Interpreting COVID-19 and Virtual Care Trends: A Call for Action

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Abstract

Background: The Coronavirus Disease (COVID-19) pandemic is rapidly spreading across the world. To date, there are more than 120,000 cases and more than 5,000 deaths related to COVID-19, and the number are increasing by the hour.

Objective: In this study, we explored possible trends in the use of virtual care during the COVID-19 initial period.

Methods: We conducted a cohort study of patients using an on-demand, state-wide Virtual Urgent Care (VUC) center. We collected data from February 1, 2020 until March 15, 2020. The data included patient demographics and chief complaints.

Results: Of the 733 total visits, 257 (35%) were COVID-19 related symptoms. Of the COVID-19 related visits, the number of female was 178 (70%). People in the 30-39 years of age (26%) and 40-49 years (25%) were 50% of the total patients. We observed a rapid increase in COVID-19 confirmed cases (n=92) in the State of North Carolina as of March 18, 2020. We report that 62 (67%) of COVID-19 confirmed cases occurred within counties that included a major airport in North Carolina namely, Raleigh-Durham International Airport (RDU) and Charlotte Douglas International Airport(CLT). We report that 57.3% COVID-19 related visits in the weeks prior to confirmed cases were initiated by individuals residing in the same counties that later had confirmed cases; such that, Wake County where RDU lies, had 49 (53%) visits while Mecklenburg County, where CLT lies, had 4 (4.3%) COVID-like visits.

Conclusions: More stringent travel policies are needed to minimize the spread of COVID-19 that should include international and domestic air travel. Virtual Care can provide services to patients with COVID-19 like symptoms, which will limit the gathering of sick people in Emergency Rooms around the country.

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Interpreting COVID-19 and Virtual Care Trends: A Call for Action

Introduction

The Coronavirus Disease (COVID-19) pandemic is rapidly spreading across the world. As of March 26th, 2020, there were more than 500,000 cases and more than 25,000 deaths related to COVID-19, and the number continues to increase [1, 2]. The swift transmission of COVID-19 is a threat to the world. It hinders our ability to contain the spread or the damage [3]. Many countries issued a pause on air travel in and out of the country in an attempt to stop, or at least, slow down the transmission of the disease. However, the numbers of infected people is in an exponential and rapid growth [4].

Calls were made to promote and use Virtual Care (VC), such as remote medical consultation, as an effort towards enforcing social distancing, efficient utilization of resources, and improving healthcare access [5]. The U.S. government and private payers, such as insurance companies, have been working closely to remove any restrictions on the use of Virtual Care, also known as Telehealth [6]. Now, people can use consumer applications such as FaceTime and Google Hangout and other video chat platforms to interaction with a medical provider remotely [7]. Additionally, insurance coverage now covers a Virtual Care between a provider and patient who have not met in person before. All these attempts were necessary to avoid the gathering of large numbers of people in the same space, except for medical reasons [8]. In this study, we explored possible trends in confirmed COVID-19 cases along with COVID-19 like virtual visits. We hypothesized that there was a pattern in the location and duration of the confirmed COVID-19 cases with COVID-19 like virtual calls prior to the occurrence of confirmed cases.

Objective

The objective of this study was to study the trends in confirmed COVID-19 cases in North Carolina, along with understanding patterns of received virtual visits related to symptoms of COVID-19.

Methods

We conducted a cohort study of patients using an on-demand, state-wide Virtual Urgent Care (VUC) center. The center was launched by a major healthcare system in Southeast region of the U.S. We collected data from February 1, 2020 until March 15, 2020. Institutional Review Board exemption was obtained prior to the study.

Our choice of study start date being February 1st stems from when the first COVID-19 case in the U.S., which occurred in Washington state on January 21st, 2020. The first case in NC was March 3rd related to a person traveling from Washington state. This indicates that during the month of February there was active transmission of COVID-19 across the US that we did not know about due to lack of screening and testing.

Data Sources

We collected data around the dates and numbers of confirmed COVID-19 cases reported by North Carolina Department of Health and Human Services (NCDHHS). Additionally, we analyzed COVID-19 like virtual visits from February 1- 28, 2020 prior to the first confirmed COVID-19 case (March 3, 2020).

