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Road Traffic Fatalities under the COVID-19 Situation in Nakhon Ratchasima Province: Trends, Impacts, and Challenges in Injury Prevention

Boonsak Hanterdsith, M.D.

Department of Forensic Medicine, Maharat Nakhonratchasima Hospital, Thailand.

Corresponding author: Boonsak Hanterdsith, Email: boonsak.ha@cpird.in.th

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Abstract The COVID-19 pandemic, declared a global emergency in 2020, significantly impacted road traffic due to venue closures, remote work, and travel restrictions. This study aimed to analyze road traffic fatalities in Nakhon Ratchasima Province from pre-COVID period (October 2017) to post-COVID (December 2023), focusing on trends, severity, and injury patterns. Using a cross-sectional design, data from forensic and hospital records were analyzed, alongside confirmed COVID-19 cases in the province. The study found a slight, non-significant negative correlation between COVID-19 cases and traffic fatalities. During the pandemic, the average monthly fatalities decreased but surged post-pandemic. The 20-29 year age group accounted for the most deaths across all periods. There were no significant differences based on gender, age, or day of the week. Fatalities at the scene of injury declined, but injury severity increased, possibly due to a rise in risky behaviors, such as alcohol consumption. Motorcycle collisions were the primary cause of death across all periods, and alcohol-related fatalities increased, particularly post-COVID. Sub-district analysis revealed mixed trends, with some areas experiencing higher fatalities during the pandemic. The peak time for fatalities remained consistent at 03:00-04:00 AM across periods. In conclusion, although COVID-19 measures helped reduce traffic fatalities during the pandemic, they may have paradoxically contributed to more severe injuries and alcohol-impaired driving. The pattern of injuries also changed during the COVID period and continued into the post-COVID period. This study highlights the need for targeted road safety interventions and suggests further investigation into long-term post-COVID effects on road safety and injury prevention.

Keywords: **road traffic fatalities; COVID-19; injury severity; alcohol drinking; public health; traffic safety; injury prevention**

Introduction

Before the COVID-19 pandemic, road traffic safety was influenced by a variety of factors that shaped injury rates and crash patterns. Key elements included traffic volume, driver behavior, infrastructure quality, and socio-economic conditions[1-4]. Traffic volume

and density are directly linked to crash rates, especially during peak hours when congestion can lead to driver frustration and aggressive driving behaviors. Driver behavior, particularly speeding, driving under the influence (DUI), and distracted driving, significantly contributed to road traffic injuries. These risky behaviors were more common during weekends and late nights. The quality of road infrastructure, including signage, lighting, and road surface conditions, also played a critical role in traffic safety. Poorly maintained roads, especially in rural areas with inadequate lighting, were associated with higher accident rates. Socio-economic factors, such as income levels, influenced travel behavior and risk exposure. In areas with lower income levels, higher crash rates were often observed due to factors like limited access to safe transportation alternatives and a higher number of uninsured drivers. Environmental conditions, including rain, fog, and snow, affected traffic safety by increasing accident rates due to reduced visibility and slippery road surfaces. The regulatory environment also varied across regions, with stricter enforcement of speed limits and DUI laws correlating with lower injury rates. Trends observed before the pandemic highlighted that while the number of crashes fluctuated based on traffic density, the severity of injuries remained a concern. Fatal crashes did not show a significant decline, even when total crash numbers decreased. Crash patterns also indicated that peak hours saw the highest frequency of incidents, and vulnerable road users, such as pedestrians and cyclists, were particularly at risk in urban areas. Efforts to improve pedestrian infrastructure were ongoing but varied greatly by location.

