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## Changes in Provider Type and Prescription Refills Among Privately Insured Children and Youth With ADHD

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### Abstract

**Objective:** The aim of this paper is to understand associations between age and health care provider type in medication continuation among transition-aged youth with ADHD.

**Method:** Using an employer-sponsored insurance claims database, we identified patients with likely ADHD and receipt of ADHD medications. Among patients who had an outpatient physician visit at baseline and maintained enrollment at follow-up 3 years later, we evaluated which ones continued to fill prescriptions for ADHD medications.

**Results:** Patients who were younger at follow-up more frequently continued medication (77% of 11–12 year-olds vs. 52% of 19–20 year-olds). Those who saw a pediatric provider at baseline and follow-up more frequently continued to fill ADHD medication prescriptions than those who saw a pediatric provider at baseline and non-pediatric providers at follow-up (71% vs. 53% among those ages 15–16 years at follow-up).

**Conclusion:** Adolescents and young adults with ADHD who changed from pediatric to exclusively non-pediatric providers less frequently continued to receive ADHD medications.

### Keywords

ADHD treatment; ADHD follow-up; transition to adult care; ADHD

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**Declaration of Conflicting Interests**

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**Supplemental Material**

Supplemental material for this article is available online.

## Background

About half of adolescents with ADHD continue to experience functional impairments from ADHD symptoms as adults (Sibley et al., 2016). Although continued treatment of ADHD in adulthood is associated with higher likelihood of employment (Halmøy et al., 2009), lower risk of being in a motor vehicle accident (Chang et al., 2014), and lower risk of concurrent substance-related problems (Quinn et al., 2017), many adults with ADHD are not receiving medication. One study found that only 10% of adults with current ADHD symptoms were receiving medication for treatment of ADHD (Kessler et al., 2006), and another found that the prevalence of medication use among adults with ADHD was half of the estimated prevalence of adult ADHD (Tseregounis et al., 2020). Other studies report that young adults are less likely than adolescents or children to fill prescriptions for medications to treat ADHD (Anderson et al., 2018; Johansen et al., 2015; Morkem et al., 2020).

One of the possible factors contributing to lower ADHD prescription rates among young adults is the transition to adult care, when young adults navigate a move from pediatric to adult providers. Relatively few adolescents receive sufficient guidance and planning for healthcare transition from their pediatric providers (Lebrun-Harris et al., 2018), pediatric providers report difficulty finding adult providers for their patients with ADHD (Marcer et al., 2008), and internists report less confidence in diagnosing and managing ADHD (Adler et al., 2019). The lack of transition preparation for youth, barriers in provider communication, and lack of training among adult doctors all raise the possibility that adolescents and young adults may discontinue medication during their transition to adult care.

While adults with ADHD are less likely to fill prescriptions for ADHD medication than children or adolescents, less is known about when adolescents and young adults stop taking medication. Additionally, changing providers may disrupt ADHD medication continuity. Our aim is to explore associations of age and types of providers seen with continuation of ADHD medications. Although the present study is descriptive and exploratory in nature, the ultimate goal of this line of research is to identify modifiable factors to improve outcomes for young adults with ADHD.

## Methods

We used claims data from the IBM® MarketScan® Commercial Databases, which represent a nationwide convenience sample of claims data from employer-sponsored insurance (ESI) plans. We accessed MarketScan data via IBM MarketScan Treatment Pathways 4.0, an online analytic platform using a dynamic version of the data that is stored on IBM Watson Health™ servers and is restricted to the roughly 75% of enrollees in plans with complete data on prescription drugs. Specifically, we accessed the 100% Treatment Pathways sample of data from January 1, 2011 through July 31, 2018. We restricted our analysis to health plans from large, nearly all self-insured employers. MarketScan data are deidentified, and their analysis is classified by the Centers for Disease Control and Prevention (CDC) as non-human subjects research. All analyses of MarketScan data were conducted by CDC staff.

## Baseline Population

To be included in the analytic sample, patients needed to have all of the following occur in either 2011, 2012, or 2013: continuous enrollment (no more than a 45-day gap in a calendar year), at least one outpatient visit, at least one claim with an International Classification of Disease, Ninth Revision, Clinical Modification (ICD-9-CM) diagnosis code for ADHD (314.xx) in any setting, and at least two filled prescriptions (the second within 180 days of the first) for an ADHD medication (list in Supplemental Table). Data from these 3 years were pooled and stratified by 2-year age groups (8–9, 10–11, 12–13, 14–15, and 16–17 years) and are reported as the baseline data.

