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## How appropriate is the increased use of methylphenidate?

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## CHAPTER 2

# Clinicians' Adherence to Guidelines When Initiating Methylphenidate Treatment

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## Abstract

### Aims

Between 2008 and 2012, the number of children and adolescents in the Netherlands who received methylphenidate prescriptions increased by 35.6%. We determined guideline adherence regarding the assessment of ADHD and rates of off-label use in those two years. We also compared adherence to guidelines between mental health and pediatrics settings.

### Methods

We conducted a medical file audit of 506 children or adolescents who had received a first methylphenidate prescription in 2008 ( $n = 208$ ) or 2012 ( $n = 298$ ) across mental health ( $n = 333$ ) and pediatrics outpatient clinics ( $n = 173$ ) in the Netherlands and assessed adherence to seven guideline recommendations.

### Results

We did not find significant differences between 2008 and 2012 regarding mean adherence to the seven recommendations (43% versus 45%) or the percentage of off-label use (35% versus 30%). Best adherence rates (over the years 2008 and 2012 combined) concerned the assessment of comorbidities (89%) and the involvement of teachers in the diagnostic process (75%). Least frequently adhered to were assessing ADHD severity (1%), the use of a (semi-)structured parent interview (16%), and providing psycho-education to parents (42%) or teachers (1%). Mental health settings showed better adherence than pediatrics settings (over the years 2008 and 2012 combined) concerning the use of (semi-)structured parent interviews (22% versus 3.1%), having a separate diagnostic session directed at the child (81% versus 63%), assessment of comorbidities (95% versus 76%), and providing psycho-education to parents (51% versus 24%).

### Conclusions

There was neither a decrease in adherence to guidelines nor an increase in off-label use between 2008 and 2012. However, there is ample room for improvement regarding guideline adherence.

## Introduction

Over the past decade, there has been a rapid and tremendous increase in many European countries in the use of methylphenidate, the most widely prescribed medication for attention deficit hyperactivity disorder (ADHD), constituting 94.2% of all ADHD prescriptions in 2012 in the Netherlands (Bachmann et al. 2017; Dalsgaard et al. 2013; Trip et al. 2009). In addition, off-label use of methylphenidate, that is, the use of methylphenidate by individuals without an ADHD diagnosis and by children under the age of 6, may be as high as 40% of the total use (Safer 2016). The increase in methylphenidate prescriptions has led to concerns about overdiagnosis of ADHD and overtreatment of children with methylphenidate. It is unclear if the increase in methylphenidate prescriptions are accounted for by improper ADHD diagnoses, intentional off-label use, or increases in use among youth with proper ADHD diagnoses. It should be noted though that, despite the increase, the prevalence of methylphenidate prescriptions is still considerably lower than the prevalence of ADHD (Cortese, 2020).

Adherence to clinical guidelines is of critical importance for providing children and adolescents with safe and optimal care and for preventing improper diagnosis and treatment. That is, on one hand, poor guideline adherence could imply decisions not based on appropriately verified information—leading to overdiagnosis; on the other hand, with insufficient information being collected about the child, fewer symptoms may be detected and underdiagnosis may occur. The leading international guidelines for the assessment and treatment of ADHD (e.g. National Institute for Health and Clinical Excellence [NICE] (2019), American Academy of Pediatrics [AAP] (Wolraich et al. 2019), Scottish Intercollegiate Guidelines Network (2009), European Society for Child and Adolescent Psychiatry (Taylor et al. 2004)) correspond on many recommendations regarding diagnostic procedures for ADHD, such as the requirement to obtain information on the child's functioning from multiple sources (e.g. parents and teachers), the need to use (semi-) structured interviews or questionnaires, and the importance of assessing comorbidities (Faraone et al. 2021). Regarding the indication for the use of medication, available guidelines recommend parent training as the first-line treatment for children with mild to moderate impairment, and methylphenidate for the more severe cases or as a follow-up treatment in case of insufficient improvement after parent training.

