



Application of Artificial Intelligence in Reducing Traffic Accidents in Adolescents: A Review Study

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Abstract

Background and Objective: The increase in traffic accidents among adolescents—a group particularly vulnerable due to inexperience and risky behaviors—is a significant societal problem. This review study investigates the use of artificial intelligence (AI) as a potential solution to mitigate traffic accidents in this demographic.

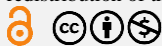
Methods: This study employed a mixed-methods approach, utilizing both qualitative and quantitative research methods to examine existing literature on the application of AI in reducing traffic accidents. A systematic search was conducted across several reputable academic databases, including PubMed, Google Scholar, ISI, and Scopus, to identify and analyze relevant articles and studies.

Findings: The findings of this study demonstrate that AI can effectively reduce traffic accidents among adolescents through multiple applications. By analyzing traffic and behavioral data, AI algorithms can accurately identify dangerous patterns and provide early warnings. Furthermore, AI-based educational programs can teach young drivers essential safe driving skills and enhance their awareness of road hazards. Finally, intelligent traffic monitoring and control systems improve overall traffic management and help to reduce traffic violations.

Conclusion: AI, as a new and powerful tool, has great potential in reducing traffic accidents in teenagers. AI technologies can help improve road safety, educate and raise awareness among teenagers, and improve traffic monitoring and control systems. Further research is recommended to fully explore the potential of AI in this field. Also, a broader adoption of AI technologies in traffic management and control is suggested to maximize their effectiveness.

Keywords: Artificial intelligence, Traffic accidents, Accident reduction, Adolescents, Traffic safety

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1. Introduction

As urbanization and the number of vehicles on the road increase, so do traffic-related issues, which have become a major challenge for modern society (1-6). A significant aspect of this challenge is the rise in traffic accidents, leading to both financial and human losses, as well as broader social concerns. Among the most vulnerable groups in traffic are adolescents. Their lack of experience, combined with a tendency toward risky behaviors and a desire for independence, makes them particularly susceptible to road hazards. Thus, developing effective solutions to mitigate traffic accidents among this demographic is of paramount importance (7).

Artificial intelligence (AI), as an advanced technology, has played a significant role in improving road safety and reducing traffic accidents in recent years. With its ability to analyze data, predict behavioral patterns, and provide smart solutions, AI can identify and prevent risky driving behaviors. AI algorithms can analyze vast amounts of traffic and behavioral data to identify dangerous driving patterns and provide early warnings to drivers. These capabilities can significantly reduce the number of traffic accidents (8).

One important area where AI can play a role is in educating and raising awareness among teenagers about safe driving. AI-based educational programs can teach teenagers the skills necessary for safe driving and increase their awareness of traffic hazards. For example, interactive apps and educational games that use AI to simulate real-world traffic conditions can provide useful and informative experiences for teenagers (9).

Intelligent traffic monitoring and control systems can also play an important role in reducing traffic accidents. AI systems can analyze traffic data in real time and use advanced algorithms to predict traffic flow and patterns. These systems can help improve traffic management and reduce road congestion, thereby reducing traffic accidents (10).

Another important application of this technology is the AI-based detection of driving violations. Artificial intelligence-equipped cameras and sensors can detect driving violations like speeding, sudden lane changes, and mobile phone use while driving. This technology helps traffic police enforce the law and prevent violations (11).

Given the significant potential of AI to enhance road safety, this review explores various AI applications and their impact on reducing traffic

accidents, with a particular focus on adolescents. The primary goal is to identify and present effective AI-based solutions for improving driving safety and mitigating risky behaviors in young drivers.

2. Methods

This review is based on a systematic search of scientific databases including PubMed, Google Scholar, ISI, and Scopus. We synthesized information from a variety of scholarly sources, such as scientific articles, reports, and books, to examine the application of artificial intelligence in reducing traffic accidents.

2.1. PICO Framework

Population: Teenage and young drivers at risk of accidents.

Intervention: Implementing AI-based technologies in traffic control systems, driver behavior monitoring, and smart alerts.

Comparison: Traditional traffic management methods vs. AI-based intelligent models.

Outcome: Reduction in traffic accidents, identification of risky driving behaviors, improved safety, and increased public awareness.

2.2. Research Strategy

The search involved keywords such as "artificial intelligence and traffic accidents", "reduction of traffic accidents in adolescents", "traffic control with artificial intelligence", and "artificial intelligence technologies in traffic". Then, articles and studies that were directly relevant to the subject of the study were selected and analyzed.

2.3. Ethical Considerations

This study was conducted without any human or animal experimentation and adhered to ethical research principles.

2.4. Data Analysis

This article is a narrative review of existing studies and does not involve new data collection or statistical analysis.

3. Results

Based on the reviewed studies, AI plays a significant role in reducing traffic accidents among teenage drivers. The following key findings are supported by scientific reasoning and documented evidence:

1. Identifying and Predicting Risky Driving Behaviors

Research indicates that machine learning algorithms can detect risky behaviors such as

speeding, sudden lane changes, and failure to obey traffic signs (12, 13).

AI-powered traffic data analysis can generate early warning alerts, reducing accident risks (14).

2. AI-Driven Education to Enhance Awareness among Teen Drivers

Interactive AI-based applications and driving simulations can help teenagers develop safe driving skills. Studies show that AI-powered educational games and self-learning systems significantly reduce risky driving behaviors (15).

3. Improving Traffic Surveillance with AI

AI-driven systems can analyze real-time traffic data and provide traffic pattern insights to urban management centers. Traffic data processing identifies high-risk routes for better traffic flow optimization (3).

