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ORIGINAL RESEARCH

Attention-Deficit Hyperactivity Disorder (ADHD) Prevalence and Its Related Factors among Traffic Crush Injured Drivers; A Cross-Sectional Study

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Abstract: **Introduction:** Attention-Deficit/Hyperactivity Disorder (ADHD), with a prevalence of about 5% in adults, is associated with risky behaviors and increased injuries. This study was conducted to investigate the ADHD prevalence and its related factors among individuals injured in traffic crashes. **Methods:** This population-based cross-sectional study included the drivers who presented to the emergency department due to traffic crash injuries during one year. Data were collected through clinical interviews, review of medical records, and the Conners' Adult ADHD Rating Scales (CAARS) questionnaire. Descriptive statistics were used to summarize demographic characteristics and inferential tests such as chi-square and logistic regression were applied to assess associations between ADHD diagnosis and crash-related variables. **Results:** 450 drivers injured in traffic crashes in the year 2024 were examined for the prevalence of ADHD. Total prevalence of ADHD among studied drivers was 17.35%. ADHD was more prevalent among younger individuals (p = 0.0235) and males (p = 0.0007). Patients with history of previous crashes were significantly more likely to have ADHD (p = 0.0009). No significant association was found between ADHD and educational level (p = 0.9116), daily (p = 0.443) or weekly (p = 0.076) driving hours, type of vehicle (p = 0.522), or location of the crash (p = 0.825). **Conclusion:** Based on the main finding the prevalence of ADHD among the studied derivers was 17.35%. The most important related factors of ADHD prevalence were younger age, male gender, and positive history of previous traffic crash injuries.

Keywords: Attention deficit disorder with hyperactivity; Accidents, traffic; Automobile driving; Wounds and injuries; Risk factors

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1. Introduction

Attention-Deficit/Hyperactivity Disorder (ADHD) is a prevalent neurodevelopmental condition associated with deficits in attention regulation, impulse control, and activity level, factors that may negatively influence driving behavior and increase the likelihood of traffic accidents (1). ADHD typically emerges in childhood and frequently continues into adulthood, exerting adverse effects on behavioral functioning, academic and occupational achievement, and social interactions, and often necessitating a combination of pharmacological and psychological intervention (2). Early diagnosis and treatment of ADHD are critically important due to its long-term impacts on individuals and society (3). As a psychiatric condition, ADHD profoundly influences risky behaviors, including unsafe driving. Core characteristics of the disorder, such as impulsivity, deficits in sustained attention, and poor impulse control, directly contribute to an increased risk of traffic crashes (4). Drivers with ADHD often struggle with identifying hazardous situations, maintaining appropriate speeds, and keeping safe distances from other vehicles (5).

The World Health Organization has stated that if preventive interventions are not promptly implemented, injuries resulting from road traffic crashes will become the fifth leading cause of death by the year 2030 (6, 7). Among the human factors contributing to traffic crashes, the impact of attention-related issues has largely been overlooked. However, drivers are exposed to multiple stimuli that can cause distractions during driving. These distractions may impair the driver's ability to focus on the primary task, thereby increasing the risk of crashes (Lane deviation, slower reaction times, etc.). Interestingly, both external and internal distractions, as well as ADHD, have been linked to traffic crashes (8-10).

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External distractions, defined as shifts of attention away from essential driving activities toward competing activities, may lead to insufficient attention to driving safety (11-13).

It is important to note that with the growing use of information technologies during driving (e.g., mobile phones, GPS devices), external distractions have increased. This is supported by experimental studies that observe participants' driving behavior under distraction-inducing conditions, revealing poorer driving performance (14-16). Internal distractions include all bodily signals that divert the driver's attention away from the driving task. This type of distraction encompasses mind wandering, that is, thoughts unrelated to the task at hand, which often occurs when drivers are already mentally preoccupied. Such distractions may contribute to lapses in attention that dangerously divert focus away from the road (17-19). One key factor influencing driver distraction is ADHD (20).

Recent studies have highlighted the increased risk of traffic crashes among individuals with ADHD; however, most research has focused on adolescents and young adults, with limited data on adult drivers, especially in the Iranian population (21). This study was conducted to investigate the ADHD prevalence and its related factors among individuals injured in traffic crashes.

