Since January 2020 Elsevier has created a COVID-19 resource centre with free information in English and Mandarin on the novel coronavirus COVID-19. The COVID-19 resource centre is hosted on Elsevier Connect, the company's public news and information website.

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Adolescent driving behavior before and during restrictions related to COVID-19

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ABSTRACT

Introduction: Understanding who heeds the driving-related COVID-19 restrictions is critical for assisting public health professionals improve response to this and future pandemic events. The purpose of the current study was to characterize driving behavior changes among adolescents as a function of COVID-19 restrictions. It was hypothesized that adolescent driving would be reduced by COVID-19 restrictions, especially for younger teens, non-minorities, females, non-working teens, and those with higher prosocial tendencies.

Methods: Participants were licensed drivers in "REACT," a longitudinal study of adolescent driving attention. Upon enrollment in REACT, drivers were required to be age 16 or 18, have been issued a driver's license within the last two weeks, and be fluent in written/spoken English. The current observational cohort study was of drivers reporting driving exposure between February 8 and April 22, 2020. Linear mixed-effects models estimated differences in driving changes between COVID-19 periods.

Results: Results indicated a decrease across pre-COVID-19 period (February 8 – March 13, 2020) in days driven per week and vehicle miles driven (VMD) was explained by the change of slope post-COVID-19 restrictions (March 14 – April 22, 2020). Post-COVID-19, driving days per week decreased by 37 % and VMD decreased by 35 %. This decrease was lower in ethnic minorities, older adolescents, and employed adolescents. Those with greater dire prosocial tendencies showed greater post-COVID-19 driving decline.

Discussion: Findings provide early evidence of COVID-19 restriction-related adolescent driving changes suggesting older, employed, minority teens and teens with lower prosocial tendencies are less likely to reduce driving behavior. These observations provide a foundation for more extensive studies of adolescent drivers during various driving and contact restrictions and inform future public health campaigns for social distancing.

1. Introduction

The coronavirus disease 2019 (COVID-19) has led to over 3 million cases and over one hundred thirty thousand deaths in the U.S. to date (Johns Hopkins University School of Medicine, 2020). As a novel virus with no known vaccine, cure, or treatment, the primary means of combatting COVID-19 has been flattening the curve (#flattenthecurve) through social distancing combined with local and state government restrictions to reduce inter-personal interaction. These restrictions were an effort to suppress drastic increases in COVID-19 cases that would overwhelm healthcare systems, but flattening the curve may prove to have unintended public health-related benefits and consequences stretching far wider than control of the virus. Common state or local restrictions were to shelter-in-place, drastically reduce non-essential travel (e.g., visits with friends), and closure of schools. Indeed, COVID-19 restrictions have had an unprecedented impact on driving across the U.S. Early reports suggest driving was reduced in March and April 2020 by as much as two-thirds of vehicle miles traveled, (Dutzik, 2020) although there are indications of a rebounding effect with personal travel increasing since April 2020 in some areas (Schuman, 2020).

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Understanding who is heeding the driving-related COVID-19 restrictions is critical for assisting public health professionals improve response to this and future pandemic events.

For adolescents, driving is a developmental milestone that fosters independence, improves quality of life, and promotes opportunities for employment and socialization (Shope, 2006). COVID-19 restrictions have limited or restricted driving in some of the most common contexts for teens: school (school closures instituted), work (non-essential businesses closed), and socialization (shelter-in-place orders enacted, social distancing practices encouraged). However, it is unknown how these measures have changed teen driving behavior. Certain subgroups of adolescents may be less likely to change their driving as a result of restrictions. Age may play a role with older adolescents who are under less parental authority driving more during COVID-19 restrictions compared to younger adolescents. Psychosocial factors may explain changes in driving behavior. For example, dire prosocial tendencies (i.e., the tendency to perform prosocial acts in emergency situations) could be related to reduced driving. Teens with these tendencies may believe that reducing driving is necessary to fulfill their societal obligations related to COVID-19 restrictions. Additionally, employed adolescents who work in the "essential" business sector (i.e., food services) may have continued working and, therefore, may not have changed their driving post-COVID-19 restrictions. According to the U.S. Bureau of Labor Statistics, blacks are overrepresented compared to the overall population in "essential" jobs such as the food service and hotel industry (Rolen and Toossi, 2018). Employed teens may view continuing to travel to and from their job in spite of restrictions as part of their continued personal responsibilities.

