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An Investigation of Double Collisions of Pickup Trucks with Multiple Fatalities in Narathiwat Province, Thailand, October 2023

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Abstract

On 11 Oct 2023, a pickup truck crashed into a roadside tree in Narathiwat Province, southern Thailand after overtaking another vehicle. We conducted a descriptive study by reviewing medical records and interviewing rescuers, officers, survivors, and witnesses. We surveyed the collision site, reviewed video records, and used Haddon's matrix to assist with the analysis. A pickup truck carrying 11 passengers (including the driver) overtook another pickup truck on a stretch of road. The driver of the first pickup truck lost control due to tire deflation and crashed into a tree resulting in eight deaths (72.7%) and three hospitalizations (27.3%). All deaths were caused by severe head injuries. Multiple factors during pre-crash (vehicle unfamiliarity leading to improper passing sight distance and speeding), the crash (overloaded truck and a roadside tree), and post-crash such as poor communication, contributed to the severity of this event. The driver of the truck had no driving license and was unfamiliar with the vehicle. Six passengers were sitting in the truck's cab and three were in the cargo bed. Pre-crash and crash speeds were determined to be 80 and 100 kilometers per hour, respectively. The passing sight distance was grossly insufficient. Poor communication in the rescue process and the crowd of people at the scene resulted in improper emergency management. Strengthening law enforcement, increasing the number of speed limit signs, felling roadside trees, and practicing mass casualty incidents should be implemented.

Keywords: pickup trucks, motor vehicle crash, injury, head trauma, roadside tree, Thailand

Introduction

The United Nations General Assembly in 2010, underlined its aim to reduce deaths from road traffic accidents to 50% by 2020.[1] Thailand ranked first among ASEAN countries in terms of road traffic deaths.[2] Approximately 6% of Thailand's gross domestic product is lost annually to road traffic deaths and injuries.[3] The number of accidents from pickup trucks increased by 7% from 2020 to 2021 and fatalities from pickup trucks increased by 18% from 2021 to 2022.[4,5] The Department of Highways reported in 2022 that pickup trucks had the highest number of accidents among all vehicles.[6]

On 11 Oct 2023, two pickup trucks were involved in a side-swipe collision resulting in one crashing into a roadside tree on Rueso-Yi-ngo Road, Narathiwat Province in southern Thailand. Eight passengers died and three were injured. A joint investigation team from Office of Disease Prevention and Control 12 Songkhla, Narathiwat Provincial Public Health Office, Narathiwat Hospital, Yi-ngo Hospital, Rangae Hospital, Rangae Police Station, Narathiwat Provincial Police Office,

Narathiwat Disaster Prevention and Mitigation Office, Narathiwat District Highway, Provincial Land Transport Official of Narathiwat, Marubotok Subdistrict Municipality, Office of Insurance Commission, Road Accident Victims Protection Company Limited (Narathiwat Branch), and the traffic engineering expert from Princess of Naradhiwas University investigated from 16 to 17 Oct 2023 to provide recommendations to prevent accidents and reduce morbidity and mortality with future occurrences.

Methods

Descriptive Study

We interviewed rescuers from the municipality, staff from Yi-ngo, Rangae, and Narathiwat Hospital, Rangae Police Station, Narathiwat Disaster Prevention and Mitigation Office, Narathiwat District Highway, and Provincial Land Transport Official of Narathiwat, the traffic engineering expert, the cases who survived, and witnesses at the scene. We obtained the number of accident victims and cases, the driver's behavior, blood alcohol level, passenger seat map, and seat belt availability and use. An accident victim was defined as a person involved in this collision on 11 Oct 2023, including the drivers and passengers. A case was defined as an accident victim experiencing a physical injury.