Several studies have evaluated the adherence to guidelines regarding the diagnostic process of ADHD and the initiation of methylphenidate treatment in children and adolescents, with mixed results, e.g. (Vrba et al. 2016; Efron et al. 2016; Allen and Glavina 2004; Epstein et al. 2014; Rushton 2004; Braithwaite et al. 2018). For instance, the percentages of clinicians who contacted schools and who used parent rating scales in their diagnostic assessments both ranged from 55% to 98% (Vrba et al. 2016; Efron et al. 2016; Allen and Glavina 2004; Epstein et al. 2014; Rushton 2004). A recent study conducted in Australia found that the mean adherence to 34 quality of care indicators for ADHD was 83.6% (Braithwaite et al. 2018). However, no studies have investigated whether guideline adherence or off-label use of methylphenidate changed over the years in which methylphenidate prescriptions increased.

Studies suggest that there may be differences in practices between clinicians in child and adolescent mental health care and pediatrics treatment settings; child and adolescent psychiatrists were shown to treat more children with multiple comorbidities than (primary care) pediatricians (Harpaz-Rotem and Rosenheck 2006), and psychiatrists to more often prescribe psychotropic medication compared to general practitioners or pediatricians (Goodwin et al. 2001). Yet, little is known about differences in guideline adherence across both treatment settings.

The primary objectives of our study were to examine possible changes in adherence to Dutch guideline recommendations for the assessment and treatment of ADHD in children and adolescents (Landelijke Stuurgroep Multidisciplinaire Richtlijnontwikkeling in de GGZ 2005) and regarding the proportion of off-label use of methylphenidate between 2008 and 2012, a period during which the numbers of prescriptions of ADHD medication to children and adolescents increased substantially in the Netherlands (the prevalence of prescriptions increased from 2.86% of children and adolescents in 2008 to 3.88% in 2012, an increase of 35.6%), as well as in other European countries (Denmark + 73.3%, Germany + 7.0%, the United Kingdom 20.0%) (Bachmann et al. 2017; Dalsgaard et al. 2013). We were specifically interested in possible changes in adherence to guideline recommendations concerning the assessment and diagnosis of ADHD, as indicators of possible improper diagnosis, as well as changes in off-label use and adherence to recommendations concerning the initiation of methylphenidate treatment, as indicators of possible overtreatment. We hypothesized lower guideline adherence and higher off-labels rates in 2012 compared to 2008, as a possible reason for the increased use of methylphenidate. As a secondary objective, we aimed to compare mental health settings with pediatrics settings regarding guideline adherence and to report changes in guideline adherence in both settings over the investigated years.

## Methods

### Sample

This study contained 506 medical records of children and adolescents who had a first methylphenidate prescription in 2008 or 2012. Patients of any sex or ethnicity could be included. We reasoned that 500 would be a good target number to investigate guideline adherence; this number was not based on an a priori power calculation though. In line with Dutch laws, no ethical approval was needed for a study solely investigating medical records.

### Measure

We used recommendations from the national Dutch multidisciplinary guideline for the assessment and treatment of ADHD in children and adolescents (Landelijke Stuurgroep Multidisciplinaire Richtlijnontwikkeling in de GGZ 2005) regarding assessment (Table 1, diagnostic recommendations 1 - 4) and indication for methylphenidate treatment (Table 1, treatment recommendations 5 - 7). We selected recommendations that would be objectively retrievable from medical records and that corresponded with recommendations of one or more international guidelines/parameters (see Table 1).

Assessment of on/off-label use was based on children's age (i.e., above or below 6) at initial methylphenidate prescription and presence or absence of an ADHD diagnosis (as documented in the medical records). We also assessed whether methylphenidate was used as the first-choice treatment or started after psychosocial treatment.

**Table 1.** Corresponding recommendations of the Dutch guideline to recommendations of the NICE guideline, and the AAP guideline regarding ADHD diagnosis (1-4) and initiation of methylphenidate (5-7)

