


The Association Between Attention-Deficit Hyperactivity Disorder, Injuries, and Methylphenidate

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Abstract

Objective. To evaluate the relationship between attention-deficit hyperactivity disorder (ADHD) and injuries and to verify whether methylphenidate (MPH), is associated with decreasing the risk of injuries. **Methods.** A retrospective cohort study using the computerized database of Maccabi Healthcare Services. The ADHD cohort included all children between 12 and 20 years of age, newly diagnosed with ADHD between 2003 and 2013. The comparison cohort was composed of children who were not diagnosed with ADHD. The primary outcome was traumatic injuries. A Cox proportional hazard regression analysis was conducted to estimate ADHD effects on the risk of injuries. We also conducted a nested case-control study to examine how MPH influences this relationship. **Results.** A total of 59 798 children were included in the cohort study; 28 921 were classified as exposed (ADHD cohort) and 30 877 were unexposed. The traumatic injuries incidence in the exposed group was significantly higher (adjusted hazard ratio = 1.63 [95% confidence interval = 1.60-1.66]). Similar increased risk was documented also for severe injuries (adjusted hazard ratio = 1.72 [1.59-1.86]). MPH use was significantly associated with 28% lower injury events. Therapy groups were significantly associated with 29% to 40% lower injuries rate for medium- or long-acting MPH. The intensity of therapy was significantly associated with 29% to 33% lower injury rate when the intensity was lower than 0.69 mg/kg/day. **Conclusion.** Children with ADHD have a 60% increased odds of experiencing an injury. Treatment with MPH reduced the risk by up to 28%. The individual and financial cost secondary to injuries, underscores the public health significance of this problem. Injury prevention should be considered in clinical evaluation of MPH risks and benefits, beyond the conventional consideration of enhancing academic achievements.

Keywords

ADHD, injuries, children, methylphenidate, Maccabi Healthcare

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Introduction

Attention-deficit hyperactivity disorder (ADHD) is one of the most common neuropsychiatric disorders of childhood and adolescence, and it often persists into adulthood.¹ The prevalence in school-age children is estimated to be between 8% and 11% and is more common in boys than among girls (male-to-female ratio 4:1 [hyperactive type] and 2:1 [inattentive type]).²

ADHD is a syndrome with 2 types of primary symptoms: hyperactivity/impulsivity and inattention. The symptoms can affect cognitive, educational, behavioral, mental, and social performance.³

For most school-aged ADHD children and adolescents (≥ 6 years of age), initial treatment with a

stimulant medication combined with behavioral therapy is commonly advised.³⁻⁷

Injuries are one of the most common causes of morbidity and mortality among youth.^{8,9} According to the World Health Organization, identifying groups that may have a greater risk of injury and applying preventive measures remain a critical public health issue.¹⁰ It has been hypothesized that due to difficulty with sustained

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attention and inability to respond correctly to situations, children with ADHD are at greater hazard for incurring intentional and unintentional injuries.¹¹⁻²¹ However, the potential protective role of methylphenidate (MPH) in preventing such risk has been only sparsely studied.

Such information can help tailoring interventions for reducing unintended injuries among children with ADHD, as well as in calculating the economic burden of these events.

Methods

Cohort Study

This was a population-based, retrospective cohort study. We compared the traumatic injury incidence rates in ADHD children with children without ADHD.

Data Source. This study was conducted using the Maccabi's Healthcare Database, which is derived from a central electronic medical record, containing longitudinal data on a stable population of 2 million people. We defined ADHD from January 1, 2003, to December 31, 2013, and traumatic injuries from birth year to April 30, 2018.

The health records capture diagnoses by using the International Classification of Diseases, Ninth Revision, Clinical Modification (ICD-9-CM). We collected each child's medical history from the outpatient and inpatient files, and all data were identified and analyzed anonymously.

We extracted demographic variables such as age and gender. Socioeconomic status (SES) was based on a score between 1 (lowest) and 10, using geographic information systems and data such as expenditures related to retail chains, credit cards, and housing. This score is highly correlated with SES measured by the Central Bureau of Statistics in Israel.²²

Study Population. The ADHD cohort composed of children between 12 and 20 years of age, newly diagnosed with ADHD (ICD-9-CM-314.01, 314.00 codes) between 2003 and 2013 by a neurologist or a pediatrician qualified by the Ministry of Health to diagnose and manage ADHD. The comparison group was composed of children who were not diagnosed with ADHD. The birth year was set as the index date.

