Data Analysis of Crime and Rates of Hospitalization due to COVID-19

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Abstract—There has been an increasing concern that African American community has been disproportionately impacted during the coronavirus pandemic. This paper analyzes why the African American community is disproportionately impacted during the coronavirus pandemic and compares the COVID-19 data with hospitalizations, real estate, school closings, and crime data. Human behavior was impacted as a result of lockdown due to COVID pandemic and it lead to a shift in crime dynamics. We analyze shifts in crime types by comparing crimes before and after the COVID pandemic in Baltimore. There was a significant decline in total crimes during the time period immediately following stay at home orders. Findings show that the disproportionality among the African American community is significantly influenced by factors such as living in more crowded housing situations, working in consumer-facing serviced industries, having higher rates of pre-existing medical conditions, and lack of insurance or a consistent care source.

Keywords— Data Analytics, COVID-19 Pandemic, Race, COVID-19, Crime Analysis.

I. INTRODUCTION

The COVID-19 pandemic has created an impact on many aspects of life in the world. Due to the lock down imposed in early 2020 as result of COVID-19 pandemic, there was decline in total crimes. Human behavior got changed due to social distancing and it lead to shift in the crime dynamics. As everyone was focused on finding the cure to the pandemic or finding a vaccine, it is interesting to find out how COVID-19 affected our social and relational health. We would like to know how social distancing changed the human behavior in all spheres of human endeavor. We have conducted a time series analyses to assess the impact of stay-at-home restrictions on different types of crime in Baltimore city and compared the crime data with COVID-19 data as well as hospitalizations, real estate, and school closings.

There are studies that have explored why African American race and Hispanic race are disproportionately impacted more than the white population for infection rate [1]. Power BI was used to analyze COVID-19 data to track trends and to compare the data with the crime rate in Baltimore. Latter data was explored for analyzing why African Americans are so disproportionately impacted by Covid-19. It was found that the African American population does indeed have disproportionately higher rates of hospitalizations and deaths due to COVID-19. One reason why certain ethnic groups were hit harder was due to them living in more crowded housing situations. Living in multi-generational and densely populated households makes it hard to practice social distancing. Another factor is that workers in consumer-facing serviced industries are more likely to use public transportation to get to work, putting them at risk for increased exposure to

COVID-19. Also having higher rates of existing medical conditions such as high blood pressure, diabetes, obesity, asthma, and heart, liver and kidney diseases, can put one at increased risk of severe illness if they get COVID-19. And lastly, lack of insurance or a consistent care source limits access to COVID-19 testing and treatment. This allowed us to make predictions and estimates on the extent of damage a patient could experience due to coronavirus [2].

Fig. 1. Bar chart created in Tableau showing a few of the crime categories and the total number of each of those crimes for each year. (Data Source: Baltimore city dataset, data used up to July 20, 2021)

Fig. 1 shows the visualization of crime data in the city of Baltimore created using Tableau. There was a direct affect seen in the drop of crimes from the start of the pandemic in March 2020. In 2021 crime in Baltimore is the lowest it has been across all categories since 2017, and it can be attributed to the statewide orders of social distancing. With less interaction between people crimes are being committed at a lower rate. Though there were months where crime began to rise again, they are generally lower for each year following coronavirus coming into the United States. These visualizations show the total number of crimes for each year prior to coronavirus, and the totals for each year after the coronavirus in the United States. The total number of crimes were very high compared to the more recent years 2020 and 2021, where they took a dip shown. The bars for each year are represented by a different color, and each crime is represented on its own for each year. Crimes like auto theft appear to happen at a much lower rate than crimes like burglary and common assault. The crimes shown in Fig. 3 dropped in the year 2020 which could've been directly affected by COVID-19 due to the state-wide orders of people being told to stay home to prevent the spread of coronavirus.

Prisons data was also explored and how it has led to the rise of COVID-19 cases. America's prisons lack cleanliness and with them being so filled with inmates it makes it very difficult to social distance and prevent the spread of the coronavirus. African Americans are also overrepresented in the system, so it makes them more likely to be among the infected inmates.

