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Effect of social distancing on injury incidence during the COVID-19 pandemic: an interrupted time-series analysis

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ABSTRACT

Objectives To evaluate the effects of social distancing on the incidence and characteristics of injuries during the COVID-19 pandemic.

Design and setting This cross-sectional study used the National Emergency Department Information System (NEDIS) database.

Participants Injured patients who visited all 402 emergency departments (EDs) between 29 February and 29 May 2020 (after-distancing), and in the corresponding period in 2019 (before distancing) to control for seasonal influences.

Outcome measures The study outcome was the incidence of injury. Using the interrupted time-series analysis models, we analysed weekly trends of study outcomes in both periods (before and after distancing), the step change (the effect of intervention), and the slope change over two periods (the change in the effect over time).

Results The incidence rates of injury per 100 000 person-days were 11.2 and 8.6 in the before-distancing and after-distancing periods, respectively. In the after-distancing period, the incidence rate of injury decreased (step change −3.23 (95% CI −4.34 to −2.12) per 100 000 person-days) compared with the before-distancing period, while the slope change was 0.10 (95% CI 0.04 to 0.24). The incidence rate ratios of all injuries and intentional injuries for the after-distancing period were 0.67 (95% CI 0.60 to 0.75) and 1.28 (95% CI 1.18 to 1.40), respectively, compared with the before-distancing period.

Conclusions Fewer injuries occurred after the implementation of social distancing programme compared with the same period in the previous year. However, this effect gradually decreased postimplementation.

Strengths and limitations of this study

- ► Social distancing measures to reduce face-to-face contact during the COVID-19 outbreak have dramatically changed people's behaviour towards life.
- ► Several studies report how implementing social distancing during the pandemic indirectly changed the incidence and characteristics of injuries in patients; however, very few studies have considered time-series changes reflecting compliance with policy enforcement at the national level.
- ► We find that after social distancing was implemented, the incidence rate of injury decreased compared with the same period in the previous year.
- ► However, postimplementation, this effect gradually decreased over time.
- ► Regarding the characteristics of injury, the proportions of intentional injury and injury at home increased. In contrast, there were fewer road traffic injuries and injuries occurring in locations where social distancing was possible.

INTRODUCTION

Globally, the COVID-19 outbreak has been a major public health crisis. Several countries have implemented strategies to prevent person-to-person transmission of the virus and reduce the burden of the pandemic, including social or physical distancing, closure of schools and workplaces, transportation restrictions and lockdowns.[1 2] Social and physical distancing restrictions were among the most effective health policies during the pandemic, particularly in environments with community transmission.[3 4]

The COVID-19 outbreak and the government's policies have changed people's behaviour compared with the prepandemic period. The fear and anxiety of contracting viral infections led to voluntary changes in people's behaviour.[5–7] Moreover, government policies to control outbreaks have significantly altered citizens' behaviour.[8 9] Importantly, social distancing has reduced the population density in various places.[3 4]

The incidence and characteristics of injury may have been also affected by changes in the surrounding environment and people's behaviour.[10] Self-harm and interpersonal violence are known to increase in stressful situations, such as wars and disasters.[11] Over half of all injuries occur at home; it is also the most common place for violence in stressful situations.[11 12] Additionally, the characteristics

of injuries are affected by the population density of the place. Road traffic injuries are most affected by the vehicle volume on the road.[13 14]

Social distancing programme to reduce face-to-face contact during the COVID-19 outbreak has dramatically changed people's behaviour to life. Several studies report how implementing social distancing during the pandemic indirectly changed the incidence and characteristics of injured patients.[15–17] However, to the best of our knowledge, few studies have considered time-series changes reflecting compliance with policy enforcement at the national level.

We hypothesised that after implementing COVID-19-related social distancing, the incidence of injuries decreased compared with that before this intervention. The magnitude of this effect would continue over time postimplementation of this intervention. We also hypothesised that the effects of the social distancing would differ according to the characteristics of the injury, such as intentionality, mechanism of injury and place of injury.

