Risk of Injury Associated With Attention-Deficit/Hyperactivity Disorder in Adults Enrolled in Employer-Sponsored Health Plans: A Retrospective Analysis

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Objective: Attention-deficit/hyperactivity disorder (ADHD) is linked to an increased risk of injury in children. This retrospective analysis evaluated the risk and type of injury associated with ADHD in adults.

Method: Data were taken from the MarketScan databases, which provide details of health care claims and productivity data for individuals and their dependents with access to employer-sponsored health plans. Adults (aged 18–64 years) with ≥ 2 ADHD-related diagnostic claims (using *ICD-9-CM* codes) between 2002 and 2007 and evidence of ADHD treatment in 2006 (n = 31,752) were matched to controls without ADHD (1:3; n = 95,256) or individuals with a depression diagnosis (using *ICD-9-CM* codes; 1:1; n = 29,965). Injury claims were compared between cohorts, and multivariate analyses controlled for differences that remained after matching.

Results: Injury claims were more common in individuals with ADHD than in non-ADHD controls (21.5% vs 15.7%; $P < .0001$) or individuals with depression (21.4% vs 20.5%; $P = .008$). Multivariate analyses indicated that the relative risk of injury claims was higher in individuals with ADHD than in the non-ADHD control (odds ratio [OR] = 1.32; 95% CI, 1.27–1.37; $P < .01$) and depression (OR = 1.13; 95% CI, 1.07–1.18; $P < .01$) groups. Injury claims increased total direct health care expenditure; total expenditures for ADHD patients with injuries were $6,482 compared with $3,722 for ADHD patients without injuries ($P < .0001$). Comparison of injury-related costs were similar between ADHD patients and non-ADHD controls ($1,109 vs $1,041, respectively), but higher for depression patients than for ADHD patients ($1,792 vs $1,084; $P < .01$). Injury claim was also associated with increased short-term disability expenditures, as ADHD patients with injury incurred higher mean cost than those without injury ($1,303 vs $620; $P = .0001$), but lower than those with injury in the depression cohort (vs $2,152; $P = .0099$)

Conclusions: Adults with ADHD were more likely to incur injury claims than non-ADHD controls or adults with depression in this sample selected on the basis of claims data rather than clinical referrals. Most injuries were relatively minor; however, individuals with injuries incurred higher total direct health care costs than those without injuries. Furthermore, the ratio of indirect costs due to workplace absence to direct health care costs was higher for adults with ADHD than for adults with depression, demonstrating not only the impact of ADHD in the workplace, but also the importance of accounting for productivity data in calculating the true economic burden of ADHD in adults.

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Attention-deficit/hyperactivity disorder (ADHD) is typically characterized as a childhood disease; however, there is increasing recognition of the burden the disorder places on adults.[1,2] It has been estimated that 50%–75% of children with ADHD continue to meet criteria for ADHD as adolescents and adults,[3] that 80% of children with ADHD continue to be symptomatic in adolescence,[4] and that 7.0% of children and 4.4% of adults in the United States are affected by the disorder.[5,6] Similar results were obtained in a World Health Organization (WHO)–backed survey, which estimated the mean ± SD prevalence of ADHD in adults in the United States to be 5.2 ± 0.6%.[7] The WHO survey also included 9 other countries and estimated the prevalence of adult ADHD to range from 1.2% in Spain to 7.3% in France. The overall rate across all 10 countries in the survey was 3.4%.[7] Subsequent analyses showed that ADHD affected 3.5% of employed adults across the countries included, although the only country in which the prevalence of ADHD differed between employed and unemployed adults was the United States (4.5% vs 7.2%; $P = .021$).[8]

The link between ADHD and injuries has been the subject of research for many years. Much of the historical literature describing this link relates to

Clinical Points

- Significantly higher risk of injury in adult patients with ADHD versus non-ADHD controls and in depressed patients (132% and 113% increase, respectively) was shown to be associated with an increase in medical costs and therefore total burden of disease.
- Risk of injury in adults was found to be higher in females than in males, unlike pediatric ADHD populations studied.
- The findings are important for clinicians who treat adults with ADHD in ensuring ongoing and adequate treatment of the disorder.

relatively major injuries requiring medical attention in children. This is especially true for retrospective studies, which generally rely on data from emergency rooms or other medically attended settings to estimate the frequency of injuries. Retrospective analysis of data from the 2000 to 2002 National Health Interview Survey (NHIS) found that children with ADHD were at a significantly higher risk for injury compared with children without ADHD (prevalence ratio = 1.65; 95% confidence interval, 1.04–2.61; $P < .05$).[9] NHIS data also showed that emotional or behavioral problems were risk factors for injury.[10] Preschool children with ADHD have been shown to be prone to more injury than case-controlled comparators (odds ratio [OR] = 4.87; 95% CI, 1.17–20.28), although no significant association was found between ADHD and emergency department–treated unintentional injuries in this patient group.[11]

In a population-based epidemiologic study in Australia,[12] the prevalence of ADHD was examined among older adolescents (aged 16–19 years) admitted to hospitals due to injuries. Patients with a diagnosis of ADHD were nearly twice as likely as those without ADHD to remain hospitalized for 3 or more days after adjusting for age, gender, socioeconomic status, and the cause of injury (OR = 1.97; 95% CI, 1.35–2.88), suggesting that ADHD was associated with more severe injuries.[12] In another retrospective study comparing children and young adults (aged 6–19 years) with ADHD with those with conduct disorders or controls without behavioral disorders,[13] the ADHD cohort was at increased risk for unintentional injury events resulting in a physician office or emergency room visit or hospitalization.

In contrast, information on injuries in adults with ADHD is much more limited. A number of studies have looked at the impact of adult ADHD on driving performance and have shown a link between ADHD and risk-taking while driving and also with driving anger.[14] Attention difficulties in adolescents could contribute to an increased risk of injuries due to accidents and may persist into adulthood.[15–17] Among young adults (aged 17–28 years), significantly more individuals with ADHD than controls with no psychiatric disorders reported a range of negative driving outcomes, including driving before being licensed, having their license revoked, or traffic/speeding citations.[18] Young adults with ADHD had more vehicular accidents (25.7% of individuals with ADHD reported having 3 or more accidents vs 9.4% among controls; $P < .01$) and caused more damage in their first crash ($4,221 vs $1,666; $P < .01$).[18] Although the medical implications of these driving outcomes were not reported, the increased number and severity of vehicular accidents among young adults with ADHD would almost certainly have increased their risk for injuries.

