COVID-19 and HICH SCHOOL TRACK PERFORMANCE

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Abstract

Throughout the COVID-19 pandemic, U.S. High School students saw significant limitations to the access they had to public school facilities. This impacted many aspects of students' lives including school performance, mental health, extracurricular activity involvement, and so forth. High School athletics were severely impacted throughout 2020 and 2021 through limited practice schedules and training period, limited facility access, and shortened or cancelled competition seasons. This paper explores the effect of CDC stay at home orders through 2020-2021 and the effect it had on High School Track performances in track race events. It further explores the effect of limited facility access on event and income strata to explore differential effects on distance vs. sprint athletes and grouped socioeconomic level areas in the US. Data used for this study was collected from publicly posted high school race times, CDC data of stay-at-home orders throughout the treatment period, and income and poverty data from the American Community Survey by the U.S. Census Bureau.

Keywords: COVID-19, High School, Track and Field, Income, Poverty

Training and Performance

Running events vary from the 100 to 3200-meter distances in the US for high schools. Generally, these distances are grouped in athlete categories; Sprinters (100 – 400 meters) and distance runners; (800-3200 meters). Both of these group's race and train at track facilities, yet differ in their consistent reliance on facilities usage such as track, weight room, and indoor school facilities to reach competitive fitness. Due to the aerobic training focus for distance runners, they spend much of their time in surrounding neighborhoods to meet their training requirements. On the other hand, sprinters do most of their training in school weight rooms, school grass/ turf fields, on track surfaces with equipment such as starting blocks. Due to the difference in facility usage, we would expect sprint athletes to be more heavily affected than distance runners during times of school lock downs during the COVID-19 pandemic.

Given the context of training differences, the 400 meter and 800 meters, though generally approached through different training methodologies, are very similar in their physiological demand on the athlete during performance specifically in male athletes. (Duffield) In this study we use these two events to represent sprint and distance training groups but can use them as comparative groups due to their physiological demand similarities.

CDC Stay-at-Home Orders

Starting in March of 2020, the CDC gave stay-at-home orders to most, if not all, geographical areas due to the spread of the COVID-19 virus, hospitalization rates, and other key data characteristics. School districts, local and state governments used these recommendations to inform decision making on stay-at-home orders and local infection control policies. Throughout the pandemic, the CDC gave stay-at-home recommendations/ orders that ranged from "Advisory" to "Mandatory for All Individuals in Jurisdiction" and rated them from 1 to 7, 1 being the most

severe restrictions. In this study, we inverse this rating system and for our purposes, 1 will mean the most conservative, and 7 to be the most severe.

Socioeconomic Status

Resource and facility availability through the high schools depended on the spread of COVID-19 as well as the current public policy form the federal, state, and local governmental restriction. However, we assume that if a student is in a higher socioeconomic area than they would have a higher probability of having access to private facilities that they could substitute away from public school facilities to train. Furthermore, this would also contribute to the participation in club teams/ leagues where they could receive private coaching, as well as opportunities to train, compete and perform.

Furthermore, lower socioeconomic areas rely more heavily on school lunches for nutritional fueling which directly relates to athletic performance. Those with higher income, would also have better at-home nutrition and therefore we would predict to perform on average better than their counterparts. We control for this with using year income data from the Census Bureau.

Data

High School track race data for boys 400- and 800-meter distances from 2017 – 2022 were collected from publicly available data repositories. CDC stay-at-home order data was collected from the CDC. Income and Poverty Data was collected from the American Community Survey (ACS) by geographical area. Panel data was constructed from race time averaged by school, year, and event. An averaged scoring system was constructed form the CDC stay at home orders throughout the training timeline from March 1, 2020 – June 30, 2020. This was used as a continues treatment variable by zip code. Median Household Income and Percent Poverty of households with

children under 18 data was then averaged over zip code and matched to race metrics and CDC treatment variables to adequately control for income effects in regression analysis.

Identification Strategy

A difference-in-difference strategy was employed over two event groups. All measures are averaged over counties controlling for poverty level, state fixed effects, and time trends.

