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Attention-Deficit/Hyperactivity Disorder Medication Use in Adolescents: The Patient's Perspective

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A B S T R A C T

Purpose: The purpose of the study was to gain more insight into the attitudes of adolescents using medication for attention-deficit/hyperactivity disorder (ADHD).
Methods: A cross-sectional study among adolescents (aged 12–18 years) who filled at least two prescriptions for ADHD medication in the preceding year was conducted. Adolescents were invited to fill in an online questionnaire containing questions on sociodemographics, health status, illness perceptions, medication adherence, and medication beliefs.
Results: We invited 1,200 adolescents of whom 181 adolescents (122 males, mean age 14.2 ± 1.7 years) completed the online questionnaire. They mostly used methylphenidate (n = 167; 92%) as a pharmacological treatment for ADHD. Half of the study population (n = 93; 51%) experienced side effects, such as decreased appetite and sleep problems. Most participants (n = 150; 83%) had an indifferent attitude (perceived low necessity and low concerns) toward their ADHD medication. More than half of the study population (n = 111; 61%) reported to be non-adherent based on the Medication Adherence Report Scale. The highest score of the Brief Illness Perception Questionnaire was on "treatment control," suggesting that adolescents do think their medication is effective, despite their indifferent drug attitude.
Conclusions: Most adolescents using ADHD medication had an indifferent attitude toward their medication and reported low adherence rates. These findings should be taken into account when treating adolescents with ADHD; regular counseling and monitoring of the pharmacological treatment might be useful to optimize treatment.

IMPLICATIONS AND CONTRIBUTION

This study reveals adolescents' perspective on attention-deficit/hyperactivity disorder medication use, by means of self-reported measurements. Low adherence rates, side effects, and an indifferent attitude are shown. Physicians and pharmacists should be aware of this, since it might affect treatment outcomes. Counseling and evaluating the pharmacological treatment with the patient is suggested.

Attention-deficit/hyperactivity disorder (ADHD) is a neuropsychiatric disorder characterized by having a short attention span, easily being distracted, excessive activity, or difficulties with controlling behavior, which is not appropriate for a person's age. This results in suboptimal performances in social, educational, or work settings [1]. The highest prevalence of ADHD is found in children and adolescents; approximately, 63 million children and adolescents are diagnosed with ADHD worldwide [2].

Adolescence is a distinctive life phase which is characterized by psychological, physical, and emotional changes. During transition from childhood to adolescence, there is a shift in ADHD symptoms and behavior from hyperactivity and impulsivity to more antisocial behavior [3]. Substance misuse and lower educational performance are often observed in adolescents with

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ADHD. They also display higher rates of oppositional defiant disorder, anxiety, depression, and they report a lower quality of life compared with their unaffected peers [3–5].

In addition to behavioral therapy, pharmacotherapy is used to control ADHD symptoms, that is, reduce hyperactivity and increase focus. The pharmacological options in the Netherlands are stimulants (methylphenidate and amphetamines) and nonstimulants (e.g., atomoxetine) [6]. Currently, the number of medication users is increasing with 12,000 each year, with approximately 215,000 users in 2015 [7]. Methylphenidate is the most commonly prescribed ADHD treatment worldwide, and it improves teacher-reported ADHD symptoms and behavior. Parents even reported an increased quality of life among younger children. However, the use of methylphenidate is also associated with adverse effects [8,9]. Several studies have shown that a substantial proportion of ADHD patients discontinue medication or are poorly adherent; nonadherence rates of children and adolescents using ADHD medication vary between 10% and 64% [10].

Adolescents undergo psychosocial changes and they start to develop their own attitudes and beliefs, which may affect their medication use and adherence levels [11–13]. Therefore, adolescence is an important life phase for medication intake behavior. However, most previous research has focused on attitudes and beliefs of parents and teachers toward ADHD medication, focused on younger children, or take children and adolescents together as one group [9,13–15], while the highest use of methylphenidate is during adolescence (age 14 years) [16].

Some studies have been done regarding the beliefs of adolescents about the disorder ADHD, while the specific beliefs of adolescents regarding ADHD medication have not yet been studied. There are also some doubts about the effectiveness of pharmacological treatments, and the adolescents' opinion might be important to improve this [9,13]. The aim of our study was to gain more insight into adolescents' actual use of ADHD medication and their attitudes toward medication use and disease.