Exclusion criteria were the following: in order to eliminate secondary ADHD, we excluded children who were hospitalized for brain injury 2 years before the diagnosis date.

We also excluded all children who were prescribed psychiatric drugs in the study period.

Outcome and Follow-up. The primary outcome was traumatic injury recorded through either physician visits, Maccabi centers for emergency medicine, or hospitalizations.

The types of injuries collected in the study are presented in the appendix.

The follow-up was terminated when a child had either the first traumatic injury or on April 30, 2018.

Statistical Analyses. All statistical analyses were conducted using a standard statistical Package (SPSS 23.0; SPSS Inc, Chicago, IL).

The differences between the 2 cohorts were tested using a *t* test for continuous variables and χ^2 test for categorical variables.

The incidence of injuries was calculated as the total number of injury occurring divided by the total sum of follow-up years.

To compare the cumulative incidence of injuries between the ADHD and non-ADHD groups, we used the Kaplan-Meier method. To assess the differences in these incidence curves, we applied the log-rank test.

The Cox proportional hazards model was adjusted for potential confounding factors, and we determined the hazard ratios (HR) and 95% confidence intervals (CI).

Case-Control Study

Database and Study Design. This was a retrospective nested case-control study.

Patient Selection. Included were children with ADHD with at least one purchase of MPH over the study period. The initial cohort included 28 921 children with ADHD.

Selection of Cases and Control. Cases included children with a first injury occurring during the study period, and those who had a weight measurement within 6-month period before or after the injury. The date of injury was used as the index date.

Controls were children who did not experience traumatic injuries during the study period, matched by exact year of birth and sex at a ratio of 1:1.

Methylphenidate Exposure. Use of MPH was based on pharmacy records. We obtained information on 270-day prescription records of MPH before the index date.

Methylphenidate cases were included in the study only if the adherence was over 24 days per month.

Methylphenidate medications were divided into 3 groups:

Table 1. Characteristics of the Study Population (Cohort Study).

Variable	Comparison Cohort (n = 30 877)	ADHD Cohort (n = 28 921)	P
Age (years)	15.93 (2.58)	16.15 (2.49)	<.001
Sex, n (%)			<.001
Female	15 548 (50.4%)	9865 (34.1%)	
Male	15 329 (49.6%)	19 056 (65.9%)	
SES, n (%)			<.001
Low	9195 (29.8%)	8889 (30.7%)	
Medium	9525 (30.8%)	12 394 (42.9%)	
High	12 157 (39.4%)	7638 (26.4%)	

Abbreviations: ADHD, attention-deficit hyperactivity disorder; SES, socioeconomic status.

Table 2. Incidence of Injuries and Hospitalization and Multivariate Cox Proportional Hazard Regression Analysis for the Study Cohorts (Error Bars: 95% CI).

Variable	Comparison Cohort			ADHD Cohort			Crude HR (95% CI)	Adjusted HR (95% CI)
	Event	Pys	Rate	Event	Pys	Rate		
Total (any event)	21 655	265 476	815	25 724	180 088	1428	1.75 (1.71-1.78)	1.63 (1.60-1.66)
Hospitalization	1027	265 476	38	1538	180 088	85	2.24 (2.06-2.42)	1.72 (1.59-1.86)

Abbreviations: CI, confidence interval; ADHD, attention-deficit hyperactivity disorder; HR, hazard ratio.

1. Short-acting, for example, ritalin, methylin
2. Intermediate-acting: ritalin SR, ritalin La
3. Long-acting: concerta, daytrana, focalin

Data were also collected on the daily dose per kilogram, categorized into: untreated, 0.1 to 0.45, 0.45 to 0.69, and 0.69 mg/kg/day or above at the index date.

Methylphenidate adherence rate was based on the proportion of days covered (PDC)—with 270 days being complete coverage of yearly week days.

Three levels of adherence were defined according to the PDC—PDC <0.32, 0.33 < PDC <0.65, and PDC >0.66.

Other Study Variables. Socioeconomic status.

Statistical Analysis. Mann-Whitney test was used for comparison of continuous variables between the groups, and χ^2 test was used for comparisons of categorical variables.

Odds ratios (OR) and 95% CI for the association between MPH use and injuries was tested by conditional logistic regression models, adjusted for the potential confounding variable.

