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Assessing the impact of the national traffic safety campaign: a nationwide cohort study in Japan

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ABSTRACT

Objectives This study aimed to examine the difference in mortality from serious road traffic injuries during the National Traffic Safety Campaign compared with other periods and identify the common mechanisms of injury by age group in Japan.

Design A retrospective review of Japan Trauma Data Bank (JTDB).

Setting A total of 280 participating major emergency institutions across Japan.

Participants Patients with road traffic injuries registered in JTDB between 2004 and 2018 were recruited in the study. We included patients injured by traffic crashes during the National Traffic Safety Campaigns and controls using a double control method. The National Traffic Safety Campaign comprises 10 consecutive days in spring and fall (20 days in each year), and controls was the same calendar days 2 weeks before and after the days in the National Traffic Safety Campaigns (40 days in each year) to control for weekday, seasonal and yearly trends.

Primary and secondary outcome measures The primary outcome was in-hospital mortality. The secondary outcome was the incidences of severe traffic injury.

Results Among 126 857 patients recorded as road traffic injuries in JTDB, we identified 6181 patients (21 cases per day) with injuries occurring during the National Traffic Safety Campaigns and 12 382 controls (21 cases per day). The overall in-hospital mortality was 11.4%. We did not observe a significant difference in in-hospital mortality between the groups (11.8% vs 11.1%) with an adjusted OR of 1.05 (95% CI 0.95 to 1.16). The most common mechanism of injury in each age group was bicycle crash among children, motorcycle crash among adults and pedestrian among the elderly.

Conclusions We found no change in the incidence of severe traffic injury or in-hospital mortality during the National Traffic Safety Campaign in Japan. Serious road trauma was high for bicycles among children, motorcycles among adults and pedestrian among the elderly.

Strengths and limitations of this study

- ► We used a nationwide trauma database, which included the details of the mechanism of injury, patient information and outcomes, and evaluated the effects of the National Traffic Safety Campaign in both spring and fall.
- ► We used a double control method, which allows us to control for weekday, seasonal and yearly trends, to evaluate the short-term effects of the National Traffic Safety Campaign in Japan.
- ► The database we used did not include on-scene deaths that not transported to hospital, which could lead to both selection and information biases.
- ► Our findings may not be fully applicable to other areas that have different healthcare systems, legislation and baseline road safety.

INTRODUCTION

Road traffic injuries are a major cause of severe injury and fatalities worldwide, and they are currently the leading cause of death among children and young adults.[1,2] Mortality among an elderly population aged 75 or above rose by 4.7% between 2010 and 2018 according to the report by the International Traffic Safety Data and Analysis Group.[3] A variety of road safety campaigns have been conducted worldwide at national and regional levels. Road safety education is an essential process for the acquisition of safe behaviour and evidence-based programmes, such as positive attitudes, risk perception and rule knowledge model are introduced.[4,5] These interventions are known to have long-term effects for improving road safety behaviours of population. A previous meta-analysis of studies on road safety campaigns reported that the weighted average effect of road safety campaigns resulted in a 9% reduction in traffic collisions.[6] Among included studies in this article, 77% of campaigns were accompanied by police enforcement, and accompanying enforcement by police and short campaign duration appeared to be beneficial. Previous research to evaluate the effect of increased police enforcement in London showed a systematic reduction in speeds during the operation, which may reduce traffic collisions.[7] Some studies have shown some effects of traffic enforcement, whereas others did not find any significant association between traffic enforcement and traffic collisions and behaviour. Although traffic enforcement by the police appears to have a short-term effect and may lead to individuals' traffic behavioural change only when the presence of the police is noticed, it plays an important role in road safety campaigns.[6]