Methods

Study design and setting

A cross-sectional study among adolescents using ADHD medication was conducted. Adolescents were selected from community pharmacies affiliated with the Utrecht Pharmacy Practice Network for Education and Research. This network contains over 1,300 community pharmacies and provides internship and research opportunities [17]. In April 2015, all community pharmacies in the network received an e-mail to participate in the study.

Participants

Adolescents (aged 12–18 years) were selected from the pharmacy information system in the participating pharmacies based on filling of at least two prescriptions for methylphenidate (Anatomical Therapeutic Chemical Classification System N06BA04) [18], dexamphetamine (N06BA02), and/or atomoxetine (N06BA09) in the preceding year. Adolescents who filled these criteria received a postal letter with a link to an online questionnaire.

Data collection

The online questionnaire consisted of sociodemographic questions (age, gender, educational level, and ethnicity), a health status question, medication-related questions (type, duration of use, and side effects), and questions about the role of parents and friends. It also contained validated questionnaires on self-reported adherence (Medication Adherence Report Scale [MARS]) [19], beliefs about medicines (Beliefs about Medicines Questionnaire-specific [BMQ-specific]) [20], and illness perceptions (Brief Illness Perception Questionnaire [Brief-IPQ]) [21]. The focus of the online questionnaire was on ADHD medication use, which was clearly stated in the introduction and above every part of the questionnaire.

Outcomes: adherence, medication beliefs, and illness perceptions

The MARS was used to assess self-reported adherence. This questionnaire consists of five questions covering both intentional and unintentional nonadherence. All items were scored on a five-point Likert scale ranging from 1 (very often) to 5 (never) resulting in a total score between 5 and 25, where a higher MARS score indicates higher self-reported adherence [19,22]. MARS scores were dichotomized by using a cutoff point of $\geq$23 for sufficiently adherent, based on previous studies [23,24]. The online questionnaire included three additional multiple choice (with "other option") questions on medication use to assess (reasons for) nonadherence and to get an insight into medication use during weekends or holidays.

The BMQ-specific was used to assess adolescents' beliefs about the necessity of their ADHD medication and their concerns about potential adverse consequences of taking ADHD medication. The questionnaire consists of 10 items divided over two subscales; five items on necessity (e.g., my life would be impossible without my medicines) and five items on concerns (e.g., having to take medicines worries me). All items were scored on a five-point Likert scale (strongly disagree to strongly agree), resulting in a score of 5–25 for each scale. A higher score indicates a stronger belief in the concepts represented by the subscale [20]. Scores above the scale midpoint (score $>$15) were considered as strong beliefs, resulting in four attitudinal groups: accepting (high necessity, low concerns), ambivalent (high necessity, high concerns), indifferent (low necessity, low concerns), and skeptical (low necessity, high concerns) [25].

The Brief-IPQ was used to assess adolescents' illness perception. This questionnaire measures cognitive and emotional representation of their illness and it covers nine different dimensions: consequences, timeline, personal control, treatment control, identity, coherence, emotional representation, concerns, and causes. The causes item was excluded, because this open-ended item was perceived as complicated by young adolescents in a previous study. The remaining eight dimensions were measured on a 0 (not at all) to 10 (very much) response scale [21].

Ethics and confidentiality

Before start of the study, approval was obtained from the institutional review board of the Division of Pharmacoepidemiology and Clinical Pharmacology, Department of Pharmaceutical Sciences, Utrecht University. The first page of the online questionnaire contained an informed consent form. Adolescents aged $<$16 years additionally had to ask their parents to agree with

participation. Data were collected anonymously, since adolescents were only asked about their gender and date of birth, and questionnaire data could not be linked to patient data in the community pharmacies.

Data analysis

Descriptive statistics were calculated. For skewed data, the median with interquartile range (IQR) is shown instead of the mean with standard deviation. Kruskal-Wallis test was used to test for adherence differences between the four attitudinal groups. Sensitivity analyses were performed using different cutoffs for adherence based on MARS scores ($\geq$21 and 25). Statistical analyses were performed using IBM SPSS Statistics for Windows, version 23.0. p values $<$.05 were considered statistically significant.

Results

Study population

In total, 68 pharmacies participated in the study. Approximately, 1,200 adolescents were invited and 235 adolescents opened the link to the online questionnaire. Of those, 183 adolescents completed the questionnaire. Two adolescents had to be excluded because their parents filled out the questionnaire; therefore, the final study population consisted of 181 adolescent users of ADHD medication (Figure 1). Characteristics of the study population are shown in Table 1: 66.9% males, mean age 14.2 $\pm$ 1.7 years (median 14; IQR: 2), the majority (98.3%) was of native Dutch origin and 51.9% was enrolled in a preuniversity high school. Most adolescents (95.6%) reported a (very) good or excellent health status.