The onset of the COVID-19 pandemic dates back to December 2019, originating from the first reported cases of a novel coronavirus in Wuhan, China. The World Health Organization (WHO) recognized the severity of the situation, declaring COVID-19 a Public Health Emergency of International Concern on January 30, 2020. The global impact became even more apparent when, on March 11, 2020, the WHO officially declared COVID-19 a global pandemic, acknowledging its rapid spread and severity. Fast forward to May 5, 2023, more than three years after the initial pandemic declaration, the WHO announced the end of the global Public Health Emergency (PHE) for COVID-19[5,6]. The pandemic led to unprecedented public health interventions worldwide, including lockdowns, travel restrictions, and social distancing measures aimed at curbing the virus's spread. These interventions significantly reduced mobility and road traffic volume, resulting in notable changes in road traffic patterns and fatalities. A significant number of studies have documented a decrease in road traffic fatalities during the pandemic, attributing this to reduced traffic volume due to lock-downs and travel restrictions[7-10]. For instance, Saewu and Kittisophonphan reported a significant decline in road traffic injuries and fatalities during the pandemic in Thailand. However, other studies have indicated that the risk of fatal crashes might have increased despite the reduction in traffic volume[11-13]. The European Transport Safety Council and the International Transport Forum highlighted that although fewer vehicles were on the road, the risk of fatal crashes increased due to factors such as higher driving speeds and changes in road user behavior. Yasin et al. emphasized that reduced traffic volume could lead to riskier driving behaviors, such as speeding, which

increases the likelihood of severe accidents. Additionally, the long-term impact on road safety remains uncertain and requires continuous monitoring and analysis[13].

Post-pandemic road traffic safety has undergone notable transformations, reflecting shifts in traffic volumes, user behaviors, and safety interventions. Following the initial decline in mobility during the lockdowns, traffic volumes have rebounded in many regions, often surpassing pre-pandemic levels. This resurgence has been associated with a concerning rise in traffic-related fatalities. In 2021, a marked 10.50 percent increase in traffic fatalities was observed compared to the previous year, with this trend continuing into 2022[14]. The return of higher traffic volumes has reintroduced risks associated with increased density on roadways, demanding renewed attention to road safety. Safety measures in the post-pandemic era have also experienced significant changes. A decline in routine traffic enforcement, driven by resource constraints and shifting public safety priorities, has reduced oversight of unsafe driving behaviors[3,4]. In response, some jurisdictions have introduced automated enforcement technologies[15], such as speed and red-light cameras, to fill the enforcement gap. However, the effectiveness of these systems varies, necessitating further evaluation of their impact on road safety. Concurrently, the pandemic has prompted discussions around enhancing road infrastructure[16], with a growing emphasis on multimodal transport systems and the development of safer road designs to prioritize public safety. Behavioral changes among road users have also contributed to the altered traffic safety landscape. An increase in high-risk driving behaviors[3], such as speeding and driving under the influence, has been documented. Speeding-related fatalities have risen significantly since the onset of the pandemic[3,4], alongside an increase in drug-impaired driving, particularly associated with marijuana legalization in some regions. Aggressive driving behaviors[3], including tailgating and reckless maneuvering, have also become more prevalent, exacerbating the dangers on roadways. Furthermore, shifts in crash patterns have been observed[3], with peak accident times moving from traditional rush hours to midday and late-night periods, likely influenced by changes in work schedules and increased leisure travel. The long-term impact of these post-pandemic changes remains uncertain, but there are clear indications that without effective interventions, road fatalities may continue to rise. This evolving context necessitates a reassessment of traffic laws, enforcement strategies, and safety policies to align with post-pandemic realities. Additionally, there is a growing need for comprehensive infrastructure improvements and targeted road safety programs to mitigate the risk of traffic injuries and fatalities in the post-pandemic world. While the recovery phase offers opportunities for advancements in road safety, it also presents significant challenges that require immediate action from policymakers, public health officials, and community stakeholders to ensure safer roads for all users.