All statistical analyses were conducted using a standard statistical Package (SPSS 23.0).

Ethics Approval. The study was approved by the Institutional Review Board of Assuta Medical Center in Israel (Institutional Review Board #: ASMC-0057-17).

Results

Cohort Study

Table 1 demonstrates baseline demographic features of the 59 798 subjects; 28 921 were diagnosed with ADHD cohort and 30 877 were classified as unexposed. The 2 cohorts differed in age, gender, and SES ($P < .05$).

The traumatic injury incidence in the exposed group was significantly higher than in the unexposed group (adjusted HR = 1.63 [95% CI = 1.60-1.66]). Similar increased risk was documented for severe injuries leading to hospitalization (adjusted HR = 1.72 [95% CI = 1.59-1.86]; Table 2).

The cumulative incidence curve is illustrated in Figure 1.

Table 3 shows sensitivity analysis by age groups, gender, and SES. In both female and male groups, ADHD was significantly associated with an increased risk for injuries. Similarly, in all SES levels and age groups, ADHD cohort was significantly associated with an increased risk for injuries.

Moreover, the injury risk is increased by age and in low SES, but there is no difference between genders.

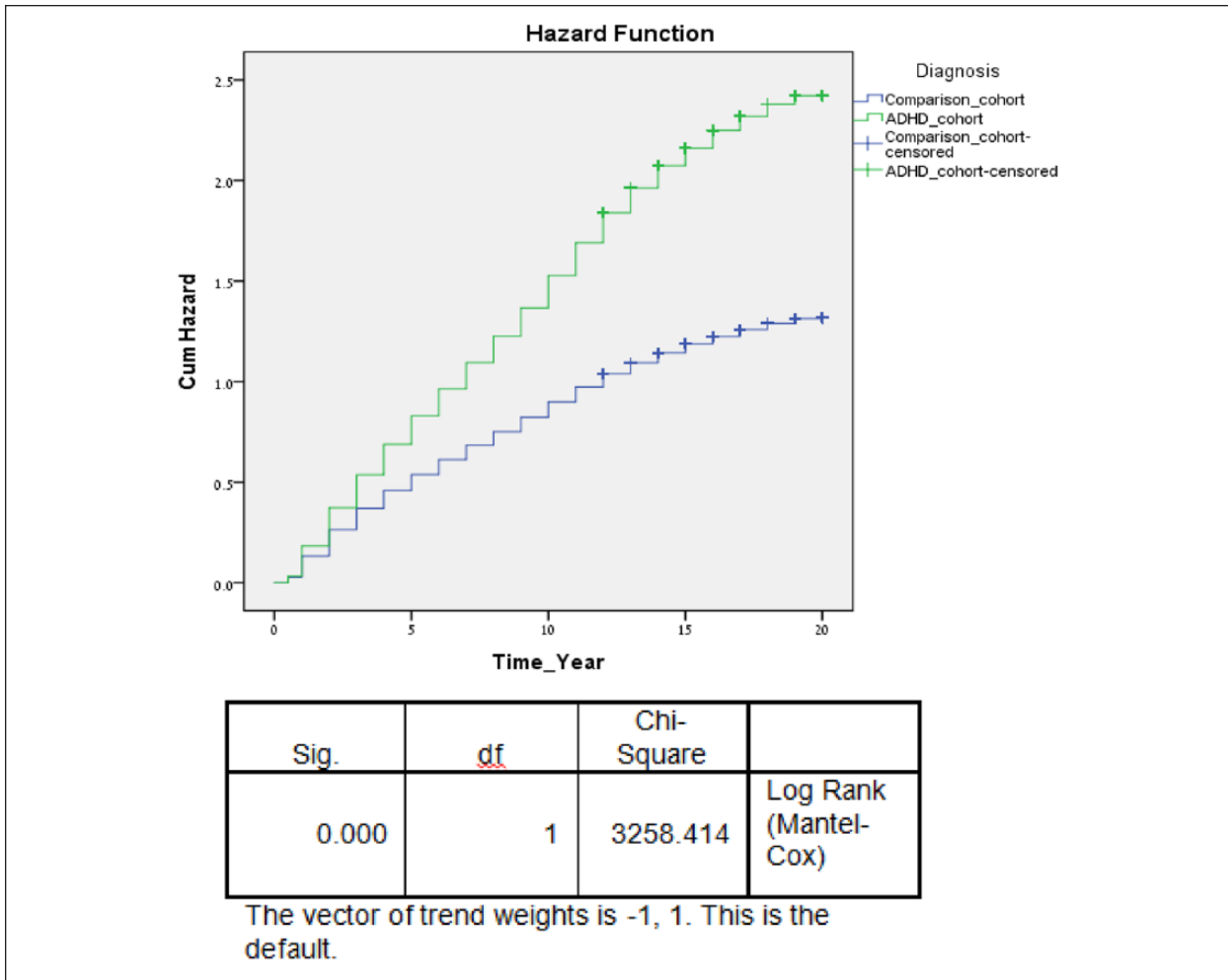


Figure 1. Cumulative incidence of injuries in the comparison and attention-deficit hyperactivity disorder (ADHD) cohorts.

Case-Control Study

After applying the inclusion criteria, 8000 cases and 3265 controls were included. Following matching for sex and age, a total of 1405 injury cases were successfully matched with 1405 controls. Table 4 shows the demographic and clinical characteristic of cases and matched controls. The distribution of the matching variables including gender and age were equal in the case and control groups. A total of 65.3% were males, mean age was 16.83 ± 2.33 years, and mean age at index date was $9.81 (\pm 2.33)$ years for the cases and $9.74 (\pm 2.35)$ years for the controls.

Only 831 (29.6%) of the children used MPH in the period of 270 days before the index date (26.8% vs 32.4% cases and controls, respectively). Medium-acting MPH was the most commonly prescribed drug class (458 [55.1%]). When MPH use was compared with no use, adjusting for SES, it was significantly associated with 28% lower injury rate ($P < .001$). Adherence to treatment, adjusted for SES, was significantly