The rest of the paper is organized as follows: Section 2 discusses the related work in crime response and health factors; Section 3 details the analysis of COVID-19 on various crime and health factors. Section 4 describes the exploration of crowded housing, and job industry in African American population. Section 5 describes the analysis of real estate and job industry data in African American community, and Section 6 discusses the drawn conclusions.

II. RELATED WORK

Abrams et al. [3], have explored the rates of crime in response to COVID-19. Their findings supported that because of COVID-19 and the implementation of stay-at-home orders there has been a significant drop in crime across almost all types of crime. Their findings concluded that overall, crime fell 23% in the first month of COVID lockdown, relative to the average of the same period in the previous 5 years. They have stated that both property and violent crimes dropped 19% on average, and that the overall drop in crime corresponds with a drop in the population's mobility. They noted that given the stay-at-home orders and business closures, people weren't driving, shopping, or walking around on the streets as much as usual. They have argued that there was a drop in both mobility due to the restrictions set in place and crime means that they are connected to each other. They have stated that the easing of COVID-related restrictions had little impact on crime rates because the mobility in cities remained restrained even as the restrictions were lifted.

Abrams et al [3] have stated that there was a drop in overall crime rates and it masks the rise in the rate of some violent crime beginning in the summer of 2020. There were substantial increases in homicides and shootings beginning in the summer of 2020 and the authors stated that it's hard to conclude whether this was due to the pandemic or other factors. But they did note that the start of this spike in some violent crimes coincided with the protests associated with the police killing of George Floyd and continued through the summer and into the fall [3].

Boman et al. [4] have detailed how COVID-19 has changed crime and has decreased across the U.S. Their study stressed that while crime overall was down during the lockdown, the reason it is down is likely due to a drop in only minor crimes which are largely committed by people in peer groups. On the other hand, Bullinger et al. [5] have explored how some crimes increased during the issuing of stay-at-home orders in Chicago. Living in multi-generational and densely populated households makes it hard to practice social distancing. Another factor is that those that work in consumer-facing serviced industries are more likely to use public transportation to get to work, putting them at risk for increased exposure to COVID-19. Also having higher rates of existing medical conditions such as high blood pressure, diabetes, obesity, asthma, and heart, liver, and kidney diseases, can put one at increased risk of severe illness if they get COVID-19. And lastly, lack of insurance or a consistent care source limits access to COVID-19 testing and treatment [2].

III. ANALYSIS OF COVID-19, CRIME, AND HEALTH FACTORS

A. COVID-19 Data

Before the coronavirus was declared a pandemic, there were no cases of COVID-19 reported, but when it was declared a pandemic in March 2020 the number of cases continued to rise each month for the rest of 2020. COVID-19 was in its very early stages, and measures and precautions were still being planned before being put into process to contain the virus.
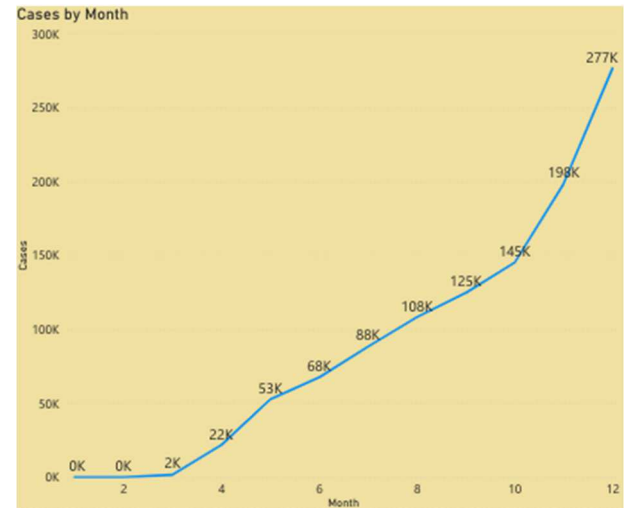

Fig. 2. Line chart created in Power BI to represent the total number of cases in the United States by each month for the year 2020.