We reviewed medical records from Yi-ngo, Rangae, and Narathiwat Hospital to collect injury characteristics and medication history. We collected details of emergency medical management at the scene and hospitals, including the type of rescue team, transferred hospitals and timelines and the time frame consisting of activation time (call received by the Emergency Medical Services Command and Control Center, also known as 1669 hotline to activation time), response time (call received by 1669 hotline to scene arrival), on-scene time (scene arrival to departure of the scene), and transfer time (scene departure to hospital arrival).[7,8] The traffic engineering expert reviewed available video footage 500 meters before the crash site. The pre-crash speed was estimated by calculating the distance traveled in kilometers (km) divided by time taken in hour (hr) and observing the other drivers' speed. The crash speed was estimated based on the American Association of State Highway and Transportation Officials (AASHTO) design guideline.[9,10]

We surveyed the collision site by inspecting the road type, number of lanes, and roadside objects. We measured the diameter of the affected tree and the distance between the road and the tree. The traffic engineering expert measured the tire mark between the index vehicle and the other party's vehicle to estimate the passing sight distance (PSD). We inspected the pickup truck wreckage at Rangae Police Station and reviewed the news from social media platforms such as webpages and Facebook specifically for images and information about the collision, impact sites, vehicle damage, and weather conditions. We reviewed a report from the Provincial Land Transport Official for the vehicle's appearance, date of tax expiration and inspection, year of tire production, and driving licenses of the drivers.

Haddon's matrix, a conceptual model in injury approach, was used to describe possible risk factors in the aspects of human, vehicle, road, and environment during pre-crash, crash, and post-crash periods.[11] Each factor was determined by the consensus of the joint investigation team.

Ethics

This study was a part of routine investigation and response activities of the Thai Department of Disease Control, Ministry of Public Health, ethics approval was not required.

Results

Location of the Accident Site and Event Description

The accident occurred on a section of the 4058 Road (between the 3rd and 4th-kilometer mark) in Marubotok Subdistrict, Ra-ngae District, Narathiwat Province. It was a straight 2-lane highway, asphaltic concrete, flat road with a smooth surface and clear road line. There was no speed limit sign, and trees were located along the roadside (Figure 1). Close to the accident site were Marubotok Subdistrict Municipality and two district hospitals: Yi-ngo Hospital, the nearest hospital—about 6 kilometers away, and Rangae Hospital—about 12 kilometers away. Narathiwat Hospital (24 kilometers away), the provincial hospital, was associated with the Emergency Medical Services Command and Control Center of Emergency Medical Services section.

On 11 Oct 2023, at 12:15 PM the index vehicle (Vehicle A), carrying 11 people including the driver, departed from a house in Rueso District, Narathiwat Province, heading to Mueang District, Narathiwat Province (Figure 1). At 12:48 PM pickup truck A hit another pickup truck (Vehicle B), carrying six passengers including the driver, while trying to overtake it and another vehicle (Vehicle C) on the right. A car (Vehicle D) was moving in the opposite lane. However, the PSD was insufficient causing Vehicle A to quickly swerve back into its lane, resulting in a collision between its wheel and those of Vehicle B.

After the collision, the wheel rims of both vehicles were fractured. The Vehicle A experienced tire deflation, lost control and crashed into a 40-centimeter-in diameter roadside tree located four meters from the road. On the day the accident occurred, the sky was clear with no rain and good visibility.