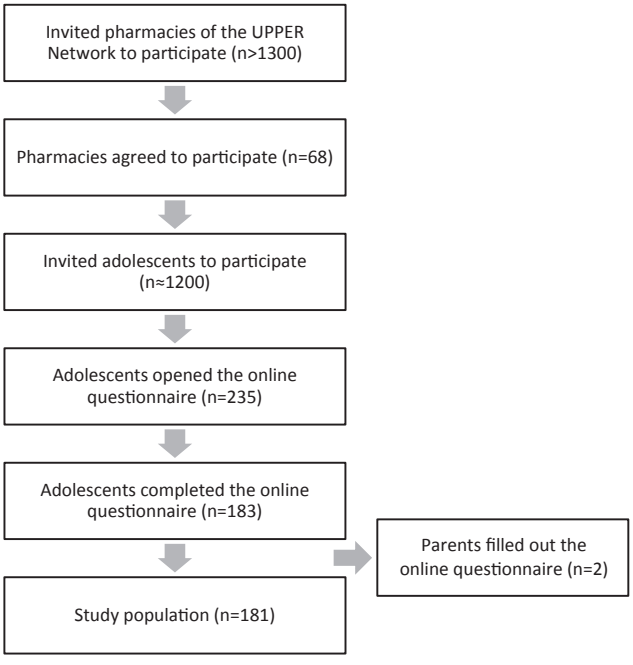

Figure 1. Flow chart of the study procedure and study population.

Table 1
Characteristics of the study population (n = 181)

	% (n)
Male gender	66.9 (121)
Age, mean (SD)	14.2 (1.7)
Native Dutch origin	98.3 (178)
Education	
Elementary school	9.4 (17)
High school: vocational level	34.8 (63)
High school: preuniversity level	51.9 (94)
Other	3.9 (7)
Lifestyle	
Alcohol use	22.7 (41)
Tobacco use	10.5 (19)
Playing sport	74.6 (135)
Sport hours per week (mean, SD)	4.6 (2.9)
Self-reported health status	
Excellent	18.2 (33)
Very good	33.1 (60)
Good	44.2 (80)
Moderate	4.4 (8)
Medication type	
Methylphenidate	92.3 (167)
Dexamphetamine	3.9 (7)
Atomoxetine	1.1 (2)
Combination (methylphenidate and dexamphetamine/atomoxetine)	2.8 (5)
Duration, mean years (SD)	3.5 (2.5)
Side effects	51.4 (93)

SD = standard deviation.

Medication use

Methylphenidate was the most frequently used ADHD medication. The mean age at which adolescents said they started ADHD medication was 10.7 years (Table 1). Most important reasons for medication use were to increase focus, treat ADHD symptoms, and achieve better school results. Half of the participants (51.4%) reported side effects, in particular decreased appetite and sleep problems. Only a few adolescents (5.5%) gave (at least once) some of their medication to friends, family, or classmates.

Self-reported medication adherence

The median MARS score was 22 (IQR: 4). More than half of the study population (61.3%; n = 111) scored below the cutoff of 23 and are thereby defined as nonadherent. The median of the items related to intentional nonadherence (items 2–5) was 5, representing "never," and the median of item 1 (unintentional nonadherence) was 4, representing "rarely" (Table 2). The percentage of adolescents who scored 1 to 3 (very often to sometimes) was the highest at items 1, 3 and 4—forgetting (27.6%), stopping for a while (28.2%), and deciding to miss out a dose (25.4%) (Table 2).

Almost half of the study population (48.1%) stated that they occasionally deviate from the prescribed dosing regimen, and 60.2% reported that they occasionally discontinue medication during weekends or holidays, that is, answered "yes" to the question: Do you sometimes decide not to take your medication during weekends or holidays?

Beliefs about ADHD medication

The mean score on the BMQ-necessity scale was 11.0 $\pm$ 3.5 (range 5–23) and the mean score on the concerns scale was

Table 2
The median and interquartile range (IQR) of the Medication Adherence Report Scale (MARS) score per item; score range 1 (very often) to 5 (never). The last column represents the percentage of the population scoring 1 (very often) to 3 (sometimes).