In Japan, although the number of deaths due to road traffic injuries used to be high because of the development of the transport infrastructure and rapid motorisation, it had decreased to 3.3 fatalities per 100 000 population in 2018, which was one of the lowest levels of traffic fatalities in the world.[3] The Government of Japan holds the National Traffic Safety Campaign in cooperation with local governments and various organisations. The aims are spreading the idea of road traffic safety widely among the people, making it a habit to follow traffic rules and practice proper traffic behaviour, and promoting efforts by the people themselves to improve the road traffic environment. It is held twice a year, once in spring and once in fall. Ten government ministries and agencies, including the Cabinet Office and the National Police Agency, as well as prefectural and municipal governments, and 13 related organisations, play a central role in this programme. Police traffic enforcement is strengthened during the National Traffic Safety Campaign.[8] There is a previous article that evaluated the effect of this campaigns in Japan from 1949 to 2019.[9] Although it did not show any statistically significant difference in mortality after 1990, this study assessed only spring events of biannual campaigns and used national police data which do not include detailed hospital outcome data such as survival information after 24 hours. As the study periods of this study was long, survival outcomes might be affected the development of emergency system and hospital care in Japan.[10]

There is still limited data on effect of road safety campaigns on mortality in Japan, and it is important to evaluate the current situation to improve the National Traffic Safety Campaign. Therefore, this study aimed to examine the difference in mortality from serious road traffic injuries during the National Traffic Safety Campaign compared with other periods using a nationwide database in Japan. We focused on police enforcement during the National Traffic Safety Campaign, which may be effective during the campaigns. We also ought to investigate the effects of the campaign in subgroups by age groups and mechanisms of injury as the campaigns approaches differently in age groups and types of transportation.

METHODS

Study design and settings

We conducted a retrospective review of the Japan Trauma Data Bank (JTDB), which is a nationwide voluntary hospital-based trauma registry in Japan. Patients with road traffic injuries registered in the JTDB between 2004 and 2018 were included in the study. We excluded patients whose records were missing information on age, sex or in-hospital mortality as well as double-counted data due to inter-hospital transport.

Japan Trauma Data Bank

The JTDB was established in 2003 by the Japanese Association for the Surgery and Trauma (Trauma Surgery Committee) and the Japanese Association for Acute Medicine (Committee for Clinical Care Evaluation).[11] It is a multicentre, standardised and anonymised database that comprises data of major trauma patients collected from 280 participating major emergency medical institutions across Japan as of 2018. The following data from trauma cases were captured in the JTDB: age, sex, mechanism of injury, Abbreviated Injury Scale (AIS) code (version 1998), Injury Severity Score (ISS), vital signs on hospital arrival, date and time series from hospital arrival to discharge, emergency management including surgical operations and CT scanning, complications and mortality at discharge. The ISS was calculated from the three highest AIS scores of injured body regions as previously described.[12] These data were completed via the Internet by medical staff who completed the AIS coding course. Data are only available on request to the JTCR and access requires appropriate ethical and governance clearances regarding use.

National Traffic Safety Campaign and control groups

The National Traffic Safety Campaign comprises the 10 consecutive days from 6 April to 15 April 15 in spring and the 10 consecutive days from 21 September to 30 September in fall; the official dates are determined by the Cabinet Office of Japan each year. In the year of the quadrennial nationwide local elections, the National Traffic Safety Campaign in spring is changed to 11 May to 20 May (eg, 2007, 2011 and 2015).

The purpose of the National Traffic Safety Campaign in Japan is to prevent traffic crashes by spreading the idea of traffic safety widely among the public, cultivating the habit of following traffic rules and practicing proper traffic manners, and promoting the voluntary efforts of the public to improve the road traffic environment.[8] The National Police Agency cosponsor this campaign with other governmental ministries, agencies and relevant sectors every spring and fall. During the 10-day campaign period, the police intensively carry out road safety activities such as roving patrols, saturation patrols and sobriety checkpoints. These activities during the study period focus on prevention of traffic crashes involving children and the elderly, promotion of the use of seatbelts and child seats, as well as crackdown on driving under the influence cases.[8]

To assess the short-term effect of the National Traffic Safety Campaigns, we used a double control method, which allows us to control for weekday, seasonal and yearly trends.[13 14] This approach can minimise potential confounding such as changes in vehicle design, travel distances and medical care and validated in analyses of road traffic risks surrounding specific events.[15–18] In this method, we defined controls as the same calendar days 2 weeks before and 2 weeks after the days in the National Traffic Safety Campaigns. The control group included the 20 days from 23 March to 1 April and from 20 April to 29 April in spring and the 20 days from 7 September to 16 September and from 5 October to 14 October in fall. In the year of the quadrennial nationwide local elections (eg, 2007, 2011 and 2015), the included days in spring for the control group were from 27 April to 6 May and from 25 May to 3 June.