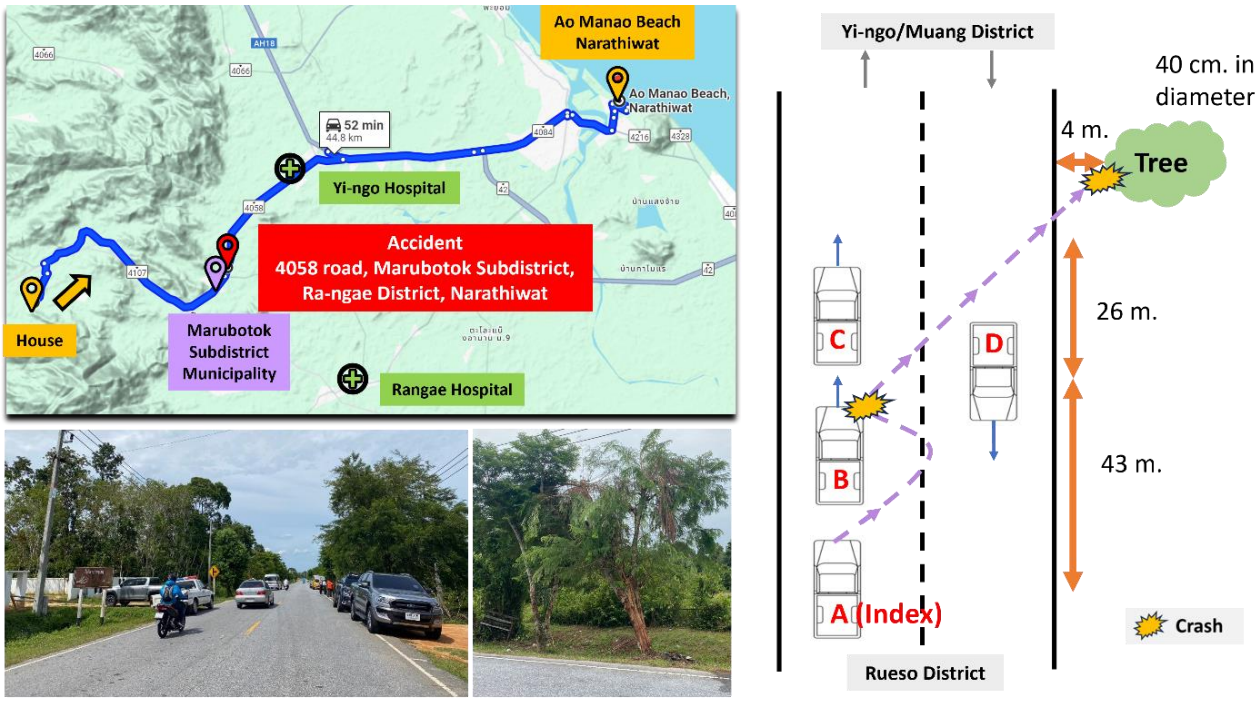

Figure 1. A road map from departure to destination, accident location, and collision diagram of the accident, Narathiwat Province, 11 Oct 2023

Characteristics of Injury

There were 17 accident victims, 11 in Vehicle A and six in Vehicle B. All six passengers in Vehicle B were uninjured. However, the 11 passengers in Vehicle A were all injured, including eight deaths (72.7%) and three hospitalizations (27.3%). Male-to-female ratio was 0.8:1. The median age was 15 years (interquartile range 11–30 years).

The passenger seat map and characteristics of body injured are shown in Figure 2. Six passengers were sitting in the cab, three in a cargo bed. The driver and another passenger were seated in the front. Among people who sat in the cab, 67% died (4/6) which was the same percentage as in the cargo bed (2/3). After the crash, six people were found outside the pickup truck and 50% of them died.

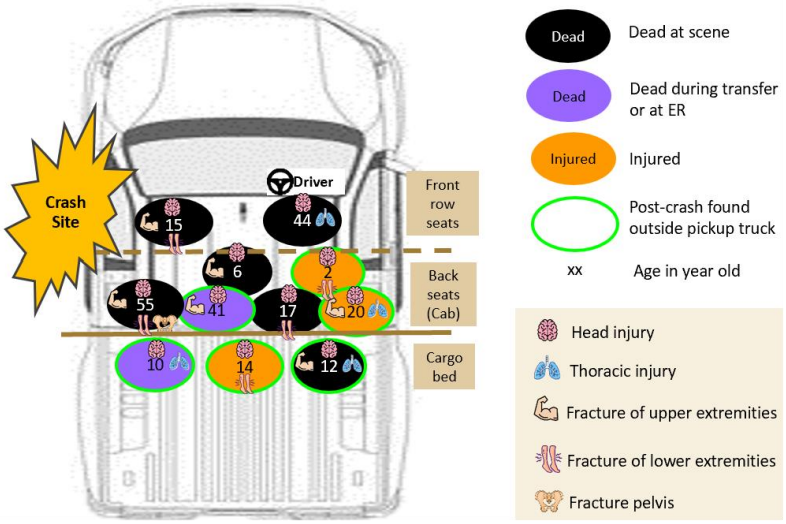

Figure 2. The passenger seat map in the index vehicle (Vehicle A) and characteristics of body injured in the accident, Narathiwat Province, 11 Oct 2023

For those who were found outside the truck, male-to-female ratio of the dead was 2:1. The mean age of the dead was higher than the survivor at 21 years (range 10–41 years) compared to 12 years (range 2–14 years). The dead had more severe head injuries than survivors (3:1) and also more thoracic injuries and fractured

upper extremities (2:1). Regarding wound type, the dead had a higher incidence of open extremity wounds (2:1) compared to the survivors. All of the dead were unresponsive at the scene and in a coma state at the emergency room, while only one survivor was unresponsive.

