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Association Between Changes in Social Distancing Policies in Ohio and Traffic Volume and Injuries, January Through July 2020

To minimize transmission of coronavirus disease 2019 (COVID-19), most US states in spring 2020 passed policies promoting social distancing through stay-at-home orders prohibiting nonessential travel.[1] While vehicle miles traveled in the US decreased by 41% in April 2020 compared with 2019,[2] the effect of this mobility decrease on motor vehicle crashes (MVCs) is poorly understood. We estimated associations between COVID-19–related social distancing policies, traffic volume, and MVC-related outcomes in Ohio.

Methods | Our observational study compared MVCs and traffic volume data from two 7-month periods: January 1, 2020, through July 31, 2020, and January 1, 2019, through August 1, 2019 (accounting for the leap-year day in 2020). Motor vehicle crash data were obtained from the Ohio Department of Public Safety's Electronic Crash Submission database.[3] Traffic volume data were obtained from the Ohio Department of Transportation through permanent count stations positioned on interstate, state, and US routes.[4]

Three state-level policies demarked 4 study periods in 2020: period 1, January 1 through March 8; period 2, March 9 (state-of-emergency declaration) through March 22; period 3, March 23 (stay-at-home order) through May 11; and period 4, May 12 (retail reopening) through July 31. Mean daily counts were calculated and compared across periods for 3 types of crash-related outcomes: (1) number of people (motor vehicle drivers and passengers, pedestrians, motorcyclists, and bicyclists) involved in MVCs (MVC involvements), (2) number of people having any injuries in an MVC (MVC injuries), and (3) number of people having a severe or fatal injury in an MVC (MVC severe or fatal injuries), along with (4) traffic volume.

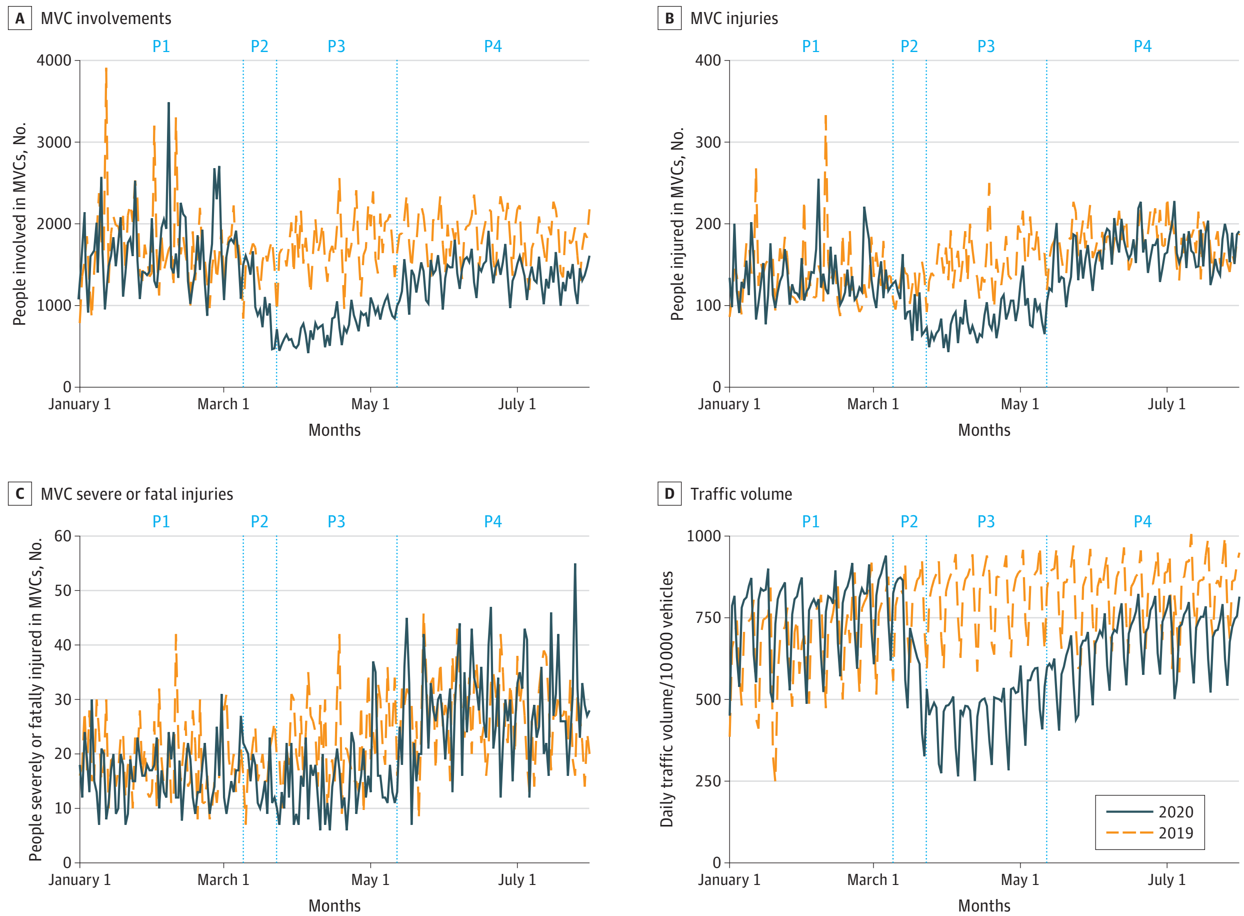
Daily interrupted time-series analyses with ordinary least-squares linear regression and Newey-West standard errors were used to estimate slope changes. All outcome variables were log transformed. Crash month, weekday or weekend occurrence, gasoline price, and unemployment rate were included in the analysis to control for seasonality and confounding. Statistical significance was defined as a 95% CI that excluded 0. As this study used publicly available, deidentified secondary data reported on an aggregated level, it did not undergo institutional review board review per institutional guidelines.