Fig. 2 shows the visualizations on COVID-19 data for total number of cases in the United States for the year 2020 created using Power BI. Another visualization was created in Tableau with data downloaded from Covid-Net [6] that gave COVID-19 Hospitalization Visualization as shown in Fig 3.
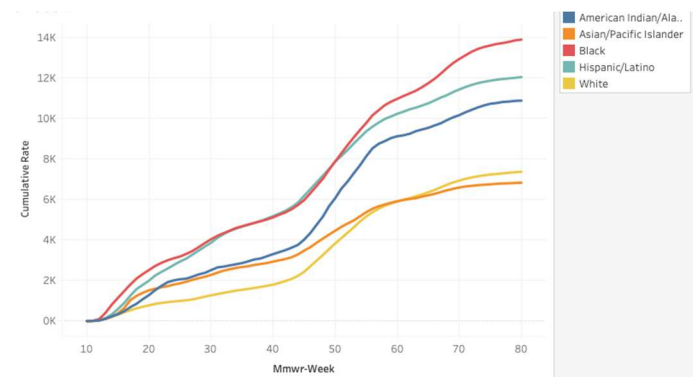

Fig. 3. Visualization of the rates of COVID-19 associated with hospital admissions using Tableau

Fig. 3 shows a line graph that details the rates of COVID-19, since the beginning of 2020, associated with hospital admissions according to race. The visualization shows that African Americans are disproportionately affected by COVID-19 and is supported through the number of blacks that continue to be admitted into hospitals at higher rates than other races. The red line represents blacks, the baby blue representing Hispanics, dark blue being American Indian, orange being Asians, and yellow being Whites. The graph shows that out of all races Blacks have been admitted into hospitals due to COVID-19 at the highest rate since the pandemic first started, with Whites being admitted at the lowest rate.

B. Crime Data

Fig. 4 show visualizations on crime data for the total number of each crime by the month created using Tableau. In Fig. 4 each year is represented on its own with line graphs to represent each type of crime and its total number for that year. Following the year 2019, crimes have been committed at lower rates than before the pandemic. There is a continual downtrend in the year's progress with 2021 being the lowest it's ever been with all crimes since 2017.
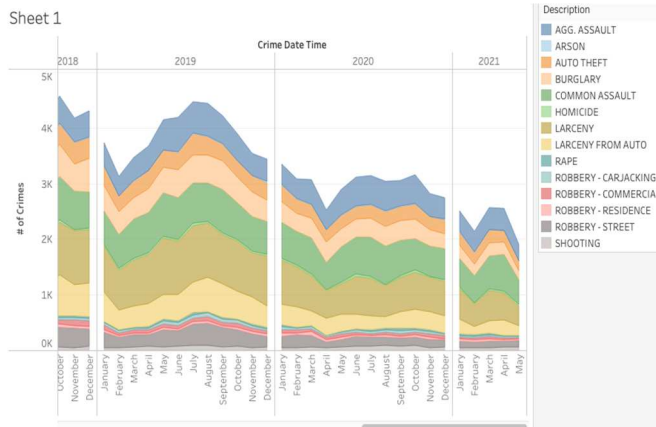

Fig. 4. Visualization made in Tableau to show the total number of each crime by the month for the years 2019-2021. Each colored line represents a different type of crime.

C. Comparing COVID-19 with Crime Data in Baltimore

Based on the findings gathered from the data and visualizations there is a correlation between the number of COVID-19 cases compared to the total number of crimes the city experienced. As far as on a month-to-month basis, there is no correlation, but there was an overall decrease in crime for the years after the coronavirus arrived. For example, the number of crimes of larceny from auto went from 5,703 in 2019 to 3,624 in 2020; larceny from auto being theft committed from a motor vehicle. Street robberies dropped from 3,372 in 2019 to 1,986 in 2020; the lowest it's been in the past 6 years. The assumption can be made that with everyone being told to stay home during the breakout of the virus, crime on the streets and in general have been at its lowest since 2014 across most categories.

