

## **Effect of Stay-at-Home Orders and Other COVID-Related Policies on Trauma Hospitalization Rates and Disparities in the United States: A Statewide Time-Series Analysis**

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1 **Abstract**

2

3 **Background:** To combat the coronavirus pandemic, states implemented several public health policies to reduce  
4 infection and transmission. Increasing evidence suggests that these prevention strategies also have had a profound  
5 impact on non-COVID healthcare utilization. The goal of this study was to determine the impact of a statewide  
6 Stay-at-Home and other COVID-related policies on trauma hospitalizations, stratified by race/ethnicity, age, and  
7 sex.

8 **Methods:** We used the North Carolina Trauma Registry, a statewide registry of trauma hospitalizations to 18  
9 hospitals across North Carolina, including all North Carolina trauma centers, to calculate weekly assault, self-  
10 inflicted, unintentional motor vehicle collision (MVC), and other unintentional injury hospitalization rates  
11 between January 1, 2019 and December 31, 2020. Interrupted time-series design and segmented linear regression  
12 were used to estimate changes in hospitalizations rates after several COVID-related executive orders, overall and  
13 stratified by race/ethnicity, age, and gender. Hospitalization rates were compared after 1) U.S. declaration of a  
14 public health emergency; 2) North Carolina statewide Stay-at-Home order; 3) Stay-at-Home order lifted with  
15 restrictions (Phase 2: Safer-at-Home); and 4) further lifting of restrictions (Phase 2.5: Safer-at-Home).

16 **Results.** There were 70,478 trauma hospitalizations in North Carolina from 2019-2020. In 2020, median age was  
17 53 years old and 59% were male. Assault hospitalization rates (per 1,000,000 NC residents) increased after the  
18 Stay-at-Home order, but only among Black/African American residents (incidence rate difference [IRD]=7.9;  
19 other racial/ethnic groups' IRDs ranged 0.9 to 1.7) and 18-44 year-old males (IRD=11.9; other sex/age groups'  
20 IRDs ranged -0.5 to 3.6). After major restrictions were lifted, assault rates returned to pre-COVID levels.  
21 Unintentional injury hospitalizations decreased after the public health emergency, especially among older adults,  
22 but returned to 2019 levels within several months.

23 **Conclusions:** Statewide Stay-at-Home orders put Black/African American residents at higher risk for assault  
24 hospitalizations, exacerbating pre-existing disparities. Fear of COVID-19 may have also led to decreases in  
25 unintentional non-MVC hospitalization rates, particularly among older adults. Policy makers must anticipate

26 possible negative effects and develop approaches for mitigating harms that may disproportionately affect already  
27 disadvantaged communities.

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29

30 **Keywords:** Stay-at-Home, trauma disparities, assault, motor vehicle collisions

## 1 **Introduction**

2 To combat the coronavirus pandemic, many countries implemented lockdowns and Stay-at-Home orders  
3 in 2020 to reduce transmission(1); in the United States, these policies were implemented on a state-by-state  
4 basis(2). While these orders had a relatively positive impact on reducing COVID-19 infections(1-3), increasing  
5 evidence suggests that these prevention strategies also have had a profound impact on non-COVID healthcare  
6 utilization. For instance, Stay-at-Home orders in the United States have been associated with decreases in  
7 emergency department (ED) visits(4, 5), trauma admissions(6, 7), and motor vehicle collisions (MVCs)(6, 8-10)  
8 as well as increases in suicide/suicidal attempts(6, 11-13), firearm injuries(6, 9, 14, 15), and domestic  
9 violence/child abuse(16-18).

10 Despite trauma patients having presumed equal access to healthcare and the highly protocolized nature of  
11 trauma management plans, racial and ethnic disparities in the United States were prevalent in traumatic injury  
12 prior to the COVID-19 pandemic(19, 20). Minority and low income individuals in the U.S. were also more likely  
13 to have public-facing occupations that required them to continue to work in person during the pandemic and Stay-  
14 at-Home orders(21, 22). Minority and low income individuals are also more likely to have crowded living  
15 conditions(22), which may place them at higher risk of domestic violence and other trauma during the pandemic.  
16 For these reasons and others, it is possible that Stay-at-Home orders and other COVID-related policies  
17 exacerbated known racial/ethnic disparities in trauma and non-COVID related hospitalizations. Gaining a better  
18 understanding of the burden and potential exacerbation of traumatic injury disparities in the United States during  
19 the pandemic is necessary to inform and appropriately address mitigation efforts and related policies.

20 Thus, the goal of this study was to assess changes in traumatic injury hospitalization rates during the first  
21 year of the pandemic in the U.S. and assess how Stay-at-Home orders or COVID-related policies were associated  
22 with these changes. We were also interested in assessing whether the potential impact of these policies were  
23 similar across race/ethnicity, age, and sex.

24

## 25 **Methods**

26 We used data from the North Carolina Trauma Registry (NCTR), a statewide registry and cooperative  
27 effort between eighteen North Carolina hospitals, including all 17 North Carolina trauma centers (6 Level I, 3  
28 Level II, and 8 Level III hospitals) and the North Carolina Office of Emergency Medical Services (NCOEMS)(23,  
29 24). This registry, which has been in place since 1987, collects near real-time information using standardized data  
30 definitions based off of the National Trauma Registry of the American College of Surgeons and designated NCTR  
31 chart abstractors(23, 24). The NCTR includes all hospitalizations where a patient is diagnosed with a traumatic  
32 injury (ICD-10-CM: S00-S99, T07, T14, T20-T28, T30-T32, T71, T79.A1-T79.A9), and is admitted to the  
33 hospital, taken to the operating room from the emergency department, transferred, or dies due to their injury.  
34 Unplanned readmissions within 30 days of the initial injury are also included.

35 For this study, we included all trauma hospitalizations that occurred between January 1, 2019 and  
36 December 31, 2020. To account for variation between weekday and weekend hospitalization rates, we calculated  
37 the weekly hospitalization rates for traumatic injuries per 1,000,000 North Carolina residents between January 6,  
38 2019, and December 26, 2020. Admissions that occurred during partial weeks (January 1-5, 2019 and December  
39 27-31, 2020) were excluded from modeling to avoid introducing bias due to underestimation (486 and 393  
40 hospitalizations, respectively; in 2019 there were an average of 682 [SD 61.9] trauma hospitalizations per week).  
41 North Carolina population counts for 2019 were obtained from the North Carolina Office of State Budget and  
42 Management(25) and were used for both 2019 and 2020 hospitalization rate calculations.