Results | From January 1 through July 31, 2020, MVCs were experienced by 284 128 individuals, with 27 809 having some level of injury and 3719 having severe injuries; there were 621 fatalities. These numbers were compared with MVCs during the 2019 study period, in which 382 098 individuals were involved in MVCs, 33 365 had some level of injury, 4243 had severe injuries, and there were 619 fatalities. When separated by period during 2020, all outcomes substantially declined during period 2 and reached their lowest levels directly following the stay-at-home order before gradually increasing through periods 3 and 4 (**Figure**).

Comparing slopes across periods, period 2 saw significantly larger daily changes than any other period of 2020 across all outcomes: for MVC involvements, −7.08% (95% CI, −8.31% to −5.82%); for MVC-related injuries, −5.08% (95% CI, −6.48% to −3.65%); for MVC-related severe or fatal injuries, −5.61% (95% CI, −8.19% to −2.95%); and for traffic volume, −4.07% (95% CI, −5.14% to −2.99%) (**Table**).

Relative to the same 2019 period, period 3 showed the largest difference: a −55% (95% CI, −62% to −49%) change in MVC

Figure. Daily Counts of Motor Vehicle Crash–Related Outcomes and Traffic Volume



The vertical dotted lines demark the study periods (P1-P4) in 2020. Period 1 was January 1 through March 8; period 2, March 9 (state-of-emergency declaration) through March 22; period 3, March 23 (stay-at-home order) through May 11; and period 4, May 12 (retail reopening) through July 31. The x-axis is in reference to 2020 dates, accounting for the leap-year day. MVC indicates motor vehicle crash.

involvements, a −47% (95% CI, −54% to −40%) change in injuries, a −34% (95% CI, −47% to −21%) change in severe or fatal injuries, and a −44% (95% CI, −48% to −39%) change in traffic volume. In period 4, mean daily counts of MVC-related injuries and severe or fatal injuries approached 2019 levels.

Discussion | The period beginning with Ohio's state-of-emergency declaration was associated with the greatest daily percentage decrease in MVC involvements, injuries, and traffic volume compared with other state-level policies implemented during early stages of the pandemic. These findings coincided with behavior change likely associated with gubernatorial state-of-emergency declarations: schools suspended in-person classes, sporting events restricted spectators, and large gatherings were banned. A return to 2019 levels in the number of MVC injuries and severe or fatal injuries was observed in period 4, perhaps due to increased alcohol and cannabinoid use, speeding, harsh acceleration and braking events, and mobile phone use observed among drivers following easing of COVID-19 lockdowns.[5,6]

This study has limitations. As injury severity in Ohio crash reports was identified by police officers rather than medical professionals, nondifferential misclassification may exist. Additionally, the public's response to the pandemic may have been influenced by factors outside of policy (eg, media coverage). Also, generalizability beyond Ohio may be limited. Results were presented by various periods to facilitate cross-state comparisons.