ArcGIS was used in Tableau to show layers of representation of the neighborhoods in Baltimore [6] and their population, population density, and the crimes in each neighborhood, shown in Fig. 5, Fig. 6, and Fig. 7.
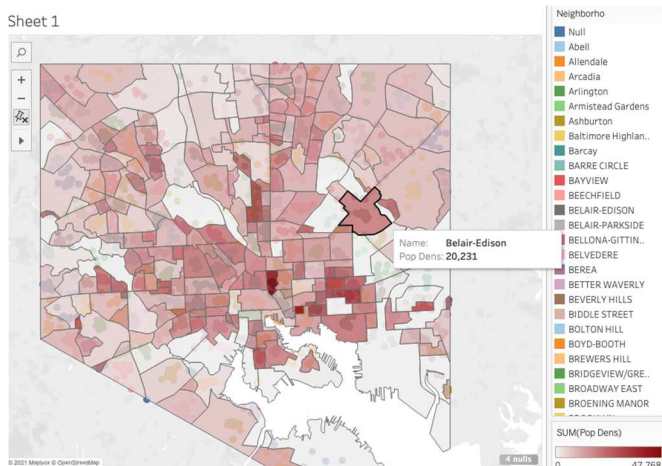

Fig. 5. ArcGIS visualization made in Tableau of the population density of each neighborhood in Baltimore for the year 2021.

It was significant to create this visualization as densely populated homes were one of the factors that heavily influenced African Americans chances of catching COVID-19. Fig. 5 shows both layers of densely populated neighborhoods along with the crimes and their totals committed in each neighborhood for a specific year. The darker the color that the area of the neighborhood is, the more densely populated it is.
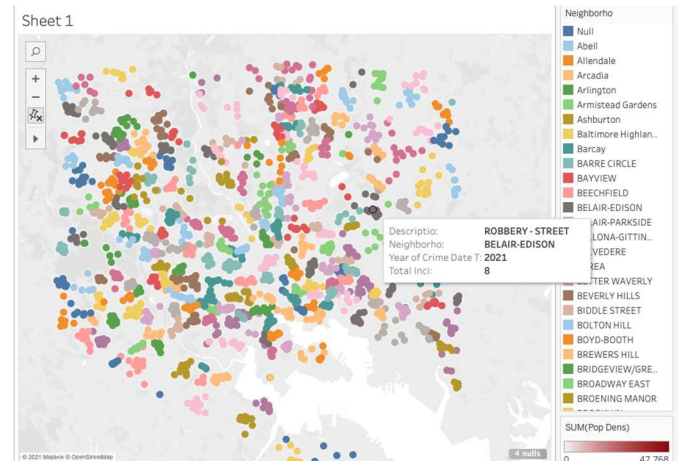

Fig. 6. ArcGIS visualization made in Tableau of the total number of each crime committed in each neighborhood for the year 2021.

Fig. 6 only details the total number of each crime, the location that it occurred specifically in that neighborhood, with each crime being represented by different colors. For example, Fig. 6 shows that the neighborhood Belair-Edison had 8 total incidents of robbery on the street in the year 2021, and upon the selection of another neighborhood it would give those numbers as well.
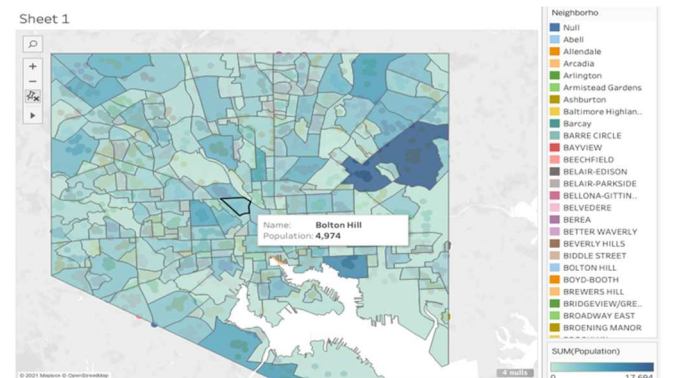

Fig. 7. ArcGIS visualization shows the population for each neighborhood for the year 2021.