Analysis for Virtual Visits with COVID-19 like Symptoms

The VC data included patient demographics and chief complaints. We stratified the virtual visits into two groups: (1) COVID-19 like visit, (2) all other visits. We categorized a virtual visit as a COVID-19 like visit if the chief complaint mentioned by the patient overlapped with COVID-19 symptoms reported by the Center for Disease Control (CDC) and the World Health Organization (WHO) such as “cough”, “fever”, “respiratory infection”, “fatigue” [9, 10]. Throughout the manuscript, we will use the term “COVID-19 like” to refer to virtual visits where patients reported chief complaints that are similar to COVID-19. At the time of the study, there were no virtual COVID-19 tests to screen if these virtual visits had patients who were indeed COVID-19 carriers.

Analysis for COVID-19 confirmed cases

Based on information we retrieved NCDHH, we mapped the number of confirmed cases on to the NC map. Then, we identified the major areas of attraction within the counties with highest

concentration of confirmed COVID-19 cases to rationalize the reasons for the high concentration of cases. Additionally, we ran a time-motion analysis on the confirmed cases over time to understand the duration and the extent of disease spread across the state counties. To demonstrate the time-motion of the disease, we used a color palette such that each color represents confirmed COVID-19 cases on a given date between March 3-18, 2020.

To plot the confirmed COVID-19 cases in North Carolina geographically, we created a map showing the number the cases of each county and assigned the color shades according to the number of cases, the deeper the color, the more the cases. Furthermore, in order to explore the relationships between VUC COVID-19 alike encounters and confirmed COVID-19 cases, we labeled the encounters as "two weeks before the outbreak" (encounters in February, 2020) and "after the outbreak" (encounters from March 1st to March 15th, 2020). Then, the number of encounters of each county were displayed geographically on map based on the same rule as the map of COVID-19 cases for a straightforward concept and comparison. To delve into the trend of how local COVID-19 cases increase temporally and spatially, we divided the COVID-19 cases on the basis of two-time range, one was a 7-day time range, the other was a day-by-day time range. A bar chart and a pie chart on map were created respectively based on the broken-down data.

Data Analysis

We analyzed patient demographics of COVID-19 related virtual visits. We conducted exploratory analysis based on their gender, age group, and state of residence. Since all visits happened through phone calls or video calls, it was important to use patients' state of residence to analyze their characteristics. Certain tools such as Microsoft Excel were used throughout this process and display the results. All the data processing work was conducted in Python using NumPy and Pandas library and the visualizations were created using tableau. This was beneficial to detect any trend or patterns of patients' behaviors.

Results

Of the 733 total virtual visits, 257 (35%) were COVID-19 like symptoms. Of the COVID-19 like visits, the number of females was 178 (70%). People in the 30-39 years of age (26%) and 40-49 years (25%) were 50% of the total patients. Additionally, approximately 97% of the COVID-like encounters came from within the State of North Carolina, Table 1.

Table 1 Summary of Characteristics of Virtual Care Patients with COVID-19 symptoms

Virtual Care Demographics	Count of Encounters	%
Gender		
Female	**178**	70%
Male	**75**	30%
Non-Binary	**4**	<1%
Total	253	100%
Age Group (years)		
2<=10	28	11%
10-20	23	9%
20-30	40	16%
30-40	67	26%
40-50	61	24%
50-60	31	12%
60-70	7	3%
Total	257	100%
State of Residence		
FL	1	0.4%

GA	1	0.4%
NC	249	96.9%
NJ	1	0.4%
SC	2	0.8%
VA	2	0.8%
WI	1	0.4%
Grand Total	**257**	**100%**

Analysis of Confirmed Cases

North Carolina, like other U.S. states, observed an acceleration in COVID-19 confirmed cases in a short time period [11]. The first case was recorded on March 3rd, 2020; in ten days, the number of cases escaladed to 24 cases and then, in only three days, there was a steep increase to 64 cases to reach a total of 92 confirmed COVID-19 cases by March 18, 2020, figure 1.

The NC map shown in Figure 2 shows that 62 (67%) of COVID-19 confirmed cases occurred within counties that have the highest density in NC and include major airports in North Carolina namely, Raleigh-Durham International Airport (RDU) and Charlotte Douglas International Airport (CLT). Figure 2 also shows that there are scattered individual cases of COVID-19 in the Eastern and Southwestern parts of the state, which are typically less dense regions.