This study seeks to evaluate the effects of social distancing on the incidence and characteristics of injuries during the COVID-19 pandemic. Furthermore, we seek to test the changes in the effects of the intervention over time postimplementation using time-series analysis.

METHODS

Study design and data source

This cross-sectional study used data from the national emergency medical service (EMS) run-sheets and the National Emergency Department Information System (NEDIS) database.

The EMS run-sheets are recorded by EMS providers at the scene and collected and operated by the EMS headquarters in each province. EMS run-sheets include information about patient demographics and prehospital information for all patients who visited the emergency department (ED) using the EMS.

NEDIS is a nationwide database operated by the National Emergency Medical Center under the Ministry of Health and Welfare since 2003. NEDIS includes demographic and clinical information for all patients who have visited EDs across the country, including demographics (such as age, sex and insurance), symptoms (chief reports and reason of visit), prehospital (EMS use and prehospital care) and ED (vital signs, emergency procedures, diagnosis codes based on the International Classification of Disease 10th Edition (ICD-10), disposition and final clinical outcomes). All patient-related information is automatically transferred from each hospital to the central government server. The data-processing system filters inaccurate data. The health authorities maintain a system of assessment of accuracy and report the results annually to the Ministry of Health and Welfare.

Study setting

The EMS system in Korea is a government-based public system operated by the National Fire Agency. EMS covers approximately 50 million population and provides prehospital care and ambulance services at approximately 1400 ambulance stations nationwide in 17 provinces.

The Ministry of Health and Welfare designed three levels of ED, depending on the availability of human resources, facilities and equipment. Currently, 38 regional EDs (level I), 125 local EDs (level II) and 239 emergency facilities (level III) provide care across the country. Level I and level II EDs provide the highest emergency care services.

In Korea, the first COVID-19 case was confirmed on 20 January 2020, while the first community-based infection occurred on 18 February 2020. To prevent the spread of COVID-19, the national crisis warning level was raised to the highest level on 23 February 2020. However, as the number of patients with COVID-19 rose rapidly, social distancing was soon implemented on 29 February. The social distancing programme to reduce the likelihood of transmitting communicable disease consisted of suspending the operation of indoor crowded places (religious, indoor sports facilities, entertainment facilities, etc), maintaining physical distance of at least 2 m between individuals in public places, working from home and closing of the schools.

Study population

The study population included injured patients who visited all 402 EDs between 29 February and 29 May 2020 (after-distancing period), and the corresponding period in 2019 between 2 March and 31 May 2019 (before-distancing period) to control for seasonal influences on injury incidence. Injured patients were defined as patients who visited the ED with injury and had S and T codes of the ICD-10 code. The study period was 13 weeks from 29 February 2020, when social distancing was implemented in Korea. The same period in the previous year was used for comparison of outcomes.

Study outcomes and variables

The primary outcome was the incidence of the injury. The secondary outcomes were the proportions of in-hospital mortality, clinically severe injury and specified injury (intentionality, mechanism and place of injury).

Clinically severe injury was defined as a patient with in-hospital mortality, patients admitted to the intensive care unit, and patients classified as severe in the initial triage.

The following demographic and clinical variables were collected from NEDIS: age, sex, mode of visit (EMS use or not), triage, intentionality, mechanism, diagnoses and disposition after ED visit. Intentional injury consists of self-harm, suicide, violence and murder. The injury mechanism was divided into six groups: road traffic injury, fall, slip down, blunt, penetrating and others. Information on

intentionality and mechanism of injury was collected only from the level I and level II EDs.

Information on the place where the injury occurred was captured on EMS run-sheets. There was no available information on the place of injury for patients who visited EDs without EMS use. The places of injury were categorised into five groups: home, traffic area, distancing-target area, non-distancing area and others. A distancing-target area is where social distancing is possible, such as schools, educational facilities, sports facilities and entertainment. The non-distancing areas were residential facilities, medical-related facilities, factories, industries, construction facilities, agriculture, primary industrial sites, seas, rivers, mountains and rice fields.