Dutch guideline (Trimbos, 2005)	NICE guideline (2009)	AAP Guideline (2011)
1. Obtain information from school about (problem) behavior of the child by questionnaires or a telephone interview, 3.4.1.2, p.32	5.17.1.1	Key action statement 2, 3
2. Use a (semi) structured interview with parent(s) to assess current problems and developmental history of the child. 3.4.1, 3.4.1.1, p31, p.33	5.17.1.1	Key action statement 2, 3
3. Have a separate diagnostic session in which the child is being interviewed/observed 3.4.1.3, p. 32	5.17.1.1	Key action statement 2, 3
4. Assess comorbidities p. 30	5.17.1.1	Key action statement 3
5. Specify ADHD severity (mild-moderate versus severe) and base treatment choice on this, appendix 1, p. 114: <ul style="list-style-type: none"> <li>• Mild-moderate: <ul style="list-style-type: none"> <li>1. Psychosocial treatment (e.g., parent training)</li> <li>2. Methylphenidate</li> </ul> </li> <li>• Severe: <ul style="list-style-type: none"> <li>1. Methylphenidate</li> <li>2. Psychosocial treatment besides methylphenidate if methylphenidate alone is insufficient</li> </ul> </li> </ul>	7.5.3.1, 10.18.2.1, 10.18.2.2	-
6. Offer psychoeducation to parents 5.3.1, p. 82	12.4.1.1, 12.5.2.2, 12.5.3.6	Overview of the ADHD care process: "Provide education to family and children: concerns (e.g., triggers for inattention or hyperactivity) and behavior-management strategies or school-based strategies"
7. Offer psychoeducation to the teacher 5.4.1, p.89	12.5.2.2, 12.5.2.3, 12.5.3.6, 12.5.3.7	Overview of the ADHD care process: "Provide education to family and children: concerns (e.g., triggers for inattention or hyperactivity) and behavior-management strategies or school-based strategies"

NICE = National Institute for health and Care Excellence, AAP = American Academy of Pediatrics, ADHD = attention-deficit/hyperactivity disorder

## Procedure

The audit was conducted in two large organizations for child and adolescent mental health care and in nine pediatrics outpatient clinics spread across the Netherlands. The catchment areas of the two large mental health care organizations together cover about half of the area of the Netherlands and each has a university outpatient clinic in addition to 19 and 9 non-university outpatient clinics, respectively. We sampled from these two organizations, as they participated in a grant aimed to investigate the appropriate use of methylphenidate. Moreover, we approached 24 pediatrics outpatient clinics (out of a total of 109 pediatrics outpatient clinics in the Netherlands), i.e., two from each of the 12 provinces of the Netherlands (one from a larger town and one from a smaller town within each province). Five of these 24 outpatient clinics let us know that they never prescribed methylphenidate. Of the remaining 19 outpatient clinics, eight agreed to participate. Added to these eight pediatrics outpatient clinics was another pediatrics outpatient clinic that also participated in our grant. The nine pediatrics outpatient clinics were all non-university settings.

We aimed to include 500 medical files in which initial prescription of methylphenidate was reported in 2008 or 2012 (in a ratio of 2:3 between 2008 and 2012 and a ratio of 1:2 between pediatrics and mental health treatment settings). All information from the records that was available at the time of the first methylphenidate prescription was used to assess guideline adherence, including information from prior visits (i.e., diagnostic assessments did not have to be done at the first medication prescription visit). Records did not contain standardized checklists on which steps recommended by guidelines could be documented. Every participating center provided a list of patients who started methylphenidate in 2008 or 2012 and we selected consecutive records from that list until we reached our target for each center (targets differed per center between pediatrics and mental health treatment settings). The records were reviewed between March 2015 and July 2016 using a checklist covering all guideline recommendations by two research assistants who had been extensively trained in the reviewing procedures and held regular meetings during data collection to secure scoring integrity and consensus.

## Data analysis

Analyses were done with the Statistical Package for the Social Sciences, version 15. We restricted our analyses regarding guideline adherence to the group of on-label users of methylphenidate. First, we compared patient characteristics (age, sex, and presence of comorbidity) between the two years of methylphenidate initiation (2008 versus 2012), settings (mental health versus pediatrics), and years within settings, using independent t-tests for age and chi-square tests or Fisher's exact tests as appropriate (that is, where cell counts in the frequency table were lower than five) for the other comparisons. In addition, we calculated percentages of overall adherence (the sum of adherence to all seven single recommendations divided by seven), and of adherence to single recommendations.

Subsequently, to examine differences between years, settings, and years within a setting, we used an independent t-test for overall adherence, and chi-square tests or Fisher's exact tests for the comparisons of adherence to each single recommendation as well as for comparisons of the frequency in which methylphenidate was used as first-choice treatment. Recommendations for which adherence

was unknown were considered as missing. To investigate differences in the percentage of off-label users between years, settings, and years within a setting we used chi-square tests or Fisher's exact tests. For all analyses, a  $p$ -value of  $< 0.05$  was set to indicate statistical significance.