Primary outcome measure and variables

The primary outcome measure was in-hospital mortality from serious road traffic injuries. We extracted the following patient information from the JTDB: age, sex, mechanism of injury, date and time of hospital admission, alcohol intake, AIS code, ISS, vital signs on hospital arrival and mortality at discharge. We categorised age into three major groups: <18 years, 18–64 years and ≥65 years, and into 10 subgroups: 0–3 years (infants/toddlers), 4–5 years (preschoolers), 6–11 years (middle childhood), 12–14 years (young teens), 15–17 years (teenagers), 18–64 years (adults), 65–74 years, 75–84 years, 85–94 years and 95 years or older.[19] We divided the time of day of the Emergency Medical System call into 6-hour time periods (ie, 00:00–05:59, 06:00–11:59, 12:00–17:59 and 18:00–23:59 hours). To assess concomitant injuries, we mapped AIS-coded injuries to the following categories: head/neck, thorax, abdomen and pelvis/lower-extremities. We defined shock as a systolic blood pressure of less than 80 mm Hg on hospital arrival and out-of-hospital cardiac arrest as a systolic blood pressure of 0 mm Hg or a heart rate of 0 bpm on hospital arrival.[20] The secondary outcomes in our study were the incidence of the severe traffic injury. We also assessed injury patterns by age and mechanisms of injury.

Statistical analysis

Continuous variables are presented as the means and SD or the median and IQR if skewed, and categorical variables as counts and percentages. Patient characteristics were compared between the groups using the Student's t-test or the Mann-Whitney U test for continuous variables and the χ^2 test for categorical variables. To compare the differences in in-hospital mortality between the two groups, we used a univariable and multivariable logistic regression analysis and calculated crude and adjusted ORs and 95% CIs. As potential prehospital confounders, factors that were biologically essential and considered to be associated with clinical outcomes were included in the multivariable analyses. These variables were age, sex, mechanism, time of day, alcohol intake and admission year as well as injury sites (head/neck, thorax, abdomen, pelvis/lower extremity) as the injury sites were known factors that potentially associated with mortality in blunt injuries.[21] We conducted a sensitivity analysis for patients injured by traffic crashes during the National Traffic Safety Campaigns and controls from the same calendar days 2 weeks before the days in the National Traffic Safety Campaigns (ie, excluding patients in the same calendar days 2 weeks after the campaigns) concerning a potential spillover effect. All tests were two tailed, and values of $p<0.05$ were considered to indicate statistical significance. All statistical analyses were performed using R Statistical Software (V.3.6.2; R Foundation for Statistical Computing, Vienna, Austria).

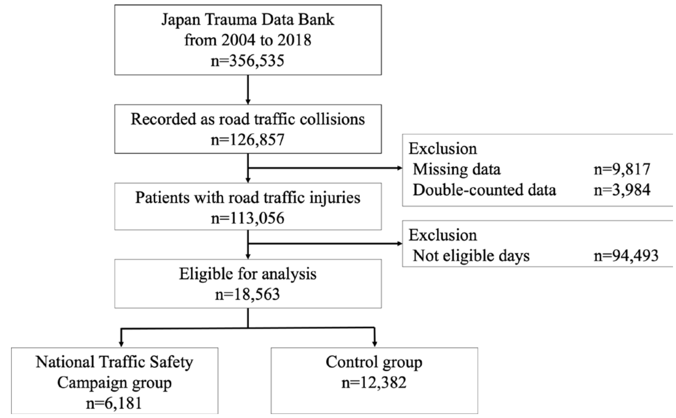

Figure 1 Patient flow.

Patient and public involvement

Patients and the public were not involved in the design, or conduct, or reporting, or dissemination plans of this research. We will not directly disseminate our findings to involved participants but plan to disseminate them through publication of this study.