Figure 3, shows the spread of confirmed COVID-19 cases by the day from the period of March 3, 2020 and March 18, 2020. The first confirmed case occurred on March 3rd in Wake County where the person had been travelling to Washington state and was exposed to a long-term facility where there was a COVID-19 outbreak [12]. The second case occurred in March 6th, 2020 in Chatham County to a person who was travelling to Italy where there had been a severe COVID-19 outbreak [13]. Chatham county is a neighboring county to Wake county where RDU airport resides. The time-motion analysis shows that the first COVID-19 cases occurred in Wake county, while the highest prevalence of COVID-19 cases was also in Wake county and Mecklenburg County. Those two counties have two characteristics in common that they are the most populous and the only counties with a major airport The color palettes in figure 3 show that the disease systematically quickly spread to the immediate neighboring counties in a

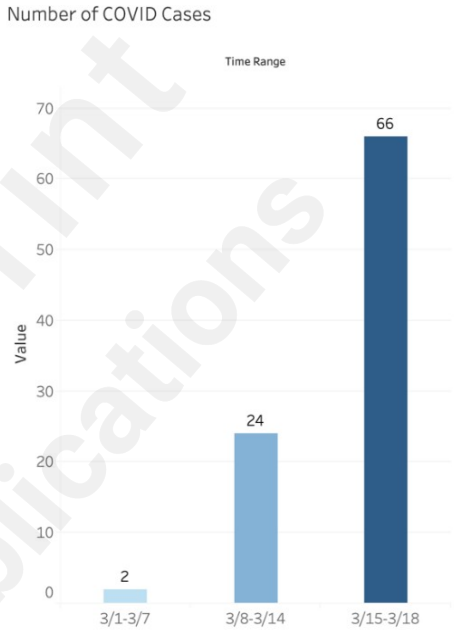

Figure 1 Number of confirmed COVID-19 cases as reported by NCDHHS.

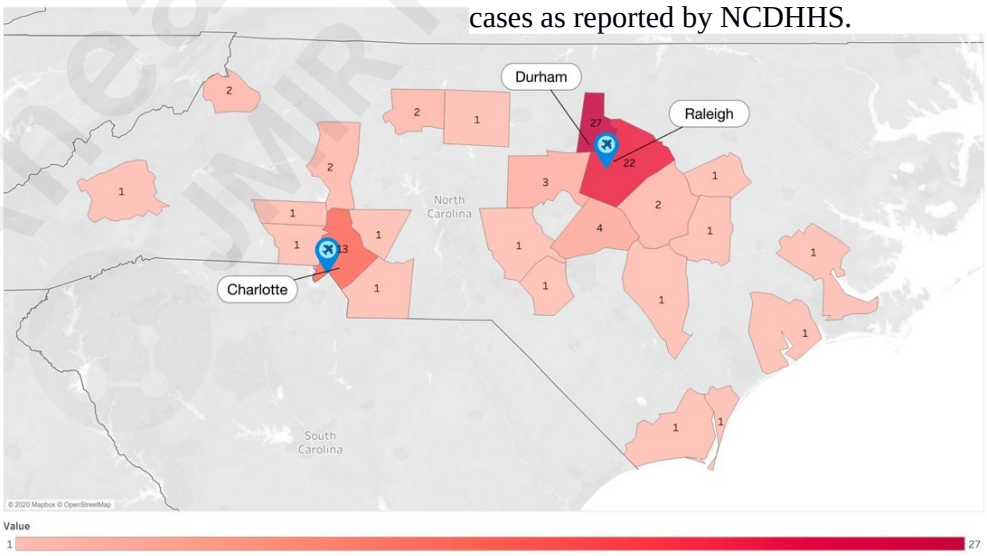

Figure 2 Mapping of NC confirmed COVID-19 cases with Airport location.

matter of 3-5 days, and it reached further counties in a relatively longer timespan of 12-14 days.