The objective of this paper was to characterize driving behavior change among a diverse sample of U.S. adolescents living in the Birmingham, Alabama metropolitan area as a function of COVID-19 restrictions. Given national patterns of reduced driving during COVID-19 restrictions, we posited the following hypotheses:

(1) General hypothesis: Adolescents would significantly reduce their driving, both the number of days driven per week and vehicle miles driven (VMD) per 2 weeks, pre- to post-COVID-19 restrictions. (2) Teen subgroup response: Older teens, minority youth, and males would reduce their driving to a lesser extent post-COVID-19 restrictions; and (3) Psychosocial factors: Adolescents with less prosocial tendencies or continued personal responsibilities (e.g., employment) would reduce their driving to a lesser extent than those with greater prosocial tendencies and no continued personal responsibilities.

2. Methods

2.1. Study design and sample

Participants were actively enrolled, licensed drivers in "REACT," a longitudinal study of adolescent driving attention. Drivers were required to be age 16 or 18 at the time of REACT enrollment, to have been issued a driver's license within two weeks of enrollment, and to be fluent in written and spoken English. From July 2018 through March 2020, participants were recruited from the following sources via fliers and letters describing the study: 1) local high schools; 2) community outreach events; and 3) targeted advertisements via media such as Facebook and radio. Interested participants were consented and screened for eligibility by a member of the study team.

Participants in REACT were enrolled for a total of 18 months and attended seven in-person visits (baseline with follow-ups every three months) during which they completed a series of performance-based measures of driving and neurocognition. Prior to each in-person visit, participants completed a battery of sociodemographic surveys. During the three-month gaps between in-person visits, participants completed brief online surveys assessing driving exposure on a biweekly basis. This study protocol was approved by a university's Institutional Review Board for Human Use.

2.2. Variables

Main outcome measures were days driven per week and vehicle miles driven in the past two weeks. *Days driven per week* was assessed through a single item "Last week, how many days out of 7 did you drive" with possible responses ranging from 0 to 7. *Vehicle Miles Driven* (VMD) *in the past two weeks* was assessed through an odometer report ("What is the current reading on the odometer of your vehicle in miles?") To confirm VMD were driven specifically by the participant, a follow-up question asked "Exactly how many of those miles did you drive?" Descriptive data regarding change in driving frequency ("In the past 2 weeks, has there been any change in your normal driving routine [more driving/less driving]") were assessed, as well as the underlying reason, if driving frequency had changed, via an open-ended response.

At enrollment, age (16 or 18), gender (male or female), race (White or Non-White), ethnicity (Hispanic or Non-Hispanic), and employment status (employed or unemployed) were reported, and the Prosocial Tendencies Measure was administered (Carlo and Randall, 2002). Of interest in this investigation was the *dire prosocial tendencies* subscale (PST-Dire) (3 items, Cronbach's alpha = .75), defined as helping behaviors during crisis or emergency situations. The items (e.g., "*I tend to help people who are in a real crisis or need*") were rated on a 5-point scale, where (1) represented "does not describe me at all" and (5) represented "describes me greatly." Higher scores indicated greater prosocial tendencies.

2.3. Statistical analysis

Analyses were restricted to two reporting periods: 1) *Pre-COVID-19*, a period prior to enactment of state or local restrictions in the state of Alabama, defined as the time period spanning February 8 to March 13, 2020 and 2) *Post-COVID-19*, a period during which there were state and/or local restrictions, defined as the time period spanning March 14 to April 22, 2020. March 13 was selected as the point of delineation because on that date the Governor of the state of Alabama declared a State of Emergency along with the state's first confirmed COVID-19 case. Restrictions became progressively more stringent over the *Post-COVID-19* period. On March 19, 2020 the Governor declared no gatherings of 25 persons or more (including funerals, weddings, reunions, etc.) or gatherings where 6 feet of social distancing could not be maintained. Beaches were closed and onsite food consumption at restaurants was no longer allowed. Preschools and childcare centers were also closed and elective medical and dental procedures were delayed. By April 3, 2020 a shelter-in-place order was enacted, requiring everyone to stay home except for essential activities and businesses had to take reasonable steps to avoid gatherings of 10 persons or more and to maintain safe social distancing of 6 feet. The health order remained in place through the end of the reporting period; however, no penalties were associated with violations.