43 Trauma admissions were classified by injury intent and mechanism into four categories – assault, self-  
44 inflicted, unintentional MVC (including MVC-bicyclist and MVC-pedestrian injuries), and unintentional non-  
45 MVC – using the ICD-10-CM code framework from the National Center for Health Statistics and National Center  
46 for Injury Prevention and Control(26).

47 Data on race and ethnicity were used to categorize hospitalized patients as non-Hispanic Black/African  
48 American, Hispanic/Latino, non-Hispanic White, and non-Hispanic other race. Other race included American  
49 Indian (n=513 hospitalizations), Asian (n=596 hospitalizations), Pacific Islander (n=87 hospitalizations),  
50 multiracial (n=202 hospitalizations), and those who listed “other” race (n=1,048 hospitalizations). Race and

51 ethnicity were self-reported by the patient (or family member) if they were present and capable; otherwise, it was  
52 based on staff designation in the electronic medical record.

53

54 COVID-related policies of interest included: U.S. declaration of a public health emergency (1/31/2020),  
55 the North Carolina statewide Stay-at-Home order (3/30/2020), an initial lifting of the Stay-at-Home order with  
56 restrictions (Phase 2: Safer-at-Home, 5/22/2020), and the further lifting of Stay-at-Home restrictions (Phase 2.5:  
57 Safer-at-Home, 9/4/2020), Supplemental Table 1. Policies were assigned to the week of their effective date. Other  
58 statewide executive orders that were not included in analyses were North Carolina declaring a state of emergency,  
59 statewide closure of K-12 public schools, Phase 1 and Phase 3 of lifting the statewide Stay-at-Home orders, and  
60 the modified Stay-at-Home order issued before the 2020 holidays. These orders were not included in analyses  
61 because either the order made relatively small changes to existing orders (e.g., Phase 1 lifting of Stay-at-Home  
62 orders) or it occurred within several weeks of a prior order that we believed would be more salient (e.g., North  
63 Carolina declaring a state of emergency).

64 Differences in patient demographics and clinical characteristics among patients admitted for traumatic  
65 injuries between 2019 and 2020 were compared using standardized differences. An absolute difference  $>0.20$  was  
66 considered meaningful.

67 We conducted a natural experiment using an interrupted-time series design and segmented linear  
68 regression(27, 28). Using ordinary least squares, we conducted injury intent and mechanism-specific segmented  
69 linear regression models to estimate the trend in trauma hospitalization rates between each pair of interruptions.  
70 Our models did not include parameters for level changes (i.e., intercept changes) to focus our analysis on *a priori*-  
71 hypothesized gradual changes in injury hospitalization rates. To reduce error in our model, we used a transformed  
72 cosine periodic function to control for potential seasonal fluctuations in hospitalization rates(29). To account for  
73 autocorrelation over time, we used Durbin-Watson tests ( $\alpha=0.05$ ) to specify autoregressive parameters in our  
74 models for lags up to 60 weeks. Similar methods were used to estimate race/ethnicity-specific and age and sex-  
75 specific hospitalization rates. Due to low overall rates, race/ethnicity and age/sex-stratified models for self-  
76 inflicted injuries were not performed.

77 All analyses were performed using SAS version 9.4 (SAS Inc., Cary, North Carolina). This study was  
78 deemed exempt by the University of North Carolina (IRB# 20-2117) and National Institutes of Health (IRB#  
79 000330) Institutional Review Boards.

80

## 81 **Results**

82 Between 2019 and 2020, there were 70,478 trauma hospitalizations at participating sites (including all  
83 trauma centers); 43.6% (n=30,712) occurred after COVID-19 was declared a U.S. public health emergency. In  
84 2020, there were 354 confirmed and 5,543 suspected COVID-19 cases (16.9%) among hospitalized trauma  
85 patients. Demographics and clinical characteristics remained relatively consistent between 2019 and 2020, Table  
86 1. The most common types of trauma admissions by intent/mechanism and year were unintentional non-MVC  
87 (2019: 60.5%; 2020: 59.6%), followed by unintentional MVCs (2019: 29.0%; 2020: 28.8%), assaults (2019:  
88 9.3%; 2020: 10.4%), and then self-inflicted injuries (1.2% in both years). The majority of unintentional non-MVC  
89 hospitalizations between 2019 and 2020 were falls (n=32,092, 77.4%).

90 In 2019 the weekly hospitalization rates of intentional (assault and self-inflicted injuries) and  
91 unintentional (MVCs and non-MVCs) injuries were stable; however, substantial changes were seen early on in the  
92 pandemic, Figure 1 and Supplemental Table 2. After the statewide Stay-at-Home order was issued, the rate of  
93 assault hospitalizations increased from 5.8 to 8.0 assault hospitalizations per 1,000,000 North Carolina residents  
94 (incident rate difference [IRD]=2.2, incident rate ratio [IRR]=1.38) by the time restrictions began to be lifted with  
95 Phase 2: Safer-at-Home. Self-inflicted injury hospitalization rates also increased between these two executive  
96 orders from 0.5 to 0.9 hospitalizations per 1,000,000 (IRD=0.4, IRR=1.80). After Stay-at-Home orders were lifted  
97 and Safer-at-Home began, which reopened businesses with limited capacity, both overall assault and self-inflicted  
98 injury hospitalization rates returned to 2019 levels, Figure 1A.

99 Both unintentional MVCs and unintentional non-MVC injury hospitalization rates dropped after the U.S.  
100 declaration of a public health emergency, with the lowest estimated rates seen at the time Stay-at-Home order was  
101 issued (MVC: decreased from 18.6 to 13.3 per 1,000,000 [IRD=-5.3, IRR=0.72]; non-MVC: decreased from 38.6  
102 to 30.4 per 1,000,000 [IRD=-8.4, IRR=0.79]). Unintentional injury (MVC and non-MVC) hospitalization rates

103 began increasing after the Stay-at-Home orders were implemented, and by the end of 2020 MVC and non-MVC  
104 injury hospitalization rates had largely returned to 2019 levels, Figure 1B.