## Physician Visit Definitions

A combination of provider type and setting information within Treatment Pathways was used to define “physician visits” for this analysis. The possible provider types listed in Treatment Pathways are facility, non-admitting physician, admitting physician, surgeon, physician, other professional (non-physician), and agency. The possible settings include specialty office visits, primary care provider (PCP) office visits, non-physician office visits, and other outpatient visits. Any claim that had both a provider type within the five physician or surgeon categories and a setting of specialty, PCP, or other outpatient was classified as a physician visit. Any outpatient visits listed under the other professional or agency provider type were designated as non-physician visits. Physician visits were identified as pediatric if the provider type was one of the twenty provider types that refer to either pediatrics in general or pediatric specialties, including child psychiatrists. Claims submitted by a physician extender billing under a physician’s supervision would generally be classified as physician visits, with the designation of pediatric or non-pediatric being determined by the provider type of the physician that the physician extender was billing under.

For this analysis, all physician visits with a pediatric provider type were classified as pediatric and all other physician visits as non-pediatric. Patients were classified as being seen by a pediatric provider in a given year if any of their physician visits for the year were with a provider coded as a pediatric provider. If the patient was seen exclusively by non-pediatric providers, then they were coded as seeing non-pediatric providers. For example, if a patient had three visits with non-pediatric providers and one with a pediatric provider, they would be coded as being seen by a pediatric provider for that year. In addition, patients may have had outpatient visits that were not coded as physician visits, due to being seen by a non-physician who billed independently or seen at a facility without a physician code being billed, for example.

## Follow-Up Assessment

Patients were included in the follow-up if they had seen a physician in the baseline year and were continuously enrolled 3 years later, for example, 2011 baseline and 2014 follow-up. In a sensitivity analysis, we restricted the sample to those in the 2011 baseline with continuous enrollment for all 4 years.

## Outcome Assessment

Outcomes included type of providers seen in the follow-up year and whether they had filled at least one prescription for an ADHD medication in the follow-up year. The follow-up data were pooled across years 2014 to 2016 stratified by ages 11–12, 13–14, 15–16, 17–18, and 19–20 years (i.e., 3 years older than at baseline).

We determined whether patients in each age group had visits with any pediatric providers at follow-up. We then stratified these results based on whether they had visit pediatric providers at baseline. Finally, we assessed the proportions in each age group who had at least 1 ADHD medication prescription filled during follow-up, stratified by provider types seen at baseline and follow-up. Patients who did not have an ADHD medication prescription filled during follow-up were considered to have discontinued medication.

## Results

### Demographics

Table 1 shows the characteristics of the MarketScan pediatric population and the analytic sample in the baseline year. The percentage of patients meeting criteria to be included in the analytic sample (i.e., having a claim with an ADHD diagnosis code and 2 or more filled prescriptions for ADHD medication) decreased with age (e.g., 7.5% at 8–9 years vs. 5.3% at 16–17 years). Younger children with a physician visit were more frequently seen by a pediatric provider (e.g., 76% at 8–9 years vs. 55% at 16–17 years).

Between 36% and 41% of each age cohort was lost between the baseline and follow-up years (Figure 1), with attrition slightly greater among those who saw only non-pediatric providers in the baseline year.

### Follow-Up Outcomes

Most patients who were still enrolled in the follow-up year had a physician visit that year, ranging from 97% of those aged 11–12 years to 92% of those aged 19–20 years (Table 2a, Figure 2). Similar to the baseline analysis, the proportion of patients who had a physician visit with a pediatric provider during the follow-up year decreased with age, with the largest drop-offs occurring from 15–16 years to 17–18 years (65%–47%) and from 17–18 years to 19–20 years (47% to 26%). Among those who had a physician visit with a pediatric provider at baseline, the majority had visits with a pediatric provider at follow-up, with the exception of those ages 19–20 years old at follow-up, of whom only 38% had visits to a pediatric provider (Table 2b, Figure 2). Among those who had physician visits with only non-pediatric providers at baseline, some proportion of all age groups had physician visits with a pediatric provider during follow-up, ranging from 49% of those ages 11–12 years to 10% of those ages 19–20 years (Table 2c, Figure 2).