Direct information on adult ADHD and injuries is also limited. In 1 study investigating the relationship between adult ADHD and trauma,[19] 58 adults admitted to the hospital with musculoskeletal trauma were evaluated for the presence of ADHD in childhood and adulthood and compared with adults with nontraumatic complaints. There were significantly more cases of adult ADHD in the trauma group than in the nontrauma group (62.1% vs 13.3%; $P = .001$).[19] Among the 26 patients reporting high-energy trauma (patients who are involved in a "high energy" event with a risk for severe injury despite stable or normal vital signs), 23 (88%) had adult ADHD, and among the 26 with a history of repeat trauma, 24 (92%) had the disorder. On the basis of these findings, the authors suggested that patients reporting high-energy traumas repeatedly should be evaluated by a psychiatrist for a diagnosis of ADHD.[19]

Two studies based on claims data from the United States have also investigated the relationship between ADHD and injuries. In the first, which used claims data from the year 1998,[20] a diagnosis of ADHD was associated with an increased likelihood of an accidental injury-related claim among adults (OR = 1.94; $P = .05$). Adults with ADHD also incurred significantly higher direct costs ($443 vs $119; $P < .05$) and total costs ($483 vs $146; $P < .05$) related to accidents than those without the disorder.[20] The second study of US claims data included children and adults and was based on a dataset including more than 60,000 individuals in each calendar year between 1998 and 2005 (approximately 61% of individuals with ADHD were aged < 20 years).[21] The study found that sprains/strains, open wounds, and limb fractures were the most common injuries and that the 2 categories of injuries most strongly associated with ADHD were intracranial injuries and injuries to blood vessels/late effects of injuries/poisoning/toxic effects.[21]

The aim of the present study was to determine the risk and type of injury associated with ADHD among adults using data from a health insurance claims database and to evaluate the impact of these injuries on health care expenditure.

METHOD

Data Source

Details of the data source and study population are described by Hodgkins et al.[22] Briefly, health care claims and productivity data taken from the MarketScan Commercial Claims and Encounters (commercial) and Health and Productivity Management (HPM) databases were retrospectively analyzed for calendar year 2006. The commercial database contained inpatient, outpatient, and outpatient prescription details of members from more than 100 self-insured large employers from across the United States. The number of covered lives was between 5.7 million and 9.6 million from 2002 to 2007. The HPM database contained workplace absence, short-term disability, and worker's compensation data for a subset of individuals in the larger commercial database.

Study Population

ADHD group. Adults meeting the following criteria were included: at least 1 claim carrying a diagnosis of ADHD in the period 2002 to 2007 (*ICD-9-CM* code of 314.0, 314.00, or 314.01), at least 1 confirmatory ADHD diagnosis within 12 months of the first diagnosis, evidence of continuing treatment for ADHD in 2006, and continuous enrollment in a health plan with pharmacy benefits in 2006.

Non-ADHD control group (comparator). Adults in the commercial database with continuous enrollment in a health plan in 2006 and who had no claims for a diagnosis of ADHD in 2002 to 2007 met the inclusion criteria for the non-ADHD control group and were matched 1:3 with the ADHD sample.

Depression group (comparator). Adults with no claims for ADHD but evidence of depression were matched 1:1 with those in the ADHD sample on the basis of gender, 5-year age bands, region, and the presence of capitated services in 2006. ADHD patients who could not be matched to the depression group were not included in those comparative analyses.

Individuals in the ADHD, non-ADHD control, and depression groups were divided into those with and without evidence of injury. At least 1 nondiagnostic claim carrying an *ICD-9-CM* code of 800.xx–959.xx in 2006 was considered evidence of injury. Individuals with a specific injury could have 1 or more injury episodes during the year, which could result in 1 or more health care claims.

Variables

Three measures were created for individuals identified as having injuries: number of unique 3-digit injury-related diagnoses in the year, number of months in the year with any injury-related claim (possible range, 1–12), and number of Barell Matrix flags activated.

Barell Matrix. The Barell Matrix provides a standardized approach for classifying injuries (recorded as *ICD-9-CM* codes) by body region and nature of injury.[23] Injury-related *ICD-9-CM* codes were tabulated by both the nature of injury (for example, fracture, dislocation, sprain/strain, and contusion) and by the body part affected (for example, head and neck, spine and back, torso, or extremities). Individual cells in the resulting Barell Matrix represented a unique combination of nature of injury and body part. To populate the matrix, an individual-level yes/no flag was created for each cell, and all flags were initially set to no/null. On the basis of each individual's injury-related diagnosis codes during 2006, flags in specific cells were activated. An individual with 2 separate instances of a specific injury in the year would have 1 cell activated, while an individual with a single instance of multiple trauma might have several cells activated (due to injuries involving a number of body parts).

Most common injuries. For each cohort, a list of the most common injuries was created on the basis of 3-digit *ICD-9-CM* codes. These injuries were identified at the unique individual-diagnosis level, so an individual with multiple claims with the same diagnosis during 2006 was only counted once when determining the most common injuries.

Injury-Related Expenditures

For all claims carrying an injury-related diagnosis, injury-related direct expenditures were calculated from the gross payment amounts (patient plus health plan portion), regardless of whether the injury diagnosis was primary or secondary. Injury-related expenditures were calculated overall and by place of service (inpatient, emergency department, outpatient visits, other outpatient services). For comparison, noninjury expenditures (all expenditures except those counted as related to injury) and total expenditures were also calculated.

Indirect expenditure (a composite of workplace absence costs, worker's compensation, and short-term disability payments) was calculated for the subset of individuals with productivity data. A cost was assigned to missed workdays using hourly wages estimated using US Bureau of Labor Statistics' Current Population Survey data for same age, gender, and region and assuming an 8-hour workday. Absence costs were estimated at 100% of wages and short-term disability costs at 70% of wages. This approximates the proportion of total wages and benefits paid by employers in the HPM database to employees on short-term disability leave and has been used in previous analyses of the MarketScan databases.[24,25] In addition, worker's compensation claims were counted, and the costs recorded by employers for these claims were summed.

Analytic Approach

Chi-square tests were used to identify differences between groups for categorical variables and *t* tests for continuous variables. Differences with a *P* value < .05 were considered statistically significant.

Multivariate analyses were performed to control for differences between the cohorts that remained after matching. The model estimated the probability of injury as a dichotomous variable. Generalized linear models, which are commonly employed when analyzing skewed data such as health care costs,[26] were run for each outcome, while controlling for individuals' demographic and clinical factors.

Demographic factors included gender, age in 2006, geographical region, employee relationship (employee or spouse/dependent), employee class (salaried or hourly wage), and employment industry. Clinical factors included a diagnosis of ADHD in 2006, the Charlson Comorbidity Index (calculated for each patient on the basis of a composite assessment of 17 medical conditions in 2006),[27] medical conditions (including obesity, diabetes, hypothyroidism, hypercholesterolemia, hypertension, other cardiovascular disease, asthma, enuresis, irritable bowel syndrome, and insomnia), and other mental health conditions (including depression/bipolar disorder, anxiety/social phobia, alcohol/substance abuse, and antisocial/oppositional/obsessive-compulsive/eating disorders).

As this study analyzed data for 1 calendar year (2006) only and there was no preperiod requirement for inclusion of subjects in the study, it was not possible to assess baseline costs. Therefore, the statistical analyses of the data did not control for baseline costs. The γ distribution function and log link were applied in the generalized linear models,[28] and the Park test[29] was performed to check the selection of variance and link functions.

