


Democratization of terrorism: an analysis of vehicle-based terrorist events

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ABSTRACT

Objectives The COVID-19 pandemic inspired social changes that promote outdoor activities including eating at restaurants, which may linger in a world hyperfocused on disease transmission prevention, increasing the vulnerabilities to vehicle-based terrorism. Vehicle ramming attacks started to transition from a relatively rare method of attack to one of the most lethal forms of terrorism in Western countries just prior to the emergence of SARS-CoV-2. This study aims to provide a historical analysis of the terrorism-based attacks using vehicles between 1970 and 2019.

Methods This study uses the methodology suggested by Tin *et al* in which the Global Terrorism Database hosted by the National Consortium for the Study of Terrorism and Responses to Terrorism was searched retrospectively for data. Data was collected from the database using the internal search function for terror events between January 1, 1970 and December 31, 2019 which used a vehicle as a means of attack.

Results There were 257 recorded terror attacks that involved some type of vehicle between 1970 and 2019. The attacks resulted in 808 fatalities and 1715 injuries when excluding the September 11 attacks. 76 events occurred at the West Bank and Gaza Strip, 25 in the USA, 16 in Israel, and 14 in the UK. Of the 257 terror incidents, 71% (183) occurred within the last 6-year span of inquiry.

Conclusion By 2016, vehicle attacks were the most lethal form of attack comprising just over half of all terrorism-related deaths in that year. Large gatherings such as festivals, sporting events, and now outdoor seating at restaurants, leave a number of people highly vulnerable to a vehicle ramming attacks depending on established countermeasures. The increased prevalence of outdoor activities and gatherings in a post-COVID-19 world will further expose large numbers of people to the potential vulnerabilities of vehicle-based terrorism. The scale of the casualties from a vehicle-based terror attack can overwhelm traditional resources and strain the abilities of the healthcare sector. Counterterrorism and disaster medicine specialists are crucial players in educating first responders and emergency medicine providers, allowing them to adequately prepare for an evolving threat in a world devastated by COVID-19.

Level of evidence VI.

INTRODUCTION

The COVID-19 pandemic has prompted numerous social changes which may linger in a world hyperfocused on disease transmission prevention. As aerosol transmission remains a concern, social activities such as eating at restaurants have spilled out onto

WHAT IS ALREADY KNOWN ON THIS TOPIC?

⇒ By 2016 vehicle ramming attacks were the most lethal form of attack comprising just over half of all terrorism-related deaths in that year.

WHAT THIS STUDY ADDS

⇒ In the COVID-19 era many establishments have increased the availability of outdoor dining which places more people in a potential path for vehicle ramming attacks.
⇒ Large gatherings such as festivals, sporting events, and now outdoor seating at restaurants leave a number of people highly vulnerable to a vehicle ramming attack depending on established countermeasures.

HOW MIGHT THIS STUDY AFFECT RESEARCH, PRACTICE OR POLICY

⇒ A single vehicle has the potential to cause a large mass casualty incident that overwhelms local and mutual aid resources. Counterterrorism and disaster medicine specialists are critical to assisting first responders and emergency medicine providers in preparing for such attacks especially in the post-COVID-19 era.

sidewalks and into streets. Cities across the USA and around the world relaxed outdoor drinking and dining regulations, allowing sidewalks and even street parking spaces to become restaurants' dining rooms.¹ Although some locations provided barricaded spaces, others merely built coned areas along the sidewalk eating areas or outdoor structures providing little protection from any hazards. Outdoor spaces have the ability to serve as sources of resilience and strength for individuals and communities,² making them prime psychological targets for terrorists. With little physical protection, these outdoor gatherings can serve as prime targets for terrorists who can leverage common means of transportation, such as cars and trucks, to instigate attacks.

This study aims to provide a historical analysis of the terrorism-based attacks using vehicles between 1970 and 2019. The data obtained from this study will provide a baseline landscape from which to evaluate the previous threat of vehicle terrorism, the potential vulnerabilities within the societal changes during and post-COVID-19, provide insight into potential future attacks and mitigation efforts, as well as to inform counterterror medicine providers who would respond to and/or treat patients from such attacks.