MARS items	Median (IQR)	Scoring 1–3 % (n)
1: I forget to take my medicines	4 (1)	27.6 (50)
2: I change the dosage of my medicines	5 (1)	13.3 (24)
3: I stop taking my medicines for a while	5 (2)	28.2 (51)
4: I decide to skip one of my medication dosages	5 (2)	25.4 (46)
5: I use my medication less than is prescribed	5 (1)	17.7 (32)

IQR = interquartile range; MARS = Medication Adherence Report Scale.

9.7 ± 3.5 (range 5–19). The minority (11%) of the study population reported high necessity, and 7.2% reported high concerns about ADHD medication (scores above midpoint). More than half of the study population (61.9%) had a positive necessity-concern differential and there was a weak correlation (.203) between this necessity-concerns differential and the MARS total score ($p = .006$).

Most adolescents (83%) experienced low necessity and low concerns toward ADHD medication, a so-called indifferent attitude. The distribution over the other three drug attitudes was 10% accepting (high necessity, low concerns), 6% skeptical (low necessity, high concerns), and two adolescents (1%) were ambivalent (high necessity, high concerns). Figure 2 showed the distribution of the study population over the four drug attitudes based on their BMQ-specific score, with the corresponding adherence rates based on their MARS score (≥23). Statistical analysis showed no significant difference ($p = .104$) between the adherence rates of the four drug attitudes. Sensitivity analyses were performed using different cutoffs (MARS scores ≥21 and 25); these did not affect the results (data not shown). There was also no significant difference ($p = .098$) between adherence percentages of the four drug attitudes based on the question "take medication sometimes differently than prescribed."