Statistical analysis

Descriptive statistics for categorical variables are presented as frequency distributions and percentages.

For the primary study outcomes, the incidence of injury per 100 000 person-days was calculated using the 2019 mid-year population from Census data. For the secondary study outcomes, the proportions of in-hospital mortality and clinically severe injury were calculated using the number of all injured patients as the denominator. The proportions by intentionality and mechanism of injury were calculated using the number of injured patients who visited level I and level II EDs as the denominator. The proportions by the place of injury were calculated using the number of injured patients with EMS use.

Table 1 Characteristics of the study population according to the social distancing intervention

	Total		Before distancing		After distancing		
	Incidence rate	N (%)	Incidence rate	N (%)	Incidence rate	N (%)	P value
Total injured, ED visits	9.90	924 952	11.18	522 175	8.62	402 777	
Age, year							<0.01
0~19	13.38	225 579 (24.4)	16.65	140 377 (26.9)	10.10	85 202 (21.2)	
20~39	9.12	230 762 (25.0)	10.00	126 502 (24.2)	8.24	104 260 (25.9)	
40~59	8.41	257 957 (27.9)	9.25	141 925 (27.2)	7.57	116 032 (28.8)	
60~79	9.46	164 406 (17.8)	10.20	88 643 (17.0)	8.72	75 763 (18.8)	
80~120	14.36	46 248 (5.0)	15.36	24 728 (4.7)	13.37	21 520 (5.3)	
Sex							<0.01
Male	11.67	544 049 (58.8)	13.15	306 379 (58.7)	10.20	237 670 (59.0)	
Female	8.13	380 903 (51.2)	9.22	215 796 (41.3)	7.05	165 107 (41.0)	
Place of injury							<0.01
Home	0.75	69 889 (31.8)	0.76	35 687 (29.8)	0.73	34 202 (34.2)	
Traffic area	0.88	82 394 (37.5)	0.98	45 807 (38.2)	0.78	36 587 (36.6)	
Distancing target	0.11	10 021 (4.6)	0.15	7082 (5.9)	0.06	2939 (2.9)	
Non-distancing	0.31	29 179 (13.3)	0.34	15 687 (13.1)	0.29	13 492 (13.5)	
Others	0.30	28 258 (12.9)	0.33	15 566 (13.0)	0.27	12 692 (12.7)	
EMS use	2.35	219 741 (23.8)	2.56	119 829 (22.9)	2.14	99 912 (24.8)	<0.01
Initial triage, severe	0.25	23 787 (2.6)	0.27	12 812 (2.5)	0.23	10 975 (2.7)	0.01
Level of ED, I and II	6.83	638 332 (69.0)	7.89	368 949 (70.7)	5.77	269 383 (66.9)	<0.01
ED disposition							<0.01
Discharge	8.21	767 366 (83.0)	9.34	436 118 (83.5)	7.09	331 248 (82.2)	
Ward admission	1.31	122 500 (13.2)	1.43	66 676 (12.8)	1.19	55 824 (13.9)	
Intensive care units	0.17	16 279 (1.8)	0.18	8631 (1.7)	0.16	7648 (1.9)	
Transfer out	0.15	14 275 (1.5)	0.18	8265 (1.6)	0.13	6010 (1.5)	
Death	0.01	1384 (0.1)	0.01	698 (0.1)	0.01	686 (0.2)	
Clinical outcomes							
Clinically severe injury	0.35	33 138 (3.6)	0.38	17 746 (3.4)	0.33	15 392 (3.8)	<0.01
In-hospital mortality	0.04	3448 (0.4)	0.04	1819 (0.3)	0.03	1629 (0.4)	0.10

Incidence rate per 100 000 person-days was calculated using the 2019 mid-year population of Census data.
ED, emergency department; EMS, emergency medical services.