Model

$$400\ \text{avg time}_{it} = \beta_0 + \beta_1 Stay\_Home_i + \beta_2 Period_t + \beta_3 Stay\_home_i * Period_t + \beta_4 \text{Percent Under Poverty}_{it} + \theta X_s + \gamma Z_t + \mu_{it}$$

$$800\ \text{avg time}_{it} = \beta_0 + \beta_1 Stay\_Home_i + \beta_2 Period_t + \beta_3 Stay\_home_i * Period_t + \beta_4 \text{Percent Under Poverty}_{it} + \theta X_s + \gamma Z_t + \mu_{it}$$

*X is a vector of state fixed effects controlling for state specific effects

*Z is a vector of year fixed effects controlling for time trends

Results

From 2017 to 2022, both boys 400-metre and 800-metre races have progressively slowed down on average nationally. A significant change in this trend is seen in 2020 for both events. (Figure 1 & 2). This trend seemed to renormalize in 2021 and continue in 2022. It is peculiar that the 2022 averages were very close to the 2020, although they follow the general time trend from 2017 onward.

Analyzing the effect that COVID stay at home order intensity had, there was a significant change in season-best-times on average for counties with a higher stay-at-home order score. For every unit of stay-at-home intensity in 2020, season bests in the 800m slowed down by an average of .49 seconds and for the 400, .17 seconds. (Tables 1,2,3,4). As the main purpose of this paper, this shows that there is strong evidence of a negative relationship for both sprinters and distance runners on their performance when athletes when facility access was more heavily denied. However, due to the nature of both running events, intra-event comparison cannot be made due to the ambiguous interpretation of relative differences in race times.

Considering geographic poverty levels, the more households under poverty in that county showed a negative effect on performance. Surprisingly, the 400m seems to be affected marginally, though statistically significant (Table 1, Figure 5 & 6) Measuring for both percent under poverty and median household income, the effects on race performance and time trends are consistent.

An interesting observation is that lower income areas tended to have less intense Stay-at-Home restrictions recommended/ mandated by the CDC. This could be for many reasons such as lack of health care benefits and therefore COVID symptoms and cases were underreported in those areas. Those areas would also rely heavier on daycare, school, and other resources and would be

affected disproportionately from lockdown circumstances and would be incentivized to avoid lockdowns. (See Figure 9)

Conclusion

CDC Stay-at-Home orders did have a significant impact on US High School Track performances in the 400-metre and 800-metre distances for Boys. Geographic poverty data also plays a significant role in race outcomes. Further research can be done to help mitigate the harm of restricted school facility access situations to students and help them succeed not only in athletics, but in other extracurricular activities, academics, and in their own mental and physical health outcomes.

Limitations

Further research can be done on the effect it had on female athletes. Due to the physiological differences between the 400-metre and 800-metre distances for girls is more significant than boys, we chose to focus on the boys for this study. (Duffeld) Race times were collected for the entire United States, but due to data cleaning constraints in matching team names to schools and their respective geographic location, only half of total race times were used in this study.

Tables

Table 1

Boys 400 m				
Observations	4327			
Groups	827			
County Average Time	Coefficient	Std. err	z	significance
Constant	61.717	0.971	63.58	0.000 ***
CDC Order	-1.064	0.230	-4.620	0.000 ***
Period	0.594	0.195	3.040	0.002 **
CDC Order*Period	0.172	0.046	3.690	0.000 ***
Percent Under Poverty	0.023	0.006	3.740	0.000 ***

*State and Time Trend Fixed effects were included in the regression, but coefficients are not included here

Table 2

Boys 800 m				
Observations	4332			
Groups	826			
County Average Time	Coefficient	Std. err	z	significance
Constant	149.99	2.848	52.66	0.000 ***
CDC Order	-2.474	0.675	-3.660	0.000 ***
Period	1.859	0.548	3.390	0.001 **
CDC Order*Period	0.485	0.131	3.680	0.000 ***
Percent Under Poverty	0.060	0.018	3.330	0.001 **

*State and Time Trend Fixed effects were included in the regression, but coefficients are not included here