Fig. 7 shows the crimes committed in each neighborhood along with the population of each neighborhood. The darker the area of the neighborhood is, the higher the population.

D. Health Factors

A visualization was created in Power BI, also utilizing Arc GIS to show a more detailed view of overcrowded homes in each state, as shown in Fig. 8. Fig. 8 shows 4 different tabs that give details on each state's percentage of overcrowded homes. In the first tab it shows the percentage of Hispanic designated homes as overcrowded, the second tab shows the

percentage of Black designated homes as overcrowded, the third tab shows the percentage of White designated homes as overcrowded, and the last tab shows the percentage of home considered as overcrowded for that state. Living in crowded home's makes it harder to practice social distancing, so when there is lack of social distancing, there will inevitably be a rise in COVID-19 cases.
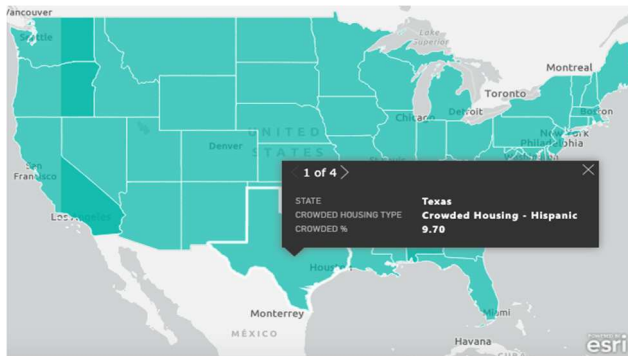

Fig. 8. Visualization made with Arc GIS in Power BI. In each state the user can select from 4 different tooltips that show the percentages of crowded homes within Black, Whites, Hispanics, and that state within the U.S.

Being in poor health, like having high rates of existing medical conditions such as high blood pressure, diabetes, obesity, asthma, and heart, liver, and kidney diseases, can put one at increased risk of severe illness if they get COVID-19. Fig. 9 was created in Power BI on data downloaded from the CDC website [7] where an interview was conducted on health statistics, that details the percentage of fair or poor health for adults aged 18 and over in the United States for the year 2019, the year before the pandemic.
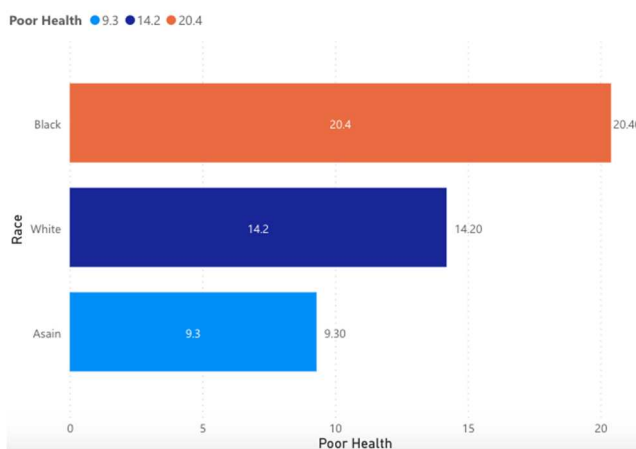

Fig. 9. Visualization created in Power BI on poor health among different races

These stacked bar charts show the different races, Blacks, Whites, and Asians, and the percentages of these that were considered in poor or fair health at the time of the interview. Blacks' percentage was at 20.4%, Whites was at 14.20%, and Asians was at 9.3%. This shows how out of all races Blacks have the highest percentage of being in fair or poor health, which puts the race at a higher risk for catching COVID-19. Another visualization was created in Power BI on data downloaded from the same interview conducted by the CDC, that details how many had health insurance at the time of the interview.