## Results

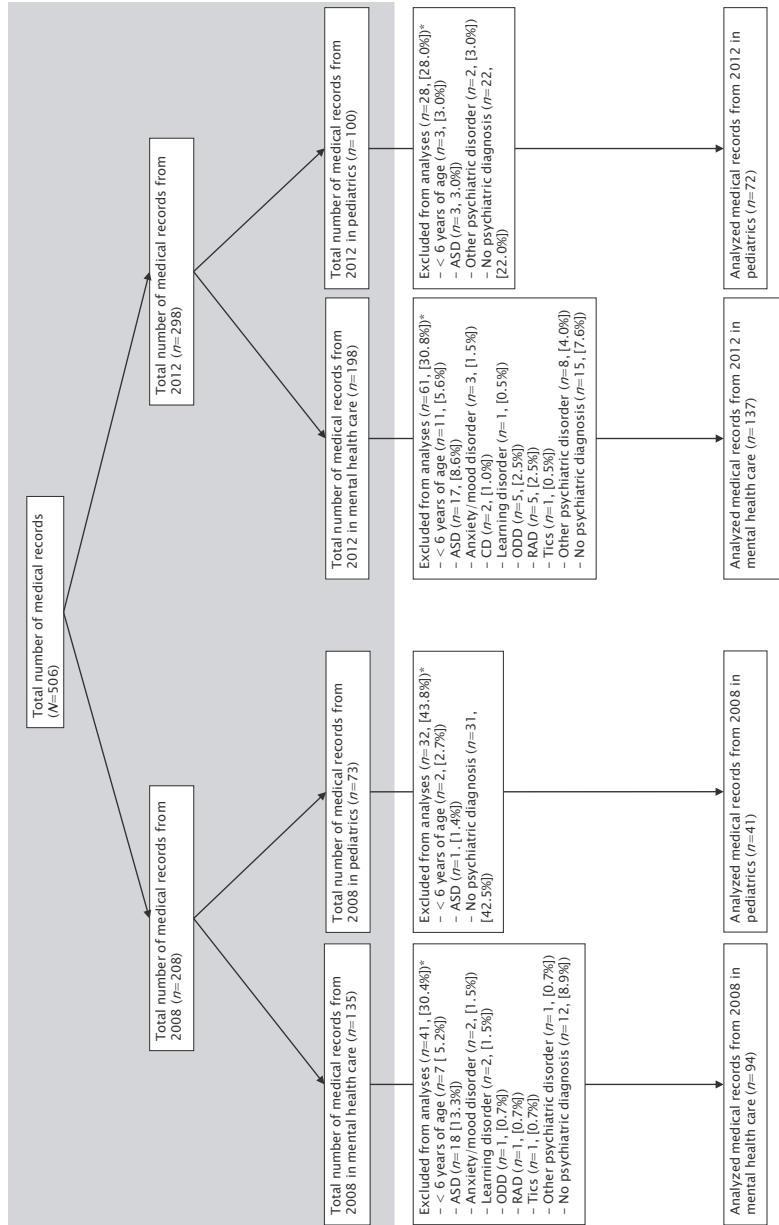
### **Age, sex, comorbidity, and overall adherence to recommendations**

Of the 506 medical records, 344 were on-label users. See Figure 1 for the flow of records and Table 2 for differences in age, sex, and comorbidity between those starting in 2008 versus those starting in 2012.

The percentage of overall adherence to recommendations, regardless of setting or years, was 44%. The use of a (semi-) structured interview with parents was mentioned in only 16% of all records. ADHD severity was specified in only 1% of the records; therefore we could not analyze differences in treatment allocation between mild, moderate, and severe ADHD cases. Most of the records reported that information from school had been obtained (75%), that a separate diagnostic session directed at the child had been done (75%), and that there had been an assessment of comorbidity (89%). We found that 42% of the records reported psycho-education with the parents and 1% with the teacher.

Methylphenidate was reported as the first-choice treatment in 66% of the records, psychosocial treatment in 28%, and a combination of both in 7%.