The percentage of subjects who filled prescriptions for ADHD medications in the follow-up year decreased with increasing age, varying from 77% in the youngest cohort to 52% in the oldest cohort (Table 3a, Figure 3). A larger proportion of those who had physician visits with pediatric provider(s) both at baseline and follow-up continued to fill medications than

those seen by a pediatric provider at baseline and only non-pediatric providers at follow-up. For example, in the cohort ages 15–16 at follow-up, the percentage continuing to fill prescriptions was 71% of those who had physician visits with a pediatric provider at baseline and follow-up. Among those who had physician visits with a pediatric provider at baseline and only non-pediatric providers at follow-up, only 53% continued to fill prescriptions for ADHD medication (Table 3b, Figure 3). Among those in the cohort ages 15–16 at follow-up who had physician visits with non-pediatric providers at both baseline and follow-up, 62% continued to fill prescriptions for ADHD medication (Table 3c, Figure 3).

Small numbers of patients had no outpatient physician visits recorded in the follow-up year. That percentage increased with age, from 3% of those ages 11–12 to 8% of those ages 19–20 (Table 2). Between 20% and 50% of those who had no physician visit in the follow-up year had refilled medications during the year, and this proportion decreased with increasing age (Table 3). In a sensitivity analysis restricted to those who saw a pediatric provider in 2011 and were continuously enrolled all 4 years, the percentages who had no physician visit in the follow-up year who refilled prescriptions were markedly lower. The results for those who saw physicians in the follow-up year were similar to those reported in the tables (data not shown).

## Discussion

In this study, we aimed to understand the age at which patients with ADHD stopped medication for ADHD and to explore the role that changing from a pediatric provider to exclusively non-pediatric providers may have played in stopping medication for ADHD. Our analysis of private insurance claims data showed a steady drop-off in continued ADHD medication claims in each successive age group up to 17–18 years, with an apparently more rapid drop-off at ages 17–18 years. This suggests that while patients with ADHD may stop medication for ADHD at any age, around age 18 seems to be a common time for stopping medication for ADHD.

The change from pediatric to non-pediatric providers may play a role in discontinuing medication for ADHD, although having a physician visit with a pediatric provider at follow-up was positively associated with ADHD medication continuity independent of baseline provider type. Patients with physician visits with a pediatric provider at both baseline and follow-up more frequently continued ADHD medication refills than either those who had physician visits with only non-pediatric providers at baseline and follow-up or those who changed from physician visits with a pediatric provider at baseline to physician visits with only non-pediatric providers at follow-up. Patients who changed from physician visits with only non-pediatric providers at baseline to a pediatric provider at follow-up were also more likely to continue to fill ADHD medication prescriptions.

We cannot definitively state that provider type or change in providers is associated with stopping ADHD medication in part because we cannot identify specific providers in MarketScan data or link providers to prescriptions. Disparities in access may also be a confounding factor; for example, fewer enrollees in rural areas saw pediatric providers and specialists within each age group. Future assessments of associations and disparities

in provider type, provider continuity, and medication continuity could generate useful information for treatment guidance and health services planning.

Understanding the role that age and change in provider play in medication continuity for adolescents and young adults with ADHD is important because a relatively small percentage of adolescents and young adults resume ADHD medication after a distinct period without medication (Brinkman et al., 2018; Newlove-Delgado et al., 2019). This suggests that disruptions in medication treatment can result in discontinuation of treatment for many adolescents and young adults with ADHD. Our study highlights groups who are potentially at higher risk for experiencing medication disruption (and thus for stopping medication altogether): older adolescents, young adults, and those transitioning from pediatric to non-pediatric providers. By knowing which groups are at risk, we can better target supports to these groups to help ensure medication continuity for them, assuming this is clinically indicated. When discontinuation is clinically indicated, primary care providers can help ensure that any other needed treatments and supports continue.