In Nakhon Ratchasima Province, the northeast region of Thailand, which has the second-largest population in the country, the COVID-19 prevention interventions resulted in a clear reduction in overall travel during 2020 and 2021 compared to pre-pandemic levels in 2019 (2019 = 15,684,861,212 vehicle-kilometers, 2020 = 15,181,986,688

vehicle-kilometers, 2021 = 11,488,281,759 vehicle-kilometers). While travel increased in 2022 and 2023, it remained below 2019 levels (2022 = 13,577,972,828 vehicle-kilometers, 2023 = 14,498,605,199 vehicle-kilometers)[17]. Despite the reduction in travel, there is limited research on how these changes impacted road traffic injuries (RTIs) and fatalities in Nakhon Ratchasima Province.

This study aimed to address this gap by analyzing the incidence, severity, and patterns of road traffic injury fatalities in the province before, during, and after the COVID-19 pandemic. This analysis is crucial for improving road safety surveillance and preparedness for future epidemic events. Moreover, this study will consider the impact of reduced traffic volume on the actual risk of fatal crashes, a factor often overlooked but essential for comprehensive road safety analysis.

Materials and Methods

A cross-sectional study design was employed to analyze all cases of road traffic fatalities examined at Maharat Nakhonratchasima Hospital between October 1, 2017, and December 31, 2023 (75 months). Data was collected from existing forensic and hospital information systems. Causes of death were classified using the International Classification of Diseases, 10th Revision (ICD-10). "Fatalities at the scene" refers to cases where death was declared at the scene, following an investigation by forensic teams. The study period was divided into three periods: pre-COVID-19 pandemic (pre-COVID period: October 1, 2017, to March 25, 2020, 30 months), during the COVID-19 pandemic (COVID period: March 26, 2020, to September 30, 2022, 30 months), and post-COVID-19 pandemic (post-COVID period: October 1, 2022, to December 31, 2023, 15 months). This study was conducted according to the emergency declaration to control and prevent the spread of COVID-19 by Thai Government, which was enforced between March 26, 2020, and September 30, 2022. Variables were compared across the three time periods, including the number of fatalities, location of death, age, sex, day of the injury, time of death, cause of death (ICD-10 code), and alcohol consumption. The analysis of time of death and ICD-10 codes was conducted solely on cases where death occurred at the scene, based on the completeness of available data. The variables were adjusted to the same unit (monthly average) for comparison purposes. Additionally, data on patients confirmed to have COVID-19 in Nakhon Ratchasima Province during the pandemic period (January 1, 2020, to December 31, 2022) retrieving from Office of Disease Prevention and Control Region 9 Nakhon Ratchasima were analyzed and compared with road traffic fatalities during the same period, using statistical methods including:

1. Analysis of the relationship between the number of traffic injury fatalities and the number of COVID-19 patients per month using linear regression analysis.

2. Comparison of the average monthly number of fatalities across the three periods using ANOVA test.

3. Comparison of median age and median blood alcohol levels across the three periods using the Kruskal-Wallis test.

4. Comparison of the proportion of fatalities by day of the week and sex of the deceased across the COVID periods using the chi-squared test.

5. Comparison of the proportion fatalities at scene

by time of death and cause of death (ICD-10 code) of the deceased across the COVID periods using the chi-squared test.

Statistical analysis and chart visualization were performed using Python programming language and the Google Colab analysis library[18].

Results

During the study period, there were 2,541 deaths from road traffic injuries, including 242 cases that occurred at the scene. The incidence for COVID-19 infection among the deceased from road traffic injuries during the pandemic was 1.45 percent (13 out of 899). When analyzing the number of deaths from road traffic injuries alongside the monthly count of COVID-19 patients between January 2021 and December 2022 (81,955 cases) in Nakhon Ratchasima Province, the linear regression analysis revealed a non-significant negative relationship between the count of confirmed COVID-19 cases and road traffic fatalities (slope = -0.0010, p = 0.08). This suggests a slight decrease in fatalities for each additional COVID-19 case, while the intercept was statistically significant at 32.80 ($p < 0.01$) (Figure 1).

The average monthly deaths from road traffic injuries decreased during the pandemic and remained below pre-COVID levels. However, the trend increased in the post-COVID period. The distribution of deaths varied monthly in all three periods, with a more pronounced trend from August to October (Table 1). In contrast, average deaths at the scene increased during and after COVID-19 (Table 2).