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METHODS

This study follows the methodology suggested by Tin *et al* in their analysis of biological agents used in terrorist events.³ The research leverages the open source, retrospective database, the Global Terrorism Database, created by the National Consortium for the Study of Terrorism and Responses to Terrorism.⁴ The online, public database includes information on domestic and international terrorist attacks from 1970 to 2019.⁵ The retrospective analysis used in this study is meant to inform the historical view of the trends in vehicle terrorism to determine the potential for future threats. The database leverages artificial intelligence to identify events from global news media which is then confirmed by National Consortium staff.⁵

The database was searched using the internal search function for events that involved vehicles from January 1, 1970 to December 31, 2019. The database defines the vehicles as weapons category which was used in this study to include incidents with vehicles that do not involve vehicle-borne explosives (ie, car or truck bombs). Data from 2020 and 2021 have yet to be published and remain a source of future research. The results from the search were exported into Excel (Microsoft, Redmond Washington, USA) for analysis. The events were categorized by location, region, and target type with frequencies calculated.

The criteria for event inclusion follow the database definitions and internal criteria. The three criteria in the database are as follows: (1) the act must be aimed at attaining a political, economic, religious, or social goal; (2) there must be evidence of an intention to coerce, intimidate, or convey some other message to a larger audience than the immediate victims; and (3) the action must be outside the context of legitimate warfare activities, that is, the act must be outside the parameters permitted by international humanitarian law, particularly the admonition against deliberately targeting civilians or non-combatants.⁴ Only the events which met all criteria were included in the results. The system excludes any ambiguous events which occur after 1997 and provide some uncertainty as to whether they meet database criteria for inclusion.⁴ Additionally, the database does not include state acts of terrorism and defines terrorist attacks as ‘the threatened or actual use of illegal force and violence by a non-state actor to attain a political, economic, religious, or social goal through fear, coercion, or intimidation.’³

RESULTS

There were 257 recorded terror attacks which involved some type of vehicle between 1970 and 2019. The attacks resulted in 3,578 fatalities including the September 11 terror attacks in the USA or 808 fatalities when excluding those attacks. Similarly, there were 23,471 people injured when including the September 11 attacks and 1,715 injuries excluding those attacks. Seventy-six events occurred at the West Bank and Gaza Strip, 25 in the USA, 16 in Israel, and 14 in the UK (figure 1). Overall, the Middle East and Northern Africa had 113 events, Western Europe 39, and North America 34 (figure 2). The Global Terrorism Database includes incidents of the same time and location as a single event, but if there is a temporal discrepancy or discontinuous geographical location, the events are coded as separate incidents. Fifty-nine of the vehicle terror attacks targeted military institutions, 53 targeted private citizens and/or private property, 37 targeted areas of multidesignation, 33 targeted police, and 31 targeted general government buildings (figure 3). Of the 257 terror incidents, 71% (183) occurred within the last 6-year span of inquiry. Twenty-one events occurred in 2019, 26 in 2016, 27 in 2014 and 2018, 37 in 2017, and 45 in 2015. The frequency of

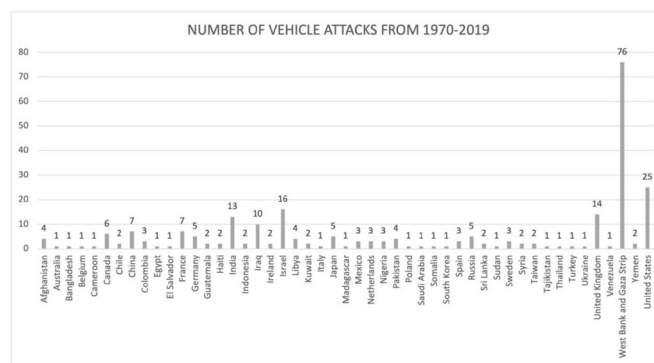


Figure 1 Number of vehicle terror attacks by location from 1970 to 2019.

incidents is a marked increase from the previous highs of seven events in a year which occurred in 2012 and 2013, just before the 6-year substantial increase (figure 4). The increase in incidents is primarily associated with the Middle East and North Africa (47 incidents since 2016), Western Europe (27 incidents since 2016), and North America (20 incidents since 2016) (online supplemental data). The incidents in these regions account for about 85% of all incidents since 2016 (N=111).