Patient factors may contribute to the observed decrease in ADHD medication use with age. The follow-up data showed that over half of patients were seeing non-pediatric practices at ages 19–20. As a result, patients appear to be making the transition to adult care while also navigating the stressors of adolescence and young adulthood, such as high school, college, work, first time living independently, etc. Discontinuation in treatment may be related to difficulties navigating the transition to adult health care at the same time as these other challenging life events. Decrease in use of ADHD medications in this population may also be due to lack of perceived need by patients and families. While studies have shown that many children and adolescents with ADHD continue to have symptoms in adulthood (Barkley et al., 2002; Biederman et al., 2010; Faraone et al., 2006; Gudjonsson et al., 2009; Young & Gudjonsson, 2008), patients and families may not recognize or expect these continued symptoms or their related impairment. Others may want to try to manage symptoms without ADHD medication. A high percentage of adolescents with ADHD who have stopped taking medication report that they could manage without it or that the medication was not helping; however, nearly all adolescents that stopped taking medication still experienced at least one domain of impairment based on self or parent report (Brinkman et al., 2018).

We found that greater than 20% of adolescents and young adults without a physician visit during follow-up continued to fill prescriptions for ADHD medication during follow-up despite not having a physician visit during the same calendar year. We recognize that there are valid reasons why this may have occurred. Some of those patients may have received care from non-physician providers such as in college counseling centers who might have coordinated prescriptions that might not be captured in the database. Others may have had a prescription from the previous calendar year that was filled in the subsequent calendar year. Some patients may have had a phone visit with their physician that was not billed but provided enough information for the provider to send refills. Nonetheless, this finding raises concerns that some patients may be continuing these medications without proper monitoring for efficacy or side effects, such as headache, high blood pressure, and weight loss, or for medication misuse, which is common in adolescents and young adults (Benson

et al., 2015; Lasopa et al., 2015; McCabe et al., 2004). While factors such as being away at college or doing well on a stable dose may result in less frequent follow-up, the highest proportions of patients who received ADHD medications but did not have a visit were in the younger age groups, when guidelines recommend regular monitoring of height, weight, and blood pressure (Wolraich et al., 2019). Future studies could explore the relationship between continuing to fill prescriptions for ADHD medications and receipt of regular follow-up as recommended by national practice guidelines.

This study has several limitations. First, MarketScan data come from people covered by employer-sponsored insurance (ESI) plans, which are similar demographically to the population with ESI in the nationally representative Medical Expenditure Panel Survey (MEPS) sample, (Aizcorbe et al., 2012). National data show that the population with ESI differs demographically from those with other insurance types, such as Medicaid, or no insurance; they are more likely to be non-Hispanic White and less likely to be Black or Hispanic. They are also more likely to have higher incomes relative to the Federal Poverty Level and much less likely to have a disability (National Center for Health Statistics, 2016).

A further limitation is the lack of clinical information. Using claims data, we were unable to determine the degree of ADHD symptoms for each individual or the appropriateness of medication continuation or discontinuation. In other words, patients with resolution of ADHD symptoms may no longer need ADHD medication and stopping medication could represent appropriate clinical care.

Further, we opted to only include those who were continuously enrolled in either the baseline or follow-up years, since it is not possible to accurately characterize provider types for those with partial year enrollments, who comprise 10% to 20% of enrollees in a year. It is also possible that patients received care or refilled prescriptions without using their insurance, which would not be captured in the MarketScan data, and we could not account for the use of diverted medications (i.e., taking medication prescribed for another individual), which studies show occurs relatively frequently (4% of middle and high school students and 17% of college students) (Benson et al., 2015; McCabe et al., 2004).

As noted previously, we are unable to determine which provider wrote the prescriptions and so cannot definitively show that changing providers accounted for the discontinuation of medication. We were only able to classify provider type and were unable to determine continuity of care from individual providers. We also did not account for the presence of co-occurring conditions, which may influence the type of provider seen and the decision to continue or discontinue medications. Finally, an important caveat is that the provider type variable can refer to either an individual provider who bills independently or a group practice, for example, “multi-specialty practice,” which may have led to incorrect categorization of some visits. For example, if a patient was seen by a pediatric specialist in a “multi-specialty practice,” the patient visit would be designated as non-pediatric.