Descriptive statistics were examined and outliers investigated and corrected. Bivariate associations among variables were tested with correlations. Main analyses included a series of multilevel models predicting the two outcome variables – days driven in the last week and VMD in the last two weeks. These multilevel models accounted for the dependent data structure, with time points (Level 1) nested within teens (Level 2). Level 1 models within-person change in driving while Level 2 models between-person differences in change in driving with predictors of individual growth parameters (intercepts, slopes). With the resulting random distribution of intercepts and slopes from the nesting of individual time points within each teen, the intercept and slope (time) were included as random effects where noted. For each outcome, the unconditional means model (i.e., a model with no predictors) was fit first to examine the overall intercept and amounts of between- and within-subject variance in the outcome variable with the intercept as a random effect. Then, the unconditional growth model was fit with time (measured in weeks) as the sole predictor and the intercept and time as

random effects. The next model added the effect of COVID-19 on the slope of driving with intercept, time, and time since COVID-19 as random effects. This COVID-19 effect estimated the average change in driving after the COVID-19 restrictions per week. The next model retained the same random effects and added demographic predictors of overall driving level (intercept) and change after COVID-19 – gender, ethnic minority, and age group at enrollment (18- vs. 16-year old). In the final model, any nonsignificant demographic effects from the previous model were removed and effects of having a job and PST-Dire were added. In addition to these fixed effects, each model also estimated the variance of random effects (intercept, time, and change after COVID). The following equations depict the model structure:

Time Points (Level 1):

$$Driving_{ij} = \pi_{0i} + \pi_{1i}*time + \pi_{2i}*COVIDtime + \varepsilon_{ij}$$

Teens (Level 2):

$$\pi_{0i} = \gamma_{00} + \gamma_{01}*Male + \gamma_{02}*Minority + \gamma_{03}*Age + \gamma_{04}*Job + \gamma_{05}*ProsDire + \zeta_0$$

$$\pi_{1i} = \gamma_{10} + \zeta_1$$

$$\pi_{2i} = \gamma_{20} + \gamma_{21}*Male + \gamma_{22}*Minority + \gamma_{23}*Age + \gamma_{24}*Job + \gamma_{25}*ProsDire + \zeta_2$$

3. Results

3.1. Study population

The sample included 58 teens who provided a total of 275 reports over 10 weeks (5.0 weeks before and 5.57 weeks after COVID restrictions implementation). Teens provided between 1 and 6 biweekly data points (M = 4.74, SD = 1.19). The outcome variable VMD in the last two weeks showed 19 outliers greater than 500. One value was changed to a lower, corrected value based on odometer readings, 11 were coded as missing due to VMD not corresponding to reported odometer readings or inconsistency with other VMD reports, and 7 were truncated to 500 to reduce the influence of outliers on the analysis. In the pre-COVID-19 reporting period, days driven in last week and VMD in the preceding 2 weeks were moderately positively correlated (r = .37, p = .005). More days driving in a week were reported by males, whites, and 16-year olds (vs. 18-year olds), but these groups did not differ on the miles driven in last 2 weeks. See Table 1 for descriptive statistics and correlations among variables included in analyses.

Following the State of Emergency declared for Alabama, 52 % (n = 28) of participants reported a change in their typical driving behaviors. Of those who reported a change in driving, 89 % (n = 25) reported the change resulted specifically in driving less with the remaining 11 % (n = 3) reporting driving more. Qualitative data for reasons in driving change were collected during COVID-19 restrictions. Responses for driving less mainly centered around COVID-19: "*Because of the Coronavirus pandemic; most places are closed; there is no reason for me to drive anywhere*," and "*Social distancing/stay at home order*." Responses for driving more cited taking a trip out of town and more flexibility in schedule enabling more time for work.

Individual trajectories of days and VMD by date are shown in Fig. 1 along with regional traffic volume sampled from 8 counting stations across the same region as participant recruitment for comparison; the overall smoothed loess curves show a significant decrease in both days and miles driven after the March 13 State of Emergency declaration in Alabama.