associated with 29% lower injuries rate when the PDC was lower than 33% coverage. Therapy groups, adjusted for SES, were significantly associated with 29% to 40% lower injuries rate for medium- or long-acting MPH. The intensity of therapy, adjusted for SES, was significantly associated with 29% to 33% lower injury rate when the intensity was lower than 0.69 mg/kg/day (Table 5).

Discussion

In this large population-based cohort study, children with ADHD had a 1.6-time increased odds of experiencing a traumatic injury, compared with controls without ADHD. Within this high-risk group, treatment with MPH conferred a 28% protective effect.

These results are consistent with previous studies, showing increased rate of injury among children with ADHD in general, and that the risk is age-dependent.^{20,21,23}

Table 3. Injury Risk Associated With ADHD Measured by Cox Proportional Hazards Regression Models Stratified by Age, Gender, and SES. (Error Bars: 95% CI).

Variable	Comparison Cohort			ADHD Cohort			Crude HR (95% CI)	Adjusted HR (95% CI)
	Event	Pys	Rate	Event	Pys	Rate		
Age group								
12-13	4902	49 613	988	4604	27 968	1646	1.67 (1.60-1.73)	1.55 (1.48-1.61)
14-15	5024	53 458	940	6209	38 715	1604	1.71 (1.64-1.77)	1.57 (1.51-1.63)
16-17	4759	59 305	802	6043	41 351	1461	1.82 (1.75-1.89)	1.66 (1.59-1.72)
18-20	6970	103 100	676	8868	72 054	1231	1.82 (1.76-1.88)	1.67 (1.62-1.73)
Sex								
Female	10 438	139 075	751	8459	66 531	1271	1.69 (1.65-1.74)	1.6 (1.55-1.65)
Male	11 217	126 401	887	17 265	113 557	1520	1.71 (1.67-1.75)	1.63 (1.59-1.67)
SES								
Low	5570	88 698	628	7774	56 261	1382	2.20 (2.13-2.28)	1.94 (1.87-2.01)
Medium	6820	80 210	850	11 150	75 171	1483	1.74 (1.69-1.80)	1.62 (1.57-1.67)
High	9265	96 569	959	6800	48 657	1398	1.46 (1.41-1.50)	1.39 (1.34-1.43)

Abbreviations: ADHD, attention-deficit hyperactivity disorder; SES, socioeconomic status; CI, confidence interval; HR, hazard ratio.

Table 4. Characteristics of Study Population (Nested Case-Control Study).