An interrupted time-series analysis was conducted to evaluate the effects of social distancing on study outcomes. Using the generalised least squares and the segmented Poisson regression models, we analysed weekly trends of outcomes in both periods (before and after distancing), estimated effect size (the step-change over two periods; the effect of the intervention) considering the underlying trends and tested the interaction effects of both periods and weekly trends (the slope change over two periods; the change in the effect of the intervention over time).[18] We applied a corARMA model to correct for autocorrelation for the generalised least squares model.[19] Residual autocorrelation can lead to the violation of the regression assumption due to the time sequencing of data points used for time-series analysis.[20] We calculated beta coefficients with 95% CIs based on differences in study outcomes between the two periods using the generalised least squares model. We used the segmented Poisson regression model for computing the incidence rate ratios (IRRs) and the hazard ratios (HRs) with 95% CIs based on the ratios of study outcomes of the two periods, adjusting for week and with an interaction term (both periods×week).

Data were analysed using R software (V.4.0.0, R Foundation for Statistical Computing, Vienna, Austria). Statistical significance was set at a two-sided significance level of 0.05.

Patient and public involvement

The National Emergency Medical Center under the Ministry of Health and Welfare was involved in the design and conduct of this research, but it was not possible to involve patients in our research.

Table 2 Characteristics of the study population according to the social distancing intervention among patients visiting level I and level II EDs

	Total		Before distancing		After distancing		
	Incidence rate	N (%)	Incidence rate	N (%)	Incidence rate	N (%)	P value
Total, level I and II EDs	6.83	638 332	7.90	368 949	5.77	269 383	
Age, year							<0.01
0~19	10.25	172 942 (27.1)	12.84	108 252 (29.3)	7.67	64 690 (24.0)	
20~39	6.19	156 645 (24.5)	6.95	87 872 (23.8)	5.44	68 773 (25.5)	
40~59	5.48	168 144 (26.3)	6.21	95 243 (25.8)	4.75	72 901 (27.1)	
60~79	6.26	108 882 (17.1)	6.93	60 232 (16.3)	5.60	48 650 (18.1)	
80~120	9.85	31 719 (5.0)	10.78	17 350 (4.7)	8.92	14 369 (5.3)	
Sex							0.16
Male	8.01	373 115 (58.5)	9.27	215 929 (58.5)	6.74	157 186 (58.4)	
Female	5.66	265 217 (41.5)	6.54	153 020 (41.5)	4.79	112 197 (41.6)	
Intentional injury	0.38	35 956 (5.7)	0.42	19 815 (5.4)	0.35	16 141 (6.1)	<0.01
Mechanism of injury							<0.01
Road traffic injury	1.19	111 295 (17.4)	1.39	64 998 (17.6)	0.99	46 297 (17.2)	
Fall	0.54	50 242 (7.9)	0.61	28 349 (7.7)	0.47	21 893 (8.1)	
Slip down	1.39	129 928 (20.4)	1.59	74 177 (20.1)	1.19	55 751 (20.7)	
Blunt	1.35	125 925 (19.7)	1.62	75 863 (20.6)	1.07	50 062 (18.6)	
Penetrating	0.96	89 762 (14.1)	1.04	48 711 (13.2)	0.88	41 051 (15.2)	
Others	1.40	131 180 (20.6)	1.65	76 851 (20.8)	1.16	54 329 (20.2)	
EMS use	1.77	164 963 (25.9)	1.95	91 331 (24.8)	1.58	73 632 (27.3)	<0.01
Initial triage, severe	0.22	20 863 (3.4)	0.24	11 160 (3.2)	0.21	9703 (3.6)	<0.01
ED disposition							<0.01
Discharge	5.71	533 324 (83.9)	6.66	310 962 (84.6)	4.76	222 362 (82.9)	
Ward admission	0.82	76 879 (12.1)	0.91	42 325 (11.5)	0.74	34 554 (12.9)	
Intensive care units	0.16	14 648 (2.3)	0.17	7767 (2.1)	0.15	6881 (2.6)	
Transfer out	0.10	9709 (1.5)	0.12	5799 (1.6)	0.08	3910 (1.5)	
Death	0.01	1222 (0.2)	0.01	622 (0.2)	0.01	600 (0.2)	
Clinical outcomes							
Clinically severe injury	0.31	28 717 (29.3)	0.33	15 318 (29.0)	0.29	13 399 (29.6)	0.03
In-hospital mortality	0.03	3026 (3.3)	0.03	1609 (3.2)	0.03	1417 (3.4)	0.08

Incidence rate per 100 000 person-days was calculated using the 2019 mid-year population of Census data.
ED, emergency department; EMS, emergency medical services.