3.2. Main analyses

3.2.1. Driving behavior changes pre- to post-COVID-19 restrictions

The unconditional means multilevel models yielded intraclass correlation coefficients of 0.44 for days driven and 0.35 for VMD, indicating that 44 % of variance in days driven and 35 % of variance in miles was due to differences among teens versus variability within each teen over time. The between-subject and within-subject variances were significant in both models ($p < .001$), suggesting the presence of unexplained variability at both levels. The unconditional growth model showed an overall decrease in both days driven and VMD, as expected. This decrease was explained in the next model by the change of slope after COVID-19 restrictions (Tables 2 and 3). Specifically, teens reported driving on average 4.96 days a week and 150.44 miles per 2 weeks before the COVID-19 restrictions, but after the restrictions, driving decreased by 0.41 days and 21.52 miles per week, on average; a 37 % and 35 % decrease across the entire observation period, respectively.

3.2.2. Driving behavior changes by demographic factors

In the next model, demographic factors were related to both overall pre-COVID-19 driving and post-COVID-19 change. Males reported driving more days a week (but not more miles) than females pre-COVID-19, but there were no gender differences in post-COVID-19 driving changes. Ethnic minority youth reported driving fewer days a week (but not miles) than white youth pre-COVID-19 but had lower decrease in miles driven post-COVID-19. Older teens reported driving fewer days per week (but not miles) pre-COVID-19 than younger teens, but their driving days and miles decreased less compared to younger teens post-COVID-19 (Tables 2 and 3).

3.2.3. Driving behavior changes by psychosocial factors

In the final model, job status and PST-dire were added. Teens who had a job did not differ from those without a job in pre-COVID-19 driving, but their decrease in driving days was lower post-COVID. Those with higher PST-Dire scores drove more miles (but not days) pre-

Table 1
Descriptive Statistics and Correlations by COVID Time Period.

	Mean (SD) or n (%)	Range	Age	Gender	Minority	Job	PST Dire	Days	Miles
Age = 18[1]	20 (34 %)	16.71 – 19.40	–	−.13	.30*	.03	.00	−.45*	−.11
Male Gender	26 (45 %)		−.14	–	−.04	.14	−.02	.28*	.12
Minority Race	41 (71 %)		.33*	−.03	–	−.02	−.06	−.31*	−.18
Has Job	21 (36 %)		.01	.15	−.00	–	−.07	.27*	.01
PST-Dire	10.11 (2.72)	4.00 – 15.00	.01	−.02	−.06	−.06	–	.10	.20
Days Driven	4.86 (2.60)[a] 3.07 (2.73)[b]	0.00–7.00	−.02	.29*	−.08	.31*	−.21	–	.37*
Miles Driven	155.89 (147.11)[a] 100.88 (131.64)[b]	0.00 – 500	.05	.23	−.17	.16	−.10	.56*	–

Note: [1]Age at enrollment.
[a] averaged across pre-COVID restrictions.
[b] averaged across post-COVID restrictions. Coefficients above the diagonal represent Pre-COVID restrictions. Coefficients below the diagonal represent Post-COVID restrictions. Spearman's Rho presented for age = 18 at enrollment, gender, minority, and employment status.