In conclusion, we found that among children and adolescents who received ADHD medications at baseline, the percentage with prescriptions filled at follow-up appeared to decline with age. With respect to the relationship between change in provider and

medication continuation, those who saw pediatric providers at baseline and follow-up were more likely to be continuing medication at follow-up than those who saw pediatric providers at baseline and non-pediatric providers at follow-up. These results suggest that older adolescents and those making the transition from pediatric to adult care may be at risk of discontinuing medication for ADHD. Studies show that continued treatment when clinically indicated is associated with better function (Chang et al., 2014; Halmøy et al., 2009; Quinn et al., 2017). This study supports recommendations for close follow-up and monitoring of patients as they make the transition from pediatric to adult care to ensure their medical needs are continuously met during the transition process (White & Cooley, 2018). Our data also suggest that many patients may be getting ADHD medication refills without regular follow-up visits with a physician or other provider. Further exploration of medication receipt without regular physician visits could fill in this important knowledge gap, which is important given the possibility of adverse effects and concerns about misuse of ADHD medications.

## Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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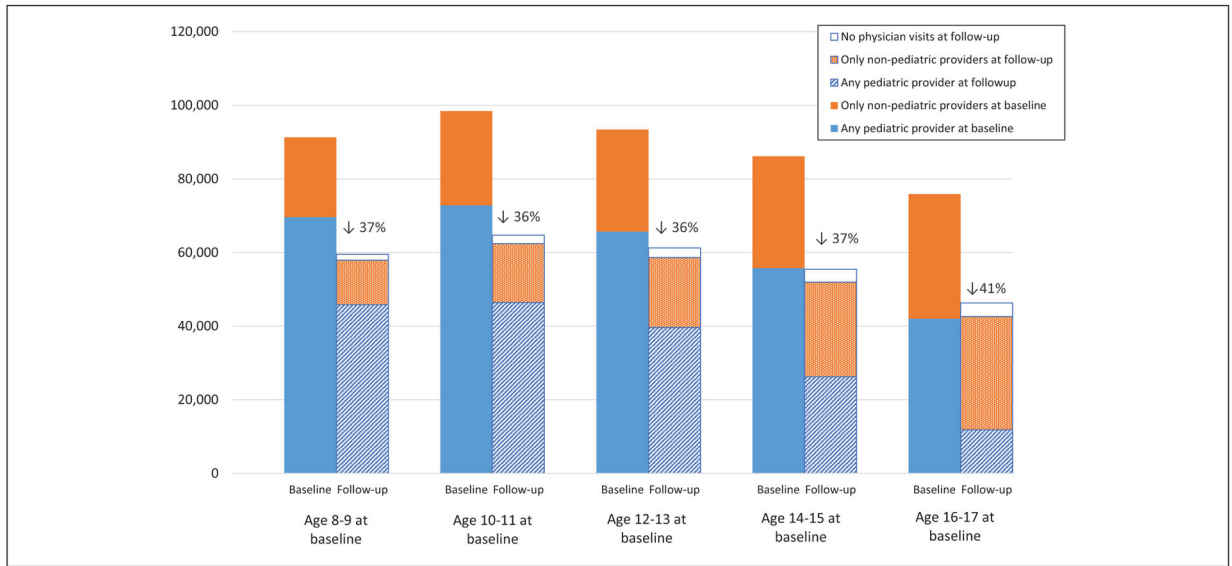