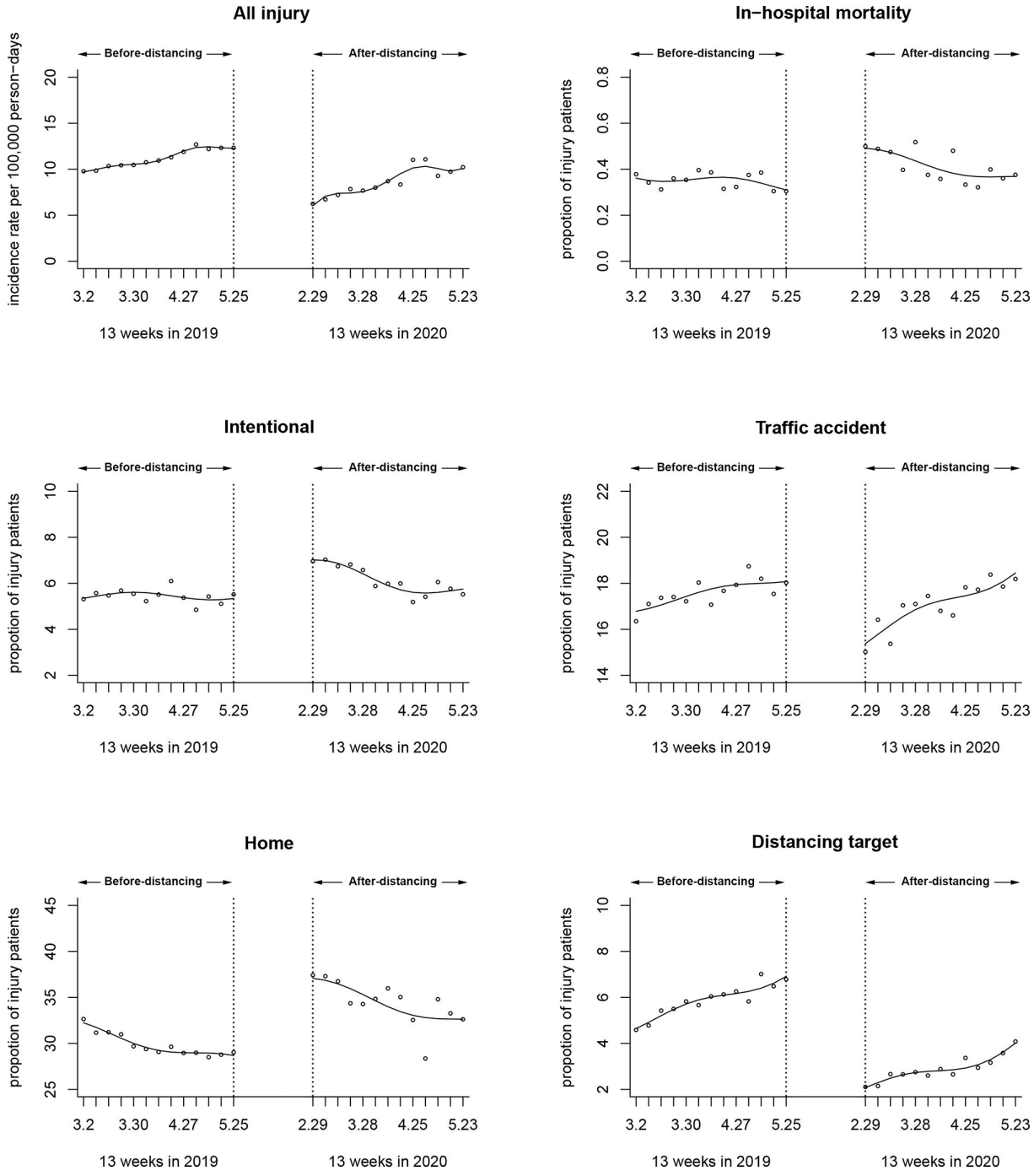

Figure 1 The weekly incidence rate of injury and proportions of study outcomes for the before-distancing (13 weeks in 2019) and after-distancing (13 weeks in 2020) periods The incidence of injury per 100 000 person-days was calculated using the 2019 mid-year population from census data. The proportions of in-hospital mortality and clinically severe injury were for all injured patients. Proportions by intentionality and mechanism of injury were for injured patients who visited Level I and Level II EDs. Proportions by the place of injury were considered for injured patients with EMS use. The period after social distancing is greyed out. ED, emergency department; EMS, emergency medical service.

RESULTS

Demographic findings

Among the 2 211 180 ED visits in the before-distancing period and 1 485 590 ED visits in the after-distancing period, the total number of injured patients was 522 175 and 402 777 in the before-distancing and after-distancing periods, respectively. The incidence rates of injury per 100 000 person-days were 11.2 and 8.6 in the before-distancing and after-distancing periods, respectively. The proportion of in-hospital mortality was 0.3% and 0.4% in the before-distancing and after-distancing periods (p value 0.10), respectively, while that of clinically severe injury was 3.4% and 3.8%, respectively (p value <0.01) (table 1).

Among the patients who visited level I and level II EDs, the proportion of intentional injury was 5.4% and 6.0% in the before-distancing and after-distancing periods,