105

#### 106 *Disparities in assault hospitalization rates during COVID-19*

107 Prior to the COVID-19 pandemic, substantial racial/ethnic disparities were seen in North Carolina assault  
108 hospitalization rates; Black/African American North Carolina residents had over 5 times the rate of  
109 hospitalizations with assault injuries compared to White, Hispanic/Latino, and other race residents, Figure 2A.  
110 Between when the Stay-at-Home order was issued and when major restrictions were first lifted (Phase 2: Safer at  
111 Home), this disparity widened due to a sharp absolute increase in assault hospitalization rates among  
112 Black/African American North Carolina residents (from 16.7 to 24.6 per 1,000,000, [IRD=7.9, IRR=1.47]),  
113 Supplemental Table 2. Minimal changes were seen in assault hospitalization rates among Hispanic/Latino, White,  
114 and other race residents during this time (IRDs 0.9-1.8 per 100,000). By the beginning of Phase 2.5: Safer-at-  
115 Home assault hospitalization rates among Black/African Americans returned to 2019 levels.

116 Among both males and females, after Stay-at-Home orders were issued, increases in assault  
117 hospitalizations were largely observed among young adults (18-44 years old), with almost no changes seen in  
118 children or older adults ( $\geq 65$  years old), Figures 2B and 2C. Assault hospitalization rates among 18-44 year-old  
119 males were substantially higher compared to both females (all ages) and their other male counterparts. Among 18-  
120 44 year-old males, assault hospitalization rates increased from 18.4 to 30.3 hospitalizations per 1,000,000 males  
121 (IRD=11.9, IRR=1.65) between when the Stay-at-Home and Phase 2: Safer-at-Home orders were issued, Figure  
122 2C and Supplemental Table 3. After the Stay-at-Home order was lifted (Phase 2: Safer-at-Home), assault  
123 hospitalization rates dropped back to 2019 levels.

124

#### 125 *Disparities in unintentional MVC hospitalization rates during COVID-19*

126 Fewer disparities were seen in unintentional MVC hospitalization rates in North Carolina, Figure 3.  
127 Across all racial/ethnic and age/sex groups, the rates of unintentional MVC hospitalizations dropped after the U.S.  
128 declared a public health emergency (Figure 3A, Supplemental Table 2), but began to return to 2019 levels after a



129 few months. Black/African American residents experienced a more substantial spike in unintentional MVC  
130 hospitalizations compared to other racial/ethnic groups (average monthly increase of 8.27 hospitalizations per  
131 1,000,000 compared to 3.84-5.13 in other racial/ethnic groups) and did not fall back to 2019 rates until the end of  
132 2020.

133 The largest drop in unintentional MVC hospitalization rates was seen among older women ( $\geq 65$  years old,  
134 average monthly change -6.00 hospitalizations per 1,000,000 female residents) after the U.S. declared a public  
135 health emergency, although decreases were seen among all females (average monthly change -0.93 to -3.93),  
136 Figure 3B. Overall, unintentional MVC hospitalization rates returned to 2019 levels within a few months among  
137 all females. Among males, adults 18-44 years old experienced almost no decrease in unintentional MVC  
138 hospitalization rates after the US declared a public health emergency, yet still saw a large spike in hospitalization  
139 rates after the Stay-at-Home order was issued (average monthly change -0.42 and +7.41 per 1,000,000,  
140 respectively), Figure 3C. Unintentional MVC hospitalization rates remained elevated among 18-44 year-old males  
141 until then end of 2020. Among 45-64 year-old males, a substantial drop (average monthly change -4.49 per  
142 1,000,000) then rapid recovery to 2019 levels by the start of Phase 2: Safer-at-Home was seen.

143  
144 *Disparities in unintentional non-MVC hospitalization rates during COVID-19*

145 While White residents experienced higher hospitalization rates of non-MVC unintentional injuries prior to  
146 the COVID-19 pandemic (average 2019 rates: 47.5 per 1,000,000 White residents compared to 16.2-23.5  
147 hospitalizations per 1,000,000 Black/African American, Hispanic/Latino, and other race residents), similar  
148 changes in hospitalization rates were seen across all racial/ethnic groups, Figure 4A. Similar to unintentional  
149 MVC hospitalizations, unintentional non-MVC hospitalizations rates dropped after the U.S. declared a public  
150 health emergency and returned to 2019 levels by the time major restrictions were first lifted (Phase 2: Safer-at-  
151 Home) among all groups.

152 Both older females and males ( $\geq 65$  years old) experienced substantially higher rates of unintentional non-  
153 MVC hospitalizations (136.0 and 106.1 hospitalizations per 1,000,000 in 2019) compared to other age groups,  
154 Figures 4B and 4C. Among females 0-64 years-old, only modest declines were seen after the U.S. declared a

155 public health emergency (average monthly change -0.72 to -2.15) compared to older females (average monthly  
156 change -18.11); a similar trend was seen among males. Unintentional non-MVC hospitalization rates bounced  
157 back to 2019 levels for all age groups (female and male) by the time major restrictions were first lifted.

158

## 159 **Discussion**

160 In a statewide analysis of trauma hospitalizations, we found that the COVID-related policies were  
161 associated with changes in assault, self-inflicted, and unintentional injury hospitalization rates. When the  
162 statewide Stay-at-Home order was issued in North Carolina, assault hospitalization rates, primarily among  
163 Black/African American residents and adults aged 18-44, increased quickly but then dropped back to 2019 levels  
164 once restrictions had been lifted. After the U.S. declared a public health emergency, both unintentional MVC and  
165 non-MVC hospitalization rates decreased across most age groups, with the most substantial changes occurring in  
166 older adults. Interestingly, men aged 18-44 saw no declines in non-MVC injury hospitalizations after the  
167 declaration but still saw the same increase a few months later, with rates not falling to 2019 levels until the end of  
168 2020. To the best of our knowledge, this is the first in-depth assessment of changes and disparities in trauma  
169 hospitalizations due to a statewide Stay-at-Home order and other COVID-related policies in the United States  
170 across race/ethnicity, age, and sex during the pandemic.

171 Increases in assault hospitalization rates, particularly firearm injuries, during the North Carolina statewide  
172 Stay-at-Home orders during the COVID-19 pandemic have been observed in other states in the U.S.(14, 15, 30).  
173 In our analysis, we also found that intentional injury hospitalization rates only increased among Black/African  
174 American residents, and adults aged 18-44 years old. The disparate effect of Stay-at-Home orders among  
175 Black/African American residents, compared to other racial/ethnic groups, may be partially explained by the  
176 increased burden of COVID-related financial, mental, and emotional strain(21, 22) among a population also at  
177 higher risk for experiencing assault. The increased rate of assault hospitalizations among women aged 18-44  
178 indicate that statewide Stay-at-Home orders may have led to an increase in domestic violence, which was both a  
179 noted concern(31) and has been observed in other studies(17, 18). While we did not observe an increase in  
180 assaults among children, increases in child abuse have been observed in at least one U.S.-based study(16); it is

181 possible that we were unable to detect a change due to the low baseline rate of assault hospitalizations among this  
182 age group. Overall, both our findings and those of other studies suggest that Stay-at-Home orders and other  
183 COVID-related policies in the U.S., and potentially other countries, had unintended consequences and that these  
184 were felt more among racial/ethnic minorities, women, and children.