The age distribution pattern remained consistent across all three COVID periods, with the highest number of deaths occurring in the 20-29 age group (Figure 2).

Regarding the day of the injury, the pattern differed, with a higher number of deaths occurring at the beginning and end of the week in the pre-COVID period. However, in the post-COVID period, more deaths were observed at the end of the week. Nonetheless, no statistically significant difference was

Figure 1 Linear regression analysis between the number of COVID-19 infection cases and road traffic fatalities during the COVID period

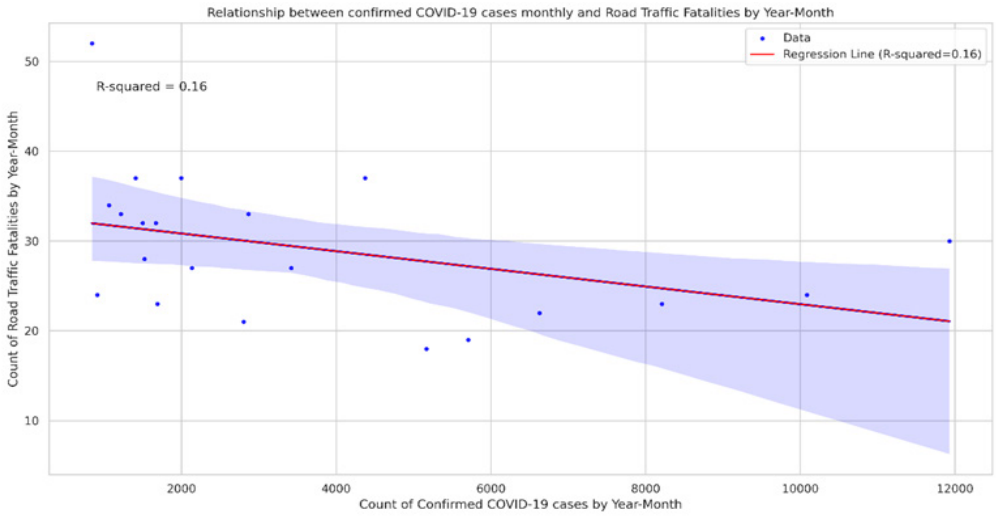


Table 1 Road traffic fatalities during the pre-COVID, COVID, and post-COVID periods

Variables	Pre-COVID (n=1,146)	COVID (n=899)	Post-COVID (n=496)	p-value
Average cases per month	38	30	33	<0.01[1]
Age (year)				
Median	40	39	41	0.55
Min-Max	1-90	1-91	1-90	-
Male (percentage)	80.45	82.65	82.46	0.40
Weekday (percentage)				0.22
Monday	14.75	14.96	17.59	
Tuesday	13.30	14.76	13.45	
Wednesday	15.30	12.91	12.76	
Thursday	14.08	15.16	14.14	
Friday	14.97	12.70	12.24	
Saturday	13.19	14.76	14.39	
Sunday	14.41	14.75	15.43	

[1] Note: ANOVA test results indicated significant differences between the pre-COVID period and the COVID period, as well as between the pre-COVID period and the post-COVID period.

Figure 2 Age group distribution of road traffic fatalities among the three COVID periods