Table 3 Interrupted time-series analysis with generalised least squares models for study outcomes of the social distancing intervention

	Step change		Slope change	
	Estimate	95% CI	Estimate	95% CI
Incidence, per 100 000 person-days				
Total population				
All injury	−3.23	−4.34 to −2.12	0.1	0.04 to 0.24
In-hospital mortality	0	−0.01 to 0	0	0 to 0
Clinically severe injury	−0.07	−0.07 to −0.06	0	0 to 0
Proportions				
All injury				
In-hospital mortality	0.13	0.1 to 0.17	−0.01	−0.02 to −0.01
Clinically severe injury	1.03	0.81 to 1.25	−0.08	−0.11 to −0.05
Level I and Level II EDs				
Intentional injury	1.52	1.28 to 1.75	−0.13	−0.16 to −0.09
Mechanism				
Road traffic injury	−1.39	−1.73 to −1.05	0.12	0.08 to 0.17
Fall	0.89	0.53 to 1.24	−0.06	−0.1 to −0.01
Slip down	0.29	−0.48 to 1.06	0.04	−0.05 to 0.14
Blunt	−2.12	−2.31 to −1.92	0.03	0 to 0.05
Penetrating	2.7	1.89 to 3.51	−0.09	−0.19 to 0.01
EMS use				
Place of injury				
Home	5.56	3.21 to 7.91	−0.14	−0.44 to 0.15
Traffic area	−2.14	−3.36 to −0.92	0.07	−0.08 to 0.23
Distancing target	−2.75	−2.9 to −2.6	−0.04	−0.06 to −0.02
Non-distancing target	0.77	0.5 to 1.04	−0.06	−0.1 to 0.03

Incidence rate per 100 000 person-days was calculated using the 2019 mid-year population of Census data.
ED, emergency department; EMS, emergency medical service.

respectively (p value <0.01). By the mechanism of injury, road traffic injuries were 17.6% and 17.2% in the before-distancing and after-distancing periods, respectively (p value <0.01) (table 2 and online supplemental table for patients who visited level III EDs).