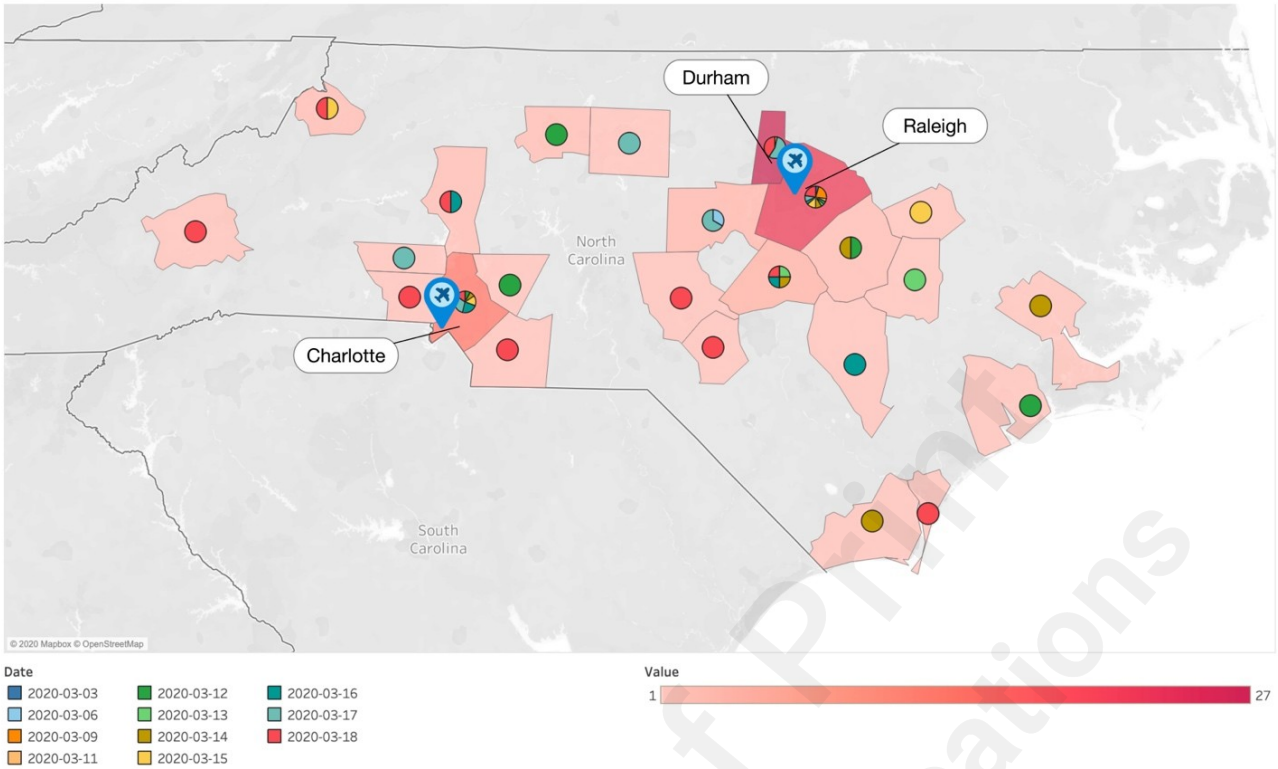

Figure 1 Time-motion analysis of confirmed COVID-19 cases from March 3, 2020 to March 18, 2020.

Analysis of Virtual Care visits

We report that 57.3% COVID-19 like visits in February prior to confirmed cases were initiated by individuals residing in the same high-density counties that later had confirmed cases. Wake County where RDU lies, had 49 (53%) visits while Mecklenburg County, home of CLT, had 4 (4.3%) COVID-19 like visits, Figure 4. Additionally, during the first 12 days since the first confirmed COVID-19 case on March 3, the number of virtual visits related to COVID-19 in Wake county was 23 (24%) and 5 (5%) Mecklenburg county.