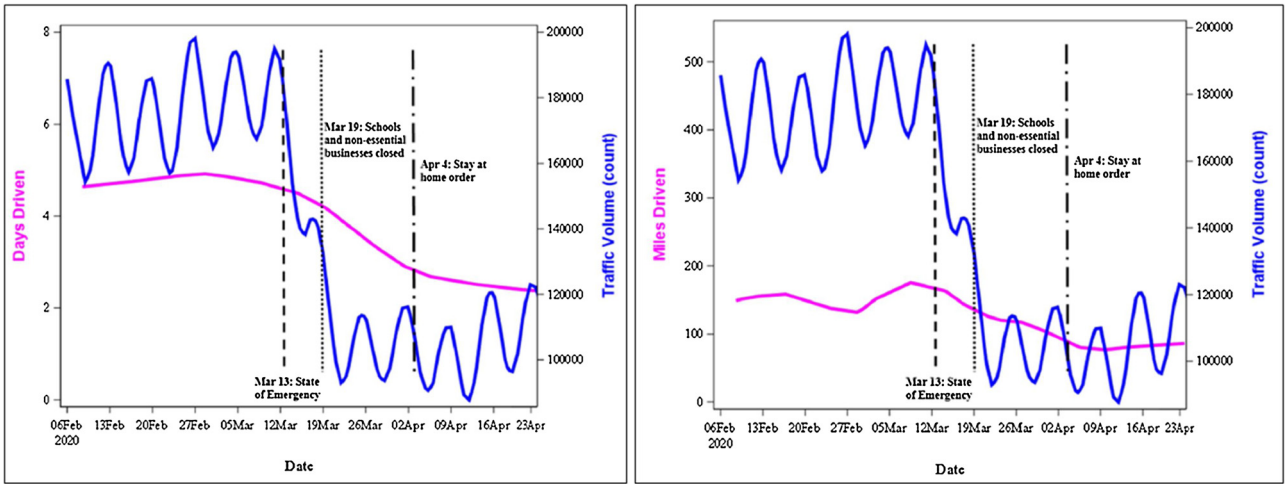

Fig. 1. Trajectories of days driven (left) and vehicle miles drive (right) by participants and regional traffic volume by date. Regional data represent traffic volumes on non-freeways in Greater Birmingham, Alabama monitored by continuous count stations.

Table 2
Multilevel Models Predicting Days Driven Per Week.

Fixed Effects		COVID-19	Demographic Predictors	Final Model
Initial Status	Intercept	4.96***	5.94***	5.82***
		(0.33)	(0.54)	(0.55)
	Male		1.48**	1.69**
			(0.51)	(0.50)
	Minority		−1.37*	−1.61**
			(0.59)	(0.57)
	18 vs 16 y old		−1.82**	−1.71**
			(0.56)	(0.54)
	Job			0.46
				(0.50)
	Prosocial Dire			0.10
				(0.09)
Slope before COVID-19	Intercept	−0.11	−0.10	−0.13
		(0.07)	(0.07)	(0.07)
Slope Change during COVID-19	Intercept	−0.41**	−0.80***	−0.73***
		(0.13)	(0.18)	(0.15)
	Male		−0.07	
			(0.15)	
	Minority		0.30	
			(0.17)	
	18 vs 16 y old		0.53**	0.63***
			(0.16)	(0.15)
	Job			0.31*
				(0.15)
	Prosocial Dire			−0.07*
				(0.03)
Variance Components				
Level 1	Within-person	1.82***	1.85***	1.75***
		(0.23)	(0.21)	(0.21)
Level 2	In initial status	5.00***	2.91***	2.55***
		(1.07)	(0.70)	(0.63)
	In rate of change	–	–	–
		–	–	–
	In change after COVID-19	0.27**	0.18**	0.16**
		(0.08)	(0.06)	(0.05)
Goodness of Fit				
	Deviance	1165.8	1126.9	1040.3
	AIC	1177.8	1150.9	1068.3
	BIC	1190.1	1175.6	1096.1

Note: * p < .05, ** p < .01, *** p < .001.

COVID-19 and showed greater decline in both days and miles driven post-COVID-19 restrictions (Tables 2 and 3).

4. Discussion

Given the unprecedented times with which we are faced due to the COVID-19 pandemic and its resulting restrictions (e.g., shelter-in-place orders) on naturally occurring face-to-face interactions for adolescents through school, work, and extracurricular activities, a dramatic decrease in teen driving was anticipated. Findings largely supported the first hypothesis, with number of driving days per week decreased by 37 % during COVID-19 restrictions and vehicle miles driven decreased 35 %. Findings lend support to adherence to social distancing among licensed teens and suggest local/state mandated restrictions led to significant reductions in teen driving quantity (miles driven) and frequency (days per week); similar to the pattern observed in vehicular traffic volume of the region. Although driving was not completely eliminated in the post-COVID-19 period, teens went from reporting an average of nearly five days of driving per week to three days under COVID-19 restrictions. The primary reasons teens drive is to go to school, work, or to engage in social or extracurricular activities. With educational facilities closed by government mandates and extracurricular activities cancelled, the reduction in driving seen in the post-COVID-19 period was expected.