185 The temporary decreases we saw at the beginning of the pandemic in unintentional injury (MVC and non-  
186 MVC) hospitalizations have also been observed in other U.S. states(6-9) and globally(32). Even prior to Stay-at-  
187 Home orders in the U.S.(3), many people began teleworking in the early months of the COVID-19 pandemic(33,  
188 34), leading to fewer people commuting and fewer MVCs(8-10, 35), and likely fewer workplace injuries  
189 (unintentional non-MVCs). School closures, which occurred prior to the Stay-at-Home order in North Carolina,  
190 may have also led to decreased unintentional hospitalization rates early in the pandemic.

191 Interestingly, we observed no initial change in the unintentional MVC hospitalization rate among males  
192 18-44 years-old, which is different from the trends we observed in every other sex/age group and inconsistent  
193 with previously reported findings of both fewer cars on the road(33-35) and fewer MVCs(6, 8-10) overall during  
194 the first several months of the pandemic in the U.S.(2) and abroad(1). And while several subgroups in North  
195 Carolina saw increases in unintentional MVC hospitalizations after these initial decreases, most stopped once  
196 hospitalization rates returned to pre-pandemic levels; among Black/African American residents and men aged 18-  
197 44 years old, assault hospitalization rates rose above 2019 levels and did not return to baseline until the end of  
198 2020. Research is needed to identify potential behavior changes and policy effects that led to these prolonged  
199 increases in MVC hospitalizations among these individuals.

200 We also did not expect to see such substantial declines in unintentional non-MVC injury hospitalizations  
201 among older adults – the majority of which were fall-related – in the first few months of the pandemic. While one  
202 other U.S.-based study also stratified by age(6), they found no change in unintentional non-MVC hospitalizations  
203 among adults  $\geq 65$  years old. However, hospitals in NCTR have an older patient population, compared to that  
204 study (37.1% vs. 16.6%  $\geq 65$  years old in 2020), and we also assessed weekly rates and allowed trends to change  
205 across several COVID-related policies, instead of averaging across the entire COVID-period, which may explain  
206 the differences in our findings. This rapid decrease in non-MVC hospitalization rates in North Carolina suggest

207 that older adults may have been avoiding seeking care at a hospital during the pandemic due to fear of COVID-19  
208 infection(36). Declines in acute myocardial infarction and stroke hospitalizations (overall and among older adults)  
209 during the first few months of the COVID-19 pandemic, illnesses which should have not been impacted by the  
210 pandemic or Stay-at-Home orders, have also been reported in the United States(37, 38) and Europe(39, 40),  
211 further suggesting that people have avoided going to the hospital for necessary medical care. Policies and  
212 messaging are needed to ensure individuals seek needed urgent care for trauma during outbreaks and pandemics  
213 to avoid possible long-term, detrimental effects.

214 This study has a few limitations. First, the NCTR only includes individuals hospitalized for a traumatic  
215 injuries and therefore only captured a proportion of all traumatic injuries; individuals who were treated in an  
216 emergency department (but never admitted) or did not seek care at all would be missed. Given the known  
217 disparities in access to care(41) and trauma(19, 20) in the U.S., it is likely that we have underestimated the burden  
218 of serious traumatic injuries among racial/ethnic minorities. Similarly, only individuals who survived their initial  
219 injuries would be sent to a hospital for treatment and could also lead to unequal underestimation; however, we  
220 compared trauma rates within racial/ethnic and age/sex groups, which would minimize the effect of  
221 underestimation. Third, outside of the COVID-19 pandemic and related policies, there were several, co-occurring  
222 nationally recognized events that could also potentially have impacted trauma hospitalization rates. Thus, our  
223 results should be interpreted with some caution. Finally, self-inflicted injury hospitalization rates were too rare to  
224 conduct stratified analyses; future studies should utilize databases that capture both emergency department visits  
225 and deaths to elucidate concerns regarding self-inflicted injuries and suicide during COVID-19.

226

## 227 **Conclusions**

228 Overall, it appears the Stay-at-Home orders implemented during the COVID-19 pandemic has had  
229 unintended consequences that disproportionately impacted racial/ethnic minorities and other marginalized groups  
230 in North Carolina, and potentially the United States. Fear of COVID-19 may have also led to decreases in  
231 unintentional non-MVC hospitalization rates, particularly among older adults, which may have long-term  
232 consequences. Given the potential far-reaching adverse impacts of national and statewide policies on racial/ethnic

233 minorities and other high-risk groups, it is crucial for policy makers to anticipate possible negative effects and  
234 develop tailored, culturally appropriate approaches to mitigate harms that may disproportionately affect already  
235 disadvantaged communities.

236

### 237 **List of abbreviations**

238 ED: emergency department

239 MVC: Motor vehicle collision

240 NCTR: North Carolina Trauma Registry

241 NCOEMS: North Carolina Office of Emergency Medical Services

242 U.S.: United States

243 SD: standard deviation

244 IRD: Incident rate difference

245 IRR: incident rate ratio

246

### 247 **Declarations**

248

249 **Ethics approval and consent to participate:** This study was deemed exempt by Institutional Review Board  
250 review (IRB protocols: 20-2117 and 000330).

251

252 **Consent for publication:** Not applicable.

253

254 **Availability of data and material:** Data is available for request from the North Carolina Office of Emergency  
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256 access.

257

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259

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265  
266 **Author's contributions:** Paula Strassle, Alan Kinlaw, and Sharon Schiro designed the study. Paula Strassle  
267 analyzed the data. Paula Strassle and Jamie Ko wrote the first draft. All of the authors critically reviewed and  
268 approved the final manuscript.

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272

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367 **Table 1.** Demographics and clinical characteristics of trauma hospitalizations captured in the North Carolina  
 368 Trauma Registry between 2019 and 2020, stratified by year.