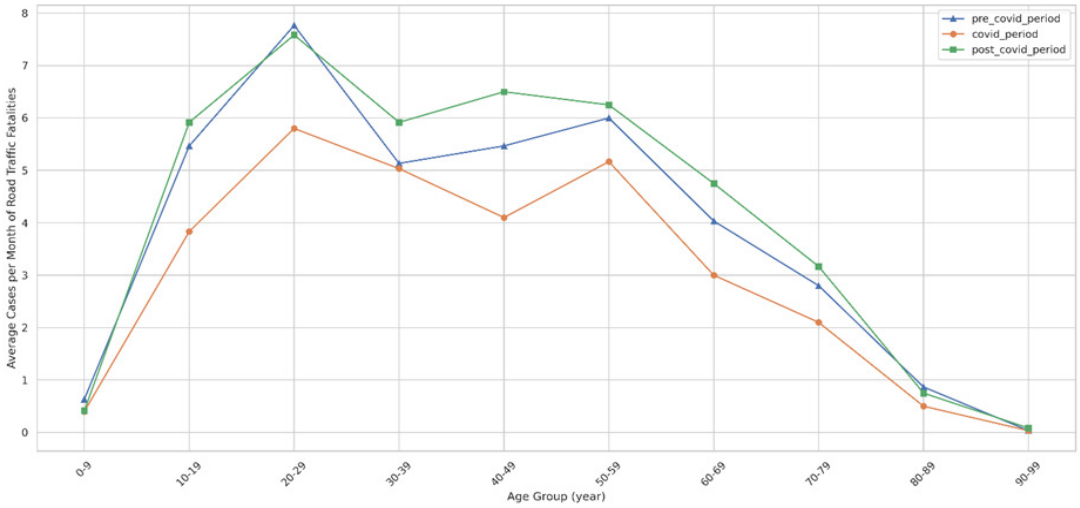


Table 2 Road traffic fatalities at scene during the pre-COVID, COVID, and post-COVID periods

Variables	Pre-COVID (n=73)	COVID (n=110)	Post-COVID (n=59)	p-value
Average cases per month	2.5	4	4	0.09
Maximum count of time of death at the scene (average cases per month)	07-08 PM (0.27)	03-04 AM (0.43)	05-06 AM (0.27)	0.89
Maximum count of cause of death: ICD-10 code (average cases per month)	V234 (0.37)	V244, V274 (0.4)	V234 (0.67)	0.02

observed among the three periods (Table 1)

Death at scene

When examining fatalities at the scene by sub-districts, most sub-districts experienced a decrease in deaths during COVID period, but some showed an increase, notably Jor Hor, Prue Yai, and See Moom. Most sub-districts continued to experience a decrease in deaths in the post-COVID period, especially Chai Mongkon, Khok Sung, Nong Boasala, Nong Chabok, and Nong Rawiang.

The time of death at the scene during the pre-COVID, COVID, and post-COVID periods followed the same pattern. However, during the COVID period, the time of death was predominant between 03:00-04:00 AM. The most common cause of death for all periods was V234. However, during the COVID and post-COVID periods, V284, V274, and V294 were predominant.

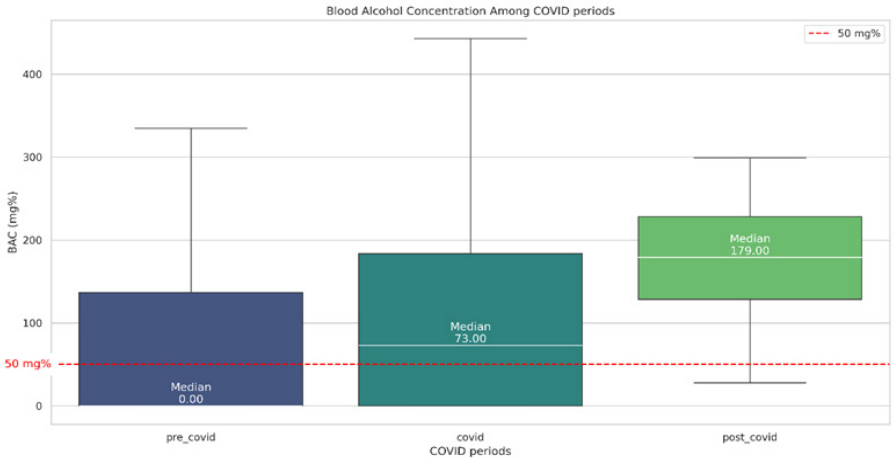
Driving Under the Influence of Alcohol (DUI)

Out of all fatalities, 529 individuals (20.82 percent) were tested for alcohol, with 42.37 percent showing a Blood alcohol concentration (BAC) above the legal limit. When comparing BAC across the three periods, the median BAC was significantly different, with a p-value <0.01, exceeding the legal limit during both the COVID and post-COVID periods (Figure 3). The proportion of positive alcohol tests showed an increasing trend from the pre-COVID to post-COVID periods. Notably, 24.07 percent of cases involved individuals below 19 years of age with a positive BAC, and this percentage tended to increase annually.