RESULTS

Figure 1 shows the patient flow in the study. During the study period, 356 535 trauma patients were registered in the JTDB and 126 857 patients were recorded in road traffic injuries. Excluding missing data and duplications, 113 056 patients were injured due to road traffic crashes. Among them, we identified 6181 patients injured by traffic crashes during the National Traffic Safety Campaigns and 12 382 controls in the 2 weeks before and after the National Traffic Safety Campaigns.

Patient characteristics in this study are summarised in table 1. The median number of recorded cases was 21 per day in the total cohort. The mean age of the overall patient population was 47.6 years, and more than half of the patients were male (68.5%). The most frequent mechanism of injury was motorcycle crash (29.5%), followed by car crash (28.6%) and bicycle crash (21.4%). The median ISS was 16 (IQR 9–25), 8.7% were in shock on hospital arrival, and 4.6% were in out-of-hospital cardiac arrest. The overall in-hospital mortality was 11.4% in this study. There was no difference between the groups in the distribution of patient characteristics except for time of the

Table 1 Patientcharacteristics of the national Traffic Safety Campaign group and control group

Characteristics	Total n=18 563	National Traffic Safety Campaign group n=6181	Control group n=12 382	P value*
No of recorded cases per day, median, Q1–Q3	21, 11–30	21, 11–29	21, 11–30	0.965
Age, years, mean (SD)	47.6 (23.6)	47.3 (23.7)	47.7 (23.5)	0.291
Age group, n (%)				0.327
<18 years	2070 (11.2)	717 (11.6)	1353 (10.9)	
18–64 years	10 927 (58.9)	3637 (58.8)	7290 (58.9)	
>65 years	5566 (30.0)	1827 (29.6)	3739 (30.2)	
Male sex, n (%)	12 716 (68.5)	4224 (68.3)	8492 (68.6)	0.748
Mechanism, n (%)				0.436
Car crash	5318 (28.6)	1783 (28.8)	3535 (28.5)	
Motorcycle crash	5470 (29.5)	1772 (28.7)	3698 (29.9)	
Bicycle crash	3974 (21.4)	1324 (21.4)	2650 (21.4)	
Pedestrian	3529 (19.0)	1211 (19.6)	2318 (18.7)	
Others	272 (1.5)	91 (1.5)	181 (1.5)	
Ambulance type				0.402
Ordinary ambulance	15 423 (83.1)	5128 (83.0)	10 295 (83.2)	
Physician-staffed helicopter	1640 (8.8)	528 (8.5)	1112 (9.0)	
Physician-staffed ambulance	794 (4.3)	279 (4.5)	515 (4.2)	
Others	705 (3.8)	246 (4.0)	459 (3.7)	
Time of day, n (%)				0.021
00:00–05:59	2506 (13.5)	766 (12.4)	1,740, (14.1)	
06:00–11:59	5229 (28.2)	1739 (28.1)	3490 (28.2)	
12:00–17:59	5840 (31.5)	1985 (32.1)	3855 (31.1)	
18:00–23:59	4801 (25.9)	1611 (26.1)	3190 (25.8)	
Alcohol intake, n (%)	1480 (8.0)	473 (7.7)	1007 (8.1)	0.271
Injury site, n (%)				
Head/neck	10 514 (56.6)	3537 (57.2)	6977 (56.3)	0.263
Thorax	7567 (40.8)	2562 (41.4)	5005 (40.4)	0.184
Abdomen	3145 (16.9)	1034 (16.7)	2111 (17.0)	0.598
Pelvis/lower-extremity	8132 (43.8)	2697 (43.6)	5435 (43.9)	0.748
ISS, median, Q1–Q3	16, 9–25	14, 9–25	16, 9–24	0.613
Shock on arrival, n (%)	1595 (8.7)	554 (9.1)	1041 (8.5)	0.218
Out-of-hospital cardiac arrest, n (%)	827 (4.6)	294 (4.9)	533 (4.4)	0.172
In-hospital mortality, n (%)	2112 (11.4)	732 (11.8)	1380 (11.1)	0.166
Admission years				0.064
2004–2006	991 (5.3)	363 (5.9)	628 (5.1)	
2007–2009	2471 (13.3)	823 (13.3)	1648 (13.3)	
2010–2012	4209 (22.7)	1376 (22.3)	2833 (22.9)	
2013–2015	6059 (32.6)	2057 (33.3)	4002 (32.3)	
2016–2018	4833 (26.0)	1562 (25.3)	3271 (26.4)	