The weekly incidence rate of injury and proportions of study outcomes for 13 weeks of the before-distancing (in 2019) and the after-distancing (in 2020) periods are shown in figure 1.

Effects of the social distancing programme on injury

We conducted an interrupted time-series analysis to evaluate the effects of social distancing on the incidence and characteristics of injuries during the COVID-19 pandemic. In the generalised least squares models, the estimate of step change for the injury incidence rate per 100 000 person-days was −3.23 (95% CI −4.34 to −2.12) in the after-distancing period compared with the before-distancing period, while the estimate of slope change was 0.10 (95% CI 0.04 to 0.24). Regarding the proportion of in-hospital mortality, the step change was 0.13 (95% CI 0.10 to 0.17), and the slope change was −0.01 (95% CI −0.02 to −0.01). For intentional injury, the step change was 1.52 (95% CI 1.28 to 1.75). By place of injury, the step changes were −2.75 (95% CIs −2.90 to −2.60) for the distancing-target area and 0.77 (95% CI 0.50 to 1.04) for the non-distancing area (table 3).

In the segmented Poisson regression analyses, the IRRs of all injuries and clinically severe injury of the after-distancing compared with the before-distancing period were 0.67 (95% CI 0.61 to 0.74) and 0.82 (95% CI 0.78 to 0.87). Compared with before-distancing, the HRs of the after-distancing period were 1.38 (95% CI 1.15 to 1.65) for the in-hospital mortality and 1.28 (95% CI 1.18 to 1.40) for the intentional injury. By place of injury, the HRs were 0.44 (95% CI 0.39 to 0.49) for the distancing-target area and 1.05 (95% CI 0.97 to 1.14) for the non-distancing area (table 4).

DISCUSSION

This study evaluated the effects of social distancing on the incidence and characteristics of injuries during the

Table 4 Interrupted time-series analysis with segmented Poisson regression models for study outcomes of the social distancing intervention

	Incidence rate ratio	95% CI
Total population		
All injury	0.67	0.60 to 0.75
In-hospital mortality	0.91	0.77 to 1.07
Clinically severe injury	0.82	0.78 to 0.87
	HR	**95% CI**
All injury		
In-hospital mortality	1.38	1.15 to 1.65
Clinically severe injury	1.24	1.12 to 1.38
Level I and level II EDs		
Intentional injury	1.28	1.18 to 1.40
Road traffic injury	0.92	0.88 to 0.97
EMS use		
Home	1.18	1.10 to 1.26
Distancing target area	0.44	0.39 to 0.49
Non-distancing target	1.05	0.97 to 1.14

Incidence rate per 100 000 person-days was calculated using the 2019 mid-year population of Census data.
ED, emergency department; EMS, emergency medical service; HR, Hazard ratio.

COVID-19 pandemic using a nationwide emergency patient database. After social distancing was implemented, the incidence rate of injury decreased (step change: estimate, −3.23 (95% CI −4.34 to −2.12) per 100 000 person-days, and IRR, 0.67 (95% CI 0.61 t0 0.74) compared with the same period in the previous year. However, this effect gradually decreased over time postimplementation (slope change: estimate, 0.10 (95% CI 0.04 to 0.24)). Regarding the characteristics of the injury, the proportions of intentional injury and injury at home increased. In contrast, there were fewer road traffic injuries and injuries occurring in locations where social distancing is possible. Our study shows how social distancing during the COVID-19 pandemic changed the incidence and characteristics of injured patients secondarily by reducing interpersonal contact, and how the effects of the intervention changed over time. These results can be used indirectly in selecting a target population that can highlight the effectiveness of the intervention, considering the decline in policy compliance over time and developing a new evidence-based intervention.