RESULTS

Demographics

Between 2002 and 2007, the commercial database contained 342,284 individuals with at least 2 medical claims for ADHD, of whom 150,936 were adults. After individuals with only a single medical claim for ADHD and those without evidence of ADHD treatment or continuous enrollment in a health plan were excluded from the 2006 dataset, 31,752 adults were eligible for inclusion in the ADHD group. These individuals were matched in a ratio of 1:3 with 95,256 non-ADHD control subjects. Because the population of individuals with depression yielded some older individuals than the ADHD group, there were no matches in the depression group for 1,787 individuals with ADHD. Consequently, 29,965 individuals with ADHD were matched with the same number of individuals with depression. Demographic characteristics of the individuals are presented in Table 1.

Prevalence of Injury Claims

The prevalence of injury claims was significantly higher in the ADHD group when compared with either the non-ADHD control group (21.5% vs 15.7%; *P* < .0001) or the depression group (21.4% vs 20.5%; *P* = .008; Figure 1). When analyzed by gender, males accounted for between 56.8% and 60.5% of all claims (Table 2), which was broadly consistent with the ratio between males and females in each group (52.3%–55.0%; Table 1). Injury claims were more common in the ADHD group than in the non-ADHD group for both males (22.2% vs 17.3%) and females (20.7% vs 13.8%; *P* < .0001 for both comparisons; Table 2). Injury claims were statistically more common in the ADHD group than in the depression group for females (20.7% vs 19.2%; *P* = .002) but not for males (22.2% vs 21.6%; *P* = not significant).

When analyzed by age, the largest proportion of injury claims was made by individuals in the 18- to 24-year age group in both the ADHD versus non-ADHD controls and ADHD versus depression comparisons (Table 3).

Number of Injury Claims

Individuals with ADHD had injury claims present in 1.21 months of the year and had a mean of 1.44 unique injury-related diagnoses during 2006 (Table 4). Figures for non-ADHD controls were significantly lower (1.17 and 1.40, respectively; *P* < .0001), although the differences between cohorts were numerically small. Individuals with depression had more injury claims than individuals with ADHD (1.54 and 1.43, respectively; *P* < .0001), although again, the absolute differences between cohorts were numerically small.

Nature of Injuries

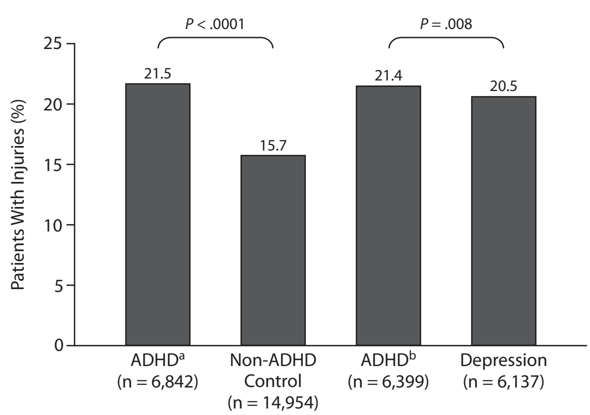
Across all cohorts, most injury claims were for relatively minor events, most commonly various types of sprains, strains, dislocations, and contusions (Table 5). All injury types reported by more than 100 individuals in either cohort were significantly more common in the ADHD cohort than among non-ADHD controls (*P* < .0001 for all comparisons). Injury types included fractures (4.7% vs 3.7%), dislocations (4.3% vs 2.6%), sprains and strains (11.0% vs 8.3%), internal injuries (1.0% vs 0.6%), open wounds (4.8% vs 3.2%), contusions

Table 1. Demographics by Cohort Among Individuals With Attention-Deficit/Hyperactivity Disorder (ADHD), Non-ADHD Controls, and Individuals With Depression

	ADHD Versus Non-ADHD Control		ADHD Versus Depression	
Demographic	ADHD (n = 31,752)	Non-ADHD Control (n = 95,256)	ADHD (n = 29,965)	Depression (n = 29,965)
Gender, n (%)				
Male	17,468 (55.0)	52,404 (55.0)	15,682 (52.3)	15,682 (52.3)
Female	14,284 (45.0)	42,852 (45.0)	14,283 (47.7)	14,283 (47.7)
Age, mean (SEM), y	32.1 (0.1)	32.1 (0.0)	32.8 (0.1)	32.8 (0.1)
Age, median, y	27	27	29	29
Age group (y), n (%)				
< 18	317 (1.0)	1,063 (1.1)	317 (1.1)	1,063 (3.5)
18–24	14,025 (44.2)	42,074 (44.2)	12,240 (40.8)	11,489 (38.3)
25–34	4,715 (14.8)	14,145 (14.8)	4,713 (15.7)	4,718 (15.7)
35–44	5,516 (17.4)	16,548 (17.4)	5,516 (18.4)	5,515 (18.4)
45–54	5,021 (15.8)	15,063 (15.8)	5,021 (16.8)	5,022 (16.8)
55–64	2,158 (6.8)	6,363 (6.7)	2,158 (7.2)	2,158 (7.2)

Abbreviation: SEM = standard error of the mean.

Figure 1. Prevalence of Injuries Among Individuals With Attention-Deficit/Hyperactivity Disorder (ADHD), Non-ADHD Controls, and Individuals With Depression



[a]ADHD matched with non-ADHD control group.
[b]ADHD matched with depression group.

Table 2. Prevalence of Injury Claims by Cohort and Gender Among Individuals With Attention-Deficit/Hyperactivity Disorder (ADHD), Non-ADHD Controls, and Individuals With Depression

	ADHD Versus Non-ADHD Control			ADHD Versus Depression		
Variable	ADHD	Non-ADHD Control	*P* Value	ADHD	Depression	*P* Value
Overall	n = 31,752	n = 95,256		n = 29,965	n = 29,965	
With injury claim, n (%)	6,842 (21.5)	14,954 (15.7)	< .0001	6,399 (21.4)	6,137 (20.5)	.008
Without injury claim, n (%)	24,910 (78.5)	80,302 (84.3)	< .0001	23,566 (78.6)	23,828 (79.5)	.008
Males	n = 17,468	n = 52,404		n = 15,682	n = 15,682	
With injury claim, n (%)	3,886 (22.2)	9,051 (17.3)	< .0001	3,443 (22.0)	3,390 (21.6)	Not significant
Without injury claim, n (%)	13,582 (77.8)	43,353 (82.7)	< .0001	12,239 (78.0)	12,292 (78.4)	Not significant
Females	n = 14,284	n = 42,852		n = 14,283	n = 14,283	
With injury claim, n (%)	2,956 (20.7)	5,903 (13.8)	< .0001	2,956 (20.7)	2,747 (19.2)	.002
Without injury claim, n (%)	11,328 (79.3)	36,949 (86.2)	< .0001	11,327 (79.3)	11,536 (80.8)	.002
Male injury claims, %[a]	56.8	60.5	< .0001	53.8	55.2	Not significant

[a]Proportion of all injury claims made by males.