Among all 11 injured, severe head injury is the highest region of injury accounting for 81.8% followed by fractures upper and lower extremities at 54.5% and 45.5%, respectively. All eight dead had severe head injuries (100%), compared to one injured case (33.3%) (Figure 3).

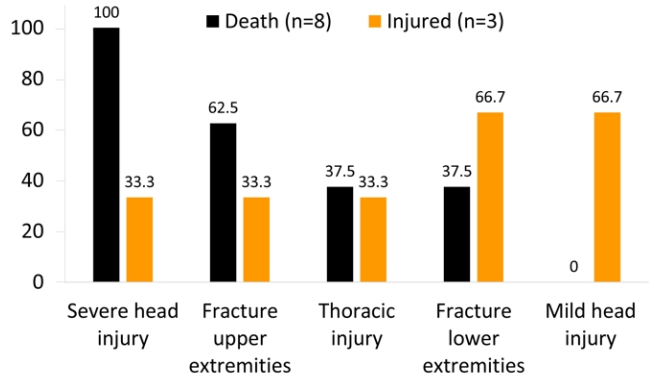

Figure 3. Percentage of cases by body region of injury among deaths (n=8) and injured cases (n=3) of the accident, Narathiwat Province, 11 Oct 2023

Pre-crash Period

The driver of Vehicle A had no driving license. He was not the vehicle owner and rarely drove it. He had a positive urine test for methamphetamine in 2018. A case said that the driver had a history of fast driving and did not sleep at night. Seat belts were present in the front-row seat only and were not used. The driver's blood alcohol level, measured at Rangae Hospital one and one and a half hours after the accident, was negative (<10 mg/dL) using the alcohol dehydrogenase method. Other substances were not tested.

Vehicle A was a Toyota Hilux Vigo Champ. The tires were produced in 2018 and the treads were worn. Vehicle B was a Mitsubishi L200 Strada with customized wheels and tires protruding beyond the fenders (Table 1).

Pre-crash speed was estimated to be 80 km/hr based on video footage that captured Vehicle A traveling 88.2 meters in four seconds and by observing other vehicles' speed, which was also 80 km/hour. The estimated PSD was 43 meters by measuring the distance retrieved from the tire mark on the road between Vehicle A and Vehicle B before Vehicle D was approaching the opposite lane.

Crash Period

The crash speed was assumed to be 100 km/hr according to the AASHTO design guideline.[11] The roof and passenger area of Vehicle A collapsed with severe damage to the passenger cabin. The left front and left back rim wheels were broken. The right front rim wheel of Vehicle B was also broken (Figure 4).

Table 1. General information of the index vehicle (Vehicle A) and other party's vehicle (Vehicle B)

General information	Vehicle A	Vehicle B
Brand and Model	Toyota Hilux Vigo Champ	Mitsubishi L200 Strada
Type of vehicle	Van & Pickup (Type3)	Van & Pickup (Type3)
Tax expiration date of the vehicle	20 Jun 2024	14 Oct 2024
Latest inspection date of the vehicle	29 Mar 2023	NA
Color	Black	Green, black
Transmission type	Manual	Manual
Engine size	4-engine 2,494 cc. 144 horsepower	4-engine 2,835 cc. 101 horsepower
Dimension	5,135 x 1,760 x 1,720 millimeters Vehicle 1,600 kilograms weigh Load 1,050 kilograms weigh Total weight 2,650 kilograms	4,935 x 1,695 x 1,710 millimeters Vehicle 1,510 kilograms weigh Load 960 kilograms weigh Total weight 2,470 kilograms
Original safety and protective systems	Safety belts located at the front row seats only	Safety belts located at the front row seats only
Passenger capacity	2 passengers	2 passengers
Year of production	2012	NA
Any modification that might affect vehicle's safety and performance	The tires were produced in 2018 and the tires' treads were worn down	The wheels and tires were customized and stick out past the fenders

NA: not available.