**Figure 1.** Flowchart of medical records  
 ASD =autism spectrum disorder, ODD = oppositional defiant disorder, RAD = reactive attachment disorder, CD = conduct disorder  
 \* off label use (i.e., no ADHD diagnosis and/or aged < 6). The separate amounts could count up to more than the total.

**Table 2.** Characteristics and differences between years and settings of on-label users at the time of the first methylphenidate prescription

	Year			Setting	
	Total (n = 344)	2008	2012	Mental health	Pediatrics
Age, years mean (SD) <sup>a</sup>	10.2 (2.9)	10.4 (2.9)	10.1 (3.0)	10.1 (3.0)	10.5 (2.8)
Male, n (%)	269 (78.4%)	114 (85.1%)	155 (74.2%)*	188 (81.4%)	81 (72.3%)
Comorbidity, n (%)	103 (29.9%)	41 (30.4%)	62 (29.7%)	92 (39.8%)	11 (9.7%)**
ODD, n (%)	33 (9.6%)	15 (11.1%)	18 (8.6%)	29 (12.6%)	4 (3.5%)*
ASD, n (%)	28 (8.1%)	8 (5.9%)	20 (9.6%)	28 (12.1%)	0 (0.0%)**
Anxiety/Mood disorder, n (%)	15 (4.4%)	4 (3.0%)	11 (5.3%)	13 (5.6%)	2 (1.8%)
Learning disorder, n (%)	11 (3.2%)	3 (2.2%)	8 (3.8%)	7 (3.0%)	4 (3.5%)
Tics, n (%)	6 (1.7%)	3 (2.2%)	3 (1.4%)	6 (2.6%)	0 (0.0%)
CD, n (%)	5 (1.5%)	2 (1.5%)	3 (1.4%)	5 (2.2%)	0 (0.0%)
Reactive attachment disorder, n (%)	4 (1.2%)	2 (1.5%)	2 (1.0%)	4 (1.7%)	0 (0.0%)
Other, n (%)	13 (3.8%)	9 (6.7%)	4 (1.9%)	12 (5.2%)	1 (0.9%)

SD = standard deviation, ODD = oppositional defiant disorder, ASD = autism spectrum disorder, CD = conduct disorder  
<sup>a</sup> results based on an independent sample t-test

\* p <0.05

\*\* p<0.001

### **Guideline adherence between 2008 and 2012**

We did not find any significant differences in adherence to single recommendations or overall adherence between 2008 (43%) and 2012 (45%) in the group of on-label users (see Table 3), nor between both years within the two settings separately. However, we did find that methylphenidate was more frequently the first-choice treatment in 2008 than in 2012 (78% versus 64%,  $X^2(7.69)$ ,  $p = 0.006$ ). This decrease in the prescription of methylphenidate as first-choice treatment between 2008 and 2012 occurred in both settings (mental health: 71% versus 57%,  $X^2(4.91)$ ,  $p = 0.03$ ; pediatrics: 93% versus 76%,  $X^2(4.76)$ ,  $p = 0.03$ ).

### **Proportion of off-label users in the two years and settings**

The percentage of off-label users did not differ significantly between 2008 and 2012 (35% versus 30% respectively,  $X^2[1.54]$ ,  $p = 0.22$ ). Similarly, there were no significant differences between mental health and pediatrics settings (31% versus 35%, respectively,  $X^2[0.86]$ ,  $p = 0.35$ ), nor between 2008 and 2012 in the mental health departments (30% versus 31% respectively,  $X^2[0.007]$ ,  $p = 0.93$ ; see Figure 1 for more details). In pediatrics settings, a significant decrease in off-label prescriptions occurred between 2008 and 2012 (44% versus 28%, respectively,  $X^2[4.67]$ ,  $p = 0.03$ ).

### **Guideline adherence between settings**

Records in mental health settings more frequently reported the use of (semi-) structured interviews with parents and a separate diagnostic session with the child (see Table 3). Moreover, in records from mental health care settings, assessment of comorbidity and psycho-education for the parents were reported significantly more often than in records from pediatrics settings. Furthermore, we found a significant difference in overall guideline adherence; records of mental health settings showed better adherence to guidelines than records of pediatrics settings (48% versus 36%,  $t(6.7)$   $p < 0.001$ ).