As the pandemic continues, policy makers should consider the effects of lockdown and reopening policies on factors beyond COVID-19 infection, including MVC-related injuries and deaths.

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Table. Mean Daily Counts and Changes in Motor Vehicle Crash Involvements, Injuries, Severe or Fatal Injuries, and Traffic Volume

Outcome and period[a]	Mean daily count (95% CI)[b]		Difference, % (95% CI)[c]		
	2019	2020	Period in 2020 vs same period in 2019[c]	Period in 2020 vs previous period in 2020[c]	2020 Daily % change (95% CI)[d]
Crash involvement					
Period 1	1759 (1634-1884)	1697 (1585-1810)	−3 (−13 to 6)	Not applicable	0.11 (−0.60 to 0.82)
Period 2	1555 (1421-1689)	1116 (907-1325)	−28 (−45 to −11)	−34 (−49 to −19)	−7.08 (−8.31 to −5.82)
Period 3	1767 (1670-1865)	788 (736-839)	−55 (−62 to −49)	−29 (−50 to −9)	0.97 (0.63 to 1.33)
Period 4	1881 (1817-1945)	1404 (1359-1449)	−25 (−30 to −21)	78 (69 to 87)	0.13 (−0.17 to 0.42)
Injuries					
Period 1	138 (128-148)	132 (125-140)	−4 (−13 to 5)	Not applicable	−0.23 (−0.89 to 0.44)
Period 2	127 (117-137)	100 (84-116)	−21 (−37 to −6)	−24 (−39 to −10)	−5.08 (−6.48 to −3.65)
Period 3	155 (146-163)	82 (76-88)	−47 (−54 to −40)	−18 (−36 to 0)	0.49 (−0.32 to 1.30)
Period 4	178 (173-184)	164 (158-170)	−8 (−12 to −3)	100 (90 to 110)	0.20 (−0.18 to 0.58)
Severe or fatal injuries					
Period 1	19 (17-20)	16 (15-17)	−14 (−25 to −3)	Not applicable	−0.41 (−1.21 to 0.40)
Period 2	18 (16-21)	16 (13-18)	−15 (−36 to 6)	−3 (−22 to 16)	−5.61 (−8.19 to −2.95)
Period 3	22 (20-24)	15 (13-16)	−34 (−47 to −21)	−7 (−28 to 14)	−0.27 (−1.43 to 0.90)
Period 4	27 (26-29)	28 (26-30)	4 (−6 to 13)	94 (75 to 113)	0.16 (−0.48 to 0.80)
Traffic volume[e]					
Period 1	686 (653-720)	758 (728-788)	10 (4 to 17)	Not applicable	0.27 (−0.05 to 0.59)
Period 2	789 (731-848)	667 (572-763)	−15 (−30 to 0)	−12 (−26 to 2)	−4.07 (−5.14 to −2.99)
Period 3	821 (791-851)	463 (438-488)	−44 (−48 to −39)	−31 (−47 to −15)	0.50 (0.28 to 0.72)
Period 4	833 (810-857)	673 (652-695)	−19 (−23 to −15)	45 (38 to 52)	0.27 (0.09 to 0.45)

[a] Between-year comparisons are adjusted to accommodate for the leap-year day in 2020. Period 1: January 1, 2020, through March 8, 2020, vs January 1, 2019, through March 9, 2019 (adjusting for the leap-year day in 2020). Period 2: March 9, 2020 (state-of-emergency declaration) through March 22, 2020, vs March 10, 2019, through March 23, 2019. Period 3: March 23, 2020 (stay-at-home order) through May 11, 2020, vs March 24, 2019, through May 12, 2019. Period 4: May 12, 2020 (retail reopening) through July 31, 2020, vs May 13, 2019, through August 1, 2019.