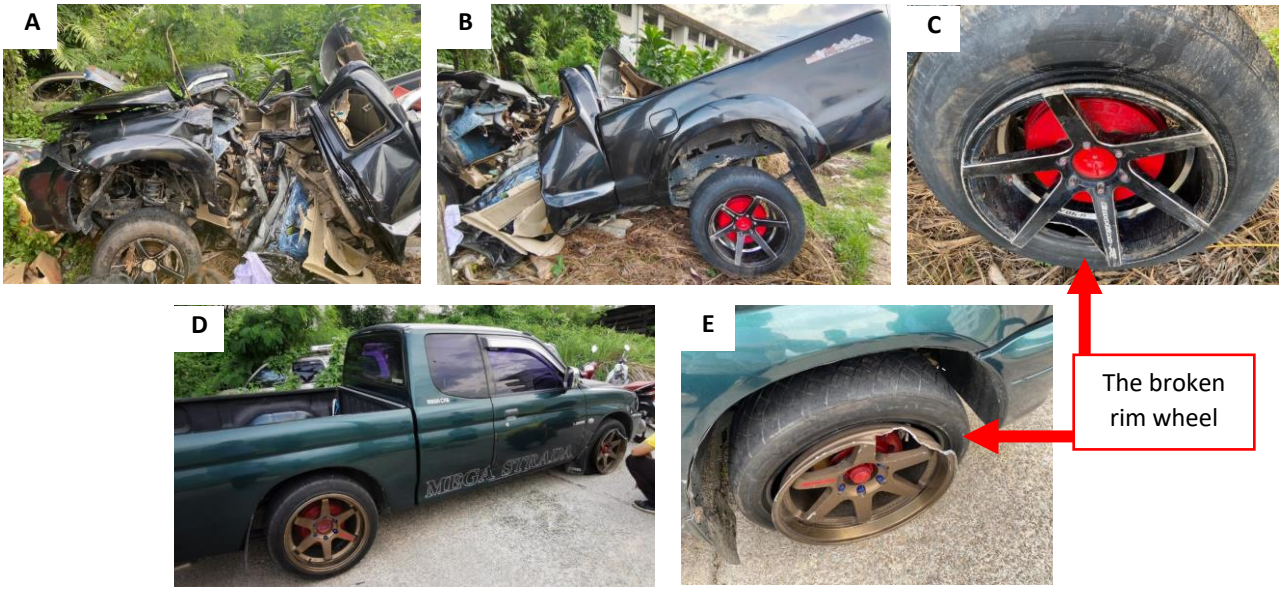

Figure 4. The index's vehicle (Vehicle A) (A–C) and other party's vehicle (Vehicle B) (D–E) of the accident, Narathiwat Province, 11 Oct 2023

Post-crash Period

After the accident, staff from Yi-ngo Hospital were notified by the Center and planned to go to the scene but the Municipality rescue team arrived at the scene first and transferred 5 red-tagged cases to Yi-ngo Hospital already (Figure 5). Staff from Rangae Hospital received the message from the center to stand by at the hospital because the center had already dispatched staff from Yi-ngo Hospital to the scene. Rangae Hospital staff were then notified to come to the scene and found only six black-tagged cases. The extrication tools arrived approximately 45 minutes after the collision because there were no extrication tools in this district. They were provided by the Narathiwat Methatham Foundation in Mueang District located 30 kilometers away. After that, Rangae Hospital staff transferred six dead cases to Rangae Hospital.