Table 3. Age Groups by Cohort and Claims for Injuries Among Individuals With Attention-Deficit/Hyperactivity Disorder (ADHD), Non-ADHD Controls, and Individuals With Depression

	ADHD Versus Non-ADHD Control					ADHD Versus Depression				
	ADHD		Non-ADHD Control			ADHD		Depression		
Injury Claim	Yes (A)	No	Yes (B)	No	*P* Value (A vs B)	Yes (C)	No	Yes (D)	No	*P* Value (C vs D)
n	6,842	24,910	14,954	80,302	…	6,399	23,566	6,137	23,828	…
Age, mean (SEM), y	32.04 (0.17)	32.06 (0.08)	31.08 (0.11)	32.23 (0.05)****	< .0001	32.93 (0.17)	32.78 (0.09)	32.59 (0.17)	32.84 (0.09)	NS
Age group (y), n (%)										
< 18	102 (1.5)	215 (0.9)****	241 (1.6)	822 (1.0)****	NS	102 (1.6)	215 (0.9)****	308 (5.0)	755 (3.2)****	< .0001
18–24	3,160 (46.2)	10,865 (43.6)***	7,155 (47.8)	34,919 (43.5)****	< .05	2,717 (42.5)	9,523 (40.4)**	2,394 (39.0)	9,095 (38.2)	.0001
25–34	801 (11.7)	3,914 (15.7)****	2,014 (13.5)	12,131 (15.1)****	< .0001	801 (12.5)	3,912 (16.6)****	892 (14.5)	3,826 (16.1)**	.001
35–44	1,130 (16.5)	4,386 (17.6)*	2,413 (16.1)	14,135 (17.6)****	NS	1,130 (17.7)	4,386 (18.6)	1,025 (16.7)	4,490 (18.8)****	NS
45–54	1,107 (16.2)	3,914 (15.7)	2,218 (14.8)	12,845 (16.0)***	< .05	1,107 (17.3)	3,914 (16.6)	1,066 (17.4)	3,956 (16.6)	NS
55–64	542 (7.9)	1,616 (6.5)****	913 (6.1)	5,450 (6.8)**	< .0001	542 (8.5)	1,616 (6.9)****	452 (7.4)	1,706 (7.2)	< .05

*$P < .05$, **$P < .01$, ***$P < .001$, ****$P < .0001$; *P* values, relative to individuals with injuries.
Abbreviations: NS = not significant, SEM = standard error of the mean.
Symbol: … = not applicable.

and other superficial injuries (5.7% vs 3.9%), and burns (0.6% vs 0.3%). There was no consistent trend in the rates of specific injury types between the ADHD and depression cohorts. Some injury types were more commonly reported by individuals with depression (eg, fractures: 5.4% vs 4.5%, $P < .0001$; internal injuries: 1.3% vs 0.9%, $P < .0001$; open wounds: 5.0% vs 4.6%, $P < .05$; and contusions and superficial injuries: 5.9% vs 5.5%, $P < .05$). Some were more common in individuals with ADHD (eg, dislocations: 4.4% vs 2.9%, $P < .0001$), and others were reported by similar proportions of individuals in both cohorts (eg, sprains and strains: 11.0% in the ADHD cohort vs 11.2% in the depression cohort and burns: 0.6% vs 0.7%, respectively; *P* = not significant).

The Barell Matrix classification confirmed that sprains and strains were the most common injury, most often involving the extremities. Compared with the non-ADHD control group, adults with ADHD had higher rates of injury claims in most cells of the Barell Matrix, which was consistent with the overall higher rate of injury claims in the ADHD treatment cohort.

Risk for Injury Claims

After controlling for differences between cohorts, multivariate analyses demonstrated that the risk for an injury claim was significantly greater in individuals with ADHD compared with both the non-ADHD control group (OR = 1.32; 95% CI, 1.27–1.37; $P < .01$) and the depression group (OR = 1.13; 95% CI, 1.07–1.18; $P < .01$; Figure 2). Female gender was associated with a significantly reduced risk of injury claims (19% lower vs non-ADHD controls; 8% lower vs depression group; $P < .01$). The presence of comorbidities (notably depression, anxiety, and substance abuse) and employment within the services industry predicted a higher probability for an injury claim in individuals with ADHD compared with the non-ADHD control and depression cohorts ($P < .01$; Figure 2).

Productivity-Related Variables

In the absence of injuries, although individuals across groups had a similar number of absence days, compared with non-ADHD controls the number of short-term disability days increased by approximately 70% in individuals with ADHD and were 3-fold higher in individuals with depression (Table 6). Among non-ADHD controls, the presence of injuries increased the mean number of days absent from the workplace and the number of days of short-term disability. In individuals with ADHD, injuries led to more days of short-term disability relative to non-ADHD controls but to fewer days compared with individuals with depression. However, injuries did not influence the mean number of days of absence in either the ADHD or depression cohorts (Table 6).

Table 4. Classification of Injuries Among Individuals With Attention-Deficit/Hyperactivity Disorder (ADHD), Non-ADHD Controls, and Individuals With Depression[a]

	ADHD Versus Non-ADHD Control		ADHD Versus Depression	
Classification	ADHD (n = 6,842)	Non-ADHD Control (n = 14,954)	ADHD (n = 6,399)	Depression (n = 6,137)
Unique diagnoses, mean ± SEM (range)	1.44 ± 0.01 (1–19)	1.40 ± 0.01 (1–10)***	1.43 ± 0.01 (1–19)	1.54 ± 0.01 (1–14)***
Months with any injury claim, mean ± SEM (range)	1.21 ± 0.01 (0–5)	1.17 ± 0.00 (0–6)***	1.21 ± 0.01 (0–5)	1.24 ± 0.01 (0–6)**
Barell Matrix flags activated, mean ± SEM (range)	1.64 ± 0.02 (1–30)	1.58 ± 0.01 (1–21)*	1.62 ± 0.02 (1–30)	1.76 ± 0.02 (1–17)***

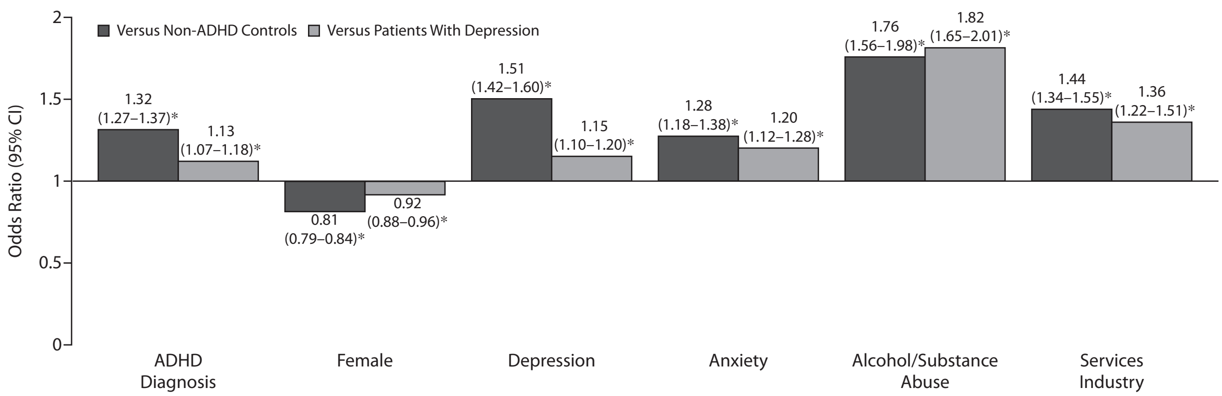
[a]Based on individuals with injury claims.
*$P < .05$, **$P < .001$, ***$P < .0001$; P values, relative to individuals with ADHD.
Abbreviation: SEM = standard error of the mean.