2. Methods

2.1. Study design and setting

This population-based cross-sectional study investigated drivers who presented to the emergency department of Bahonar Hospital, Kerman, Iran, due to traffic crash injuries from April 2024 to April 2025. Data were collected through clinical interviews, review of medical records, and the Conners' Adult ADHD Rating Scales (CAARS) questionnaire. Descriptive statistics were used to summarize demographic characteristics and inferential tests such as chi-square and logistic regression were applied to assess associations between ADHD diagnosis and crash-related variables.

The study protocol received ethical approval from the Ethics Committee of Kerman University of Medical Sciences, as indicated by the ethical code IR.KMU.AH.REC.1403.155. All participants provided written informed consent after receiving a clear explanation of the study aims, procedures, confidentiality measures, and the voluntary nature of participation.

2.2. Participants

Participants were selected using a simple random sampling method from all eligible drivers admitted to Bahonar Hospital due to traffic crashes during the study period. Inclusion criteria were: being the driver at the time of the crash; age between 18 and 65 years; ability and willingness to complete the self-report questionnaire; and providing informed consent for participation in the study.

Patients with traumatic brain injury resulting in decreased consciousness affecting participation; being a non-driver victim involved in the crash; presence of other psychiatric disorders aside from ADHD; use of substances that affect attention, such as alcohol or drugs, before or during the crash; use of sedatives or medications impairing cognitive functions at the time of the crash; and incomplete responses in the questionnaire exceeding 10

2.3. Data gathering

Data were gathered through standardized self-report questionnaires, including the validated Persian version of the Conners Adult ADHD Self-Report Screening Scale to assess ADHD symptoms. Additional demographic and driving-related information were collected via structured interviews during hospital admission. To reduce bias and improve quality control, we used strict inclusion/exclusion criteria; validated instruments; simple random sampling; and trained personnel and cross-checked records.

The data collection instrument consisted of two parts. The first part included demographic information such as age, education level, history of previous crashes, daily and weekly driving hours, type of vehicle, and location of the crash.

The second part involved the Conners' Adult ADHD Self-Report Screening Scale (CAAS-S: SV), a brief diagnostic tool designed to assess ADHD in adults aged 18 and over. This tool has been widely validated, and its reliability and validity in the Iranian population have been confirmed (22). It has high internal consistency and strong construct validity across its three subscales.

The scale quantitatively assesses symptoms of inattention using a 9-item scale, hyperactivity–impulsivity using another 9-item scale, and the overall ADHD index with a 12-item scale. The subscales do not have overlapping items. The items are rated on a four-point Likert scale ranging from 0 (never, not at all) to 3 (very much, always). The ADHD Index score was used as the main screening criterion, with a score above 16 indicating the presence of ADHD, based on prior studies and the tool's validation in Iranian samples (23). Additionally, a total score exceeding 70, calculated by summing all subscale scores, was used as a supportive criterion, as applied in a similar study in reference (24). This self-report tool aligns with diagnostic criteria outlined in diagnostic manuals such as DSM-IV and DSM-5, reflecting core ADHD symptom domains. While the CAAS-S SV provides a robust screening measure, ADHD diagnosis typically requires a comprehensive clinical evaluation, including retrospective symptom assessment and functional impairment. However, for this epidemiological study, the Conners scale was the principal diagnostic instrument.

The variables examined in the study included the independent variables: age, gender, education level, history of previous crashes, daily and weekly driving hours, type of vehicle, and location of the crash. The dependent variable was the prevalence of Attention-Deficit/Hyperactivity Disorder. The variables chosen for this study, including ADHD symp-

tom severity, driving exposure, and psychiatric comorbidities, were selected based on their documented association with increased crash risk in previous research.

Driving exposure variables like average weekly driving hours and history of prior crashes were included as known risk modifiers in driving safety literature. Participants with psychiatric disorders other than ADHD were excluded to minimize confounding effects. These selections are supported by theoretical models linking neurobehavioral deficits in ADHD to impaired driving performance.

Potential confounders considered in the analysis were demographic variables (age, gender, education), driving exposure variables (driving hours, vehicle type), and prior crash history, which might affect both ADHD screening outcomes and the likelihood of traffic crash.

Effect modifiers examined included gender differences and age groups, as these may influence the association between ADHD symptoms and traffic crash risk. Interaction terms were assessed where appropriate to determine if effects varied across subgroups.

2.4. Outcomes

The primary outcome of this study was the prevalence of ADHD among adult drivers who sustained injuries in traffic crashes. ADHD status was assessed using the validated Conners Adult ADHD Self-Report Screening Scale (CAAS-S SV), which quantified symptoms in three subscales: inattention, hyperactivity-impulsivity, and overall ADHD index. The secondary outcome was to evaluate the associated factors of ADHD in studied population.