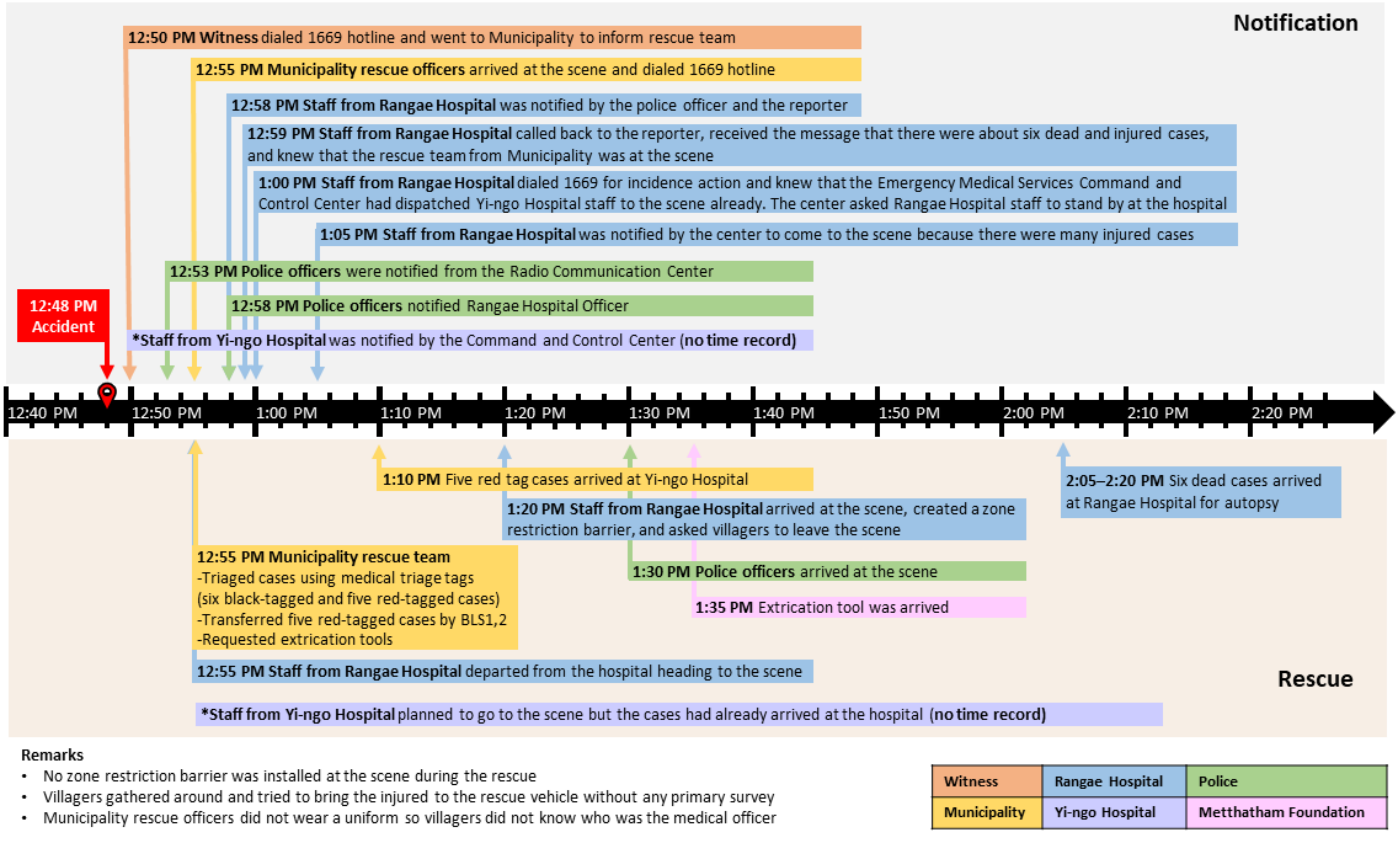

Figure 5. Emergency medical service timeline by notification and rescue process of the accident, Narathiwat Province, 11 Oct 2023

At the crash site, no zone restriction barriers were installed. Villagers gathered around and tried to move the injured to a rescue vehicle without performing a primary survey. Municipality rescue officers did not wear a uniform so villagers did not know who was the medical officer resulting in difficulty in leading the team.

Basic life support teams from the municipality transferred five red-tagged cases to Yi-ngo Hospital by ambulance and patrol car, of whom one died during the transfer, one died at the emergency room and three were referred to and hospitalized at Narathiwat Hospital. All six black-tagged cases, who were dead at the scene were transferred by the advanced life support team from Rangae Hospital to Rangae Hospital by ambulance. All the cases had no pre-hospital treatment. The response time was five minutes for the basic life support team (12:50 PM to 12:55 PM) and 30 minutes for the advanced life support team (12:50 PM to 1:20 PM) (Table 2).