Table 5. Most Common Injuries Among Individuals With Attention-Deficit/Hyperactivity Disorder (ADHD), Non-ADHD Controls, and Individuals With Depression[a]

	ADHD Versus Non-ADHD Control			ADHD Versus Depression		
Injury Classification (*ICD-9* injury code)	No. of Individuals	ADHD (n = 31,752)	Non-ADHD Control (n = 95,256)	No. of Individuals	ADHD (n = 29,965)	Depression (n = 29,965)
Unspecified injury (959)	4,044	1,320 (4.2)	2,724 (2.9)***	2,494	1,199 (4.0)	1,295 (4.3)*
Unspecified sprain of back (847)	3,339	1,038 (3.3)	2,301 (2.4)***	2,159	1,001 (3.3)	1,158 (3.9)**
Other multiple/ill-defined dislocations (839)	1,790	710 (2.2)	1,080 (1.1)***	1,067	695 (2.3)	372 (1.2)***
Sprains/strains of ankle and foot (845)	2,266	694 (2.2)	1,572 (1.7)***	1,220	640 (2.1)	580 (1.9)
Contusion to leg/unspecified sites (924)	1,387	437 (1.4)	950 (1.0)***	864	404 (1.3)	460 (1.5)

[a]Values presented as n (%) unless otherwise specified.
*$P < .05$, **$P < .001$, ***$P < .0001$; P values, relative to individuals with ADHD.
Abbreviation: *ICD-9* = *International Classification of Diseases, Ninth Revision.*

Figure 2. Risk Factors for Injury Claim Among Individuals With Attention-Deficit/Hyperactivity Disorder (ADHD), Non-ADHD Controls, and Individuals With Depression



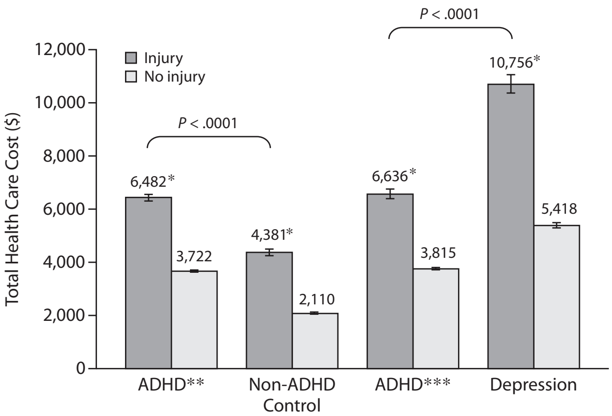
*$P < .01$.

Table 6. Impact of Injury Claims on Productivity-Related Variables

	ADHD Versus Non-ADHD Control				ADHD Versus Depression			
	ADHD		Non-ADHD Control		ADHD		Depression	
Variable	Injury	No Injury	Injury	No Injury	Injury	No Injury	Injury	No Injury
Absences, n[a]	126	503	287	1,600	126	499	106	519
Number of days, mean	20.7	20.1	24.0***	19.8	21.0	20.0	23.0	21.0
Short-term disability, n	433	1,969	1,008	6,341	433	1,967	423	1,995
Number of days, mean	11.8****	5.7	8.4****	3.3	12.0****	6.0	18.0****	10.0
Worker's compensation, n	305	1,250	676	4,026	305	1,247	304	1,252
% of patients	10.5**	5.6	9.2**	6.3	10.5**	5.6	11.2*	7.6

[a]Includes all types of work absences, including paid holidays, vacations, and sick days, because some employers do not differentiate.
*$P < .05$, **$P < .01$, ***$P < .001$; ****$P < .0001$; P values, relative to corresponding individuals without injury claims.

Figure 3. Total Health Care Costs Among Individuals With and Without Injury Claims in the Attention-Deficit/Hyperactivity Disorder (ADHD), Non-ADHD Control, and Depression Groups[a]



[a]Error margins represent standard errors.
*$P < .0001$ relative to individuals in the same cohort with no injury claims.
**ADHD matched 1:3 with non-ADHD control group.
***ADHD matched 1:1 with depression group.

Annual Health Care Costs

Direct costs. When all groups were compared, direct mean health care expenditures (in individuals with or without injury claims) were highest in individuals in the depression group, followed by the ADHD group, then the non-ADHD controls. The presence of an injury claim approximately doubled direct mean health care costs in all groups ($P < .0001$ for the difference between costs for individuals with injury claims and those without injury claims in the ADHD, non-ADHD control, and depression groups; Figure 3). For individuals with injury claims, direct costs were higher for individuals in the ADHD group than for those in the non-ADHD control group (means: \$6,482 vs \$4,381, $P < .0001$; medians: \$3,453 vs \$1,513), while direct costs for individuals in the depression group were higher than those in the ADHD group (means: \$10,756 vs \$6,636, $P < .0001$; medians: \$4,398 vs \$3,601).

Direct injury-related costs were similar for individuals with ADHD and non-ADHD controls (means: \$1,109 vs \$1,041 per individual, $P =$ not significant; medians: \$273 vs \$256) but significantly lower for individuals with ADHD than for those with depression (means: \$1,084 vs \$1,792 per individual $P < .01$; medians: \$266 vs \$306), with most of the difference in direct mean costs due to increased inpatient admission costs in the depression group (Figure 4).

Indirect costs. The presence of an injury claim did not significantly affect indirect expenditures for worker's compensation in any of the cohorts studied. There were also no significant differences in mean worker's compensation costs for individuals with injuries between cohorts (\$488 vs \$439 and \$488 vs \$785 for the ADHD vs non-ADHD control and ADHD vs depression comparisons, respectively, $P =$ not significant for both comparisons). Median worker's compensation costs were zero for patients with injury claims in all cohorts, regardless of the presence of injury claim(s).