Table 3. Guideline adherence in mental health care and pediatrics in 2008 and 2012

	Years		Settings		Chi <sup>2</sup> -value	p-value
	2008	2012	n	n		
<i>1. Information from school has been obtained as part of the assessment, n (%)</i>	135 113 (83.7%)	209 180 (86.1%)	209	231	0.537	0.468
<i>2. Semi-structured interview with parents has been used as part of the assessment, n (%)</i>	130 18 (13.8%)	194 35 (18.0%)	194	227	0.317	<0.001
<i>3. Separate diagnostic session directed at the child has been used as part of the assessment, n (%)</i>	135 105 (77.8%)	209 152 (72.7%)	209	231	0.293	<0.001
<i>4. Comorbidity has been assessed, n (%)</i>	135 115 (85.2%)	209 191 (91.4%)	209	231	0.073	<0.001
<i>5. ADHD severity has been specified, n (%)</i>	135 0 (0.0%)	209 4 (1.9%)	209	231	0.106	0.011
<i>6. Psychoeducation has been provided to parents, n (%)</i>	134 50 (37.3%)	208 94 (45.2%)	208	231	0.150	<0.001
<i>7. Psychoeducation has been provided to the teachers, n (%)</i>	134 2 (1.5%)	208 2 (1.0%)	208	231	0.656	0.102

ADHD = attention-deficit/hyperactivity disorder

## Discussion

We investigated whether the increase in methylphenidate prescriptions that occurred between 2008 and 2012 according to national prescription trends was accompanied by a decrease in ADHD guideline adherence among clinicians working in child and adolescent mental health or pediatrics centers. We were interested whether there was an increase in improper diagnostic procedures, as this might lead to overdiagnosis of ADHD. However, we did not find changes over time in adherence to guideline recommendations for the assessment and diagnosis of ADHD, nor in adherence to recommendations concerning the initiation of methylphenidate. Of note, the use of methylphenidate was more frequently the first treatment choice in 2008 than in 2012, suggesting that, in later years, clinicians and/or parents and children were more willing to try psychosocial treatment options first. Our findings therefore suggest that the reported increase in methylphenidate prescriptions in the investigated period (Bachmann et al. 2017; Dalsgaard et al. 2013) cannot be explained by reduced guideline adherence in mental health or pediatrics care. It must be stressed, however, that we do not have data whether the prescription rates of methylphenidate within the clinical settings included in our study actually increased between 2008 and 2012; in other words, we cannot rule out a link between increases in prescription rates of methylphenidate and lessened guideline adherence.

We did not find any increases either in off-label use that could be indicative of increased improper treatment. Still, strikingly, off-label use of methylphenidate accounted for more than 30% of all prescriptions within our sample. This was not only due to the use of methylphenidate in children below the age of six, but also due to its use in children with a variety of other disorders, most often autism spectrum disorder, but also oppositional-defiant disorder, reactive attachment disorder, and mood disorder. This points to quite prevalent transdiagnostic use of methylphenidate. The high off-label use we encountered is in line with the 32% off-label use in children, according to a report from the French Pharmacovigilance Database (Trenque et al. 2014) and also in line with Canadian data that indicated that around 25% of ADHD medications were prescribed to school age children for a reason other than ADHD (Brault and Lacourse 2012). In Germany, off-label use of ADHD medication appears considerably lower, accounting for 12.7% of all prescriptions (Scholle et al. 2021).

We also investigated whether mental health and pediatrics settings differed in guideline adherence. We found that (semi) structured interviews with parents were more often used as part of the assessment of ADHD in mental health care than in pediatrics settings (22% versus 3%). Diagnostic assessments with the child were also more frequently done in mental health care settings (81% versus 63%). Furthermore, more mental health records reported assessment of comorbidity (95% versus 76%), and psycho-education of parents (51% versus 24%), compared to records in pediatrics departments. These results indicate that clinicians in mental health settings adhere better to guideline recommendations than clinicians in pediatrics, perhaps due to shorter visit time availability and less specific training of clinicians in mental health assessments in pediatric settings.