	Cases (n = 1405)	Control (n = 1405)	P
Age, years	16.83 (\pm 2.33)	16.83 (\pm 2.33)	1
Sex, male	917 (65.3%)	917 (65.3%)	1
Age at index date	9.81 (\pm 2.33)	9.74 (\pm 2.35)	.43
Weight, kg	35.45 (\pm 12.99)	35.16 (\pm 13.53)	.19
SES level			
Low	394 (28%)	423 (30.1%)	.454
Medium	590 (42%)	581 (41.4%)	.454
High	421 (30%)	401 (28.5%)	.454

Abbreviation: SES, socioeconomic status.

In our study, the incidence of injuries was nearly 60% higher among both females and males with ADHD, suggesting that sex is not a significant predictor of injury. This is consistent with 2 previous studies.^{24,25}

The incidence of injuries was nearly 94% higher among low SES children with ADHD than among low SES children without ADHD. The incidence of injuries among high SES level with ADHD was only 39% higher than that among high SES level without ADHD. The present study demonstrates the importance of SES as a predictor of injury risk.

Medication status might be a vital factor for injuries. The first-line treatment options for ADHD involve using behavioral therapy, pharmacotherapy with stimulants, or combining both of these methods. MPH is the stimulant of choice for treating ADHD.

Consistent with previous studies, we found a statistically significant 28% reduction in the risk of injuries among MPH-treated children.^{20,21}

To the best of our knowledge, our study is the first analysis to quantify the effect of MPH prescription patterns on injury risk, addressing short-, intermediate-, and long-acting, as well as treatment intensity, while controlling for age, sex, and SES.

The findings reveal that MPH treatment as medium- or long-acting were linked to nearly 30% to 40% lower risk for injuries comparing with those who have not received MPH. Importantly, short-acting MPH did not appear to mitigate significantly the risk for injury.

Moreover, the protective effect was significant in the low- and medium-intensity treatment. These results suggest that children treated with low- and medium-severity treatment have a lower risk to have an injury than ADHD children who have not received treatment 270 days before the injury.

When examining high-intensity treatment, no significant protective effect was detected. This may be a consequence of a limited sample size and insufficient power. Alternatively, it is conceivable that children with

Table 5. Methylphenidate Drug Exposure and the Association Between Methylphenidate Drug Use and Injuries by Conditional Logistic Regression Models (Error Bars: 95% CI).

	Cases, n = 376	Control, n = 455	P	OR	P	95% CI
Use of methylphenidate; Ref.—no treatment	376 (26.8%)	(32.4%)	.001	0.72	<.001	0.61-0.86
Therapy groups; Ref.—no treatment						
Short acting (27.6%)	109 (29%)	121 (26.6%)		0.81	.14	0.62-1.12
Medium acting (55.1%)	208 (55.3%)	250 (54.9%)	.5	0.71	.003	0.56-0.89
Long acting (17.2%)	59 (15.7%)	84 (18.5%)		0.61	.005	0.42-0.85
Adherence; ref.—no treatment						
PDC < 0.32 (33%)	122 (32.4%)	153 (33.6%)		0.71	.01	0.54-0.92
0.33 < PDC < 0.65 (42.3%)	159 (42.3%)	193 (42.4%)	.89	0.71	.07	0.56-1.23
PDC > 0.66 (24.5%)	95 (25.3%)	109 (24%)		0.75	.075	0.56-1.12
The intensity of therapy; ref.—no treatment						
mg/kg < 0.45 (31.2%)	113 (30.1%)	147 (32.3%)		0.67	.004	0.51-0.88
0.45 < mg/kg < 0.69 (33.4%)	124 (33%)	154 (33.8%)	0.62	0.71	.01	0.54-0.92
mg/kg > 0.69 (35.2%)	139 (37%)	154 (33.8%)		0.78	.072	0.61-1.13

Abbreviations: CI, confidence interval; PDC, proportion of days covered.

high-dose intensity are those with more severe forms of ADHD, and hence even high-dose intensity may not reduce the risk of injury.

Previous studies observed the relationship between MPH duration and brain injuries and found a significant 51% decrease in risk for traumatic brain injury with >84 defined daily doses of MPH prescription.²⁶ Another study found that only the cohort treated for more than 180 days was associated with lower risk for fracture among ADHD patients.²⁷ In our study, we examined a wide range of injuries (as shown in the appendix) and not only fracture and trauma brain injury. We found a trend toward decrease in injuries in all the PDC groups, while the only significant difference was in the low PDC. However, this is likely as a consequence of a limited sample size and therefore insufficient power.