Government preventive measures and traffic fatalities

According to several government preventive measures aimed at preventing the spread of COVID-19, key regulations included curfews and alcohol consumption bans. The Office of National Security Council website[19] lists various announcements from the COVID-19 Center in Thailand, such as restrictions on alcohol sales in restaurants, limited operating hours, and the temporary closure of bars and nightclubs during high-risk periods. Strict measures like the nationwide curfew (10:00 PM to 4:00 AM) and prohibition on the sale of alcoholic beverages were in April and May 2020. When comparing the year-on-year changes in

Figure 3 Blood alcohol level among the three COVID periods



overall traffic fatalities for April and May of 2019 and 2020, the average decrease is 40.55 percent. For the months outside of April and May, the percentage change ranges between 37.14 percent decrease and 46.15 percent increase. In cases of positive alcohol tests, year-on-year changes show an average decrease of 45.84 percent. For the months outside of April and May, the percentage change ranges from an 80 percent decrease to a 700 percent increase.

Discussion

This study reveals a significant decrease in road traffic fatalities from the pre-COVID period to the COVID period, and from the COVID period to the post-COVID period. This finding indicates a potential shift in traffic patterns and behaviors during the pandemic, consistent with several previous studies that reported a reduction in road traffic fatalities during the COVID-19 pandemic[7-10]. It is noteworthy that even after the cessation of preventive measures, the average monthly road traffic fatalities remained lower than the pre-COVID period, although the trend increased significantly in the fourth quarter compared to the pre-COVID period. Despite a slight decrease in fatalities with each additional COVID-19 case, the relationship between confirmed COVID-19 cases and road traffic fatalities was not significant. This finding suggests that the decrease in deaths was not solely due to COVID-19 infection, as previously shown in research[20]. These results indicate a complex interplay between the pandemic and road traffic safety. While COVID-19 measures have successfully reduced the number of COVID cases, they cannot be relied upon to reduce traffic fatalities. Therefore, to effectively lower deaths from traffic injuries, it is essential to implement injury prevention measures alongside public health initiatives. The incidence of COVID-19 infection among road traffic fatalities during the pandemic was 1.45 percent, highlighting the need for further investigation into the impact of the virus on traffic-related fatalities. This study demonstrated no significant differences in the patterns of death based on gender, age group, and day of death. The lack of variation in the gender and age groups of those who died during the three COVID periods indicates that the same groups of road users were affected across all three periods, suggesting that the presence of COVID did not alter the demographic profile of road users. However, the highest number of deaths occurred in the 20-29 age group, emphasizing the importance of targeted public health interventions to reduce fatalities among young adults, particularly during times of crisis such as the COVID-19 pandemic. The pattern of deaths varied by the day of the injury. During the pre-COVID period, deaths frequently occurred at the beginning and end of the week. In contrast, during the COVID period, deaths tended to occur steadily throughout the week, while during the post-COVID period, they tended to occur at the end of the week.

The death at the scene indicates the severity of road traffic injuries or the delay of post-crash response. This study found that while road traffic fatalities decreased, the severity of injuries likely increased, consistent with studies in other countries[7], and this trend continued in the post-COVID period. Further research should evaluate post-crash response and injury severity to improve survival rates. Despite reduced traffic volumes, many countries have observed an increase in the number of vehicles exceeding the speed limit[11]. This trend may have contributed to

higher fatalities at the scene during the COVID-19 period.