Certain demographic groups differed in reduction of driving under COVID-19 restrictions. Supporting the second hypothesis, findings suggested that older teens, ethnic minorities, and employed teens reduced their driving to a lesser extent during COVID-19 restrictions. The role of parents/guardians was not examined but could have explained changes in driving under COVID-19 restrictions. For instance, younger teens are more likely to be under greater parental control and therefore forced to reduce driving more than older teens, whereas older teens are afforded more autonomy as they transition into emerging adulthood (Arnett, 2000). Additionally, some older teens in this study were in college and might have moved back in with parents after being forced out of university housing and may not have been under the same rules as when they were younger and living with parents/guardians. Further, families who were not practicing social distancing may have not limited their teens' driving or set examples of behavior modification under restrictions for their teens to follow. Future research regarding parental and familial influences on adherence to restrictions is warranted.

Some teens suggested that their normal driving routine changed in favor of driving more during COVID-19 restrictions due to more openness in their schedules (i.e., no more school) and the ability to work more. Although non-essential businesses closed in Alabama due to

Table 3
Multilevel Models Predicting Vehicle Miles Driven Per 2 Weeks.

Fixed Effects		COVID-19	Demographic Predictors	Final Model
Initial Status	Intercept	150.44***	188.23***	203.65***
		(16.12)	(28.76)	(29.39)
	Male		28.17	
			(27.45)	
	Minority		−54.45	
			(31.68)	
	18 vs 16 y old		−28.56	
			(30.11)	
	Job			13.15
				(28.20)
	Prosocial Dire			13.08*
				(5.05)
Slope before COVID-19	Intercept	3.05	2.72	1.59
		(4.82)	(4.77)	(5.18)
Slope Change during COVID-19	Intercept	−21.52**	−41.99***	−40.97**
		(7.87)	(9.79)	(10.63)
	Male		3.72	
			(7.84)	
	Minority		18.51*	15.96
			(8.73)	(9.27)
	18 vs 16 y old		17.10*	15.72
			(8.33)	(8.58)
	Job			12.26
				(8.31)
	Prosocial Dire			−3.87*
				(1.52)
Variance Components				
Level 1	Within-person	9765.12***	9911.86***	9881.27***
		(1229.68)	(1130.28)	(1219.84)
Level 2	In initial status	7597.29**	6216.03**	6051.78**
		(2210.31)	(1847.99)	1956.54
	In rate of change	64.43	66.50	70.92
		(76.20)	(44.26)	(66.26)
	In change after COVID-19	151.45	–	7.59
		(274.62)	–	(247.02)
Goodness of Fit				
	Deviance	3227.6	3212.7	3014.6
	AIC	3241.6	3236.7	3044.6
	BIC	3256.0	3261.4	3074.4

Note: * $p < .05$, ** $p < .01$, *** $p < .001$.

local and state restrictions on March 19, many teens are employed in sectors considered “essential” that remained open (e.g., food service, personal care, sales) (Bureau of Labor Statistics [BLS], 2019). Similarly, many Blacks are employed by businesses deemed essential (Khunti et al., 2020; van Dorn et al., 2020). Regardless of their “essential” status, teens may have been less likely to reduce their employment-related driving behavior because they felt a continued personal responsibility to provide for themselves and their family. Thus, less change in driving behavior among employed and minority youth was expected. Additionally, at-home opportunities for social and entertainment activities may differ between some groups (i.e., the digital divide) and contribute to less adherence to social distancing guidelines. It is important to note that different jurisdictions have vastly different recommendations or actual restrictions. Other states have shown reductions in traffic volumes of varying amounts. For example, California traffic volumes declined about 80 % in certain counties from early March to mid-April, (Shilling and Waetjen, 2020) while North Carolina and Virginia had about a 40 % and 50 % reduction, respectively (Transportation Research Board, 2020). These reductions could suggest that other states were reducing their driving more than in Alabama where the restrictions may have been more lax.