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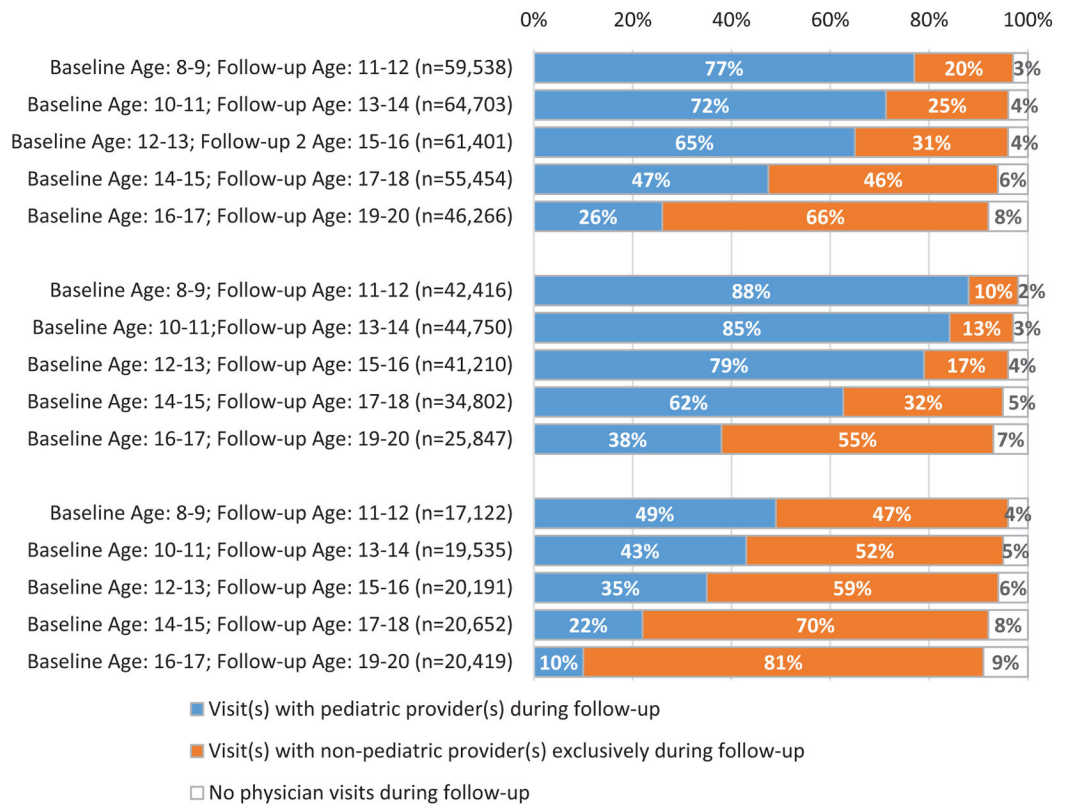
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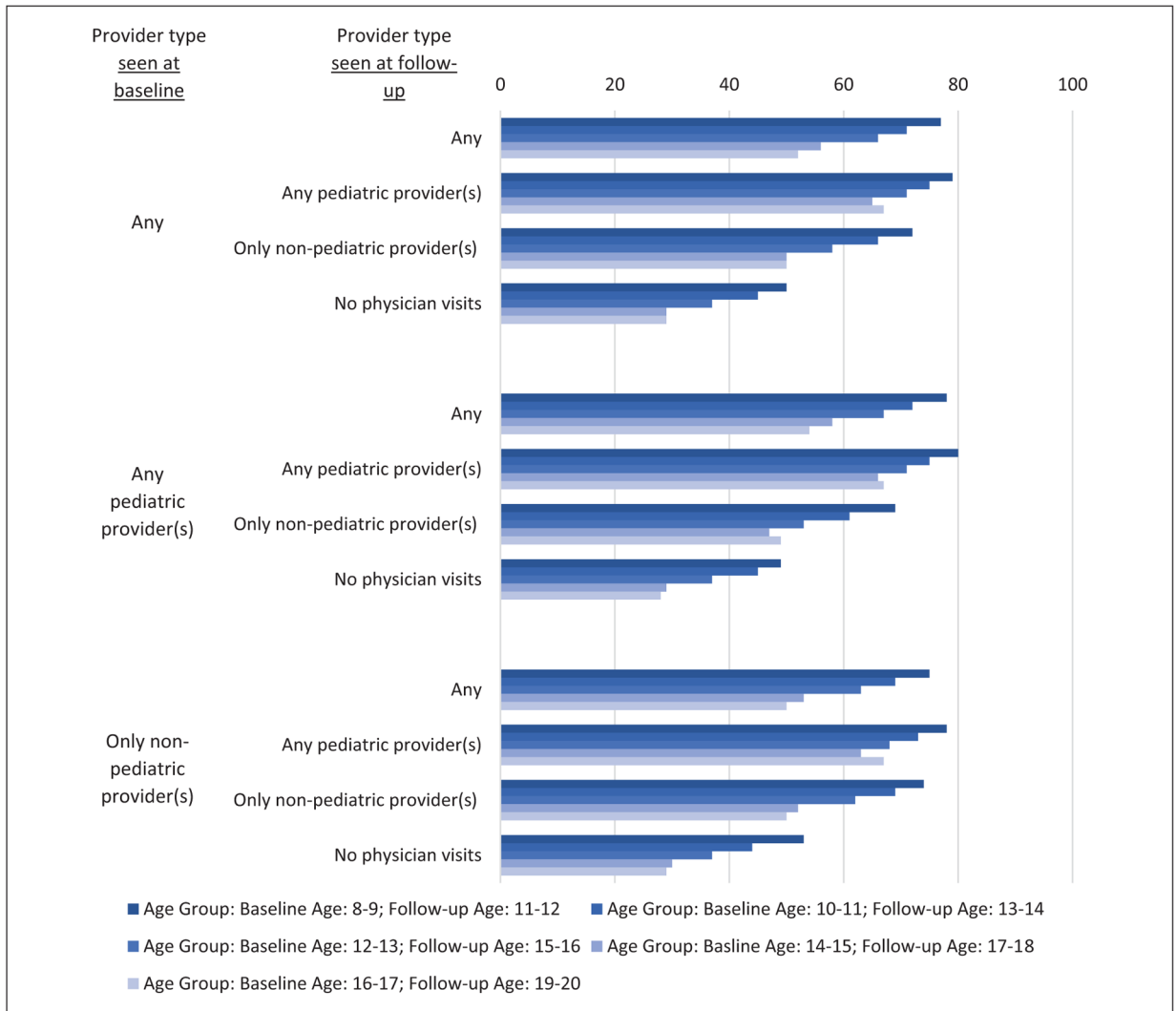
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**Figure 1.**  
Analytic sample size at baseline and follow-up by age cohort and provider type.