2.5. Statistical analysis

The required sample size was estimated based on the study by Kamal El Farouki and colleagues (25), which reported a 12% prevalence of ADHD among drivers involved in traffic crashes in France. Using the standard formula for cross-sectional studies and assuming this prevalence, the initial estimated sample size was 410. In order to improve accuracy and account for a potential 10% dropout rate, the final sample size was increased to 450 participants to maintain statistical power and ensure the generalizability of the results.

Descriptive statistics summarized participant characteristics and quantitative variables such as age, driving hours, and ADHD scores. Inferential analyses included multivariate logistic regression to identify independent predictors of ADHD symptom presence and traffic crash risk, adjusting for confounders and effect modifiers. Model assumptions, including independence of observations and absence of multicollinearity, were verified. Interaction terms were assessed to explore effect modification. Continuous variables were analyzed as such when possible, and categorical groupings were used where epidemiologically justified. All analyses were performed using SPSS version 22. A significance level of $p < 0.05$ was applied to all tests.

Missing data were assessed for patterns and extent before analysis. Cases with more than 10% incomplete responses in the self-report questionnaire were excluded from the study. For other missing values, complete case analysis (listwise deletion) was applied, excluding participants missing key variables from relevant analyses. We evaluated the missingness mechanism and assumed data were missing completely at random (MCAR) based on observed patterns. Sensitivity analyses were conducted to examine the impact of missing data on study findings. Multiple imputation was considered but not used due to the relatively low proportion of missing data.

3. Results

3.1. Baseline characteristics of studied patients

A total of 450 patients who had presented to the emergency department of Bahonar Hospital in Kerman in one year due to traffic crashes were enrolled. Of these, 12 individuals were excluded from the analysis due to incomplete data.

Baseline characteristics of studied drivers are addressed in table 1. The mean age of participants was 34.38 ± 9.78 (range: 18-65) years (60.50% male). In terms of educational level, the highest frequency among traffic crash patients was observed in those with a bachelor's degree (28.31%), followed by individuals with a high school diploma (25.57%) and those with middle school education (19.63%).

An examination of variables related to driving revealed that 60.50% of patients had a history of previous crash, while 39.49% reported no such history. The average daily driving time among these patients was 3.29 ± 6.24 hours, and the average weekly driving time was 15.84 ± 32.03 hours. The type of vehicle used by the patients was also analyzed; the majority (57.99%) used motorcycles, while 42.00% used cars. Additionally, the location of the crash was reported to be within the city in 64.61% of cases and outside the city in 35.38% of cases.

3.2. ADHD prevalence and its related factors

76 (17.35%) drivers were diagnosed with ADHD based on the subscales of the Conners' questionnaire. In contrast, 362 individuals (82.65%) did not exhibit signs of the disorder. The mean score for inattention, hyperactivity/impulsivity, and overall ADHD among the patients was 20.18 ± 5.97, 19.80 ± 6.11, and 27.61 ± 7.69, respectively (Table 1).

The statistically significant correlated factors of ADHD prevalence were age (31.64 ± 9.61 years for ADHD vs. 33.95 ± 9.59 for others; P = 0.023); gender (76.98% male in ADHD vs. 59.57% male in other group; (p = 0.0007); and the history of previous crash (56.34% in ADHD patients vs. 38.46% in non-ADHD patients; p = 0.0009).

4. Discussion

Based on the main finding, the prevalence of ADHD among the studied derivers was 17.35%. The most important related factors of ADHD prevalence were younger age, male gender,

and positive history of previous traffic crash injuries.

A comparison of average age showed that patients with ADHD were generally younger than non-ADHD individuals. This finding aligns with studies such as Kittel-Schneider et al. (2019) (26) and Zamani et al. (2020) (27), which stated that younger individuals involved in various traffic incidents, whether as drivers or passengers, are more likely than older individuals to have ADHD. Young people with ADHD are more prone to crashes due to risky behaviors, poor impulse control, and reduced ability to process stressful situations.

The results of the present study showed that men were more frequently represented among ADHD patients involved in traffic crashes compared to women. These findings are in line with the research by Chang et al. (2014) (28) in Sweden, which demonstrated that men with ADHD, due to social roles, greater driving responsibilities, and a tendency toward risky behavior, have a higher likelihood of being involved in crashes.