This stacked column chart was created to show the percentage of each race that was uninsured. At the time of the

interview that was conducted in 2019, 14.4% of Blacks were uninsured, 13.1% of whites were uninsured, and 7.2% of Asians were uninsured. With Blacks having the highest percentage of being uninsured, this too shows how Blacks are disproportionately affected by COVID-19 due to the lack of health care access and means of being able to get help or treatment in face of the pandemic.
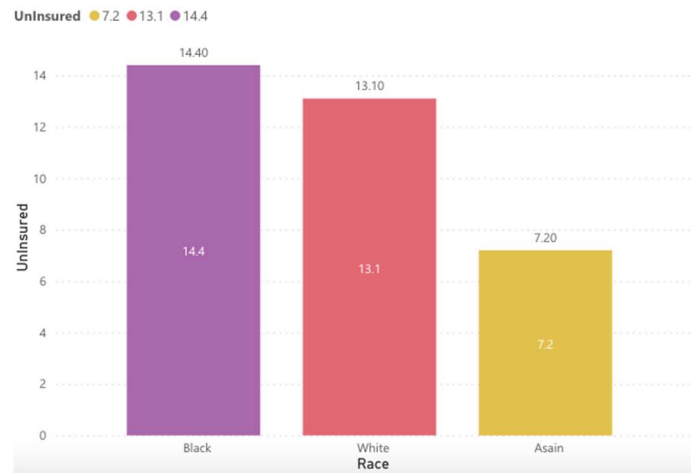

Fig. 10. Visualization created in Power BI on the percentage of certain races being uninsured.

IV. ANALYSIS OF CROWDED HOUSING AND JOB INDUSTRY DATA IN AFRICAN AMERICAN COMMUNITY

A. Crowded Housing

For the year 2020, in the United States there were 3.6% of occupied housing units designated as Black or African American with more than one person per room, with white designated housing units sitting at 1.4%, and Hispanic designated housing units at 10.8%. This is clear evidence that shows why black are impacted by the coronavirus, more crowding equals increased chances of catching covid [8]. A visualization made utilizing ArcGIS, with data downloaded from the resource America's Health Ranking.
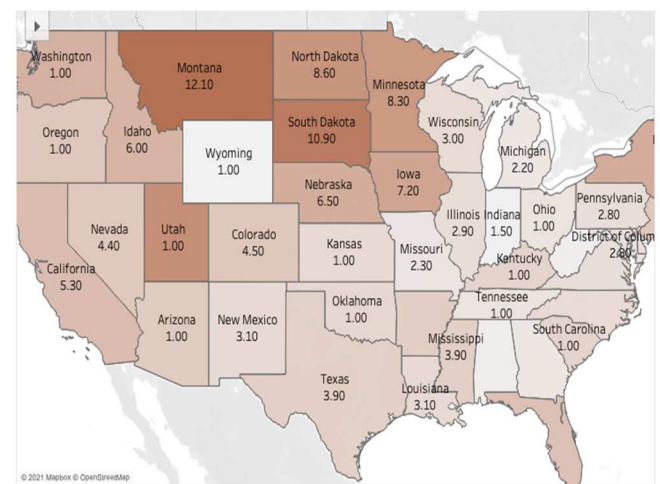

Fig. 11. Visualization made in Tableau the percentage of black owned homes considered "overcrowded" in each state.

Fig. 11 shows the percentage of black owned homes considered "overcrowded" in each state in the United States. The darker that area of the state represents the higher the percentages of black designated homes were considered

"overcrowded". States like Montana and South Dakota have the highest percentages of black designated homes being considered as "overcrowded".