**Figure 2.** Distribution of provider types seen by adolescent and young adult patients during follow-up year.



**Figure 3.** Proportion of patients getting 2 refills of ADHD medications during follow-up year.

**Table 1.**

Patient Characteristics Within the Baseline Year (Pooled, Years 2011–2013).

	Age 8–9 years <i>n</i> (%)	Age 10–11 years <i>n</i> (%)	Age 12–13 years <i>n</i> (%)	Age 14–15 years <i>n</i> (%)	Age 16–17 years <i>n</i> (%)
Patients with continuous coverage and any outpatient encounters	1,257,321	1,342,464	1,373,816	1,419,023	1,465,922
ADHD diagnosis & 2+ filled prescriptions of ADHD medications <sup>a</sup>	93,956 (7.5)	101,135 (7.5)	96,055 (7.0)	88,535 (6.2)	78,082 (5.3)
Any physician visit <sup>b</sup>	91,292 (97)	98,434 (97)	93,385 (97)	86,160 (97)	75,848 (97)
Physician visit with any pediatric provider <sup>c</sup>	69,609 (76)	72,837 (74)	65,669 (70)	55,738 (65)	42,030 (55)

*Note.* All subjects were continuously enrolled in MarketScan Commercial employer-sponsored insurance plans with prescription drug coverage during the baseline calendar year and had outpatient claims. Children with attention ADHD had 1 ADHD diagnosis code and 2 claims for ADHD medications in the calendar year.

<sup>a</sup>Percentages shown here are the medication treated current-year prevalence of ADHD in the age group in the baseline year.

<sup>b</sup>Percentages shown here are the percentages of those with current-year medication treated ADHD who had a claim associated with an office visit of any physician provider type.

<sup>c</sup>Percentages shown here are the percentages of those with any physician visit who saw a pediatric provider.

**Table 2.** Distribution of Provider Types Seen by Adolescent and Young Adult Patients During the Follow-Up Year (Pooled, Years 2014–2016).