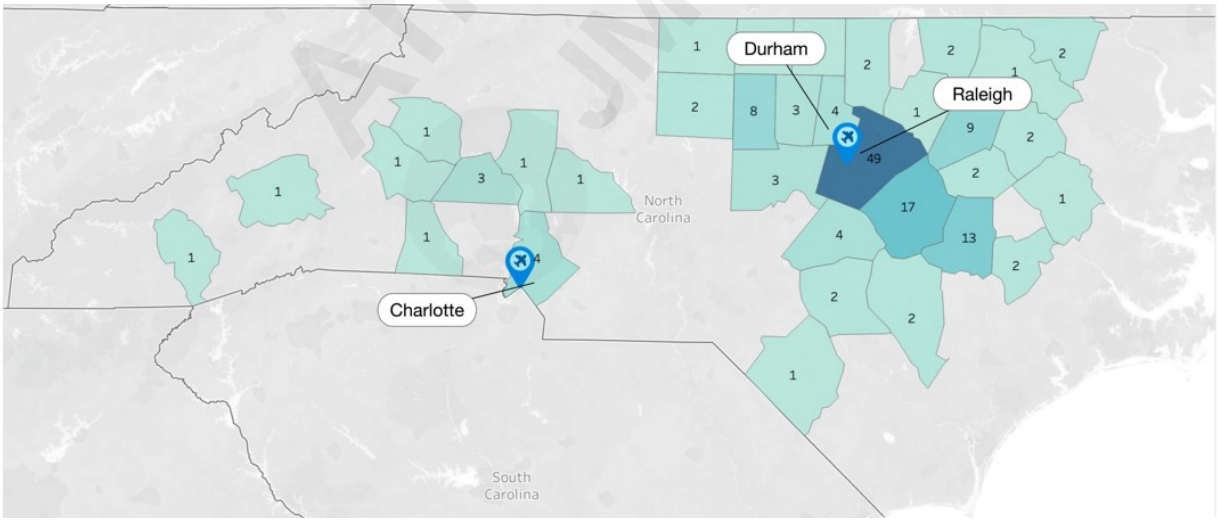

Figure 2 Quantification of Virtual Care visits during February 1-28, 2020.

Discussion

This study aimed to understand the trends in confirmed COVID-19 transmission as well as the use of

Virtual Care to triage COVID-19 like symptoms. Calls have been made for more research investigating the transmission of the virus and identify vulnerable populations and regions [14].

We analyzed and mapped the dates and locations of confirmed COVID-19 cases and COVID-19 like virtual visits during February 1, 2020 and March 15, 2020. A clear relationship exists between the geographic location of the first confirmed COVID-19 cases and the density and the presence of a major airport. The first two cases in North Carolina were individuals who travelled from areas with COVID-19 outbreak. The first confirmed COVID-19 cases occurred in the counties with the highest population density and major international airports. Additionally, the spread of cases transitioned into the immediate neighboring counties and then, further into more distant counties.

When looking at COVID-19 like cases in the weeks prior to confirmed cases, we observed that most of the COVID-19 like visits came from the same counties that later had confirmed cases. This has two implications. First, Virtual Care can help reduce the number of ED visits by providing remote medical consultation to patients residing in counties with increasing number of confirmed COVID-19 cases, which may result in overcrowding and more chances of spreading the disease,. Second, it is possible that we can forecast the spread of the disease by monitoring the volume and location of confirmed COVID-19 cases coupled with the volume and location of visits in the Virtual Care realm, as shown in this study. Alternatively, the possibility of higher number of confirmed cases may lead to a higher number of virtual visits as individuals self-quarantine.

This study provides several suggestions. First, limiting the movement of people through physical distancing and reduced travel domestically and internationally will help flatten the COVID-19 curve. Second, wider adoption and promotion of Virtual Care may reduce the number of unnecessary ED and Urgent Care visits, which is important during this time to avoid the transmission of the disease as well as freeing medical resources to high-risk cases. Third, monitoring the utilization of Virtual Care through Geospatial analysis and Predictive modelling can help us better understand trends and better manage our expectations to what the future holds [14-16].

The Centers for Medicare & Medicaid and insurance companies have waived telehealth restrictions infear of exhausting our healthcare system capacity and resources, which should drive the push for more virtual case-based interventions. Although, major healthcare systems are launching virtual care clinics, there seems to be a need for more promotion especially among vulnerable and older populations who may not have the technological means to access such a service. We suggest continued efforts to deploy and promote the importance of Virtual Care as an important medium as we fight for our existence.

Study limitations and future directions

This study presents data from a single healthcare system in one U.S. state. The definition of COVID-19 like virtual visits were labeled if the COVID-19 symptoms defined by WHO matched the chief complaints of the patient. Due to the lack of virtual COVID-19 screening and the rapid turnaround of events, we could not ensure that all these studies were actual COVID-19 cases.