In this study, most of the patients under investigation had a high school diploma or a bachelor's degree. However, there was no significant difference among individuals with different educational levels in terms of ADHD prevalence, in those involved in traffic crashes. The studies by Eensoo et al. (29) and also by Zamani (28) showed that educated individuals, due to occupations related to driving or frequent activity in urban areas, are more exposed to crashes, which contrasts with the findings of the present study. These differences could be due to variations in the populations studied in different research studies, suggesting that a more comprehensive investigation is needed to determine the impact of education level.

Previous crash history was more common in ADHD patients than in non-ADHD individuals. More than half of the patients reported a previous crash, which may indicate recurring and persistent behavioral patterns. This finding is consistent with the studies by Kittel-Schneider (27) and Amiri et al. (2020) (30), which showed that individuals with ADHD, due to decision-making problems, impulse control issues, and inattention, have a higher history of repeated crashes. These results underscore the importance of targeted interventions, such as educational programs and psychological counseling, to reduce the likelihood of repeated crashes. Additionally, screening for ADHD should be considered in drivers who are repeatedly involved in traffic crashes.

The present study showed that ADHD patients were more likely to be involved in traffic crashes while using motorcycles. The study by Sadeghi-Bazargani et al. (2014) (22) emphasized that motorcyclists with ADHD are at higher risk due to specific behavioral characteristics, such as impulsivity and neglecting safety details. This may stem from easy access to motorcycles, lower costs compared to cars, and the preference for faster transportation. These findings highlight the importance of designing educational programs and mandating the use of safety equipment for motorcyclists. Additionally, offering specialized guidelines for individuals with ADHD, such as training in risk management techniques and optimal use of vehicles, can play a significant role in reducing motorcycle-related crashes (31).

In the present study, 17% of patients had ADHD. This prevalence suggests a possible link between ADHD and traffic crashes, especially among individuals who visit the emergency department following crashes. These findings are consistent with the study by Sarah Kittel-Schneider in 2019 in Germany, which showed that the prevalence of ADHD among traffic crash victims ranged from 9% to 12%. Although the prevalence in Kittel-Schneider's study was lower than in the present study, the difference may be due to varying screening methods, diagnostic tools, or differences in study populations. For instance, the German study used the ASRS-18 questionnaire, which may have lower sensitivity than the tools used in this study for detecting ADHD in high-risk groups. On the other hand, the study by Shahrokh Amiri in 2020 (30) in Iran showed that the prevalence of ADHD in adults with head injuries from crashes was only about 6%, which is much lower than the rate reported in the present study. This discrepancy may be due to differences in the type of injury (head trauma versus general injuries) or cultural and behavioral differences in the study populations. The findings of the present study, compared to the above research, highlight the need for more comprehensive evaluations and analysis of underlying factors related to the higher prevalence of ADHD among traffic crash victims. More effective diagnostic tools, early identification, and implementation of preventive interventions can play a key role in reducing injuries and crashes associated with this disorder. These findings not only emphasize the importance of identifying ADHD in injured patients, but also suggest that the high prevalence reported in this study may indicate a lack of timely diagnosis and appropriate treatment in this group. This underscores the necessity for screening-based interventions in high-risk populations to prevent more serious injuries.

The findings highlight the necessity for early screening and diagnosis of ADHD, along with targeted interventions including educational programs, psychological counseling, and promotion of safer driving behaviors. Additionally, enhancing road safety infrastructure and enforcing mandatory use of safety equipment, especially for motorcyclists, are critical for reducing crashes in this vulnerable group. Future multicenter longitudinal research is recommended to deepen understanding of this association in diverse populations and to develop more effective preventative strategies.

5. Limitations

This study has some limitations that merit consideration. The sample was drawn from a single hospital, which may limit generalizability to broader populations. Limited follow-up duration restricts assessment of long-term outcomes. Cross-sectional design limits the ability to infer causality. Despite these limitations, the study provides valuable insights

into the association between adult ADHD and traffic crashes and suggests directions for future longitudinal and multicenter research.

6. Conclusions

Based on the main finding, the prevalence of ADHD among the studied derivers was 17.35%. The most important related factors of ADHD prevalence were younger age, male gender, and positive history of previous traffic crash injuries.

7. Declarations

7.1. Acknowledgments

We sincerely thank all participants who took part in this study. We acknowledge the support of the research staff and university administration for facilitating data collection.