	<b>2019</b>	<b>2020</b>	<b>SD<sup>a</sup></b>
	N (%)	N (%)	
<b>Total, N</b>	35,616	34,862	-
<b>Age, years, med (IQR)</b>	54 (28, 74)	53 (29, 74)	0.01
<b>Age group, n (%)</b>			
0-17	3,898 (10.9)	3,468 (9.9)	0.03
18-44	10,659 (29.9)	11,061 (31.7)	0.04
45-64	7,618 (21.4)	7,413 (21.3)	0.00
≥65	13,441 (37.7)	12,920 (37.1)	0.01
<b>Male, n (%)</b>	20,474 (57.5)	20,569 (59.0)	0.03
<b>Race/ethnicity, n (%)</b>			
American Indian	234 (0.7)	279 (0.8)	0.02
Asian	332 (0.9)	264 (0.8)	0.02
Black/African American	7,516 (21.3)	7,888 (22.9)	0.04
Hispanic/Latino	2,005 (5.7)	2,062 (6.0)	0.01
White	24,497 (69.6)	23,352 (67.7)	0.04
Other <sup>b</sup>	526 (1.5)	522 (1.5)	0.00
Multiracial	94 (0.3)	108 (0.3)	0.00
Missing	412	387	-
<b>Primary payer, n (%)</b>			
Any private insurance	10,862 (30.5)	9,954 (28.6)	0.04
Medicare/Medicaid only	16,010 (45.0)	15,785 (45.4)	0.01
Self-pay	5,629 (15.8)	5,981 (17.2)	0.04
Other <sup>c</sup>	3,061 (8.6)	3,066 (8.8)	0.01
<b>Transferred to center, n (%)</b>	10,578 (31.2)	9,323 (29.7)	0.03
<b>ISS, med (IQR)</b>	9 (4, 11)	9 (4, 13)	0.03
<b>Mechanism, n (%)</b>			
Assault	3,253 (9.3)	3,565 (10.4)	0.04
Self-inflicted	434 (1.2)	413 (1.2)	0.00
Unintentional	31,223 (89.4)	30,168 (88.4)	0.03
MVC <sup>d</sup>	10,116 (29.0)	9,817 (28.8)	0.01
Non-MVC	21,107 (60.5)	20,351 (59.6)	0.02
Undetermined	706	716	-
<b>ED LOS, hours, med (IQR)</b>	4.5 (2.8, 6.8)	4.6 (2.8, 7.2)	0.09
<b>LOS, days, med (IQR)</b>	3 (1, 6)	3 (1, 6)	0.03
<b>ICU LOS<sup>e</sup>, days, med (IQR)</b>	2 (1, 4)	2 (0, 4)	0.01
<b>Discharge disposition, n (%)</b>			
Routine/home	22,902 (65.6)	23,324 (68.7)	0.06
Longterm care <sup>f</sup>	8,865 (25.4)	7,488 (22.0)	0.00
Transferred <sup>g</sup>	1,878 (5.4)	1,815 (5.3)	0.08
Died	1,260 (3.6)	1,345 (4.0)	0.02
Missing <sup>h</sup>	711	890	-
<b>COVID-19 infection, n (%)</b>			
Confirmed	N/A	354 (1.0)	-
Suspected	N/A	5,543 (15.9)	-

Abbreviations: SD, standardized difference; med, median; IQR, interquartile range; ISS, injury severity score; MVC, motor-vehicle collisions; ED,

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emergency department; LOS, length of stay; ICU, intensive care unit

<sup>a</sup> Absolute standardized difference (SD) comparing demographics and clinical characteristics between 2019 and 2020; an SD >0.20 was considered meaningfully different

<sup>b</sup> Other race includes Other race and Hawaiian/Pacific Islander; race was collapsed due to small cell sizes

<sup>c</sup> Other insurance types include worker's compensation, other government insurance, Champus, and not billed

<sup>d</sup> Include all MVC-related (e.g., MVC-bicyclist, MVC-pedestrian), motorcyclist, and other transport accidents

<sup>e</sup> Among those admitted to ICU (n=20,827)

<sup>f</sup> Long-term care includes: hospice, long-term care facility, nursing home, rehabilitation facility, skilled nursing facility (SNF)

<sup>g</sup> Transfers to: acute care facilities, burn center, mental health facility, other trauma center, and transferred (unspecified)

<sup>h</sup> Includes individuals who left against medical advice (n=559)

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## Figure legends.

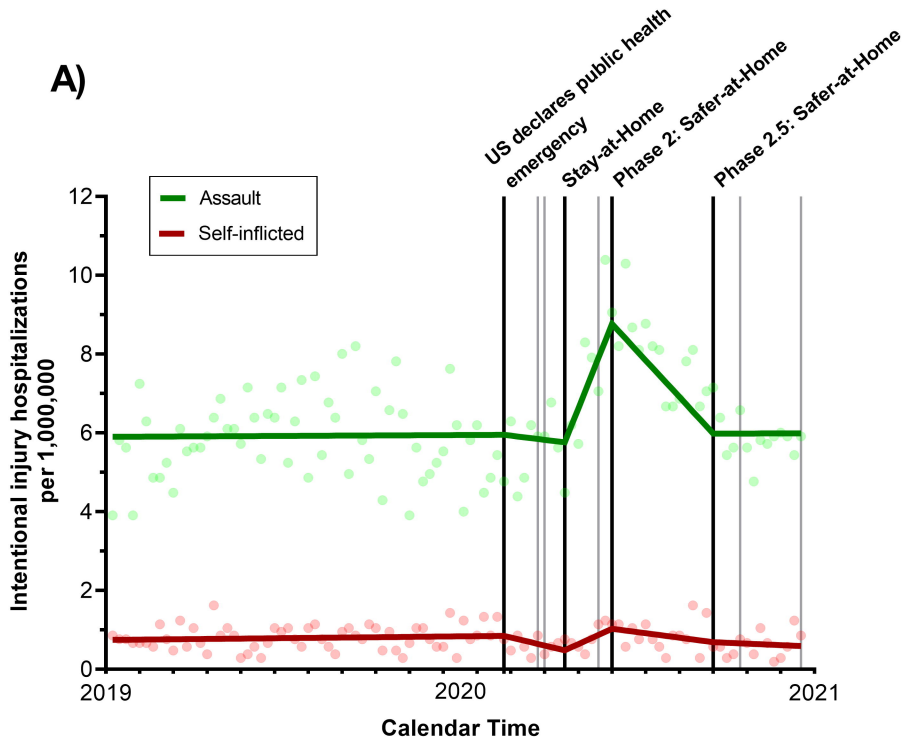
**Figure 1.** Overall impact of COVID-19 executive orders on weekly number of trauma admissions to trauma centers for A) intentional and B) unintentional injuries between January 2019 and December 2020 in North Carolina. The black lines represent the timing of the four executive orders assessed in the analyses (US declares public health emergency, North Carolina statewide Stay-at-Home order, statewide Phase 2: Safer-at-Home order, and statewide Phase 2.5: Safer-at-Home order); grey lines represent the time of the other COVID-related executive orders.