*P values were calculated using Student's t-test or Mann-Whitney U test for continuous variables and $\chi 2$ test for categorical variables.
ISS, Injury Severity Score.

Nakao S, *et al. BMJ Open* 2022;**12**:e054295. doi:10.1136/bmjopen-2021-054295

Table 2 Unadjusted and adjusted ORs of in-hospital mortality for the National Traffic Safety Campaign group and control group by logistic regression analyses

	National Traffic Safety Campaign group	Control group	P values
In-hospital mortality, % (n/N)	11.8 (732/6181)	11.1 (1380/12 382)	
Crude OR (95% CI)	1.01 (0.99 to 1.02)	Reference	0.158
Adjusted OR* (95% CI)	1.05 (0.95 to 1.16)	Reference	0.342

*ORs were adjusted for age, sex, mechanism, time of day, alcohol intake, injury sites (head/neck, thorax, abdomen, pelvis/lower extremity) and admission year.

day. The frequencies of injuries in each 6-hour interval of the time of day were different between the National Traffic Safety Campaign group and the control group (p=0.021). During the National Traffic Safety Campaign, severe road traffic injuries occurred less in time interval from 0:00 to 5:59 and more from 12:00 to 17:59 hours compared with the control group.

We did not observe a difference in in-hospital mortality between the National Traffic Safety Campaign group and the control group (11.8% vs 11.1%, p=0.166). Comparisons between the two groups yielded a crude OR of 1.01 (95% CI 0.99 to 1.02, p=0.158) and an adjusted OR of 1.05 (95% CI 0.95 to 1.16, p=0.342) as shown in table 2. In a sensitivity analysis with using only patients injured in the same calendar days 2 weeks before the campaigns, the in-hospital mortality was not statistically significantly different from those injured during the National Traffic Safety Campaigns: adjusted OR of 1.10 (95% CI 0.95 to 1.27, p=0.189).

Subgroup analyses between age groups of in-hospital mortality are summarised in table 3 and online supplemental table S1. We found no significant differences in in-hospital mortalities in the National Traffic Safety Campaign group versus the control group for each age group: adjusted ORs of 1.02 (95% CI 0.66 to 1.55, p=0.944) for the paediatric population, 1.12 (95% CI 0.97 to 1.29, p=0.119) for the adult population, and 0.99 (95% CI 0.84 to 1.15, p=0.862) for the elderly population. The most common mechanism of injury in each age group was bicycle crash among children, motorcycle crash among adults and pedestrian among the elderly. We found no significant differences in in-hospital mortalities in the National Traffic Safety Campaign group versus the control group for each mechanism of injury as shown in table 4.

DISCUSSION

In this nationwide study using the JTDB, there was no statistically significant difference in in-hospital mortality or the incidence of serious traffic injury patients during the National Traffic Safety Campaign compared with the control group. There was also no statistically significant decrease in in-hospital mortality or the incidence of serious traffic injury patients in the paediatric, adult and elderly populations during the National Traffic Safety Campaign. We could not detect any statistically significant difference in background characteristics except for time of the day of the injuries.