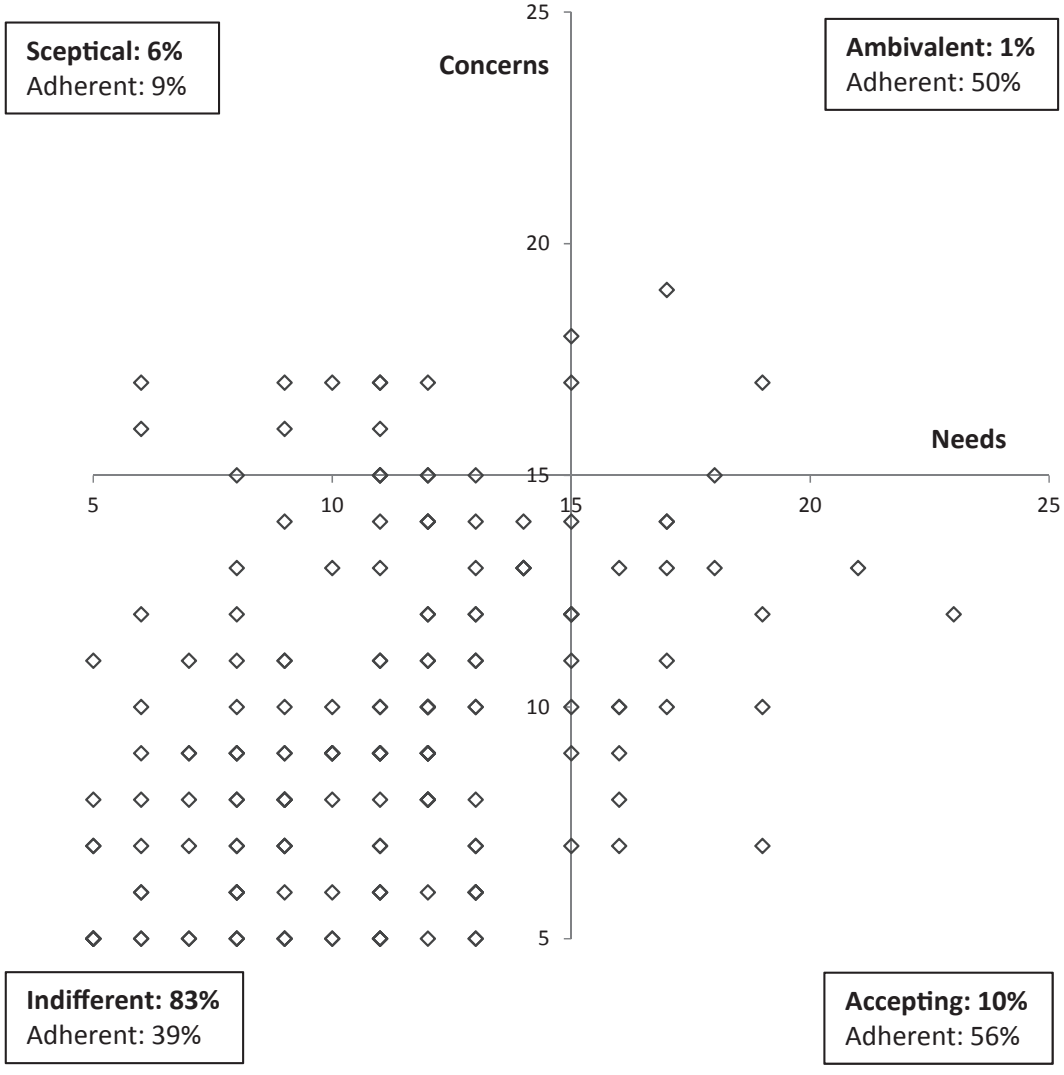

Figure 2. Scatter plot of the necessity and concern scores, divided in four drug attitude groups. Scores above scale midpoint (>15) were considered as strong beliefs. The percentage of adolescents with a particular attitude toward their medicines and their corresponding adherence rate (based on MARS score ≥23) are shown. No significant difference ($p = .104$) is found between the adherence rates of the four drug attitudes.

Table 3
The median score and interquartile range (IQR) on the Brief Illness Perception Questionnaire (Brief-IPQ) items; response scale 0 (not at all) to 10 (very much)

Domains	Items	Question	Median (IQR)
Cognitive illness representations	Consequences	How much does your illness affect your life?	6 (2)
	Timeline	How long do you think your illness will continue?	7 (5)
	Personal control	How much control do you feel you have over your illness?	5 (3)
	Treatment control	How much do you think your medication can help your illness?	8 (2)
	Identity	How much do you experience symptoms from your illness?	1 (4)
Illness comprehensibility	Coherence	How well do you feel you understand your illness?	8 (4)
Emotional representations	Emotional representation	How much does your illness affect you emotionally? (e.g,. does it make you angry, scared, upset or depressed?)	5 (5)
	Illness concern	How concerned are you about your illness?	2 (3)

IQR = interquartile range.

Adolescents' perception toward disease

The illness perception questionnaire (Brief-IPQ) was completed by 180 adolescents. Table 3 shows the median and IQR per item. Adolescents scored the highest on treatment control (median 8, IQR: 2) and coherence (median 8, IQR: 4). The lowest scores were on identity (median 1, IQR: 4) and illness concern (median 2, IQR: 3).

Discussion

Most adolescents (83%) in this study had an indifferent drug attitude; they experience low necessity and have low concerns toward their ADHD medication. A similar attitude is observed in a study focusing on adolescents using inhaled corticosteroids [23]. Previous research showed necessity beliefs to be associated with adherence [12,26,27]; however, our study showed no significant difference in adherence between the four drug attitude groups. This might be related to the sample size and the distribution of adolesents over the drug attitudes. On the other hand, we showed a weak correlation between the differential "necessity-concerns" and MARS total score, suggesting that higher perceived necessity is slightly associated with higher adherence rates.

The MARS scores suggest that less than 40% of the adolescents is adherent to their ADHD medication (MARS score $\geq$23). The lowest scores were found on the item related to unintentional nonadherence, suggesting that forgetting is a major reason for not taking medication as prescribed in adolescent ADHD patients. This is confirmed by the additional adherence questions, where "forgetting" was selected as the most important reason for nonadherence. This is in line with results from studies in adolescents with asthma or inflammatory bowel disease [28,29]. Forgetting seems age specific, since adolescents are still in the process of developing their executive functions and self-regulation skills. Moreover, most adolescents have busy schedules and are forgetful about all, except items of their highest priority, such as their friends.

Another main reason for aberrant medication intake was "discontinuing medication during weekends and holidays." This was also shown by scores on MARS items 3 and 4, were 28% sometimes to very often stopped taking medication for a while, and 25% decided to miss out a dose. Stopping during weekends and holidays is suggested by the Dutch general practice guidelines for ADHD treatment in children, if school problems are the main issue, because pharmacological treatment of ADHD is mainly aimed to control symptoms [6]. As stimulants have a fast onset of action, the actual impact of nonadherence on overall efficacy might be relatively low. There is, however, also a debate about intermittent use as this can result in both withdrawal and first dose symptoms. Other reasons for a so-called "drug holiday" are to test whether medication is still needed and to manage side effects, for example, reduce insomnia and appetite suppression, while ADHD symptoms are not increasing [30,31]. Weekends and holidays also have a different daily routine, which might negatively affect medication intake [32]. The exact reason for stopping during weekends or holidays and whether this was on the initiative of the adolescent or the physician's advice was not assessed in this study. Therefore, stopping during weekends or holidays will not always be a nonadherent behavior.