**Figure 2.** Impact of COVID-19 executive orders on weekly number of assault admissions to trauma centers between January 2019 and December 2020 in North Carolina, stratified by A) race/ethnicity, B) age group among females, and C) age group among males. The black lines represent the timing of the four executive orders assessed in the analyses (US declares public health emergency, North Carolina statewide Stay-at-Home order, statewide Phase 2: Safer-at-Home order, and statewide Phase 2.5: Safer-at-Home order); grey lines represent the time of the other COVID-related executive orders.

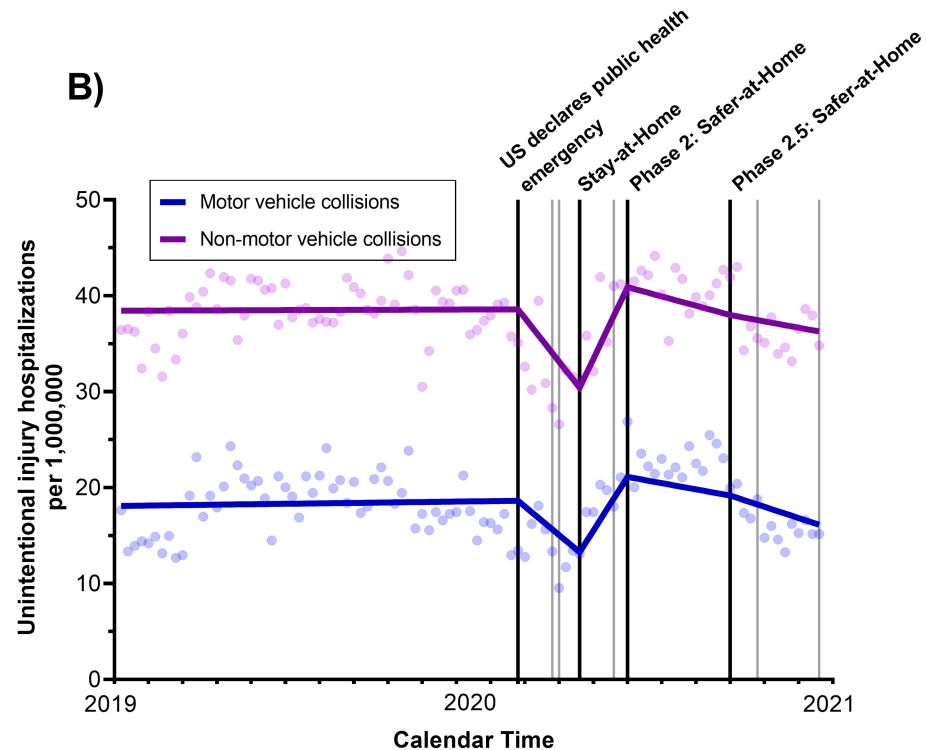
**Figure 3.** Impact of COVID-19 executive orders on weekly number of unintentional MVC admissions to trauma centers between January 2019 and December 2020 in North Carolina, stratified by A) race/ethnicity, B) age group among females, and C) age group among males. The black lines represent the timing of the four executive orders assessed in the analyses (US declares public health emergency, North Carolina statewide Stay-at-Home order, statewide Phase 2: Safer-at-Home order, and statewide Phase 2.5: Safer-at-Home order); grey lines represent the time of the other COVID-related executive orders.

**Figure 4.** Impact of COVID-19 executive orders on weekly number of unintentional non-MVC admissions to trauma centers between January 2019 and December 2020 in North Carolina, stratified by A) race/ethnicity, B) age group among females, and C) age group among males. The black lines represent the timing of the four executive orders assessed in the analyses (US declares public health emergency, North Carolina statewide Stay-at-

Home order, statewide Phase 2: Safer-at-Home order, and statewide Phase 2.5: Safer-at-Home order); grey lines represent the time of the other COVID-related executive orders.

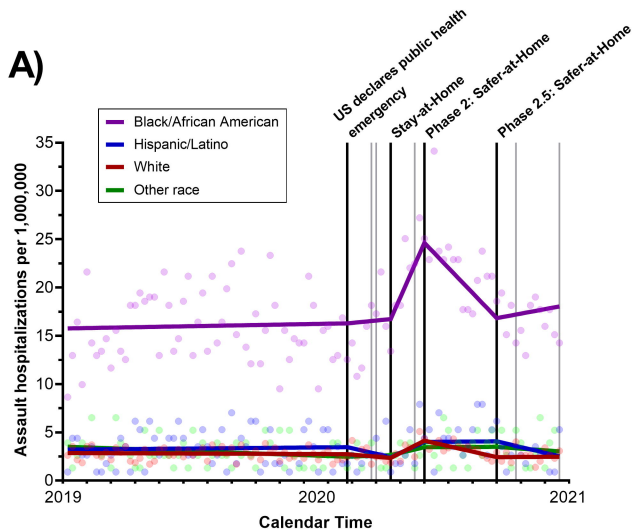


	2019	Average change in monthly hospitalization rates after...			
		US declares public health emergency	Stay-at-home	Phase 2 (Safer-at-home)	Phase 2.5 (Safer-at-home)
Assault	+0.00	-0.09	+1.87	-0.81	+0.00
Self-inflicted	+0.01	-0.18	+0.34	-0.81	-0.03