7.2. Authors' contributions

M. E. S. and A. K. conceived the original idea of the study, contributed to the study design, and supervised all stages of the research process. S. R. was responsible for data acquisition, including conducting clinical interviews, administering the Conners' Adult ADHD Rating Scales (CAARS), and extracting relevant information from medical records. A. K. participated in refining the study methodology, coordinated patient recruitment, and contributed to the interpretation of clinical findings. H. A. performed the statistical analyses, including descriptive statistics and multivariable logistic regression, and contributed to the interpretation of the results. N. B. drafted the initial manuscript, contributed to data interpretation, and performed critical revision of the manuscript for important intellectual content. All authors read and approved the final manuscript and agree to be accountable for all aspects of the work, ensuring its accuracy and integrity.

7.3. Ethical issues

The thesis mentioned in this article has been ethically reviewed at Kerman University of Medical Sciences (Ethical Code: IR.KMU.AH.REC.1403.155). The authors confirm their consent to the publication of this article.

7.4. Competing interests

The authors have declared no conflicts of interest.

7.5. Funding

The study had no financial support.

7.6. Using artificial intelligence chatbots

Artificial intelligence (AI) tools are used only for language polishing and formatting. All scientific content, analysis, and interpretations are generated by the authors.

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Table 1: Baseline characteristics of studied drivers (N = 438)

Variables	Values	Variables	Values
Age (years)		**Previous crash history**	
Mean ± SD	34.38 ± 9.78	Yes	265 (60.50)
Gender		No	173 (39.49)
Male	265 (60.50)	**Daily driving time (hour)**	
Female	173 (39.49)	Mean ± SD	6.24 ± 3.29
Education		**Weekly driving time (hour)**	
Illiterate	26 (5.93)	Mean ± SD	32.03 ± 15.84
Primary	86 (19.63)	**Vehicle type**	
Secondary	42 (9.58)	Car	184 (42.00)
High school diploma	112 (25.57)	Motorcycle	254 (57.99)
Bachelor's degree	124 (28.31)	**Crash location**	
Master's degree	35 (7.99)	In the city	283 (64.61)
PhD or higher	13 (2.96)	Out of the city	155 (35.38)
Attention score		**ADHD***	
Inattention	20.18 ± 5.97	Yes	76 (17.35)
Hyperactivity/Impulsivity	19.80 ± 6.11	No	362 (82.65)
ADHD Index	27.61 ± 7.69		

Data are presented as mean ± standard deviation (SD) or frequency (%). *: Based on the subscales of the Conners Adult Self-Report Questionnaire. ADHD: Attention-Deficit/Hyperactivity Disorder; PhD: Doctor of Philosophy.

Table 2: Investigating the associated factors of attention deficit hyperactivity disorder (ADHD) prevalence among traffic crash drivers

Variables	ADHD*		P value
	Positive	Negative	
Age (years)			
Mean ± SD	31.64 ± 9.61	33.95 ± 9.59	0.0235
Gender			
Male	59 (76.98)	265 (59.57)	0.0007
Female	17 (23.01)	97 (40.42)	
Education Level			
Illiterate	7 (7.14)	19 (5.45)	0.9116
Primary	12 (11.11)	30 (8.97)	
Secondary	19 (19.84)	67 (19.55)	
High school diploma	24 (26.98)	88 (25.00)	
Bachelor's degree	23 (26.19)	101 (29.17)	
Master's degree	8 (6.35)	27 (8.65)	
PhD or higher	3 (2.38)	10 (3.21)	
Daily driving time (hour)			
Mean ± SD	6.05 ± 3.13	6.32 ± 3.35	0.443
Weekly driving time (hour)			
Mean ± SD	32.88 ± 16.40	29.92 ± 14.18	0.076
Previous crash history			
Yes	43 (56.34)	139 (38.46)	0.0009
No	33 (43.65)	223 (61.53)	
Vehicle type			
Car	34 (44.44)	149 (41.02)	0.522
Motorcycle	42 (55.55)	213 (58.97)	
Crash location			
In the city	48 (63.49)	236 (65.06)	0.825
Out of the city	28 (36.50)	126 (34.93)	

Data are presented as mean ± standard deviation (SD) or frequency (%). *: Based on the subscales of the Conners Adult Self-Report Questionnaire. ADHD: Attention-Deficit/Hyperactivity Disorder; PhD: Doctor of Philosophy.