Findings suggested that teens who exhibited less dire prosocial behavior were more likely to continue driving during COVID-19 restrictions, supporting our third hypothesis. Research suggests that dire prosocial behavior is related to internalizing prosocial reasoning, as well as empathic qualities and concerns, suggesting that those focused on the concerns and well-being of others may avoid traveling outside of their home during emergency situations such as the COVID-19 outbreak. Those with greater prosocial tendencies may be more likely to help by adhering to regulations set in place to keep others safe (Eberly-Lewis and Coetzee, 2015).

Limitations of the current work include a modest sample size, although complemented by intensive longitudinal data collection, with 275 reports providing sufficient statistical power to detect differences in driving behavior. The findings are provisional and future work may provide additional evidence of COVID-19 related effects on teen driving behavior. Although the sample size was modest, it was diverse (71 % ethnic minority) and similar to the racial composition of the local area according to U.S. Census data enabling us to examine differences in driving behavior by this factor. The primary outcome measure was self-reported driving behavior (days per week driven) which could be biased (Langford et al., 2008); however, in an effort to provide objectivity, an odometer reading was requested at every time point. Driving exposure was measured every two weeks, which provided a level of specificity superior to any data currently available on this topic, but could be further enhanced through daily reports. Future naturalistic driving studies may provide a more fine-grained analysis of driving during COVID-19 restrictions, including where teens drove (e.g., interstate vs residential), under what conditions (e.g., following social distancing), and whether the trip was essential (e.g., grocery store). As previously noted, the generalizability of the study results may be limited to jurisdictions with similar COVID-19 mitigation efforts and restrictions. Other regions with more controlled lockdown restrictions may yield more driving reductions among adolescents.

One unexpected consequence of the COVID-19 restrictions could be increased risk of high-speed crashes, which are more likely to be severe and fatal (National Highway Traffic and Safety Administration [NHTSA], 2019), due to light traffic density with reduced overall vehicle travel during COVID-19 restrictions and propensity for risk taking (e.g., speeding behavior) common among adolescents. Future work is needed to understand crash risk and rates during COVID-19 restrictions in various geographic regions across the U.S. and worldwide, as many other countries also enacted restrictions on travel. Another unexpected consequence of COVID-19 restrictions could be under-prepared licensed drivers. Under current state and local restrictions, some jurisdictions have waived the on-road driver’s license test requirement because it breaks the 6 foot minimum distance between individuals rule (Cooke, 2020; Evans, 2020). Future work is also encouraged to consider changes in the licensure process as it affects teen driving behavior and risk.

COVID-19 restrictions are likely to have public health benefits and consequences that extend well beyond controlling the morbidity and mortality of the virus to reduce burden on the healthcare system. Findings provide early evidence of COVID-19 restriction-related adolescent driving changes suggesting older, employed, minority teens and teens with lower prosocial tendencies are less likely to reduce driving behavior. This information informs future pandemic response of clinicians and public health professionals, identifying groups who may need specially tailored, targeted social distancing messages given the importance of changes in travel activities in reducing the spread of the virus.

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This work has not been presented previously (either as a publication or abstract/poster).

CRediT authorship contribution statement

Despina Stavrinos: Conceptualization, Methodology, Validation, Investigation, Resources, Writing - original draft, Writing - review & editing, Data curation, Visualization, Supervision, Project administration, Funding acquisition. **Benjamin McManus:** Conceptualization, Methodology, Software, Validation, Formal analysis, Investigation, Data curation, Writing - original draft, Writing - review & editing, Visualization. **Sylvie Mrug:** Formal analysis, Writing - original draft, Writing - review & editing. **Harry He:** Resources, Writing - original draft, Writing - review & editing. **Bria Gresham:** Investigation, Writing - original draft, Writing - review & editing. **M. Grace Albright:** Investigation, Writing - original draft, Writing - review & editing. **Austin M. Svancara:** Investigation, Writing - original draft, Writing - review & editing. **Caroline Whittington:** Investigation, Writing - original draft, Writing - review & editing. **Andrea Underhill:** Writing - original draft, Writing - review & editing, Visualization. **David M. White:** Visualization, Writing - original draft, Writing - review & editing.

Declaration of Competing Interest

None.

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Appendix A. Supplementary data

Supplementary material related to this article can be found, in the online version, at doi:https://doi.org/10.1016/j.aap.2020.105686.

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