Figures

Figure 1

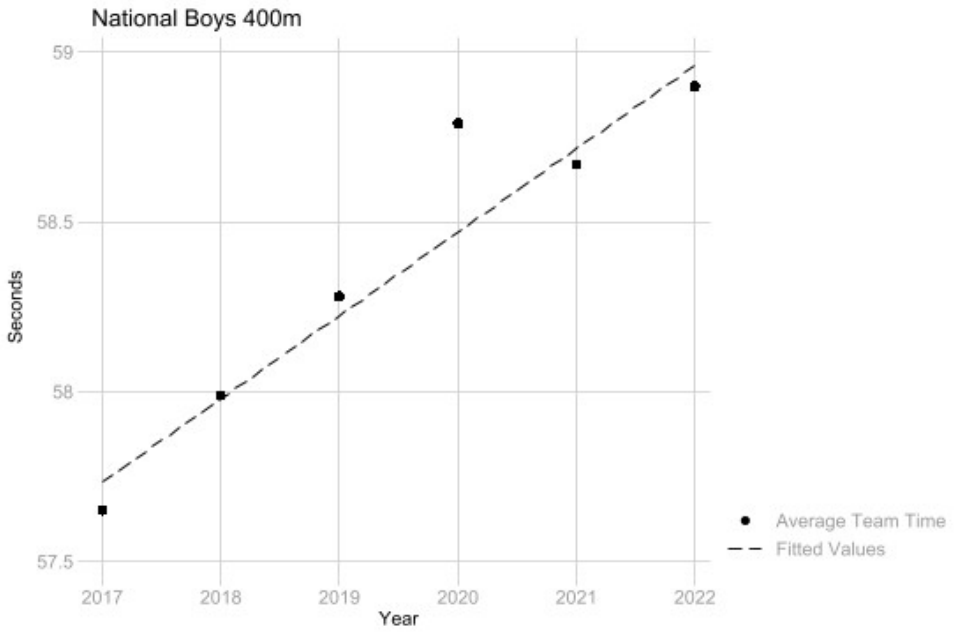


Figure 2

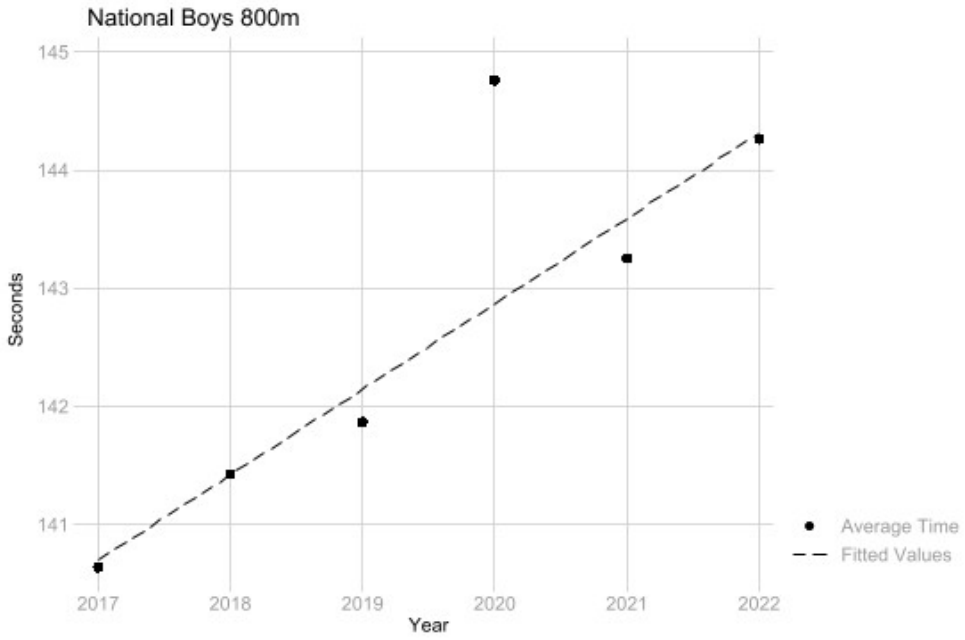


Figure 3

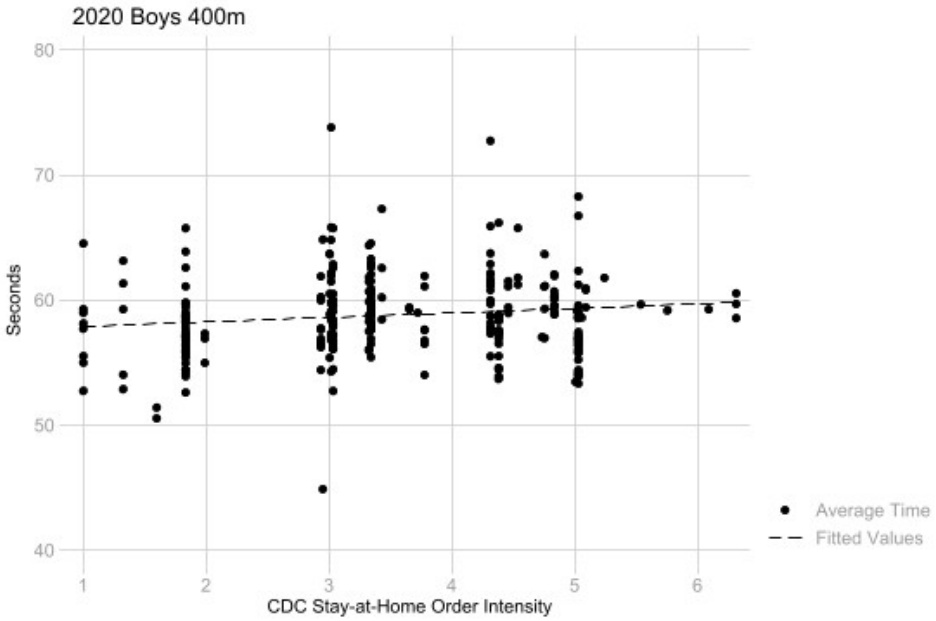


Figure 4

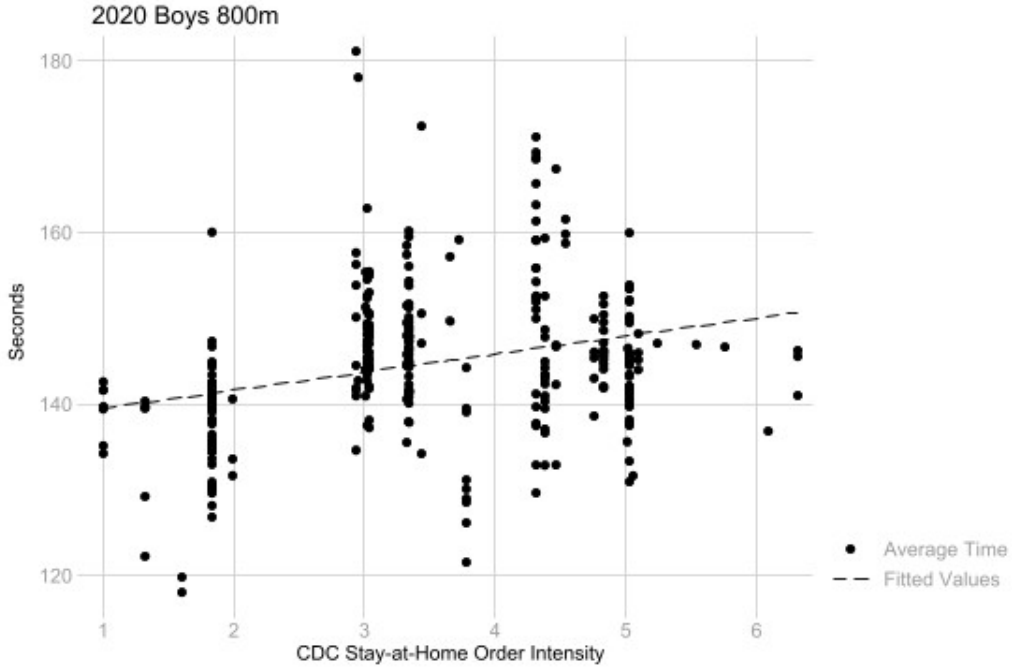