Table 3 Unadjusted and adjusted ORs of in-hospital mortality for the national Traffic Safety Campaign group and control group for each age group

	National Traffic Safety Campaign group	Control group	P values
Paediatric population aged <18 years			
In-hospital mortality, % (n/N)	5.2 (37/717)	5.2 (79/1353)	
Crude OR (95% CI)	1 (0.98 to 1.02)	Reference	0.99
Adjusted OR* (95% CI)	1.02 (0.66 to 1.55)	Reference	0.944
Adult population aged 18–64 years	10 (365/3637)	8.8 (643/7290)	
In-hospital mortality, % (n/N)			
Crude OR (95% CI)	1.15 (1.01 to 1.32)	Reference	0.039
Adjusted OR* (95% CI)	1.12 (0.97 to 1.29)	Reference	0.119
Elderly population aged >65 years			
In-hospital mortality, % (n/N)	18.1 (330/1827)	17.8 (667/3739)	
Crude OR (95% CI)	1 (0.98 to 1.02)	Reference	0.838
Adjusted OR* (95% CI)	0.99 (0.84 to 1.15)	Reference	0.862

*ORs were adjusted for age, sex, mechanism, time of day, alcohol intake, injury sites (head/neck, thorax, abdomen, pelvis/lower extremity) and admission year.

Table 4 Unadjusted and adjusted ORs of in-hospital mortality for the national Traffic Safety Campaign group and control group for each mechanism of injury

	National Traffic Safety Campaign group	Control group	P values
Car crash injury			
In-hospital mortality, % (n/N)	9.6 (172/1783)	9.4 (332/3535)	
Crude OR (95% CI)	1 (0.99 to 1.02)	Reference	0.765
Adjusted OR* (95% CI)	1.01 (0.82 to 1.23)	Reference	0.945
Motorcycle crash injury			
In-hospital mortality, % (n/N)	9.1 (161/1772)	8.2 (305/3698)	
Crude OR (95% CI)	1.01 (0.99 to 1.02)	Reference	0.299
Adjusted OR* (95% CI)	1.11 (0.90 to 1.37)	Reference	0.316
Bicycle crash injury			
In-hospital mortality, % (n/N)	10.9 (144/1324)	9.9 (262/2650)	
Crude OR (95% CI)	1.01 (0.99 to 1.02)	Reference	0.332
Adjusted OR* (95% CI)	1.14 (0.90 to 1.43)	Reference	0.284
Pedestrian injury			
In-hospital mortality, % (n/N)	20 (242/1211)	19.6 (455/2318)	
Crude OR (95% CI)	1 (0.98 to 1.03)	Reference	0.802
Adjusted OR* (95% CI)	1.03 (0.85 to 1.25)	Reference	0.749

*ORs were adjusted for age, sex, time of day, alcohol intake, injury sites (head/neck, thorax, abdomen, pelvis/lower extremity) and admission year.

Strengthened traffic enforcement during the National Traffic Safety Campaign did not reduce the number of deaths and serious injuries. Our results are consistent with the previous analysis evaluating the road safety campaigns in spring in Japan although we also included the campaigns in fall and performed different analyses.[9] A previous report from the European Union pointed out that intensified and targeted enforcement campaigns often result in temporary and localised compliance improvement across the board.[22] In our study, we could not detect the temporary effect on the fatal traffic collisions during the campaigns. As this report suggested, the effects of drivers' awareness and behaviour by police enforcement should be assessed in the future studies. A previous report suggested that more aggressive traffic enforcement by increasing the number of police motorcycles and radar guns would reduce fatalities and serious traffic injuries.[23] More powerful interventions may be needed for police regulation during the National Traffic Safety Campaign to be effective. Increased police checks on seat-belt wearing, police enforcement of speeding, increase of speed traps could help increase the road safety, and appeared to be cost-effective according to a previous systematic review.[24] Injuries during night-time are known to be associated with higher mortality.[25] In this study, there were fewer serious injuries in the time interval from midnight to early morning during the National Traffic Safety Campaign. This could be because police enforcement was more effective due to the highly visible police presence by police lights in less traffic congestions.[26] Interventions to reduce serious injuries during other time intervals may need to be strengthened.

Activities during the National Traffic Safety Campaign in Japan include public events held by governments, municipalities, and public institutions, in addition to the increased police traffic enforcement. A previous report from Australia argued that road safety advertising can be a robust tool to transform community expectations and values and contribute to behavioural change.[27] The decrease in the number of traffic injuries from midnight to early morning could be due to the success of road safety activities by transportation-related companies. There should be different programmes for different age groups, which may lead to a change in behaviour towards road safety and prevention of serious injuries in the specific age groups. In this study, there was no difference in the incidence of severe trauma or in-hospital mortality during the period for injuries in children, adults or the elderly.