Table 2. Pre-hospital emergency medical service by type of rescue teams, type of cases' medical triage tag, and the duration of time of the accident, Narathiwat Province, 11 Oct 2023

Type of Rescue team	Organization	Duration in this event/goal[15, 16] (minutes)				Type of transferal cases (number)	Type of transferal car	Pre-hospital Treatment	Transferal hospitals
		Activation time	Response time	On scene time	Transfer time				
BLS1	Municipality	NA*/2	5/4	NA†/10	NA†/10	Red (3)	Ambulance	None	Yi-ngo
BLS2	Municipality	NA*/2	5/4	NA†/10	NA†/10	Red (2)	Patrol car	None	Yi-ngo
ALS1	Rangae Hospital	NA*/2	30/8	NA†/10	NA†/10	Black (6)	Ambulance	None	Rangae

**No information about activate time. †No information about the time they getting out of the scene. ☐ Under standard, ☐ Equal/over standard. BLS: basic life support. ALS: advanced life support.*

Possible Risk Factors

In the pre-crash period, human factors included driver unfamiliarity with the vehicle, unlicensed driving, improper PSD, and speeding. Environmental factors included the absence of speed limit signs on the road and vehicle factors included worn tire treads. In the crash period, overloading passengers, absence and non-use of safety belts, and roadside trees increased the severity of injuries. In the post-crash period, unclear communication between rescuers and bystanders, improper management at the scene, difficulty in accessing and evacuating accident victims, and delays in the provision of extrication tools may have contributed to a higher fatality (Table 3).

Table 3. Haddon's matrix applied to the accident, Narathiwat Province, 11 Oct 2023

	Human	Vehicle	Road and environment
Pre-crash	• Unfamiliarity and unlicensed driving • Improper PSD • Speeding	• The tires were produced in 2018 and the tires' treads were worn down	• No speed limit sign
Crash	• Overloading passenger • Did not use of seatbelts	• A side-swipe collision • Additional crash on the roof of the pickup truck and severe structural damage • Absence of safety belts and/or safety equipment at back row seat and cargo bed	• Crashed into a 40-centimeter in diameter roadside tree
Post-crash	• Stuck in the vehicle (waiting for extrication tools for 45 minutes)	• Severe structural damage leading to difficulty in rescue	• Unclear notification and communication • Improper management at the scene (inappropriate practices by villagers, no primary survey) • Difficult to access and evacuate (crowded people, not able to identify who were officers, improper zone management)

Action Taken

The relevant authorities attended a meeting to assess risks and provide recommendations. We proposed and agreed on environmental and roadside management including adding speed limit signs along one kilometer of this road and felling roadside trees.

After this investigation, the speed limit signs were installed at the accident location. The Narathiwat Provincial Public Health Office emphasized the Emergency Medical Services Command and Control Center to dispatch a rescue team to the accident scenes promptly. They also emphasized that all traffic incidents be systematically recorded. The Road Safety Operations Center Committee of Narathiwat Province convened a meeting to plan and structure the incident command system in mass casualty incidents and to extract lessons learned from this accident. Training sessions for community emergency medical responders were organized. They recommended posting the 1669 hotline stickers at all hospitals in Narathiwat Province and distributing them to villagers in the community. The Narathiwat Provincial Police Office has enforced 10 road traffic prevention measures, launched by the Royal Thai Police, and monitored law enforcement monthly.