DISCUSSION

Vehicle ramming attacks have started to transition from a relatively rare method of attack to becoming one of the most lethal forms of terrorism in Western countries. By 2016, vehicle attacks were the most lethal form of attack comprising just over half of all terrorism-related deaths in that year.⁶ The ease of access to vehicles for legitimate purposes makes gathering pre-attack intelligence to prevent an event nearly impossible. As such, the increasing popularity of this modus operandi is not surprising as vehicles are one of the most effective and relatively simple attack methods available for terrorists. These attacks require minimal resources and planning to inflict widespread death and injury. The effectiveness and simplicity make vehicle ramming attacks an increasingly popular option for lone actors, further complicating the ability to mitigate the threat prior to the event.

Large gatherings such as festivals, sporting events, and now outdoor seating at restaurants leave a number of people highly vulnerable to a vehicle ramming attack depending on established countermeasures. A single vehicle has the potential to cause a large mass casualty incident that overwhelms local and mutual aid resources. Additionally, the traumatic injuries that result from a vehicle ramming incident have the potential to overwhelm

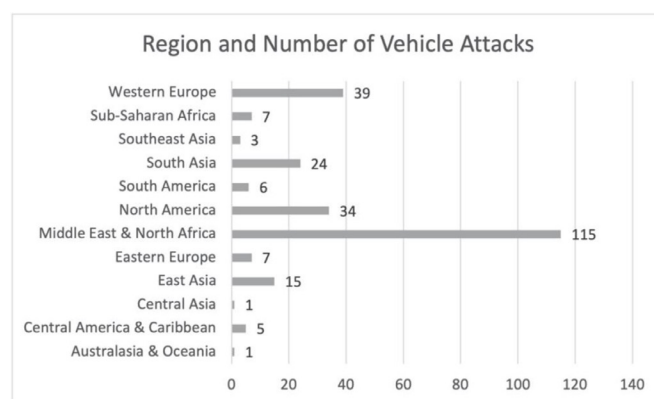


Figure 2 Number of vehicle attacks by region from 1970 to 2019.

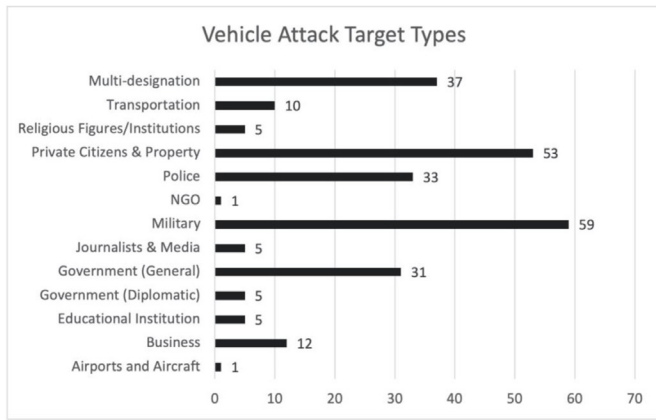


Figure 3 Vehicle attacks by target type from 1970 to 2019. NGO, non-governmental organization.

the medical capabilities of emergency and operating rooms. In one incident in 2016 alone, a vehicle terror attack killed 86 and injured over 400 spectators at a French independence day festival. Although ISIS was not the first terror group to employ such tactics as they have in London, Nice, Lyon, Graz, and New York, they have adopted such methods into their propaganda, encouraging supporters to use vehicle ramming attacks.⁷

Unlike other forms of terrorism, such as biological attacks, there is no need for any special skills or advanced knowledge necessary to complete a terrorist attack with a vehicle. There are no international treaties such as the Biological Weapons Convention or Chemical Weapons Convention that prohibit access to the means of attack as vehicles have legitimate everyday purposes. In fact, there were an estimated 1.2 billion vehicles on world’s roads as of 2014 with an estimated increase to 2 billion by 2035.⁸ The relative ease of finding a vehicle for which to use for an attack without raising undue suspicion that precursors for biological, chemical, or explosive attacks might make vehicle terrorism a large vulnerability around the world.