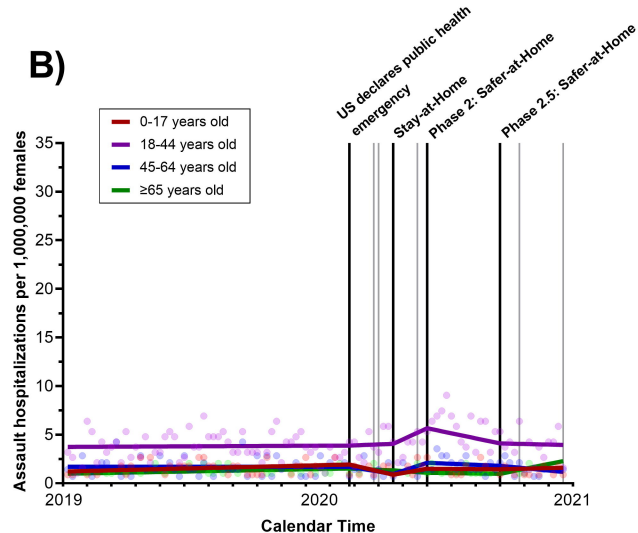
	2019	Average change in monthly hospitalization rates after...			
		US declares public health emergency	Stay-at-home	Phase 2 (Safer-at-home)	Phase 2.5 (Safer-at-home)
MVC	+0.04	-2.59	+4.87	-0.56	-1.02
non-MVC	+0.01	-3.95	+6.52	-0.84	-0.57

A)



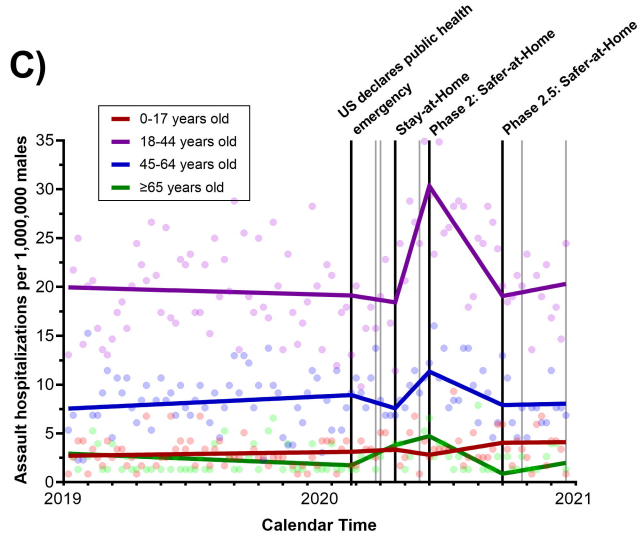
	Average change in monthly hospitalization rates after...				
	2019	US declares public health emergency	Stay-at-home	Phase 2 (Safer-at-home)	Phase 2.5 (Safer-at-home)
Black/African American	+0.04	+0.21	+4.91	-2.28	+0.41
Hispanic/Latino	+0.02	-0.50	+0.97	+0.02	-0.52
White	-0.01	-0.19	+1.11	-0.49	+0.01
Other race	-0.06	+0.07	+0.52	+0.01	-0.16

B)



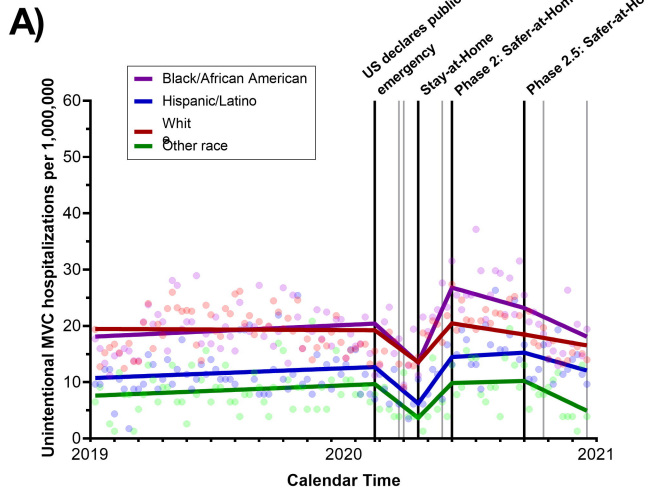
	Average change in monthly hospitalization rates after...				
	2019	US declares public health emergency	Stay-at-home	Phase 2 (Safer-at-home)	Phase 2.5 (Safer-at-home)
0-17	+0.05	-0.51	+0.38	-0.01	+0.05
18-44	+0.01	+0.09	+1.00	-0.45	-0.05
45-64	+0.00	-0.36	+0.72	-0.09	-0.21
≥65	+0.04	-0.09	-0.15	-0.03	+0.44

C)

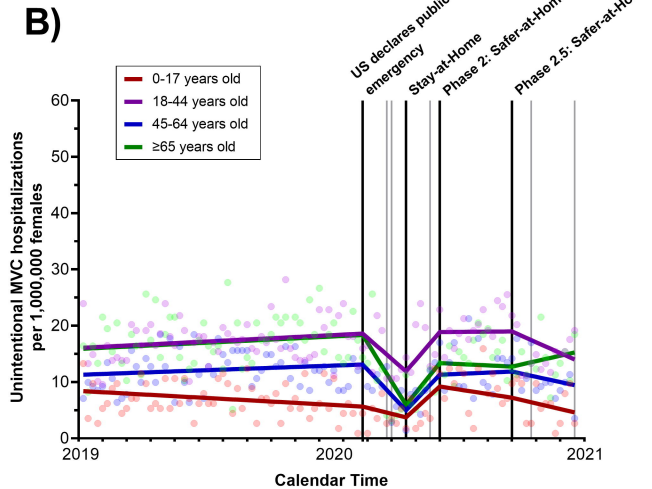


	Average change in monthly hospitalization rates after...				
	2019	US declares public health emergency	Stay-at-home	Phase 2 (Safer-at-home)	Phase 2.5 (Safer-at-home)
0-17	+0.03	+0.11	-0.33	+0.36	+0.02
18-44	-0.06	-0.34	+7.40	-3.27	+0.41
45-64	+0.10	-0.66	+2.34	-1.00	+0.05
≥65	-0.09	+1.00	+0.56	-1.11	+0.37

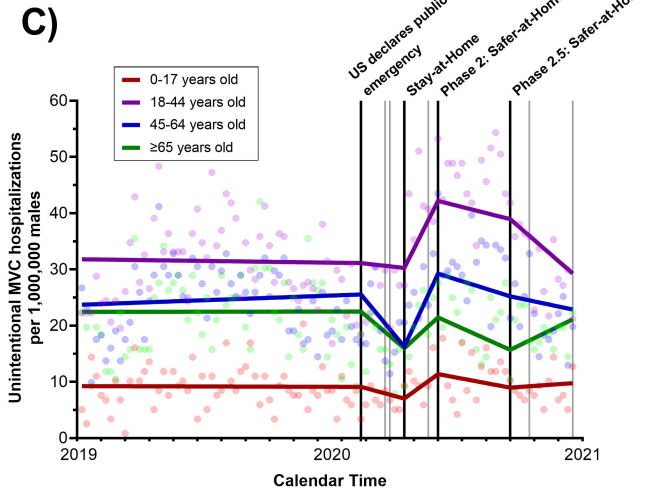




	Average change in monthly hospitalization rates after...				
	2019	US declares public health emergency	Stay-at-home	Phase 2 (Safer-at-home)	Phase 2.5 (Safer-at-home)
Black/African American	+0.17	-3.34	+8.27	-1.05	-1.70
Hispanic/Latino	+0.14	-3.12	+5.13	+0.22	-1.06
White	-0.02	-2.75	+4.29	-0.57	-0.64
Other race	+0.15	-2.90	+3.84	+0.11	-1.78