Figure 5

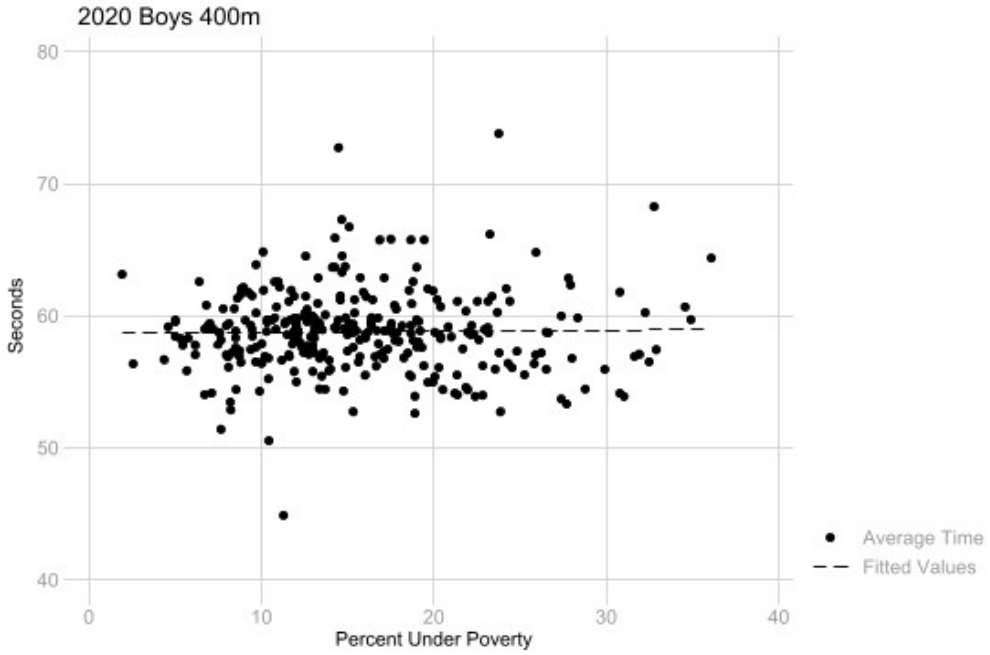


Figure 6

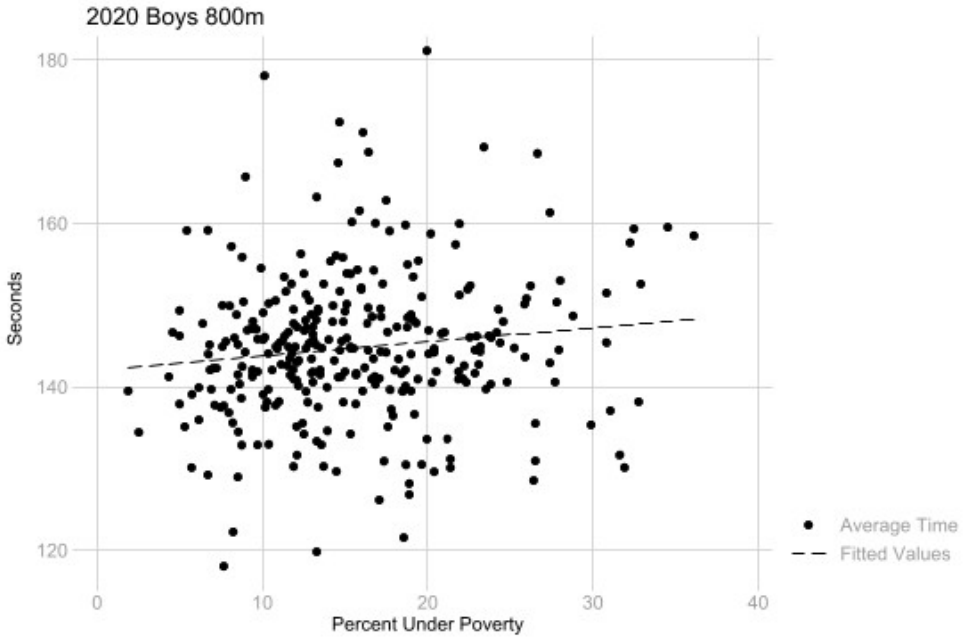


Figure 7

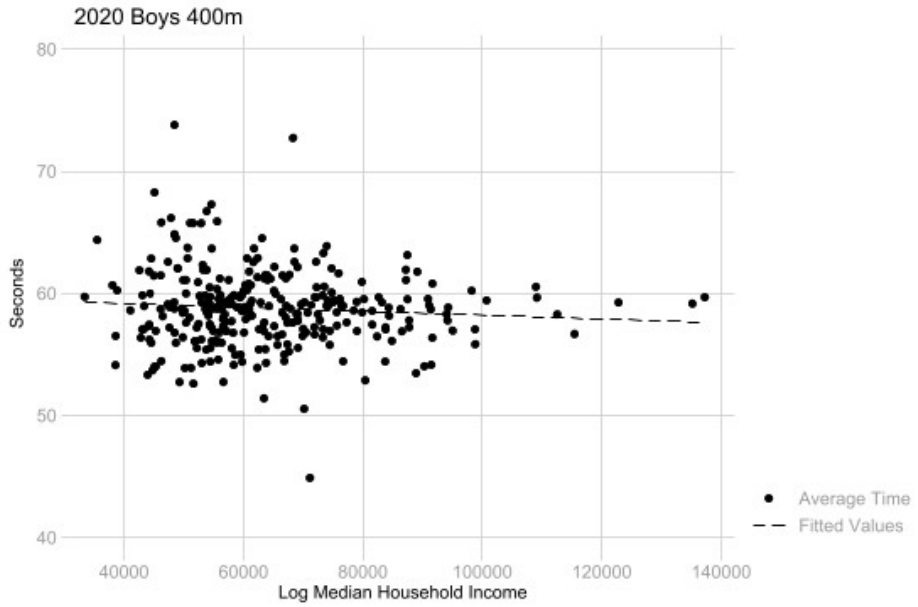


Figure 8

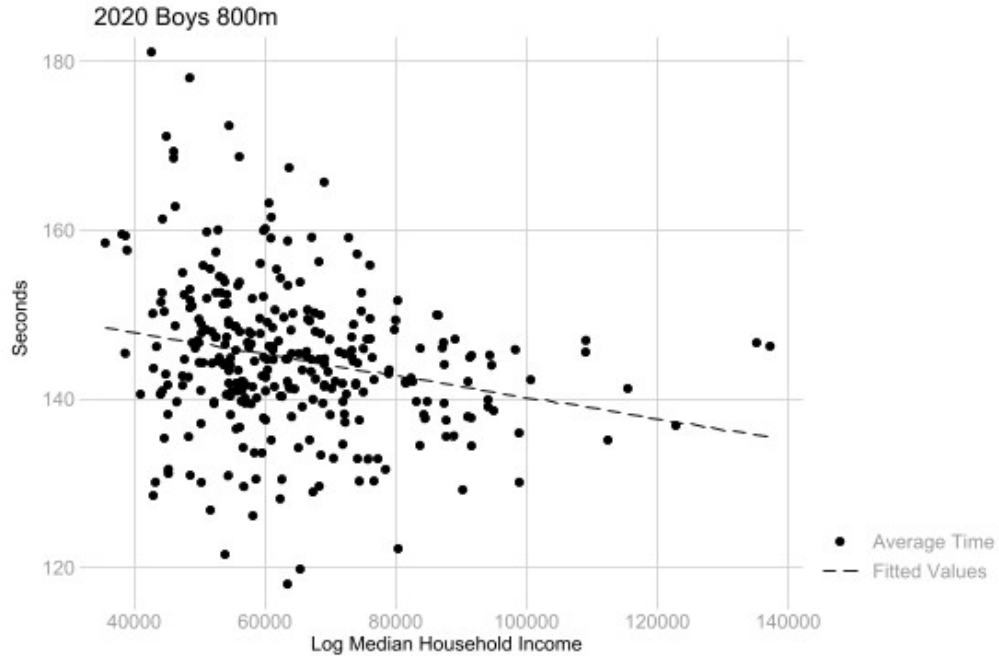