B. Job Industry

Based on a population survey of data from 2020 U.S Bureau of Labor Statistics on annual averages of employed persons by detailed occupation (between whites, blacks, Asians, and Hispanics/Latinos), 9.7% of blacks made up all Management, professional, and related occupations, 17% of all service occupations, 12.5% of all Sales and office occupations, 7.5 % of all natural resources, construction, and maintenance occupations, and 16.7% of all Production, transportation, and material moving occupations. This shows that in 2020 the jobs that African Americans filled up the most consisted of customer-facing jobs and jobs that dealt with transportation and handling of materials, all of which tie into the previous stated factors that increase the chance of getting COVID such as those that work in consumer-facing serviced industries being more likely to use public transportation to get to work, putting them at risk for increased exposure to COVID-19 [3]. Fig. 12 shows a visualization made in Power BI representing the percentage of blacks that make up major detailed occupations.
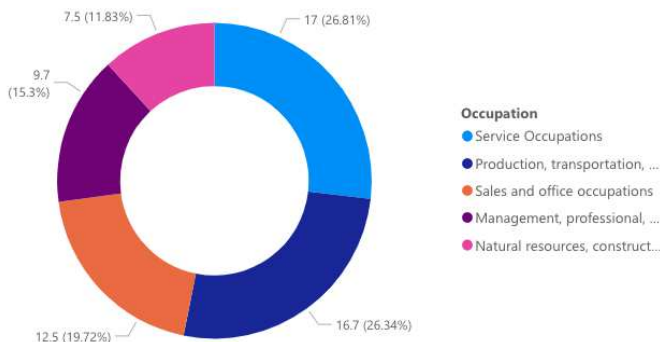

Fig. 12. Visual made in Power BI detailing the percentage of blacks that make up major detailed occupations.

In Fig. 12 the two detailed occupations, Service and Production/Transportation/Material Moving take up most of the circle graph and combine for about 53% of all the occupations represented. This is very telling as it shows just how much of the major detailed occupations that Blacks represent that puts them at more risk for catching COVID-19.

V. ANALYSIS OF SCHOOL CLOSINGS, REAL ESTATE, AND CRIME

A. School Closings

On March 12, 2020, all public schools in Maryland were ordered to close from March 16th-27th. As a result, virtual learning was implemented, and COVID-19 was also declared a pandemic by the World Health Organization. Officials stated that during that time all schools and school busses would be cleaned without classes being in session [9]. Then on March 26th, 2020, Maryland public schools were closed for four more weeks amid the pandemic, eventually leading to virtual learning being implemented for the rest of 2020 for the state of Maryland's public schools [10]. Elementary schools and public separate day schools had been open for four days of in-person learning each week for all students since May 10th, 2021, with middle and high schools being opened for select/identified students four days each

week since then as well. But it wasn't until May 19th, 2021, that the Dept. of Communications/Community Outreach announced that all BCPS students can return to school buildings for four in-person learning each week beginning Monday, May 24th. It was stated that each middle and high school would reach out to families with details about how to confirm students return to school buildings [11].

B. Crimes Vs. Schools Closing Due to COVID-19

Based on the crime data in Baltimore another visualization in Tableau was created that detailed the number of crimes by the month from the beginning of 2020 to the most current data shows how schools closing and re-opening may have affected the crime rate (refer Fig. 13).
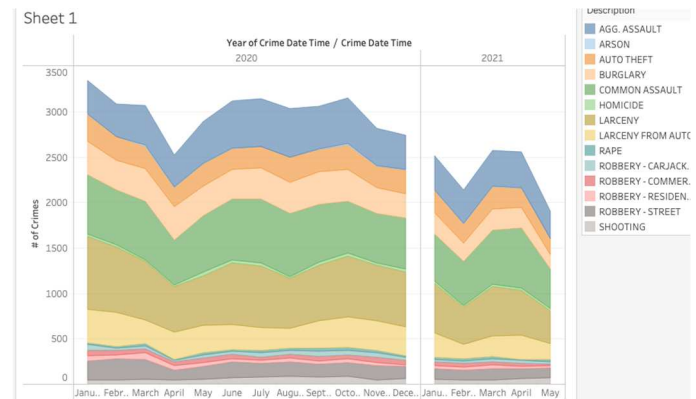

Fig. 13. Visualization made in Tableau detailing the number of crimes by the month from the beginning of 2020 to the most current data.