Age at baseline (years)	Age at follow-up (years)	Enrolled at follow-up with outpatient visits N	Physician visit with a pediatric provider during follow-up n (%) <sup>a</sup>	Physician visit with non-pediatric providers during at follow-up n (%) <sup>b</sup>	No physician visits during follow-up n (%) <sup>c</sup>
(a) Those who had a physician visit with any provider (pediatric or non-pediatric) at baseline.					
8–9	11–12	59,538	45,790 (77)	12,106 (20)	1,642 (3)
10–11	13–14	64,703	46,382 (72)	16,031 (25)	2,290 (4)
12–13	15–16	61,401	39,616 (65)	19,012 (31)	2,613 (4)
14–15	17–18	55,454	26,225 (47)	25,753 (46)	3,476 (6)
16–17	19–20	46,266	11,826 (26)	30,758 (66)	3,682 (8)
(b) Those who had a physician visit with a pediatric provider visit at baseline.					
8–9	11–12	42,416	37,442 (88)	4,045 (10)	929 (2)
10–11	13–14	44,750	38,043 (85)	5,849 (13)	1,276 (3)
12–13	15–16	41,210	32,469 (79)	7,145 (17)	1,446 (4)
14–15	17–18	34,802	21,678 (62)	11,282 (32)	1,842 (5)
16–17	19–20	25,847	9,755 (38)	14,269 (55)	1,823 (7)
(c) Those who had a physician visit with only non-pediatric provider visits at baseline.					
8–9	11–12	17,122	8,348 (49)	8,061 (47)	713 (4)
10–11	13–14	19,535	8,339 (43)	10,182 (52)	1,014 (5)
12–13	15–16	20,191	7,147 (35)	11,877 (59)	1,167 (6)
14–15	17–18	20,652	4,547 (22)	14,471 (70)	1,634 (8)
16–17	19–20	20,419	2,071 (10)	16,489 (81)	1,859 (9)

Note. All subjects were continuously enrolled in MarketScan Commercial employer-sponsored insurance plans with prescription drug coverage during the baseline calendar year and follow-up year. Analyzes were stratified by type of provider seen at baseline.

<sup>a</sup>Percentages in this column show the percentage of patients in a given age group who saw a pediatric provider among those who had a visit in that age group.

<sup>b</sup>Percentages in this column show the percentage of patients in a given age group who saw only non-pediatric providers among those who had a visit in that age group.

<sup>c</sup>Percentages in this column show the percentage of patients in a given age group who had no physician visits among those who had a visit in that age group.

**Table 3.** Proportion of Patients Getting 2 Refills of ADHD Medications During Follow-Up Year (Pooled, Years 2014–2016).

Age at baseline (years)	Age at follow-up (years)	Filled ADHD medications during follow-up among those with outpatient visits during follow-up <i>n</i> (%)	Filled ADHD medications during follow-up among those who had a physician visit with a pediatric provider during follow-up <i>n</i> (%)	Filled ADHD medications during follow-up among those who had physician visits with only non-pediatric providers during follow-up <i>n</i> (%)	Filled ADHD medications during follow-up among those with no physician visits during follow-up <i>n</i> (%)
(a) Those who saw any provider at baseline.					
8–9	11–12	45,995 (77)	36,400 (79)	8,766 (72)	829 (50)
10–11	13–14	46,255 (71)	34,700 (75)	10,535 (66)	1,020 (45)
12–13	15–16	40,123 (66)	28,042 (71)	11,117 (58)	964 (37)
14–15	17–18	30,993 (56)	17,085 (65)	12,892 (50)	1,016 (29)
16–17	19–20	24,176 (52)	7,889 (67)	15,234 (50)	1,053 (29)
(b) Those who saw pediatric providers at baseline.					
8–9	11–12	33,088 (78)	29,857 (80)	2,780 (69)	451 (49)
10–11	13–14	32,734 (72)	28,619 (75)	3,545 (61)	570 (45)
12–13	15–16	27,500 (67)	23,617 (71)	3,805 (53)	528 (37)
14–15	17–18	20,100 (58)	14,228 (66)	5,435 (47)	527 (29)
16–17	19–20	14,063 (54)	6,502 (67)	7,054 (49)	507 (28)
(c) Those who saw only non-pediatric providers at baseline.					
8–9	11–12	12,907 (75)	6,543 (78)	5,986 (74)	378 (53)
10–11	13–14	13,529 (69)	6,081 (73)	6,990 (69)	450 (44)
12–13	15–16	12,623 (63)	4,875 (68)	7,312 (62)	436 (37)
14–15	17–18	10,893 (53)	2,857 (63)	7,547 (52)	489 (30)
16–17	19–20	10,113 (50)	1,387 (67)	8,180 (50)	546 (29)

*Note.* All subjects were continuously enrolled in MarketScan Commercial employer-sponsored insurance plans with prescription drug coverage during the baseline calendar year and follow-up year. Analyzes were stratified by type of provider seen at baseline.