Social distancing during the COVID-19 outbreak has dramatically changed people's behaviour towards life. It has limited people's outdoor activities, reduced population density in various places and increased the time spent at home. We found that after the implementation of social distancing, the incidence of all injured patients decreased significantly compared with the same period in the previous year. These results are consistent with several studies.[15–17] Notably, our results may indirectly demonstrate the effects of enforcing social distancing. However, the magnitude of the decrease in the incidence of injury was lower in this study. In several societies, social distancing inertia has been observed. For example, in the USA, stay-at-home orders were violated and movement began increasing only 2 weeks after the declaration of disaster.[21] This quarantine fatigue may be caused by warmer weather, tiredness from staying at home and unaffordability of living while unemployed. Importantly, psychological fatigue with social distancing may be a major challenge in curbing pandemics.

Meanwhile, the proportions of in-hospital mortality and clinically severe injury increased in the after-distancing period. During the COVID-19 pandemic, the number of patients visiting EDs with medical illnesses decreased, but mortality rates increased for patients with specific diseases.[22 23] Patients with acute emergency symptoms would hesitate from visiting the ED due to the risk and fear of transmission of COVID-19.[24 25] This may have decreased the number of patients who visited the ED without severe injuries and increased the proportions of in-hospital mortality and clinically severe injury.

Regarding the characteristics of injury, the proportion of intentional injury increased in the after-distancing period. Similar trends are observed in other geographies: domestic violence increased by 25% during the social distancing period in the UK,[26] while violence and gunshot injuries increased in Philadelphia.[27] A high proportion of intentional injuries, such as violence-related injuries, during the period of the social distancing programme may lead to increase the in-hospital mortality rate and clinically serious injuries. In terms of the mechanism of injury, road traffic injuries declined in most countries due to reduced traffic after social distancing was implemented. California reported a 60% reduction in traffic, and road traffic injuries were reduced by half.[28] In Spain, traffic fell by 62.9%, while road traffic injuries decreased by 74.3%.[29] In terms of place of injury, as the time spent at home increased, the proportion of injuries occurring at home increased; moreover, the risk of domestic violence increased due to stress in the family.[16 27 30] In this study, non-distancing target areas remained unaffected by social distancing, while the proportion of injury occurring in locations where social distancing could be observed was reduced to less than half. Furthermore, the slope change significantly decreased with a negative step change. This indirectly demonstrates that social distancing had a powerful effect on changing people's behaviour, reducing injuries.

This study has several limitations. First, this study was not a randomised controlled study of social distancing interventions. Although we tried to reduce the bias by using a time-series analysis, potential biases could have affected our results. Second, information on the intentionality and mechanism of injury is available only at level I and level II EDs. Furthermore, information on the location of injury is collected only in patients with EMS use.

We calculated the proportions of specific injuries using injured patients with available information as denominators. Therefore, it can act as a potential bias. Third, the population in this study was injured between 29 February and 29 May in both 2019 and 2020. Considering the seasonal variations in the incidence of injury, we analysed data from discontinued periods rather than consecutive periods. Using data from 4 January 2019 to 30 May 2020, a plot of the interrupted time-series analysis for the main study outcomes is illustrated in online supplemental figure. Similar results were observed in the data from the consecutive periods from 2019 to 2020.

In summary, the incidence of injuries after the implementation of social distancing decreased compared with that before the intervention. However, this effect decreased over time postimplementation. These results may indirectly demonstrate the effects of enforcing social distancing on changes in people's behaviour. Importantly, tailored intervention programmes are needed to reduce the public health burden, including communicable diseases and strategies to maintain policy compliance.

Contributors YSR had full access to all of the data in the study and take responsibility for the integrity of the data as well as the accuracy of the data analysis. Conceptualisation: YSC and YSR; data curation: YSC, JHP and YSR; formal analysis: YSC and YSR; funding acquisition: none; investigation: SM; methodology: YSR and SM; software: YSC; supervision: YSR and SM; validation: YSR, JHP and SM; visualisation: YSC; writing—original draft: YSC; writing—review and editing: YSR, JHP and SM; approval of final manuscript: all authors.

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Data availability statement Data may be obtained from a third party and are not publicly available. The data of this study were obtained from the National Emergency Medical Center under the Ministry of Health and Welfare in Korea but restrictions apply to the availability of these data and so are not publicly available.

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