Discussion

This accident resulted in the tragic loss of eight lives. Many factors were related to the accident and its severity including vehicle unfamiliarity, which is known to be associated with increased injury severity.[12] The driver of vehicle A had no driving license and was unfamiliar with this vehicle, resulting in the improper PSD and speed. In this event, the PSD was seven times lower than the recommended distance. According to the AASHTO, the PSD is the distance a driver must be able to see ahead to complete a safe overtaking maneuver.[9,10] In this event, the passed vehicle's speed was 80 km/hr and the passing vehicle's speed was 100 km/hr, therefore the PSD should be 320 meters.[10] Vehicle familiarity also influences faster perception-reaction time, which is the time required for drivers to respond to roadway events.[10,13,14]

Pre-crash speed exceeded the legal limits of 65 km/hr for pickup trucks and 60 km/hr for pickup trucks with passengers in the cargo bed.[15,16] Speeding is one of the most important human factors contributing to road traffic injuries and deaths.[13,17] An in-depth investigation showed that speeding accounted for about 62% of all crashes in Thailand.[18]

Passenger overloading violated the law and increased the risk of injuries. According to the Royal Thai Police Act in 2023, no more than three passengers are allowed to sit in the cab and no more than six passengers are allowed in the cargo bed.[15] Overloading impeded acceleration, complicated overtaking, and increased severity of injury for cargo bed passengers due to lacking safety equipment.[13,14,19–21]

Roadside trees are one of the most common and serious roadside hazards, contributing to 72% of the roadside crashes on Thai highways.[14,17,20–23] A clear zone is an area beside a road that should be free of hazards to allow drivers of errant vehicles to recover.[23] The width of a clear zone depends on many factors such as road type, design speed, and traffic volume.[24] Trees with a diameter exceeding 10-centimeter are defined as roadside hazards.[23] Trees should not be located within five meters of the road unless they are smaller than 10 centimeters in diameter.[23–25]

Post-crash difficulties in rescue also contributed to the increased morbidity and mortality. Unclear communication about the number of injured cases and the type of team that arrived at the scene resulted in the delay of advanced life support team. Crowds, absent zone restriction barriers, and unidentified rescue officers led to difficulties in accessing and evacuating injured victims. Villagers' inappropriate practice of attempting to move injured victims without performing a primary survey was evident in this incident. Delayed extrication tools increased mortality for stuck passengers.[26]

Limitations

There were limitations in our investigation. We could not obtain the driver's behavior directly. We relied on interview with their relatives and reviews of medical records and driving license. Although the driver had a history of methamphetamine use, substance use could not be confirmed. There were no video records at the collision site. Therefore, the crash speed was estimated based on AASHTO guideline. For victims found outside the truck, we could not ascertain their distance from the truck or the tree immediately after impact, nor whether they had collided with external objects. Lastly, official records from the rescue team were unavailable. Therefore, the activation time, on-scene time, and transfer time were unknown. Instead, we interviewed personnel, officers, cases, and witnesses for time estimates.

Recommendations

For short-term goals, the Provincial Public Health Office and the Emergency Medical Services Command and Control Center should provide knowledge of first aid management to villagers, and practice for mass casualty incidents in the community.

For the long-term goal, the Department of Highways should conduct surveys to identify trees eligible for removal to minimize roadside injury. Additionally, in collaboration with a community referendum, efforts should focus on felling roadside trees if they have a diameter exceeding 10 centimeters and are located within five meters of the road. Furthermore, police officers should strengthen law enforcement in terms of the number of passengers in vehicles and/or propose legislation to reduce the number of passengers allowed in the cab and cargo bed of the pickup truck. Finally, the Department of Land Transport should provide education on these rules to individuals who renew or apply for a driving license.

Conclusion

Double collisions, including a side-swipe collision of two pickup trucks, followed by one truck crashing into a roadside tree in Narathiwat Province on 11 Oct 2023, resulted in eight deaths. Various factors contributed to the high morbidities and mortalities. These include the driver's unfamiliarity with the vehicle, poor decision-making, speeding, vehicle overloading, roadside hazards, and difficulties in rescue. Strengthening law enforcement in inspecting driving licenses and the number of passengers, and increasing the number of speed limit signs along the road should be enhanced. Felling roadside trees and practices for mass casualty incidents should be implemented to reduce future accidents, morbidity, and mortality.

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Conflict of Interest

This study declared no conflict of interest.

Declaration of AI and AI-assisted Technologies in the Writing Process

During the preparation of this work, the authors used ChatGPT in order to correct grammar. After using this tool/service, the authors reviewed and edited the content as needed and took full responsibility for the content of the publication.

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