When considering deaths at the scene by sub-districts, the pattern of death was different. During the COVID period, there was a mixed trend in sub-districts, with some experiencing an increase and others a decrease in fatalities. In the post-COVID period, most sub-districts continued to see a decrease in fatalities, indicating a potential long-term impact of the pandemic on road safety in these areas. Therefore, the authorities should focus more deeply on each sub-district in the province to prevent road traffic injuries. The data indicates that the time of death at the scene during the pre-COVID, COVID, and post-COVID periods followed the same pattern, suggesting a stable pattern in general. However, during the COVID period, the time of death was predominant between 03:00-04:00 AM. This finding is significant as it highlights a potential shift in the timing of fatal road traffic incidents during the pandemic. Understanding these temporal variations is crucial for implementing targeted interventions and allocating resources effectively to mitigate risks during specific time periods, particularly during times of crisis such as the COVID-19 pandemic. Further research may be warranted to explore the underlying factors contributing to this shift in the time of death and to develop tailored strategies to address road safety challenges during these hours. Regarding the ICD-10 codes, the pattern of causes of death varied significantly among the three COVID periods. However, the most common cause of death across all periods was motorcycle riders injured in collisions with four-wheeled vehicles (V234). Despite motorcycles being the most common road user type, the pattern of injuries changed during the COVID period and continued into the post-COVID period, with an increase in motorcycle rider injuries in collisions with fixed objects and non-collision incidents. The shift in motorcycle injury patterns during and after COVID-19 likely stems from several factors. Reduced traffic led to higher speeds and more single-vehicle crashes, while increased alcohol consumption at home may have contributed to non-collision incidents. Less strict law enforcement and changes in road usage likely exacerbated these trends. A comprehensive study examining these factors, along with rider behavior and road infrastructure changes, could provide valuable insights into preventing similar patterns in the future. Further research is essential to explore the underlying causes and guide policy adjustments.

The Blood Alcohol Concentration (BAC) serves as an important indicator for evaluating preventive measures against road traffic injuries[21]. Driving under the influence of alcohol contributes to 10 to 30 percent of fatal crashes in several countries [13]. During the public health emergency, there was a significantly higher incidence of positive alcohol and drug impairment tests for driving compared to before the pandemic[22-24]. This study also identified a substantial increase in alcohol-related driving, including among children and adolescents. These findings underscore the importance of targeted interventions to address underage drinking and its implications for road safety. Notably, the year-on-year comparison of positive alcohol cases between the pre-COVID and post-COVID periods did not show significant differences during the months when nationwide curfew and alcohol sales prohibitions were in effect, compared to months without such restrictions. The BAC levels

in road traffic fatalities during the COVID and post-COVID periods were higher than those in the pre-COVID period. These findings, consistent with previous study[23], suggest that the preventive measures implemented during the COVID-19 pandemic may have led to a higher incidence of alcohol consumption while driving. Despite Thailand's national law on alcohol limits while driving, BAC testing remains dependent on police orders and their judgment. This indicates potential inadequacies in law enforcement of road traffic measures during the COVID-19 pandemic, which may have contributed to the observed increase in alcohol-related road fatalities.

Conclusion

This study provides a comprehensive analysis of road traffic injury fatalities in Nakhon Ratchasima Province before, during, and after the COVID-19 pandemic. The findings indicate that while there was a reduction in travel during the pandemic, the risk of fatal crashes may have increased due to changes in driving behavior and other factors. This highlights the need for targeted road safety interventions during periods of reduced traffic volume and emphasizes the importance of continuous monitoring and analysis of road safety trends. Even numerous strategies for reduction of COVID-19 infection such as travel restrictions, alcohol sales prohibition, and law enforcement could have reduced road accidents during the pandemic period. This study showed some strategies were not effective properly in Nakhon Ratchasima Province. The study's implications are significant for public health and road safety policy focuses on increased traffic-related law enforcement which should be stricter enforcement of traffic laws during lockdowns and promoting campaigns to encourage safe driving and adherence to traffic regulations. Policymakers should consider the findings when designing interventions to improve road safety during and after public health crises. Future research should continue to explore the long-term effects of the pandemic on road safety and develop strategies to mitigate the risk of fatal crashes in similar situations.

