pre-university	60.9 (111)
Other	1.1 (2)
Physician diagnosis asthma	84.6 (154)
Well-controlled asthma ^b	49.5 (90)

^aBoth parents Dutch ethnicity.^bACQ-score <0.75.Table 2. Reasons for non-adherence in patients with MARS scores <23 ($n = 107$).

Reason	% (n)
Forgetting to take medication	56.1 (60)
Only symptomatic use	41.1 (44)
Desire to test whether I can live without medication	29.9 (32)
Not necessary to use medication	16.8 (18)
Complex medication regimen/treatment strategy	18.7 (20)
I use medication as prescribed	16.8 (18)
Other ^a	12.1 (13)

^aNot enough support, sign of weakness, ashamed, concerns.

Self-reported medication adherence

Mean score of self-reported ICS adherence assessed by the MARS was 20.3 ± 4.2 (range 7.0–25.0) and 40.9% of the patients were defined as adherent to their ICS treatment by using a cut-off point of 23. Adolescents mostly mentioned forgetting to take their medication (56.1%) and only using medication when experiencing symptoms (41.1%) as reasons for not using their medication as prescribed (Table 2).

Beliefs about medicines

Mean score on the BMQ-necessity scale was 13.0 ± 4.7 (range 5.0–25.0) and mean score on the BMQ-concern scale was 9.6 ± 3.6 (range 5.0–24.0). Almost half of the participants (41.9%) perceived strong necessity beliefs (scores above scale midpoint) and 10.1% were highly concerned about the potential adverse effects with regard to their ICS use. Figure 1 shows the overall percentage of patients with the four possible attitudes about their ICS use including adherence rates per attitudinal group. Most patients were classified as indifferent or accepting users. Patients defined as indifferent, accepting, ambivalent or skeptical differed with respect to ICS adherence; adherence rates were highest for accepting users ($p < 0.05$) (Table 3).

Factors associated with adherence

The results of the logistic regression analysis are shown in Table 3. Currently, well-controlled asthma was associated with higher adherence rates (adjusted OR: 2.1, 95% CI: 1.1–4.1, $p = 0.02$). Stronger necessity beliefs towards use of ICS was associated with higher adherence rates (adjusted OR: 2.0,

95% CI: 1.0–3.8, $p = 0.04$). Furthermore, patients classified as indifferent users were more often non-adherent compared to accepting users. Having sufficient knowledge about asthma medication was associated with better adherence rates ($p = 0.03$). Peer support was borderline significantly associated with a higher chance of good ICS therapy adherence ($p = 0.07$).

Discussion

This study shows that self-reported ICS adherence rates among adolescents were relatively low: approximately 40% of the study participants reported to be adherent to their ICS treatment regimen. Adolescent ICS adherence rates were associated with knowledge about medicines and patients' perceptions about medicines. We found a significant association between ICS adherence and currently well-controlled asthma, which is in line with previous studies assessing ICS adherence and asthma outcomes [2,18]. This finding underlines the need of good adherence to reach and maintain sufficient disease control.

In line with other studies [23,24], adolescents mentioned forgetting to take medication as an important reason for deviating from physicians advice to use ICS. Furthermore, adolescents mentioned adjusting their medication use to their obtained level of asthma control (only symptomatic ICS use) and the desire to test if they could live without medication as reasons for not using medication as prescribed. These factors may be related to both knowledge about disease and medication and perceptions towards medicines (needs and concerns beliefs), two potential modifiable factors that we in this study found to be associated with self-reported ICS adherence rates. In accordance with studies performed in pediatric and adult populations, we showed the importance of medication beliefs to achieve sufficient adherence rates; however, both needs and concerns scores in our adolescent patient population were lower compared to previous studies in adult or parent/children populations [4,8,25]. The large majority of the adolescents in our study did not perceive strong concerns regarding their ICS use, however, in line with other studies, approximately 40% expressed the belief that ICS treatment was necessary to control their disease. Adolescents' perceptions about medication seem to differ from adult perceptions. Previous studies reporting on medication beliefs show higher concern scores [8,26]. Participants were classified into four attitudinal groups and we showed in this study that adolescent patients seemed less concerned compared to adult patients; most adolescents in this study reported low concerns and more than half of the population were classified as indifferent users (low necessity, low concerns). Studies performed in adult populations showed more equal distributions across the four attitudinal groups with approximately one-third classified as indifferent users [8,27–29]. We also observed differences in adherence rates between the different attitudinal groups, with accepting users (high necessity, low concerns) having higher adherence rates. This indifferent attitude with low personal needs for medication use also has implications for educational and behavioral strategies to improve adherence behavior, which should especially address the importance of the individual need for