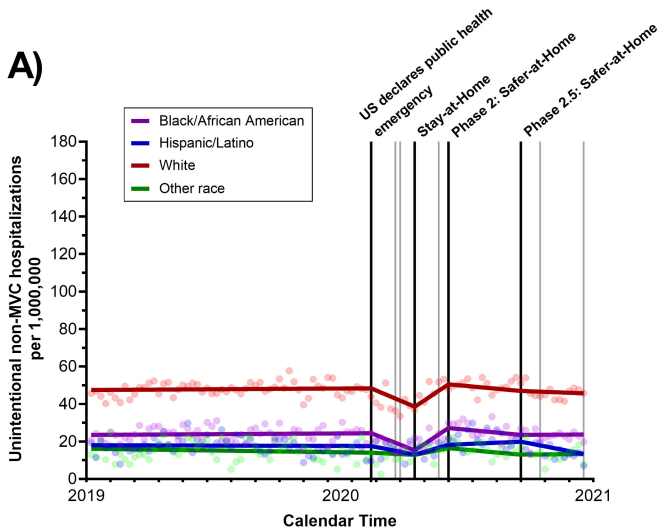


	Average change in monthly hospitalization rates after...				
	2019	US declares public health emergency	Stay-at-home	Phase 2 (Safer-at-home)	Phase 2.5 (Safer-at-home)
0-17	-0.20	-0.93	+3.40	-0.58	-0.88
18-44	+0.19	-3.24	+4.34	+0.03	-1.66
45-64	+0.14	-3.93	+3.93	+0.16	-0.81
≥65	+0.18	-6.00	+4.61	-0.18	+0.83



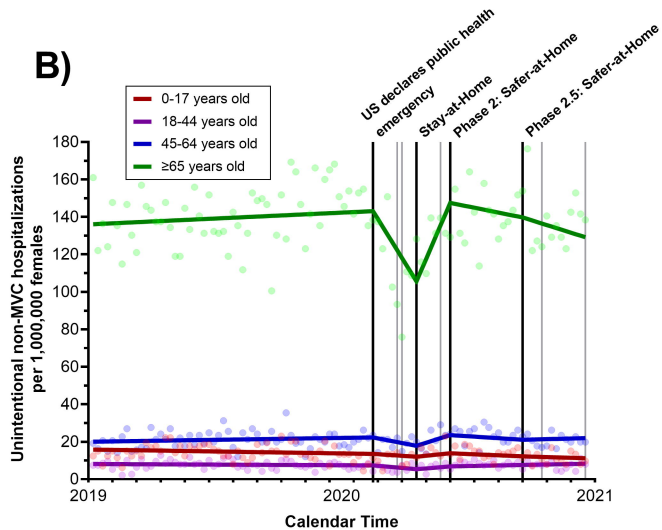
	Average change in monthly hospitalization rates after...				
	2019	US declares public health emergency	Stay-at-home	Phase 2 (Safer-at-home)	Phase 2.5 (Safer-at-home)
0-17	-0.01	-1.00	+2.70	-0.70	+0.26
18-44	-0.05	-0.42	+7.41	-0.94	-3.23
45-64	+0.14	-4.49	+8.06	-1.17	-0.79
≥65	+0.00	-3.15	+3.40	-1.67	+1.81

A)



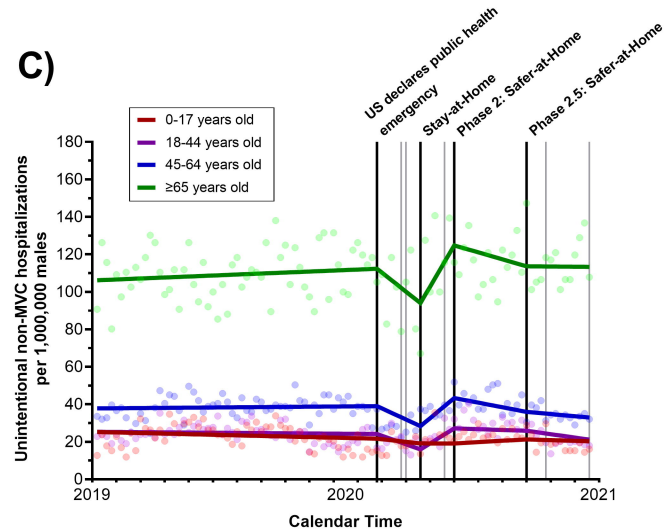
	Average change in monthly hospitalization rates after...				
	2019	US declares public health emergency	Stay-at-home	Phase 2 (Safer-at-home)	Phase 2.5 (Safer-at-home)
Black/African American	+0.07	-4.43	+7.43	-1.07	+0.07
Hispanic/Latino	-0.03	-2.22	+3.26	+0.48	-2.17
White	+0.07	-4.76	+7.45	-1.03	-0.42
Other race	-0.16	-0.55	+2.19	-0.99	+0.10

B)



	Average change in monthly hospitalization rates after...				
	2019	US declares public health emergency	Stay-at-home	Phase 2 (Safer-at-home)	Phase 2.5 (Safer-at-home)
0-17	-0.17	-0.72	+1.13	-0.47	-0.34
18-44	-0.06	-0.99	+0.95	+0.22	+0.21
45-64	+0.17	-2.15	+3.55	-0.72	+0.28
≥65	+0.52	-18.11	+26.02	-2.25	-3.53

C)



	Average change in monthly hospitalization rates after...				
	2019	US declares public health emergency	Stay-at-home	Phase 2 (Safer-at-home)	Phase 2.5 (Safer-at-home)
0-17	-0.27	-1.21	-0.03	+0.64	-0.35
18-44	-0.09	-3.97	+6.99	-0.38	-1.57
45-64	+0.09	-5.16	+9.32	-2.14	-1.00
≥65	+0.46	-8.84	+19.11	-3.23	-0.10