After the closing of schools, there was a significant drop in crimes in April. This could be caused by people being ordered to stay home to prevent the spread of COVID-19, therefore preventing people from committing most crimes. An interesting find was the slight rise of crime in the months that followed April. It seems that as the summer season ensued crimes increased each month until August where it was seen to decline each month after. This resulted in the overall distribution being skewed right, representing a decrease in crimes since the pandemic. This then made us wonder about factors that may have slightly increased the crime in ways not thought of or obviously seen. One could recall that people were panicking, angry, scared, losing jobs, and filing for unemployment. It could be due to that mix of emotions from experiencing a situation like this that puts a lot of people on edge, resulting in the slight uptrend of crimes.

C. Real Estate

Real estate data was investigated, and findings showed that real estate in Baltimore has also been affected in response to COVID-19. Jerusalem Demsas [10] stated that due to the demand of the past year of people wanting to buy homes, combined with a historically low supply of housing, has led to the increased bidding in the prices of available properties, sending home prices soaring. It was stated that "People are scrambling to take advantage of plummeting mortgage rates that make the cost of buying a home much cheaper", and that among everyone included in this demand is "America's biggest generation ever, millennials" that have "aged into their prime homebuying years.". After learning about all that, another resource was explored that detailed how the Baltimore housing market did during the midst of the pandemic [10]. Fig. 14 shows the change in median sale price of Baltimore City homes.
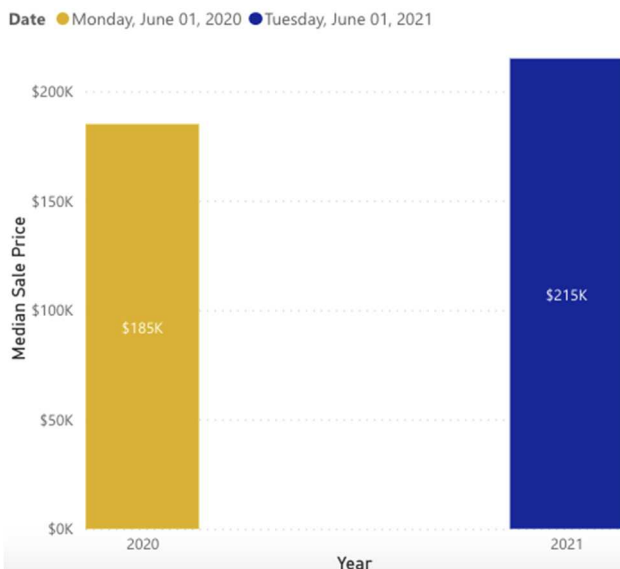
Fig. 14. Visualization made in Power BI detailing the median sale price of Baltimore City homes in June 2020, and June 2021.

In March 2020 when the stay-at-home orders were given the median sale price for Baltimore City Homes was $185,000 as shown in the figure above. However, in March 2021, the median sale price was $215,000, an increase of 16% or $30,000 compared to last year. Also, the number of units sold is also up 28% versus a year ago [12].

VI. CONCLUSIONS

COVID-19 had a major impact on crime in the city of Baltimore as well as the real estate prices. Many factors played a part in influencing the African American group to being disproportionately affected by the pandemic. The factors were such as living in more crowded housing situations, working in consumer-facing serviced industries, having higher rates of existing medical conditions such as high blood pressure, diabetes, obesity, asthma, and heart, liver and kidney diseases, lack of insurance or a consistent care source limits access to COVID-19 testing and treatment, and the prison system. It was found that African Americans lived in more crowded housing situations, having higher rates of medical conditions, having the least access to health care, and account for having health insurance the least, all to which heavily correspond to why they are admitted the most into hospitals for COVID-19.

Findings from the data analysis show that there was a drop in crimes due to the pandemic, African Americans were admitted into hospitals for COVID-19 more than Whites, Asians, Hispanics, and Indians, African American are uninsured the most and sat 14.4% of African Americans being uninsured, the median sale price of Baltimore City Homes rose by 11%, 20.4% of African Americans are in poor health, and 3.6% of occupied housing units designated as Black or African American were overcrowded. The African American community could be impacted more positively if there were improved living conditions, more access to healthcare, and better health care. There are hopes that necessary measures can be set in place to protect the African American community and help prevent them from being affected at much higher rates than other races.

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