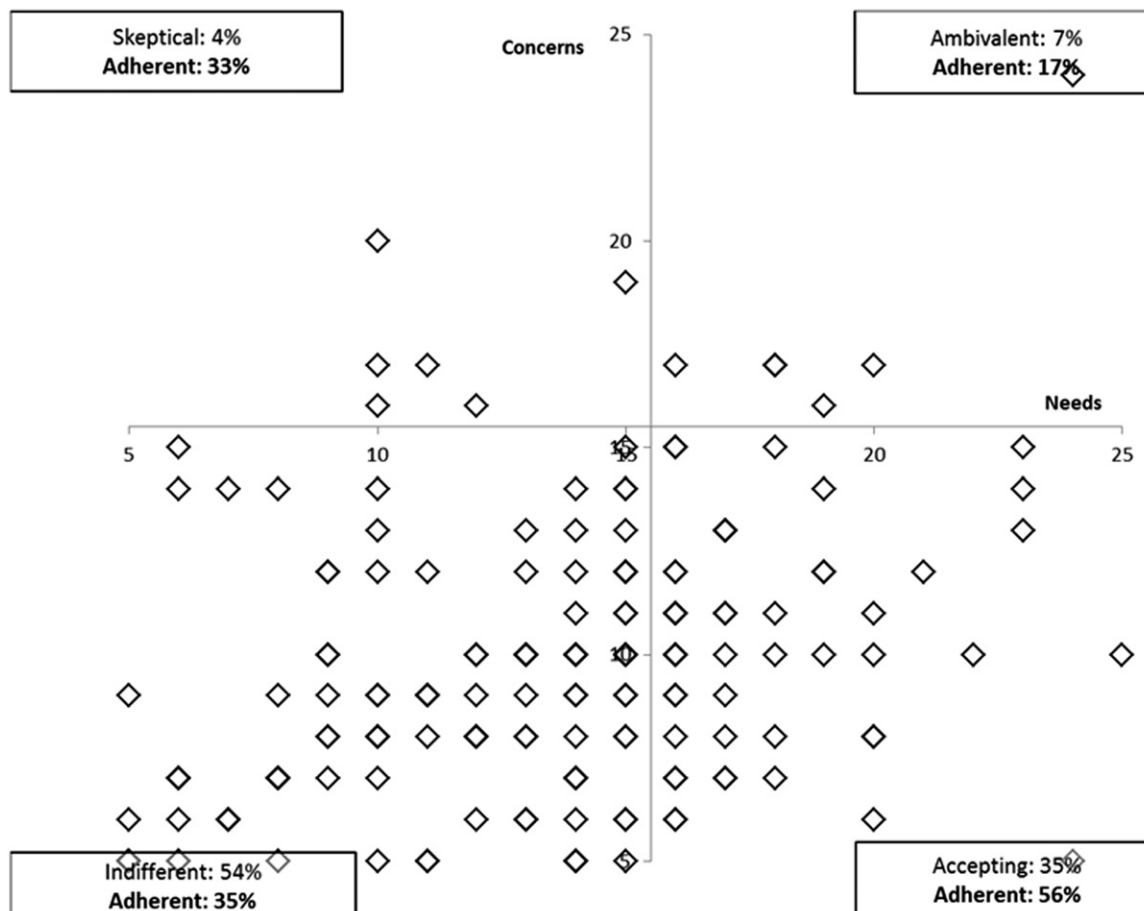


Figure 1. Scatter plot of the necessity and concern scores. BMQ domains and the subdivision into four attitudinal groups. In the boxes, the percentage of patients that have the specific attitude towards the therapy is shown including self-reported adherence rate per attitudinal group.

Table 3. Factors associated with self-reported ICS adherence.