Preventative measures

Measures for countering attacks are more straightforward compared with other forms of terrorism. Vehicle barriers and traffic-calming measures are two key mitigation measures that security planners can implement to reduce the vulnerabilities and consequences of an attack. Most of the traffic-calming measures would be implemented in the design of the area which is not easily adaptable. However, horizontal deflection based on lateral shifts or chicanes can be artificially implemented for an event with the use of chicanes at entrances and exits and with the use of concrete barriers.⁹ Vehicle barriers thus become the most important mitigation measure of any event or outdoor gathering. Passive (concrete walls), active (retractable bollards), and redeployable barriers are the most useful measures for protecting

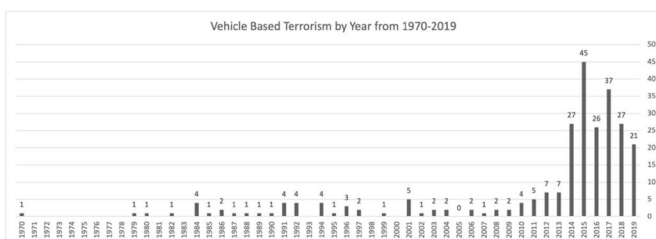


Figure 4 Vehicle-based terrorism by year from 1970 to 2019.

patrons at outdoor events. Setting barriers that prevent vehicles from accessing areas where people are gathered can limit the impact of a vehicle-borne attack. Improvised barriers such as large vehicles including dump trucks can help fill the gaps and provide more adequate access control to roadways or sidewalks where people may be gathered.⁹ Mitigation strategies cannot be a one-size-fits-all approach, and instead must be tailored to physical and functional demands of a location and event. Physical security measures and access, planning, and personnel protective measures must all be considered and implemented to ensure a truly safe space.

Injury patterns and impacts for medical response

Vehicle-based terrorism is unlike any other mass casualty scenario as it is a result of blunt, non-penetrating trauma. The impacts result in high-power injuries which include blunt trauma to the central nervous system, and thoracoabdominal organs with crush injuries if the victims are run over.¹⁰ A retrospective analysis of patient data following intentional vehicular assaults in Jerusalem, Israel from October 2008 to May 2016 found a higher severity of injury and mortality rate following these incidents compared with general pedestrian injury.¹¹ The study found that more patients arriving from intentional vehicular assaults were intubated and required a significantly higher number of surgical procedures. These patients also received blood products at a significantly higher amount than general pedestrian trauma. Head, face, spinal and lower extremity injuries were significantly more common in the intentional assault groups with mortality also being significantly higher in the intentional assault group.¹¹ Whereas any pedestrian trauma may overwhelm resources in the operating room and emergency department, most non-intentional-related car incidents involve victims who are hit by decelerating vehicles with patients being shoved away from a vehicle with more extremity and pelvis injuries than head trauma. However, with intentional attacks looking to cause the most injuries and fatalities, deliberate acceleration of vehicles prior to impacting a victim can lead to high-energy trauma to lower extremities and severe head trauma as a victim is pushed towards a vehicle.

Counterterrorism medicine is an emerging field of specialization within the field of disaster medicine. As the world continues to respond to the threats of terrorists, counterterror education regarding tactics, mitigation methods, and injury patterns can help support resiliency in the face of an attack. Whereas many of the injuries from vehicle ramming attacks mirror those of other traumatic injuries that prehospital and emergency or operating departments commonly see, the ability to triage and manage an influx in the number of complex cases requiring immediate surgical intervention is an additional complication. Such focuses should be embedded into emergency medicine education, both prehospital and for in-hospital clinical staff such as nurses and emergency department physicians and surgeons. Acknowledging the potential for an increase in the vehicle ramming attack methodology can increase discussions about training and exercises for the man-made threats of the future which mandate sophisticated medical preparedness.