Several potential limitations of our study have to be addressed:

Misclassification (information) biases: diagnoses that are entered by doctors and health workers may introduce inaccuracy in determining the diagnosis since it was made according to clinical impression and not based on specific laboratory tests. To overcome the issue of misclassification, ADHD diagnosis was included only if a neurologist or a qualified pediatrician established the diagnosis, as this is a focus of their practice. Loss to follow-up bias in Maccabi is 1% to 2% per year. We minimized this potential bias by including only members who visited the clinic at least

once a year during the study period and were still active members in the end of the follow-up on April 2018.

Drug exposure misclassification may occur when individuals obtain drugs by paying “out-of-pocket” or via alternative drug coverage plans. In Israel, this is very rare, and even during a private purchase, usually the insured member uses a Maccabi card in pharmacies and recovers the payment.

Previous studies suggested several variables that are associated with both ADHD and injuries and therefore might be confounders. Among them are alcohol, drug abuse, and psychiatric drugs. Alcohol and drug abuse are rare in this age group, and children treated with psychiatric drugs were excluded.

Future work should also attempt to adjust for the clinical phenotype of ADHD. However, this would demand accurate information about the presence and intensity of the core symptoms—hyperactivity, inattention, and impulsivity (Add referencehere).

In conclusion, our results demonstrate that ADHD is associated with an increased incidence of injuries, and that MPH appears to mitigate this risk.²⁸

The high prevalence and persistence of ADHD, and the individual and financial cost secondary to injuries, underscores the public health significance of this problem. Injury prevention should be considered in the more extensive clinical evaluation of MPH risks and benefits, beyond the conventional consideration of enhancing academic achievements.

Appendix

Types of injuries included in the study (using the International Classification of Diseases, Version 9 (ICD-9):

1. Fracture of skull, neck, and trunk (800-809)
2. Fracture of upper/lower limb (810-829)
3. Dislocation (830-839)
4. Sprains and strains of joints and adjacent muscles (840-848)
5. Intracranial injury excluding those with skull fracture (850-854)
6. Internal injury of thorax, abdomen, and pelvis (860-869)
7. Open wound of head, neck and trunk, upper/lower limb (870-897), superficial injury (910-919)
8. Contusion with intact skin surface (920-928)
9. Burns (940-949)
10. Injuries to nerves and spinal cord (950-957)

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Author Contributions

SS performed all analyses and wrote the first draft. GH, GK and VS conceived the project and oversaw all analyses and interpretations. DW participated in data analysis.