Our results suggest that a number of improvements can be made in clinical practice, such as a greater use of (semi) structured parent interviews. Also, the low percentage of application of psychoeducation for parents and teachers (42% and 1%, respectively) leaves room for improvement. Notably, ADHD severity was almost never documented, which is remarkable, as in most guidelines severity is related to treatment choice. Our finding is in line with a study (Vrba et al. 2016) reporting ADHD severity in only 2% of medical records. Future guidelines should provide guidance on how to specify ADHD severity.

Guidelines have sometimes been criticized by clinicians for not being suitable for their patients (Hart et al. 1997). Also, it has been shown that the implementation of guideline recommendations into clinical practice is often suboptimal (Grol and Grimshaw 2003; Bero et al. 1998; Grimshaw et al. 2004; Richens et al. 2004; Forsner et al. 2010; Cababa et al. 1999; Grimshaw and Eccles 2004; Gatej et al. 2019). Barriers include low awareness of and familiarity with guidelines and negative attitudes towards or disagreement with guidelines (Cababa et al. 1999). To help clinicians overcome some of these barriers, it may be useful to include guideline recommendations in electronic medical records templates to continuously remind clinicians of important steps and recommendations. Randomized controlled trials found that the implementation of a computerized decision support system resulted in higher adherence to guidelines regarding the diagnosis and management of ADHD (Epstein et al. 2011; Carroll et al. 2013). To overcome negative attitudes towards guidelines training in the importance of guidelines could be (better) integrated in (continued) education. Studies have indicated that such training may lead to large and lasting improvements in the quality of ADHD care (Epstein et al. 2008; Epstein et al. 2010).

Our study should be considered in light of its strengths and limitations. A strength is that we investigated guideline adherence in a period characterized by a steep increase in the use of methylphenidate (Bachmann et al. 2017; Dalsgaard et al. 2013). This gave us the opportunity to examine a possible decline in guideline adherence or increased off-label use as indicative for overdiagnosis or overtreatment. Another strength is our large sample and inclusion of guideline recommendations that are common in leading international guidelines, such as the NICE and AAP guideline (National Collaborating Centre for Mental Health (UK) 2009; American Academy of Pediatrics 2011).

Our study has some limitations as well. First, we relied on information from medical records. Information in medical records does not reflect all steps that a clinician may have taken, and we could not distinguish between non-adherence and a failure to document steps in the medical records. This may have underestimated the adherence to guidelines. Furthermore, our sample size may have been too low to detect small differences in guideline adherence between the years 2008 and 2012. Also, unfortunately, we did not assess inter-rater reliability of our review of the medical records between different raters. Future studies may investigate guideline adherence using different methods, for instance a combination of an audit of medical records and surveys and interviews with clinicians (Gatej et al. 2019; Levelink et al. 2019), and may also investigate whether there are age differences in adherence to guidelines. It may be that guideline adherence is lower in adolescents (for example it is harder to contact a teacher and clinicians may more often rely on self-report).

Another limitation of our study is that we did not include records from children with an ADHD diagnosis who had never used methylphenidate. It would be interesting to investigate whether the proportion of children with an ADHD diagnosis without medication has changed over the years, as well as whether any changes have occurred in the use of psychosocial treatments. Furthermore, it is difficult to estimate to what extent our results can be generalized to populations from other countries or to more recent years. Differences in treatment attitude, insurance, and accessibility of treatments between countries may all impact guideline adherence. However, the current prevalence of methylphenidate use in children and adolescents in the Netherlands is very comparable to that in 2012. Finally, we did not include all kinds of physicians who prescribe methylphenidate, for example, we did not consider general practitioners.

## Conclusion

We did not find differences in guideline adherence on seven internationally corresponding recommendations between 2008 and 2012, indicating that the increase in methylphenidate prescriptions that occurred between those years had little to do with reduced guideline adherence in clinical practice. In addition, the ratio of on/off-label use of methylphenidate did not change, which might have explained overtreatment. The medical records of mental health care clinics showed better guideline adherence than those from pediatrics. There is room for improvement regarding guideline adherence in several areas: clinicians should be encouraged to more frequently use (semi-) structured parent interviews for the assessment of ADHD; to more frequently offer psychoeducation to parents and, in particular, teachers of children and adolescents diagnosed with ADHD; and to specify the severity of ADHD, which should be used to guide the first choice of treatment.

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