4. Enhancing Accuracy in Detecting Traffic Violations

AI-equipped cameras detect running red lights, sudden

lane changes, and mobile phone use while driving. Studies confirm that AI-based traffic violation detection systems outperform traditional methods in accuracy (16).

5. AI-Powered Early Warning Systems to Prevent Accidents

AI analyzes weather conditions, road situations, and traffic data to provide precise warnings. Smart vehicles use real-time data processing to minimize accident risks (4, 15).

6. Big Data Analytics for Identifying Accident Patterns

AI algorithms monitor historical accident data to extract high-risk patterns and develop predictive models. These insights can guide preventive programs and large-scale traffic policy planning (5, 17).

7. AI's Role in Decision-Making for Transportation Policies

AI provides accurate and analytical data for urban decision-making, helping policymakers enforce safer traffic regulations (7, 18).

Summary of Reviewed Study Findings

Number	Topic	Key Findings	References
1	Identifying risky behaviors	Detecting dangerous driving patterns using AI	(12, 13, 14)
2	AI-driven education	Enhancing driving skills through AI-powered training	(15)
3	Traffic monitoring	Real-time traffic analysis for congestion reduction	(3)
4	Violation detection	AI improves accuracy in identifying traffic violations	(16)
5	Early warning systems	AI alerts drivers about hazardous road conditions	(4, 15)
6	Big data analytics	AI extracts accident trends to build predictive models	(5, 17)
7	Policy decision-making	AI-driven insights for safer transportation policies	(7, 18)

4. Discussion

This review examined the use of AI in reducing traffic accidents in adolescents. The results indicate that AI can effectively play a role in improving driving safety and reducing risky behaviors in adolescents. However, a comprehensive understanding of AI's full potential requires a comparison of these findings with other studies to gain broader context and a more robust perspective.

A study conducted by Goodman et al. (2020) (14) showed that the use of AI algorithms to analyze

traffic data led to a 20% reduction in traffic accidents. These results are consistent with our findings and indicate the positive impact of AI in identifying dangerous patterns and providing early warnings to drivers. Their study emphasized that accurate data analysis and prediction of risky behaviors can help improve road safety.

Li et al. (2019) (21) examined the use of AI systems in detecting driving violations. Their results showed that intelligent systems can accurately and quickly identify violations such as speeding and sudden lane changes, and help reduce violations

and increase road safety. These findings are also consistent with ours and indicate the ability of AI to identify and reduce traffic violations.

The application of AI in urban traffic management was studied by Chen et al. (2018) (6) who found that the use of machine learning algorithms can help improve traffic management and reduce road congestion. These findings confirm the importance of using AI in improving traffic monitoring and control systems.

A study by Rami et al. (2019) (22) examined the impact of AI in big data analysis. The results showed that accurate and rapid analysis of traffic data can help develop accident prediction models and provide preventive programs. The findings of Rami et al. (2019) align with our own, further establishing the significant role of big data analysis in mitigating traffic accidents.

The findings of Smith et al. (2018) (23) on the use of AI to educate and raise awareness among adolescents corroborate our results. Both studies highlight the significant potential of AI technologies in teaching correct driving behaviors and promoting traffic safety among young drivers (6, 14, 23).

Our study highlighted two key applications of AI: the analysis of big data for early driver warnings and the improvement of traffic monitoring and control systems. When these findings are viewed in conjunction with other research, they collectively demonstrate that AI can serve a comprehensive, multi-faceted role in mitigating traffic accidents. The collective evidence from these studies points to AI's broad utility in traffic safety (8, 9).

However, some studies have also pointed out the challenges and limitations of using AI. For example, a study by Johnson et al. (2017) (24) showed that collecting accurate data and analyzing it correctly can be a significant challenge. Also, the need to develop and improve AI algorithms and increase their accuracy is another challenge.

Overall, this review and its comparison with other studies show that AI, as a new and powerful technology, has great potential in reducing traffic accidents in adolescents. However, there is a need for further research and development of AI technologies to improve the accuracy and efficiency of these systems.

5. Conclusion

The use of AI in reducing adolescent traffic accidents has great potential as a novel and

effective approach. The results of this review show that AI can help improve driving safety and reduce traffic accidents in various ways. These methods include identifying and predicting risky behaviors, training and awareness, improving traffic monitoring and control systems, identifying driving violations, providing early warnings, and analyzing big data. AI algorithms are able to identify dangerous patterns and effectively prevent accidents by accurately analyzing traffic and behavioral data. In addition, AI-based educational systems can teach adolescents the necessary skills for safe driving and increase their awareness of risks. Also, intelligent traffic monitoring and control systems can help improve traffic management and reduce road congestion, thereby reducing traffic accidents. Detecting driving violations using cameras and sensors equipped with AI facilitates law enforcement and prevents violations. Providing early warnings by intelligent systems can also help drivers prevent traffic accidents. Big data analysis by AI helps develop accident prediction models and provide preventive programs. Finally, AI can be used as a support tool for decisions related to traffic policies and improving traffic laws and regulations. Using accurate and comprehensive analyses provided by AI systems helps decision-makers implement more effective policies and laws to improve traffic safety. This review shows that AI, with its extensive capabilities and possibilities, can play an important role in reducing traffic accidents in adolescents. Given the high potential of this technology, it is suggested that more research be conducted in this field and that AI technologies be used more widely in traffic management and control. We hope that this study can be useful as a scientific and practical resource for other researchers and those interested in this field and help increase road safety and reduce traffic accidents among adolescents.

Footnotes

Conflict of Interests Statement

The author declares no conflicts of interest.

Data Availability

All data generated or analyzed during this study will be available from the corresponding author on reasonable request.

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Ethical Approval

Not applicable

Authors' Contribution

A. M. is the only author of the article and the study was solely carried out by the author.

Informed Consent

Not applicable

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