For individuals in either the ADHD or depression cohorts, the presence of an injury claim had no significant impact on costs due to workplace absence, although these costs were significantly higher for non-ADHD individuals with an injury than for non-ADHD individuals without an injury claim (means: \$4,335 vs \$3,237, $P < .0001$; medians: \$2,783 vs \$2,812). Workplace absence costs for individuals with injuries were similar for the comparisons between the ADHD versus non-ADHD control and the ADHD versus depression cohorts (means: \$3,397 vs \$4,335 and \$3,397 vs \$3,856, respectively, $P =$ not significant for both comparisons; medians: \$2,566 vs \$2,783 and \$2,566 vs \$2,973, respectively).

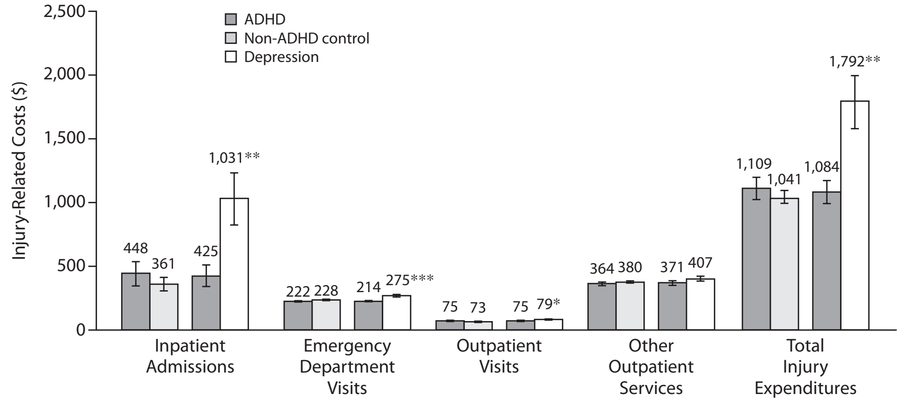
The presence of an injury claim was associated with increased short-term disability expenditures in all cohorts. In the ADHD cohort, mean short-term disability costs were \$1,303 for individuals with an injury claim and \$620 for those without an injury ($P = .0001$). In the depression cohort, short-term disability costs were \$2,152 for individuals with injuries and \$1,131 for those without ($P < .0001$), and among non-ADHD controls, these figures were \$946 and \$341, respectively ($P < .0001$). Mean short-term disability costs for individuals with ADHD with injury claims (\$1,303) were numerically higher than those of non-ADHD control individuals with injuries (\$946, $P =$ not significant), but significantly lower than for individuals with depression and injury claims (\$2,152, $P = .0099$). Median short-term disability costs were zero in all cohorts regardless of the presence of injury claim(s).

Ratio of indirect costs to direct costs. In the comparisons between the ADHD and depression groups, total mean direct health care costs were greater than total indirect costs in individuals with injury claims (\$6,636 vs \$5,188 in the ADHD group; \$10,756 vs \$6,793 in the depression group). In individuals without injuries, mean direct costs were close to, or slightly lower than, indirect costs (\$3,815 vs \$4,238 and \$5,418 vs \$5,462, respectively). The ratio of indirect costs to direct costs was higher for individuals with ADHD than for individuals with depression regardless of injury status. For individuals with injuries, this ratio was 0.78 for the ADHD group and 0.63 for the depression group; for those without injuries, the ratios were 1.11 and 1.01, respectively.

DISCUSSION

ADHD in adults remains a relatively poorly studied condition, and little is known about the consequences of the impairments associated with adult ADHD. In

Figure 4. Injury-Related Costs Among Individuals With Attention-Deficit/Hyperactivity Disorder (ADHD), Non-ADHD Controls, and Individuals With Depression[a]



[a]Error margins represent standard errors.
$^{*}P < .05$, $^{**}P < .01$, $^{***}P < .0001$; *P* values, relative to individuals with ADHD.

addition to the core symptoms of inattentiveness, hyperactivity, and impulsivity, ADHD can result in impairments to normal function, including planning skills,[30] sleep patterns,[31] and psychomotor speed/response times.[32,33] Furthermore, psychiatric comorbidities are common in individuals with ADHD, and the associated impairments tend to increase with age.[34] These impairments and the symptoms of ADHD can have a considerable impact on workplace performance. When combined with the nontrivial prevalence of adult ADHD and the fact that treatment rates are generally low (even though cost-effective therapies are available), ADHD has been identified as a good candidate for targeted workplace screening/treatment programs.[8]

This large-scale, claims-based analysis provides information on the economic and personal impact of ADHD in adults. It also demonstrates an association between ADHD and the risk for injury in this population. Our analysis showed that adults with ADHD were more likely to make injury claims than both non-ADHD controls and individuals with depression. Most injuries were relatively minor, which is consistent with previous research identifying sprains and strains as one of the most common types of injury in the general population.[35,36] In general, males and younger individuals were more likely to claim for injuries, which is consistent with injury data from the general population.[37,38]

Our results are also broadly consistent with those from a recent retrospective study of claims data from children and adults, which also reported an association between ADHD and injuries. The earlier study found that strains and sprains were the most common injuries among the general population and that injuries were most likely in younger individuals (aged 5–9 years).[21] The association between injuries and ADHD, however, was strongest in very young individuals (aged 0–4 years), and injuries most strongly associated with ADHD were those of an intracranial nature. Although there are broad similarities between this earlier study[21] and the present analysis (both were retrospective analyses of US claims data), there are several differences that should be highlighted when trying to compare results. The present study focused exclusively on adults, while the earlier study included children and adults. The present study was also based on more recent data (2006 compared with 1998–2005) and from a larger database (between 5.7 million and 9.6 million individuals per year compared with approximately 60,000) than the earlier study.[21]

In the present study, it was interesting to note that injury claims were significantly more common among females with ADHD than among either those without ADHD or those with depression. If individuals with depression are genuinely less prone to injuries than individuals with ADHD, it could be that the inclusion of individuals with comorbid depression in the ADHD group lowered the injury rate. These results suggest that, for adult females, injury claims are more likely in individuals with ADHD than in those without ADHD. However, it should be noted that, although a number of comparisons achieved statistical significance in this analysis, the absolute difference between cohorts was small in many cases, so these differences should be interpreted with caution.

It should also be noted that, although the original ADHD, non-ADHD control, and depression cohorts were matched on various demographic characteristics, there were differences between cohorts in the subsequent stratification by injury status. Some of the differences (or lack thereof) in injury data and expenditures in the present analysis could be due to these differences or due to other unmeasured differences between cohorts. For example, it has been estimated that less than 20%

of adults with ADHD have been diagnosed or treated,[39] so it is possible that the non-ADHD cohorts (controls and individuals with depression) included individuals with undiagnosed ADHD. If this was the case, the cost of injuries reported here for the non-ADHD control group may overestimate the costs incurred by individuals who genuinely do not have the disorder.