Limitations

The reliance on the Global Terrorism Database for findings could limit the inclusion of other attacks that were not recognized by the artificial intelligence. However, the validity of the database’s repository and the comprehensive nature of the record of documented terror events are supported by the platform serving as the

basis for other terrorism-related measures including the Global Terrorism Index (GTI). This study is retrospective in nature and does not include data about vehicle incidents in 2020 or 2021 which could be the focus of future research to determine if the trends of vehicle ramming attacks were sustained following the drastic increases in the late 2010s. The findings in this study are constrained by the criteria as established by the National Consortium for the Study of Terrorism and Responses to Terrorism. The lack of universally agreed-upon definitions of terrorism can create inconsistencies in the availability of attack information in different databases and the use of the Global Terrorism Database could yield disparate results from a different database.

CONCLUSION

The rise in vehicle ramming attacks prior to the emergence of the COVID-19 pandemic should raise concerns for counterterrorism operators around the world. This unsophisticated and low-tech tactical approach to terrorism minimizes the potential for pre-attack detection by law enforcement. Vehicle ramming attacks have the ability to further democratize terrorism as a successful attack that merely requires a willingness to kill and can be completed by only one actor. The increased prevalence of outdoor activities and gatherings in a post-COVID-19 world will further expose large numbers of people to potential vulnerabilities within security that place them at risk of being the victim of vehicle-based terrorism. The medical management of such incidents follows the general trauma principles that prehospital and emergency medical professionals are accustomed to using. The scale of the casualties from a vehicle-based terror attack can, however, overwhelm traditional resources and strain the abilities of the healthcare sector. Counterterrorism and disaster medicine specialists must be on the forefront of assisting first responders and emergency medicine providers in preparing for such attacks, increasing the resilience of a community to a potentially evolving threat in a world devastated by COVID-19.

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REFERENCES

- 1 Fox D. *Even post-Covid, outdoor dining should keep going. our staid restaurant culture has to evolve*: NBC News, 2021.
- 2 Mateer TJ, Rice WL, Taff BD, Lawhon B, Reigner N, Newman P. Psychosocial factors influencing outdoor Recreation during the COVID-19 pandemic. *Front Sustain Cities* 2021;3.
- 3 Tin D, Sabeti P, Ciottone GR. Bioterrorism: an analysis of biological agents used in terrorist events. *Am J Emerg Med* 2022;54:117–21.
- 4 National Consortium for the Study of Terrorism and Responses to Terrorism. Global Terrorism Database. <https://www.start.umd.edu/data-tools/global-terrorism-database-gtd>.
- 5 National Consortium for the Study of Terrorism and Responses to Terrorism. About the GTD. <https://www.start.umd.edu/gtd/about/>.
- 6 Miller V, Hayward KJ. 'I Did My Bit': Terrorism, Tarde and the Vehicle Ramming Attack as an Imitative Event. *Br J Criminol* 2019;59:1–23.
- 7 Bloom M. Vehicle Ramming: The Evolution of a Terrorist Tactic Inside the US. Just Security. 2020. <https://www.justsecurity.org/71431/vehicle-ramming-the-evolution-of-a-terrorist-tactic-inside-the-us/>.
- 8 Voelcker J. 1.2 Billion Vehicles On World's Roads Now, 2 Billion By 2035: Report. 2014. https://www.greencarreports.com/news/1093560_1-2-billion-vehicles-on-worlds-roads-now-2-billion-by-2035-report#:~:text=Now%2C an industry analyst has,number is 1.2 billion already.&text=Navigant Research estimates in a,shortly cross 1.2 billion themselves.
- 9 NCTC, DHS, FBI. Vehicle-Borne Attacks: Tactics and Mitigation. 2020. https://www.dni.gov/files/NCTC/documents/jcat/firstresponderstoolbox/NCTC-FBI-DHS_Vehicle-Borne_Attacks_-_Tactics_and_Mitigation-survey.pdf.
- 10 Shokoohi H, Pourmand A, Boniface K, Allen R, Petinaux B, Sarani B, Phillips JP. The utility of point-of-care ultrasound in targeted automobile ramming mass casualty (TARMAC) attacks. *Am J Emerg Med* 2018;36:1467–71.
- 11 Almog G, Kedar A, Bala M. When a vehicle becomes a weapon: intentional vehicular assaults in Israel. *Scand J Trauma Resusc Emerg Med* 2016;24:149.