Characteristics	Crude OR (95% CI)	<i>p</i>	Adjusted ^a OR (95% CI)	<i>p</i>
General				
Male gender	0.6 (0.4–1.2)	0.15	0.6 (0.3–1.2)	0.13
Age, mean (SD)	1.0 (0.8–1.1)	0.81	1.0 (0.8–1.2)	0.85
Education				
Primary school	REF	REF	REF	REF
Vocational	0.8 (0.3–2.1)	0.58	0.9 (0.3–2.7)	0.87
Higher general secondary/pre- university	0.9 (0.4–2.2)	0.82	1.1 (0.4–2.7)	0.90
Religious	1.4 (0.7–2.6)	0.38	1.3 (0.6–2.6)	0.46
Disease related				
Well-controlled asthma ^b	1.8 (1.0–3.2)	0.06	2.1 (1.1–4.1)	0.02
Hospitalization past year	1.0 (0.2–5.9)	0.97	1.4 (0.2–9.3)	0.74
Medication use				
Oral steroid use past year	1.7 (0.6–5.0)	0.31	1.8 (0.6–5.8)	0.30
Use of other chronic medication	1.3 (0.7–2.4)	0.44	1.3 (0.7–2.5)	0.40
Perceptions				
Strong necessity beliefs	1.8 (1.0–3.4)	0.04	2.0 (1.0–3.8)	0.04
Strong concern beliefs	0.4 (0.1–1.2)	0.10	0.4 (0.1–1.4)	0.15
BMQ attitude groups				
Skeptical	0.4 (0.1–2.3)	0.31	0.5 (0.1–3.0)	0.44
Indifferent	0.4 (0.2–0.8)	0.01	0.4 (0.2–0.8)	0.01
Ambivalent	0.2 (0.0–0.8)	0.03	0.2 (0.0–1.1)	0.06
Accepting	REF	REF	REF	REF
Sufficient knowledge	2.4 (1.2–4.6)	0.009	2.1 (1.1–4.1)	0.03
External support				
Importance parental support	0.8 (0.4–1.5)	0.53	0.7 (0.4–1.4)	0.35
Importance peer support	2.3 (0.6–8.5)	0.21	3.7 (0.9–14.9)	0.07

^aAdjusted for current asthma control, necessity beliefs and knowledge.

^bACQ-score <0.75.

Bold interface indicates *p* values <0.05.

medication use to control symptoms and maintain good health.

Many perceptions and feelings regarding asthma and medication use resulting in poor adherence may be caused by a lack of knowledge. Wamboldt et al. [13], performed a focus group study including adolescent asthmatics and reported poor adherence as result of misinformation and incorrect assumption about asthma. We also showed an association between knowledge and adherence rates. Participants with sufficient knowledge on asthma medication and the purpose of medicines had better adherence rates. Menckeberg and colleagues [30] showed before that new users of ICS who did not continue treatment were often unaware of anti-inflammatory actions of the prescribed therapy.

One of the strengths of this study is that we included a broad range of patients within the primary care setting and not only focused on patients in specific care groups. Many previous studies were small-scale and qualitative in nature, whilst we used validated quantitative measurements of adherence, medication beliefs and asthma control and were thus able to quantitatively study determinants of adherence in a larger sample of asthmatic adolescents. We used a web-based survey, which is an efficient way to collect data and suitable for adolescent populations [31]. Overall response rate in our study was relatively low. Patients were invited by (postal) mail to complete the online questionnaire. Response rates might have been higher if invitations had been sent by email with a direct link to the questionnaire. In three pharmacies we phoned patients after two weeks to remind them of the study; however, this did not increase our response rate. Participation of adolescents in health research may be challenging [32,33]. Previous studies also described reasons for unsuccessful recruitment as young people do not want to be reminded of their condition (illness perceptions). Furthermore, Christian and co-workers [34] described the importance of applying appropriate methods to ensure success. Non-responder analysis showed no differences in age, gender or asthma medication use between adolescents who agreed to participate compared to adolescents who refused participation. However, generalizability may be a limitation, as the majority of the participants was Caucasian and most were higher educated. Also the presence of responder bias might have been a problem: study participants might have a more positive attitude towards medicines in general and therefore our study might underestimate the real life situation. However, this limitation is shared with previous survey studies and would imply that adherence rates and perceptions among non-responders might even be lower and even more underline the need for extra attention for adherence and the need to improve adherence rates among adolescent ICS users.

Conclusion

We showed that sufficient knowledge about medication and medication beliefs are important factors in achieving good adherence rates in adolescent ICS users. Higher adherence rates were associated with improved asthma control. This highlights the importance of asthma disease and therapy

education in adolescents. Future research in the area of interventions aimed at improving adolescent adherence behavior should focus on development of educational material in which improving knowledge regarding medication and disease as well as stimulating positive perceptions (e.g. behavioral interventions) should be key factor. These behavioral interventions should especially focus on the necessity of drug therapy, since low necessity scores were more strongly associated with non-adherence. Furthermore, attention should be paid to reminding services or organizational tools to support adherence to a medication regimen as adolescents mentioned forgetting to take medication as important reason for not using medication as prescribed.

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Declaration of interest

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