In addition to the direct costs of health care claims, the MarketScan databases provide the additional benefit of quantifying indirect (productivity-related) costs. Given the profound impact that the disorder can have on productivity, these costs are of particular value in studies of ADHD. Previous research supported by WHO estimated that ADHD is responsible for a total of 143.8 million days of lost productivity in the 10 countries studied.[8] In the United States, ADHD resulted in a mean of 10.0 days of absenteeism, 29.1 days of decreased work quantity, and 13.6 days of decreased work quality per year for every affected employed individual. This translated to a total of 104.7 million days of lost productivity in the United States alone.[8] Across all 10 countries, employed adults lost a mean of 22.1 days of productivity per year, with 15.8 days of these being directly attributable to ADHD rather than to comorbidities. Although no evidence of work quality was collected in the present study, it is conceivable that some injuries associated with ADHD could affect workplace performance without necessitating a period of absence from the workplace. If this was the case, the productivity losses associated with injuries reported here are probably underestimates.

In both the ADHD and depression groups in the present study, direct treatment costs were higher than indirect costs for individuals with injury claims, while for individuals without injuries, indirect costs were slightly higher than direct costs. This suggests that injuries tended to have more of an impact on direct treatment costs than on costs due to lost productivity. Although total health care costs were high for individuals with depression, it should be noted that the ratio of indirect costs to direct costs was higher for patients with ADHD than for those with depression, regardless of injury status. This finding provides further evidence of the impact ADHD can have on adults in the workplace and reinforces the importance of productivity data in quantifying the economic burden of ADHD.

Claims data provide a valuable alternative to clinical data for investigating the relationship between injuries and ADHD, with some potential advantages. The patient population in the MarketScan databases is likely to be more representative of the general population than the homogeneous group typically selected for clinical trials. Clinical trials frequently exclude individuals who are nonadherent to medication or who have multiple and/or serious physical and mental comorbidities, despite the fact that these individuals can represent a large proportion of the overall ADHD population.[40] Although the present analysis was retrospective in nature, the data used were not collected specifically to study the link between ADHD and injuries and are therefore not subject to bias in recall associated with some retrospective clinical research.[41]

The present study expands on a smaller study of the relationship between ADHD and injury claims that reported data from 1998.[21] In that study, 38% of the 222 eligible adults with ADHD claimed for injuries, compared with 18% of matched patients without ADHD ($P < .05$ for the difference). The prevalence of injury claims was lower in the present study, although the study sample was considerably larger. Differences in design between the present study and the 1998 data[21] make direct comparisons difficult, but it is interesting to note that total health care costs for individuals with ADHD were significantly higher than for controls in both studies. In contrast, injury-related costs were significantly higher for individuals with ADHD than for those without the disorder in the earlier study[21] ($483 vs $146, respectively, $P < .05$), while there was no significant difference in injury-related costs between the ADHD and non-ADHD control groups in the present study (> $1,000 in both groups).

Given that ADHD treatment is generally associated with an improvement in the symptoms associated with the disorder, it is possible that the number of injury claims related to attentional deficits, impulsivity, or hyperactivity would be reduced by treatment. In the present study, all individuals with ADHD were required to have evidence of treatment, so the injury rates reported may be lower than the rates among individuals with untreated ADHD.

Limitations

Despite the potential benefits of using claims-based data rather than clinical data for retrospective analyses of ADHD, it is important to note that this study has a number of limitations. First, the study used an injury claim as a proxy for actual injury. While it is possible that a dataset based on claims data may capture more injuries than one based on clinical data (which may only capture relatively major injuries necessitating a referral to an emergency room), minor injuries not worthy of any medical attention would not be captured by either claims data or clinical data. The frequency of these injuries is likely to be higher than that of major injuries, but additional research in this area would be required to confirm this. Although all individuals with ADHD were required to have evidence of treatment, no measures of treatment adherence were collected for the present analysis. Consequently, it is not known to what extent individuals were adherent to their treatment regimens, so the impact of treatment on injury claims cannot be determined.

Second, only data from individuals with access to employer-sponsored health insurance were captured. Approximately 40% of the individuals in the MarketScan data presented here were insured employees; the remainder had access to a health plan because a family member was insured. As the employment status of dependents/spouses was not recorded, it was not possible to quantify the overall employment rate of the individuals in the present analysis. Although the MarketScan databases are geographically diverse, covering the whole of the United States, they may underrepresent unemployed or uninsured individuals, and are therefore not necessarily representative of the whole population. This is particularly relevant for studies of ADHD, as adults with the disorder are 2 to 3 times less likely to be in full-time employment than non-ADHD controls.[42,43] As a consequence, the present study may represent only a fraction of the overall picture of injury risks in adults with ADHD in the United States. Unemployment has also been shown to be more common among patients with depression than among those without the condition,[44] so the risk of injuries among patients with depression may also be an underestimate of the rate in the general population.

Finally, individuals who died during 2006 were not eligible for inclusion in the study because they were not enrolled in a health plan for all 12 months of the year. Consequently, data relating to the frequency of fatal injuries could not be measured, and it should not be inferred from our data that individuals with ADHD did not incur serious injuries.

CONCLUSION

In this population selected on the basis of medical claims and productivity data rather than clinical referrals, adults with ADHD were more likely to report injury claims than adults without ADHD or adults with depression. Although most injuries were relatively minor in nature, individuals with injuries incurred higher total direct health care costs than those without injuries. Furthermore, the ratio of indirect costs due to workplace absence to direct health care costs was higher for adults with ADHD than for adults with depression, demonstrating the importance of productivity data in calculating the true economic burden of ADHD in adults.