[b] Mean number of outcomes per day were calculated from raw totals.

[c] The 2-sample *t* test with unequal variance was used to calculate the difference between periods. Differences were scaled by the reference period's point estimate to determine percentage difference.

[d] Daily percent change was derived from interrupted time-series analysis using the slope of each period. Slope changes were estimated using Newey-West standard errors and daily interrupted time-series analyses with ordinary least-squares linear regression. All outcome variables were log transformed with a 7-day lag period. Models control for month, weekend vs weekday, weekly gasoline price, and monthly unemployment rate.

[e] Indicates daily traffic volume divided by 10 000.

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COMMENT & RESPONSE

Use of e-Cigarettes for Smoking Cessation

To the Editor The role of electronic cigarettes (e-cigarettes) in smoking cessation is unclear. We are concerned about the interpretation of the recent trial by Dr Eisenberg and colleagues,[1] which demonstrated an increased rate of smoking cessation that did not persist at 24 weeks. Although this study did not demonstrate harm from e-cigarettes, neither did it demonstrate harm from combustible cigarettes. It is discordant to tout the potential safety of e-cigarettes from examining short-term outcomes in small numbers while acknowledging that harms from combustible cigarettes often take decades to manifest and occur only in a fraction of smokers. More than 50 years elapsed between the mass marketing of cigarettes in the late 19th century and realization of their association with lung cancer in the 1940s. As late as 1960, only one-third of US physicians thought the link between cigarettes and cancer had been established.[2] The mass marketing of e-cigarettes, which have been available for only 15 years, parallels that seen in prior decades with combustible cigarettes. In addition, the unclear messaging from physicians about potential harms of e-cigarettes also seems to parallel that of combustible cigarettes.

Recommending e-cigarettes as a promising intervention for smoking cessation is therefore premature. As currently used, e-cigarettes impede smoking cessation, resulting in 28% lower odds of quitting.[3] Two possible explanations for the disparity between controlled studies and real-world results are volunteer bias, which occurs when participants who volunteer in a trial differ from the general public, and the Hawthorne effect, which occurs when the knowledge of being monitored alters participant behavior. Unlike varenicline or bupropion, e-cigarettes are freely available consumer products that require no monitoring from a physician. In comparison, nicotine patches became ineffective once they became available over the counter.[4]

It is frustrating that the success rate for curing tobacco abuse, a common and deadly habit, remains abysmally low. There is incontrovertible evidence demonstrating harms of e-cigarettes, and the risks are greater in the US, where regulation is limited.[5] Whether those harms are greater than conventional therapies is currently unknown, and in the absence of close monitoring, e-cigarette use does not appear to actually reduce smoking. Until e-cigarettes demonstrate greater efficacy as a smoking cessation aid, and until the long-term risks are ascertained, physicians should refrain from recommending them as smoking cessation aids and from speculating that they are free from harm.

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In Reply We agree with Dr Lanspa and colleagues that the role of e-cigarettes in smoking cessation is unclear. However, despite the surprising dearth of randomized clinical trials in this area,[1] many smokers have spontaneously turned to e-cigarettes as a potential method for quitting conventional cigarettes. Therefore, we believe that multiple studies in different settings are required to examine the efficacy and safety of e-cigarettes for smoking cessation. The adverse effects of smoking conventional cigarettes are well known.[2] Although the long-term effects of vaping e-cigarettes are unknown, most experts agree that, while their safety profile remains poorly understood, e-cigarettes are likely to be safer than conventional cigarettes.[3] In our article,[4] we acknowledge that the safety of e-cigarettes is an ongoing concern and recommend that, if adopted for smoking cessation, e-cigarettes should be used for a short period only.

Lanspa and colleagues also suggest that use of e-cigarettes may impede smoking cessation. However, several previous trials have suggested that e-cigarettes may be potentially useful for smoking cessation.[5] Our trial adds to the evidence base in this area, specifically whether short-term use of e-cigarettes for 12 weeks can lead to longer-term cessation of conventional cigarette smoking. Importantly, most participants in our trial had previously tried to quit multiple times, and most had used other smoking cessation therapies, including varenicline and bupropion. First-line smoking cessation therapies,