Some past studies reported positive effects of road safety interventions for adolescents and activities in a summer curriculum.[28 29] There are also reports that competition may be effective in traffic safety campaigns for children.[30] Child safety seats have been reported to reduce serious road trauma in children and have been emphasised during the National Traffic Safety Campaigns, but their use in Japan may not yet be widespread.[31 32] Community-based activities and school education may also be effective.[33–35] Japan has one of the oldest populations in the world, and it has been reported that road traffic fatalities among the elderly increase year by year, and the mortality rate is high.[36 37] Therefore, road safety awareness among the elderly is also important. Our study revealed that serious road trauma in Japan was high for bicycle crash among children, motorcycle crash among adults and pedestrian among the elderly, and more emphasis should be placed on these types of transportation to encourage changes in traffic behaviour in each age group while the campaign approaches in each age group and type of transportation every year.

There may be some age group-specific road safety activities that have been continued with limited effect.[38] However, simply providing knowledge alone may not lead to behavioural change. Additionally, various activities may have some effect on the participants but none on those who do not participate. It is necessary to engage people who have not been targeted in the past and to develop new ways to change their traffic behaviour.

There are several limitations in our study. First, the JTDB is not a population-based sample of trauma patients, and the data are registered voluntarily although major critical care centres in Japan participate. The data could not include on-scene deaths that not transported to hospital. Therefore, both selection and information biases exist. Second, our results may not be fully applicable to other areas that have different healthcare systems, legislation and baseline road safety. Third, as we used the JTDB, only patients with serious injuries were analysed, and patients with mild injury were not included. Therefore, we could not assess the impact of the National Traffic Safety Campaign on reducing the total number of traffic injuries. However, data from trauma registries is able to provide detailed information on injury severity and outcomes.[39] Fourth, we could not separate the data into urban and rural areas, nor could we evaluate other potential effects of the National Traffic Safety Campaign, such as the rate of wearing seatbelts, helmet usage, frequencies of drunk drivers and illicit drug use or use of child restraints. Furthermore, we could not assess the strength of police traffic enforcement or the change in the number of traffic violations caught by police during the National Traffic Safety Campaign. Thus, we cannot provide specific proposals for police traffic enforcement to reduce the mortality from serious road traffic injuries during the National Traffic Safety Campaign. As we used a double control method, a potential spillover effect of the National Traffic Safety Campaign could lead to underestimation of the benefit of the intervention. However, we performed a sensitivity analysis without controls with potential spillover effects, and the result was not statistically significant.

CONCLUSION

This study showed no change in the incidence of severe traffic injury or in-hospital mortality during the National Traffic Safety Campaign in Japan. Although it is not sufficient to reduce the number of serious traffic injuries and mortality only during specific periods, it may be necessary to improve the activities of the National Traffic Safety Campaign. More emphasis should be placed on for bicycle crash among children, motorcycle crash among adults, and pedestrian among the elderly to encourage changes in traffic behaviour in each age group.

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Contributors SN conceived the study. SN and YN participated in the data curation. SN, YK and TKit structured the methods and the statistical analysis. SN prepared the manuscript. SN, YK, TKit, TH, JT, KI, MO, TKigu, YU, TN, TM and KK performed the data interpretation. All authors critically reviewed and approved the final version of the manuscript. SN is the guarantor of the article.

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Patient consent for publication Not applicable.

Ethics approval The institutional ethics committee of Osaka University Graduate School of Medicine approved this study and waived the need for informed consent because all analyses used anonymous data (approval no. 16260).

Provenance and peer review Not commissioned; externally peer reviewed.

Data availability statement Data may be obtained from a third party and are not publicly available. The approving authority for data access was the Japan Trauma Care and Research (JTCR). Data are only available on request to the JTCR and access requires appropriate ethical and governance clearances regarding use. Statistical code is available in online supplemental material.

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