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REFERENCES

1. Hammerness P, Surman C, Miller K. Update on adult attention-deficit/hyperactivity disorder. *Curr Neurol Neurosci Rep*. 2008;8(6):484–489.
2. National Institute for Health and Clinical Excellence. Attention deficit hyperactivity disorder: diagnosis and management of ADHD in children, young people and adults. Clinical guideline 72. National Institute for Health and Clinical Excellence. http://www.nice.org.uk/nicemedia/pdf/ADHDFullGuideline.pdf. Accessed February 24, 2011.
3. Biederman J, Wilens TE, Spencer TJ, et al. Diagnosis and treatment of adults with attention-deficit/hyperactivity disorder. *CNS Spectr*. 2007;12(suppl 6):1–15.
4. Weiss M, Murray C. Assessment and management of attention-deficit hyperactivity disorder in adults. *CMAJ*. 2003;168(6):715–722.
5. Bloom B, Cohen RA, Freeman G. Summary Health Statistics for US Children: National Health Interview Survey, 2007. *Vital Health Stat 10*. 2009;239(239):1–80.
6. Kessler RC, Adler L, Barkley R, et al. The prevalence and correlates of adult ADHD in the United States: results from the National Comorbidity Survey Replication. *Am J Psychiatry*. 2006;163(4):716–723.
7. 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(5):402–409.
8. de Graaf R, Kessler RC, Fayyad J, et al. The prevalence and effects of adult attention-deficit/hyperactivity disorder (ADHD) on the performance of workers: results from the WHO World Mental Health Survey Initiative. *Occup Environ Med*. 2008;65(12):835–842.
9. Xiang H, Stallones L, Chen G, et al. Nonfatal injuries among US children with disabling conditions. *Am J Public Health*. 2005;95(11):1970–1975.
10. Sinclair SA, Xiang H. Injuries among US children with different types of disabilities. *Am J Public Health*. 2008;98(8):1510–1516.
11. Garzon DL, Huang H, Todd RD. Do attention deficit/hyperactivity disorder and oppositional defiant disorder influence preschool unintentional injury risk? *Arch Psychiatr Nurs*. 2008;22(5):288–296.
12. Lam LT. Attention deficit disorder and hospitalization due to injury among older adolescents in New South Wales, Australia. *J Atten Disord*. 2002;6(2):77–82.
13. Bruce B, Kirkland S, Waschbusch D. The relationship between childhood behaviour disorders and unintentional injury events. *Paediatr Child Health (Oxford)*. 2007;12(9):749–754.
14. Richards TL, Deffenbacher JL, Rosén LA, et al. Driving anger and driving behavior in adults with ADHD. *J Atten Disord*. 2006;10(1):54–64.
15. Barkley RA, Murphy KR, Kwasnik D. Motor vehicle driving competencies and risks in teens and young adults with attention deficit hyperactivity disorder. *Pediatrics*. 1996;98(6, Pt 1):1089–1095.
16. Woodward LJ, Fergusson DM, Horwood LJ. Driving outcomes of young people with attentional difficulties in adolescence. *J Am Acad Child Adolesc Psychiatry*. 2000;39(5):627–634.
17. Fried R, Petty CR, Surman CB, et al. Characterizing impaired driving in adults with attention-deficit/hyperactivity disorder: a controlled study. *J Clin Psychiatry*. 2006;67(4):567–574.
18. Barkley RA, Murphy KR, Dupaul GI, et al. Driving in young adults with attention deficit hyperactivity disorder: knowledge, performance, adverse outcomes, and the role of executive functioning. *J Int Neuropsychol Soc*. 2002;8(5):655–672.
19. Kaya A, Taner Y, Guclu B, et al. Trauma and adult attention deficit hyperactivity disorder. *J Int Med Res*. 2008;36(1):9–16.
20. Swensen A, Birnbaum HG, Ben Hamadi R, et al. Incidence

and costs of accidents among attention-deficit/hyperactivity disorder patients. *J Adolesc Health*. 2004;35(4):346, e1–e9.
21. Merrill RM, Lyon JL, Baker RK, et al. Attention deficit hyperactivity disorder and increased risk of injury. *Adv Med Sci*. 2009;54(1):20–26.
22. Hodgkins P, Montejano L, Sasané R, et al. Cost of illness and comorbidities in adults diagnosed with attention-deficit/hyperactivity disorder: a retrospective analysis. *Prim Care Companion CNS Disord* 2011;13(2):e1–e12
23. Barell V, Aharonson-Daniel L, Fingerhut LA, et al. An introduction to the Barell body region by nature of injury diagnosis matrix. *Inj Prev*. 2002;8(2):91–96.
24. Hawkins K, Wang S, Rupnow MF. Indirect cost burden of migraine in the United States. *J Occup Environ Med*. 2007;49(4):368–374.
25. Lee DW, Ozminkowski RJ, Carls GS, et al. The direct and indirect cost burden of clinically significant and symptomatic uterine fibroids. *J Occup Environ Med*. 2007;49(5):493–506.
26. Blough DK, Ramsey SD. Using generalized linear models to assess medical care costs. *Health Serv Outcomes Res Methodol*. 2000;1(2):185–202.
27. Deyo RA, Cherkin DC, Ciol MA. Adapting a clinical comorbidity index for use with *ICD-9-CM* administrative databases. *J Clin Epidemiol*. 1992;45(6):613–619.
28. Manning WG, Mullahy J. Estimating log models: to transform or not to transform? *J Health Econ*. 2001;20(4):461–494.
29. Park RE. Estimation with heteroscedastic error terms. *Econometrica*. 1966;34(4):888.
30. Desjardins C, Scherzer P, Braun CM, et al. A verbal planning impairment in adult ADHD indexed by script generation tasks. *J Atten Disord*. 2010;14(3):220–231.
31. Surman CB, Adamson JJ, Petty C, et al. Association between attention-deficit/hyperactivity disorder and sleep impairment in adulthood: evidence from a large controlled study. *J Clin Psychiatry*. 2009;70(11):1523–1529.
32. Johnson DE, Epstein JN, Waid LR, et al. Neuropsychological performance deficits in adults with attention deficit/hyperactivity disorder. *Arch Clin Neuropsychol*. 2001;16(6):587–604.
33. McLean A, Dowson J, Toone B, et al. Characteristic neurocognitive profile associated with adult attention-deficit/hyperactivity disorder. *Psychol Med*. 2004;34(4):681–692.
34. Newcorn JH. Managing ADHD and comorbidities in adults. *J Clin Psychiatry*. 2009;70(2):e40.
35. Bureau of Labor Statistics. Nonfatal occupational injuries and illnesses requiring days away from work, 2007. http://www.bls.gov/news.release/osh2.nr0.htm. Accessed February 24, 2011.
36. Vyrostek SB, Annest JL, Ryan GW. Surveillance for fatal and nonfatal injuries: United States, 2001. *MMWR Surveill Summ*. 2004;53(7):1–57.
37. Heinen M, Hall MJ, Boudreault MA, et al. National trends in injury hospitalizations, 1979–2001. Hyattsville, Maryland: National Center for Health Statistics; 2005. http://www.cdc.gov/nchs/injury/injury_chartbook.htm. Accessed February 24, 2011.
38. National Center for Injury Prevention and Control. CDC Injury Fact Book. Atlanta, Georgia: Centers for Disease Control and Prevention; 2006. http://www.cdc.gov/ncipc/fact_book/InjuryBook2006.pdf. Accessed February 24, 2011.
39. Newcorn JH, Weiss M, Stein MA. The complexity of ADHD: diagnosis and treatment of the adult patient with comorbidities. *CNS Spectr*. 2007;12(suppl 12):1–14, quiz 15–16.
40. Weiss MD, Gadow K, Wasdell MB. Effectiveness outcomes in attention-deficit/hyperactivity disorder. *J Clin Psychiatry*. 2006;67(suppl 8):38–45.
41. Davidson LL. Hyperactivity, antisocial behavior, and childhood injury: a critical analysis of the literature. *J Dev Behav Pediatr*. 1987;8(6):335–340.
42. Biederman J, Faraone SV. The effects of attention-deficit/hyperactivity disorder on employment and household income. *MedGenMed*. 2006;8(3):12.
43. Barkley RA, Fischer M, Smallish L, et al. Young adult outcome of hyperactive children: adaptive functioning in major life activities. *J Am Acad Child Adolesc Psychiatry*. 2006;45(2):192–202.
44. Lerner D, Adler DA, Chang H, et al. Unemployment, job retention, and productivity loss among employees with depression. *Psychiatr Serv*. 2004;55(12):1371–1378.