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กลุ่มงานนิติเวช โรงพยาบาลมหาราชนครราชสีมา
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ติดต่อผู้เขียน: บุญศักดิ์ หาญเทอดสิทธิ์ E-mail: boonsak.ha@cpird.in.th

บทคัดย่อ: การระบาดของโรคติดเชื้อไวรัสโคโรนา 2019 (COVID-19) ซึ่งประกาศเป็นภาวะฉุกเฉินทั่วโลกในปี พ.ศ. 2563 ส่งผลให้มีมาตรการควบคุม เช่น การทำงานจากบ้าน และการจำกัดการเดินทาง ทำให้ปริมาณการจราจรลดลงทั่วโลก สำหรับในจังหวัดนครราชสีมามีการเดินทางลดลงมากเช่นเดียวกันในช่วง พ.ศ. 2563-2564 อย่างไรก็ตาม ผลการศึกษาจากงานวิจัยทั่วโลกมีความแตกต่างกันเกี่ยวกับแนวโน้มการบาดเจ็บและเสียชีวิตจากการบาดเจ็บจราจรในช่วงการระบาด การศึกษานี้มีวัตถุประสงค์เพื่อวิเคราะห์การเสียชีวิตจากอุบัติเหตุจราจรในจังหวัดนครราชสีมา ตั้งแต่ช่วงก่อน COVID-19 (ตุลาคม พ.ศ. 2560) จนถึงหลัง COVID-19 (ธันวาคม พ.ศ. 2566) โดยมุ่งเน้นที่แนวโน้ม ความรุนแรงและรูปแบบการบาดเจ็บ เป็นการศึกษาแบบภาคตัดขวาง โดยใช้ข้อมูลจากนิติเวชและเวชระเบียนโรงพยาบาลร่วมกับผู้ป่วย COVID-19 ในจังหวัดนครราชสีมา ผลการศึกษาพบว่าจำนวนผู้ป่วย COVID-19 และการเสียชีวิตจากการบาดเจ็บจราจรมีความสัมพันธ์เชิงลบเล็กน้อยแต่ไม่มีนัยสำคัญทางสถิติ ในช่วงการระบาดจำนวนผู้เสียชีวิตเฉลี่ยต่อเดือนลดลง แต่กลับเพิ่มขึ้นหลัง COVID-19 กลุ่มอายุ 20-29 ปี มีจำนวนการเสียชีวิตสูงสุดในทุกช่วง ไม่พบความแตกต่างในตัวแปรเพศ อายุ หรือวันในสัปดาห์ จำนวนการเสียชีวิตในที่เกิดเหตุลดลง แต่ความรุนแรงของการบาดเจ็บกลับเพิ่มขึ้นหลัง COVID-19 การบาดเจ็บจากรถจักรยานยนต์เป็นสาเหตุหลักของการเสียชีวิตในทุกช่วงเวลา โดยพบการเพิ่มขึ้นของพฤติกรรมเสี่ยง เช่น การบริโภคแอลกอฮอล์ในผู้ใช้ถนนหลังการระบาด สำหรับรูปแบบการบาดเจ็บนั้นมีการเปลี่ยนแปลงไป และต่อเนื่องถึงช่วงหลังการระบาด ดังนั้น จึงมีความจำเป็นในการเสริมสร้างกลยุทธ์ความปลอดภัยบนท้องถนนในช่วงการระบาด โดยเฉพาะเมื่อพิจารณาผลกระทบในระยะยาวที่อาจเกิดขึ้นหลังสถานการณ์การระบาด

คำสำคัญ: **การเสียชีวิตจากอุบัติเหตุทางถนน; โควิด-19; ความรุนแรงของการบาดเจ็บ; การดื่มแอลกอฮอล์; สาธารณสุข; ความปลอดภัยทางถนน; การป้องกันการบาดเจ็บ**