Declaration of Conflicting Interests

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

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References

1. Fayyad J, De Graaf R, Kessler R, et al. Cross-national prevalence and correlates of adult attention-deficit hyperactivity disorder. *Br J Psychiatry*. 2007;190:402-409.
2. Visser SN, Danielson ML, Bitsko RH, et al. Trends in the parent-report of health care provider-diagnosed and medicated attention-deficit/hyperactivity disorder: United States, 2003-2011. *J Am Acad Child Adolesc Psychiatry*. 2014;53:34-46.e2.
3. Subcommittee on Attention-Deficit/Hyperactivity Disorder; Steering Committee on Quality Improvement and Management; Wolraich M, et al. ADHD: clinical practice guideline for the diagnosis, evaluation, and treatment of attention-deficit/hyperactivity disorder in children and adolescents. *Pediatrics*. 2011;128:1007-1022.
4. Pliszka S; AACAP Work Group on Quality Issues. Practice parameter for the assessment and treatment of children and adolescents with attention-deficit/hyperactivity disorder. *J Am Acad Child Adolesc Psychiatry*. 2007;46:894-921.
5. Taylor E, Döpfner M, Sergeant J, et al. European clinical guidelines for hyperkinetic disorder—first upgrade. *Eur Child Adolesc Psychiatry*. 2004;13(suppl 1):17-130.
6. Chan E, Fogler JM, Hammerness PG. Treatment of attention-deficit/hyperactivity disorder in adolescents: a systematic review. *JAMA*. 2016;315:1997-2008.
7. Harpin VA. Medication options when treating children and adolescents with ADHD: interpreting the NICE guidance 2006. *Arch Dis Child Educ Pract Ed*. 2008;93:58-65.
8. Vincenten J; European Child Safety Alliance. The Stockholm Manifesto. Creating a safe environment for children in Europe. *Int J Inj Contr Saf Promot*. 2005;12:123-127.
9. Borse NN, Gilchrist J, Dellinger DM, Rudd RA, Ballesteros MF, Sleet DA. *CDC Childhood Injury Report: Patterns of Unintentional Injuries Among 0-19 Year Olds in the United States, 2000-2006*. Atlanta, GA: Centers for Disease Control and Prevention; 2008.
10. Valent F, Little D, Bertollini R, Nemer LE, Barbone F, Tamburlini G. Burden of disease attributable to selected environmental factors and injury among children and adolescents in Europe. *Lancet*. 2004;363:2032-2039.
11. Barbaresi WJ, Colligan RC, Weaver AL, Voigt RG, Killian JM, Katusic SK. Mortality, ADHD, and psychosocial adversity in adults with childhood ADHD: a prospective study. *Pediatrics*. 2013;131:637-644.
12. DiScala C, Lescohier I, Barthel M, Li G. Injuries to children with attention deficit hyperactivity disorder. *Pediatrics*. 1998;102:1415-1421.
13. Hinshaw SP, Owens EB, Zalecki C, et al. Prospective follow-up of girls with attention-deficit/hyperactivity disorder into early adulthood: continuing impairment includes elevated risk for suicide attempts and self-injury. *J Consult Clin Psychol*. 2012;80:1041-1051.
14. Leibson CL, Katusic SK, Barbaresi WJ, Ransom J, O'Brien PC. Use and costs of medical care for children and adolescents with and without attention-deficit/hyperactivity disorder. *JAMA*. 2001;285:60-66.
15. Lam LT. Attention deficit disorder and hospitalization owing to intra- and interpersonal violence among children and young adolescents. *J Adolesc Health*. 2005;36:19-24.
16. Pastor PN, Reuben CA. Identified attention-deficit/hyperactivity disorder and medically attended, nonfatal injuries: US school-age children, 1997-2002. *Ambul Pediatr*. 2006;6:38-44.
17. Swensen A, Birnbaum HG, Hamadi RB, Greenberg P, Cremieux PY, Secnik K. Incidence and costs of accidents

- among attention-deficit/hyperactivity disorder patients. *J Adolesc Health*. 2004;35:346.e1-e9.
18. Farmer JE, Peterson L. Injury risk factors in children with attention deficit hyperactivity disorder. *Health Psychol*. 1995;14:325-332.
 19. Halperin JM, Newcorn JH, Matier K, Bedi G, Hall S, Sharma V. Impulsivity and the initiation of fights in children with disruptive behavior disorders. *J Child Psychol Psychiatry*. 1995;36:1199-1211.
 20. Dalsgaard S, Leckman JF, Mortensen PB, Nielsen HS, Simonsen M. Effect of drugs on the risk of injuries in children with attention deficit hyperactivity disorder: a prospective cohort study. *Lancet Psychiatry*. 2015;2:702-709.
 21. Man KKC, Chan EW, Coghill D, et al. Methylphenidate and the risk of trauma. *Pediatrics*. 2015;135:40-48.
 22. Shalev V, Chodick G. The healthy adherer effect—reply. *Arch Intern Med*. 2009;169:1633-1638.
 23. Marcus SC, Wan GJ, Zhang HF, Olfson M. Injury among stimulant-treated youth with ADHD. *J Atten Disord*. 2008;12:64-69.
 24. Cairney J, Hay JA, Veldhuizen S, Missiuna C, Faight BE. Developmental coordination disorder, sex, and activity deficit over time: a longitudinal analysis of participation trajectories in children with and without coordination difficulties. *Dev Med Child Neurol*. 2010;52:e67-e72.
 25. Cairney J, Hay J, Veldhuizen S, Missiuna C, Mahlberg N, Faight BE. Trajectories of relative weight and waist circumference among children with and without development coordination disorder. *CMAJ*. 2010;182:1167-1172.
 26. Liao YT, Yang YH, Kuo TY, et al. Dosage of methylphenidate and traumatic brain injury in ADHD: a population-based study in Taiwan. *Eur Child Adolesc Psychiatry*. 2018;27:279-288.
 27. Chen VC, Yang YH, Liao YT, et al. The association between methylphenidate treatment and the risk for fracture among young ADHD patients: a nationwide population-based study in Taiwan. *PLoS One*. 2017;12:e0173762.
 28. Faigel HC, Sznajderman S, Tishby O, Turel M, Pinus U. Attention deficit disorder during adolescence: a review. *J Adolesc Health*. 1995;16:174-184.