A recent study of Emilsson et al. (2016) showed high adherence rates among adolescents with ADHD (88%); they focused on the mean MARS score in comparing to the total score [28]. If we focus on the mean MARS score of our study, an adherence rate of 85% is found. However, as the distribution of the total MARS score is very skewed, using a cutoff is more appropriate to calculate (non)adherence based on the MARS. If we apply the MARS cutoff ($\geq$23) to the study of Emilsson et al., an adherence rate of 47% is found which is in line with our study, where 39% mentioned to be adherent (based on the MARS). Our findings are also in line with previous studies focusing on adolescents with other chronic diseases, such as asthma and diabetes, were adherence rates are often below 50% [32,33].

Adherence is a complex phenomenon, and during adolescence, it might be even more complex since children become independent during this life phase. Other characteristics of adolescents are the tendency toward oppositional behavior and the importance of peers in developing their social identity [34,35]. Taking medication does not fit in the self-image of most adolescents, potentially resulting in lower adherence rates compared with adults. Side effects are commonly reported for ADHD medication and might also affect adherence [9,27,36]. In our study, half of the participants (51.4%) reported decreased appetite and sleep problems. Surprisingly these frequent side effects do not really seem to affect adolescent's concerns about treatment, which are relatively low. Moreover, the majority of our study population reported a good to excellent overall health status.

The highest score on the items of the Brief-IPQ was on "treatment control." Thus, adolescents do think their medication is effective, despite the indifferent drug attitude. This surprising finding might indicate that adolescents do not see the importance of their ADHD medication. The positive thoughts about the efficacy of medication are in line with reports from other studies [37,38]. This creates an opportunity to improve ADHD treatment; those who treat adolescents with ADHD should support their patients' necessity beliefs and make them more aware of their

positive medication attitude. A suggestion to achieve this is via shared decision-making, which might increase the adolescent's sense of autonomy. Future work should focus on the effectiveness of this shared decision-making on medication intake behavior.

Our study included a large sample of adolescents (n = 181) using ADHD medication. The mean age was 14.2 years, which deviates from other studies toward children using ADHD medication (9.7 years) [9]. The participation rate of the pharmacies was low, because only 68 (of 1,300) pharmacies participated. This might be due to the specific time window of the study or due to the invitation by a single e-mail which might end up in spam or remain unnoticed. However, the participating pharmacies are a representative sample of Dutch community pharmacies [17], and 1,200 adolescents were invited from those pharmacies.

A response rate around 15%–20% is often seen in studies focusing on adolescents. In our study, the patient response rate was 15%. If we focus on the self-reported substances of abuse (Table 1), our study population is largely comparable to the Dutch adolescent population (aged 12–16 years); 25.5% of the Dutch adolescents drink alcohol and 10.6% smoke [39]. Furthermore, the mean age of our sample was 14.2 years and most of them used methylphenidate; this is in line with the highest use of methylphenidate at age 14 years [16]. Nonetheless, we have to be aware of participation bias due to self-selection. Thus, adolescents who are more aware of their medication and disease might probably be more eager to participate. This might result in a slightly overestimation of our results for the total adolescent ADHD population.

To ensure the diagnoses of ADHD, we selected adolescents based on filling of at least two prescriptions for methylphenidate, dexamphetamine, and/or atomoxetine in the preceding year. In the Netherlands, one prescription covers 3 months of medication use; therefore, the participants used ADHD medication at least for half a year. Unfortunately, the diagnosis ADHD is not verified by a physician. Another limitation is that our results are solely based on self-reported measurements, which may be subjected to social desirability bias. However, if we focus on, for example, the MARS score, the mean score (21.1 ± 3.0) does not suggest that adolescents using ADHD medication are always adherent, which is in line with previous adherence studies based on direct measurements.

In this study, most adolescents using ADHD medication had an indifferent drug attitude (perceived low concerns and low necessity). They mentioned frequently skipping medication doses, both intentionally (e.g., weekends and holidays) and unintentionally (forgetfulness). Adolescents also frequently experienced side effects, although this did not result in high concerns toward the treatment. These findings should be taken into account when treating adolescents with ADHD. A suggestion to improve the treatment of ADHD might be to continuously combine pharmacological treatment with psychological and behavioral treatments [40]. Furthermore, monitoring and discussing the experiences of patients with their ADHD medication might be useful to optimize the treatment for adolescents with ADHD; pharmacists might play a role in this.

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