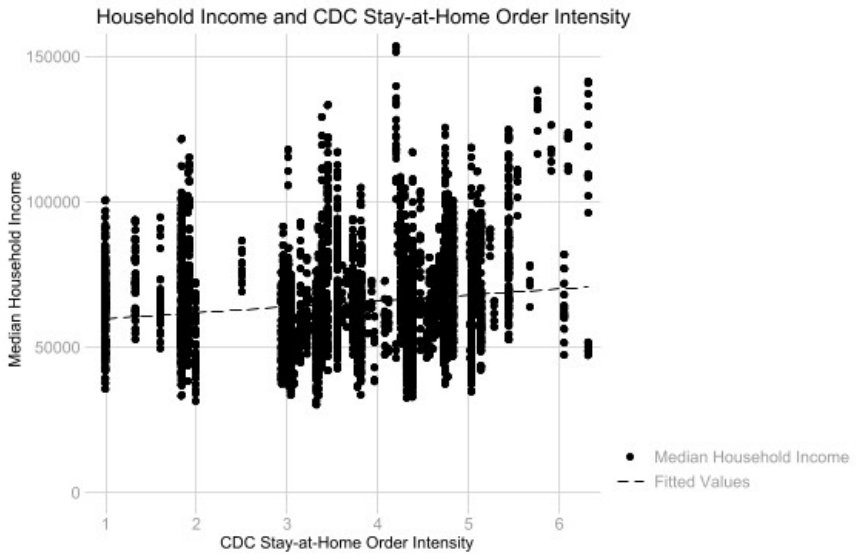


Figure 9


Household Income and CDC Stay-at-Home Order Intensity
Median Household Income
150000
100000
50000
0
1
2
3
4
5
6
CDC Stay-at-Home Order Intensity
Median Household Income
Fitted Values

References

Duffield, R., Dawson, B., & Goodman, C. (2005). Energy system contribution to 400-metre and 800-metre track running. *Journal of Sports Sciences*, *23*(3), 299–307. https://doi.org/10.1080/02640410410001730043