Our future work will include an analysis of Virtual Care accessibility pre and post COVID-19 with regards to specifics geographic locations. We are also interested in assessing the patient experience using virtual care during the COVID-19 period. Finally, we aim to evaluate the effectiveness of the Telehealth expansion on in-person and virtual clinics.

Conclusions

The use of Virtual Care presents promising potential in the fight against COVID-19. Virtual Care is capable to reduce ER visits, conserve healthcare resources, and avoid the spread of COVID-19 by treating patient remotely. Our study shows that VC can provide efficient triaging in the counties were the highest number of COVID-19 cases. We also confirmed that the widespread of the disease occurs in areas of high population density as well as in areas with major airports. We call on more adoption of Virtual Care by health systems across the U.S. and the world during the COVID-19 pandemic.

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Supplementary Files

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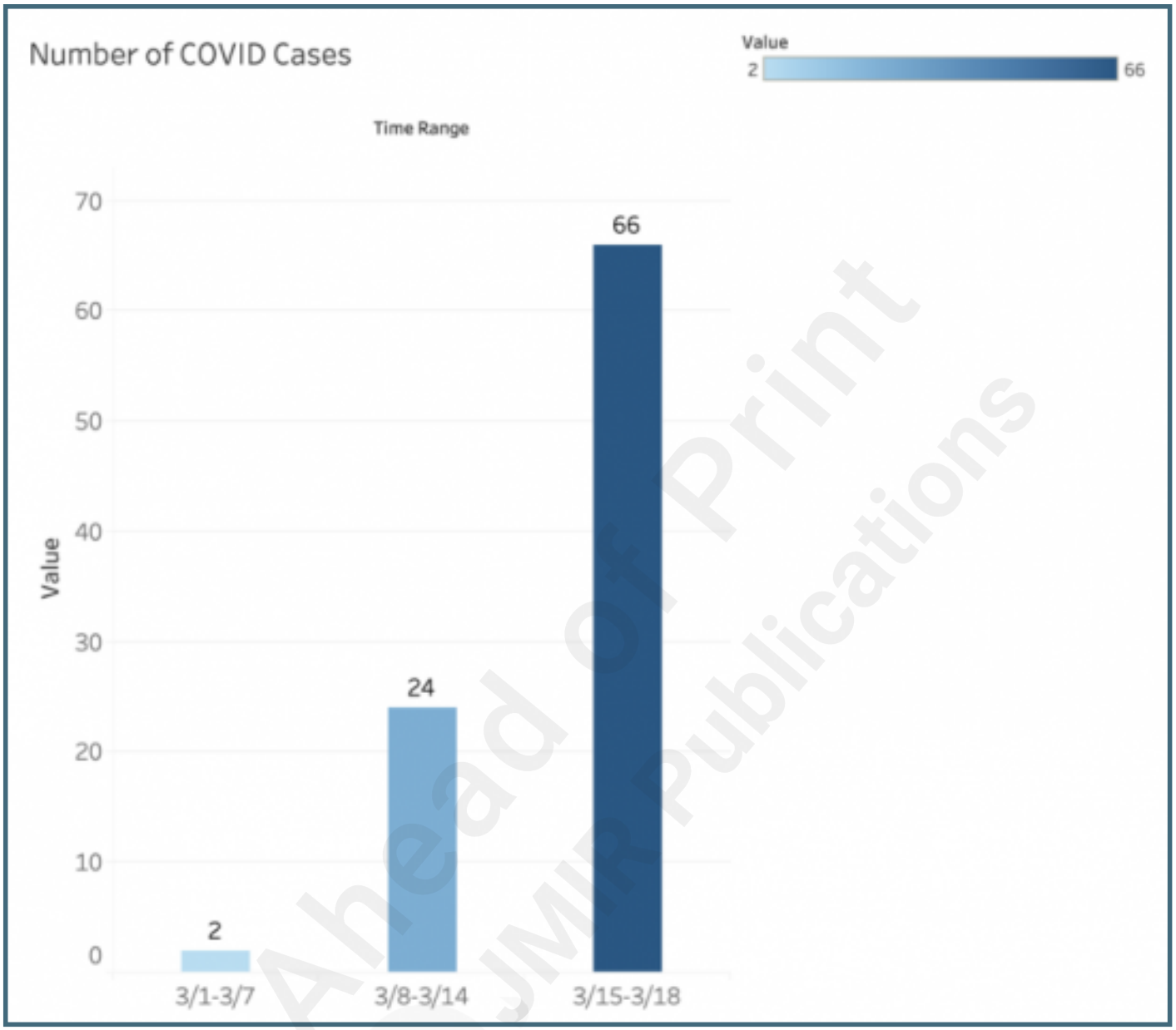
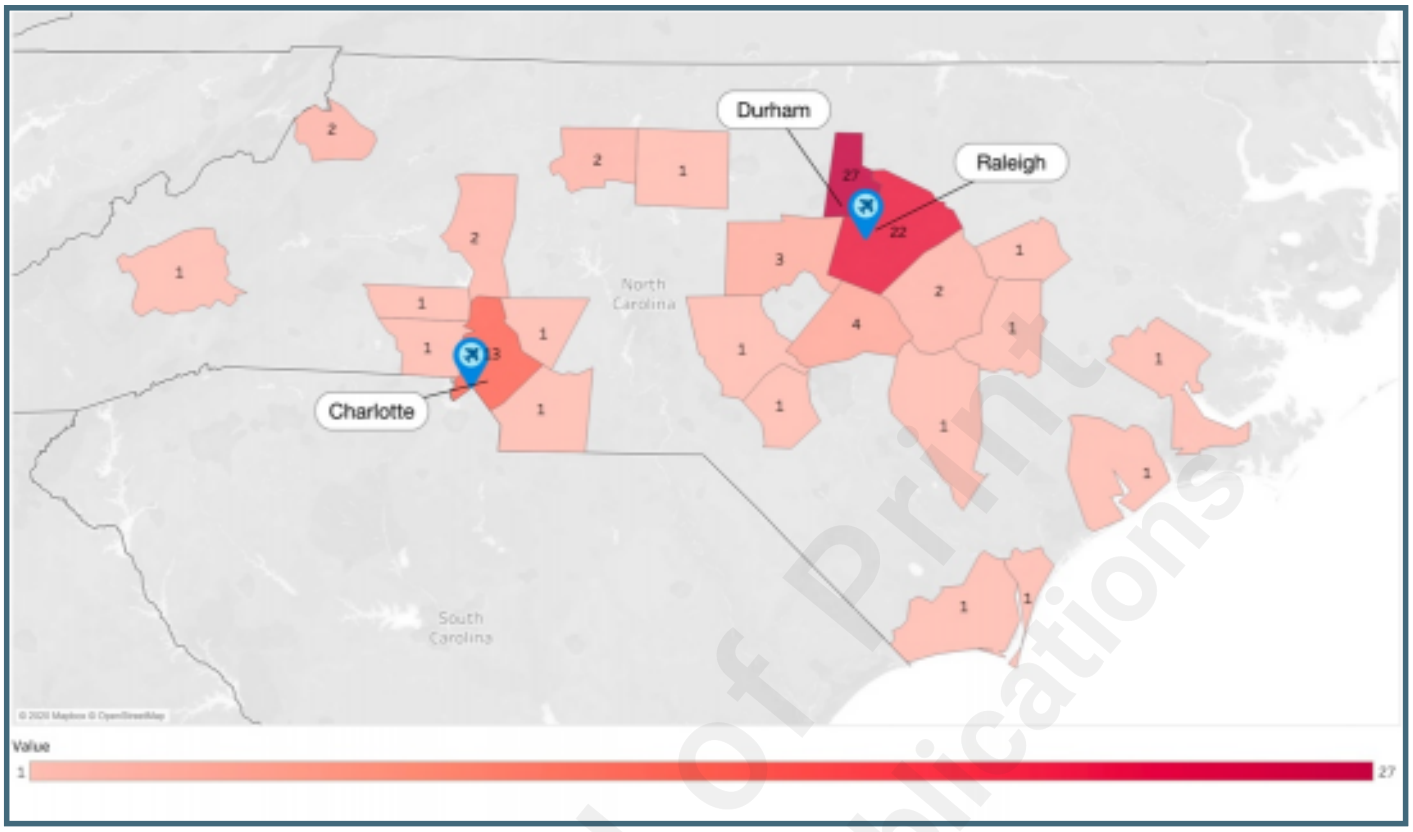
Other materials for editor/reviewers onlies

Mapping of North Carolina confirmed coronavirus disease cases with airport locations.

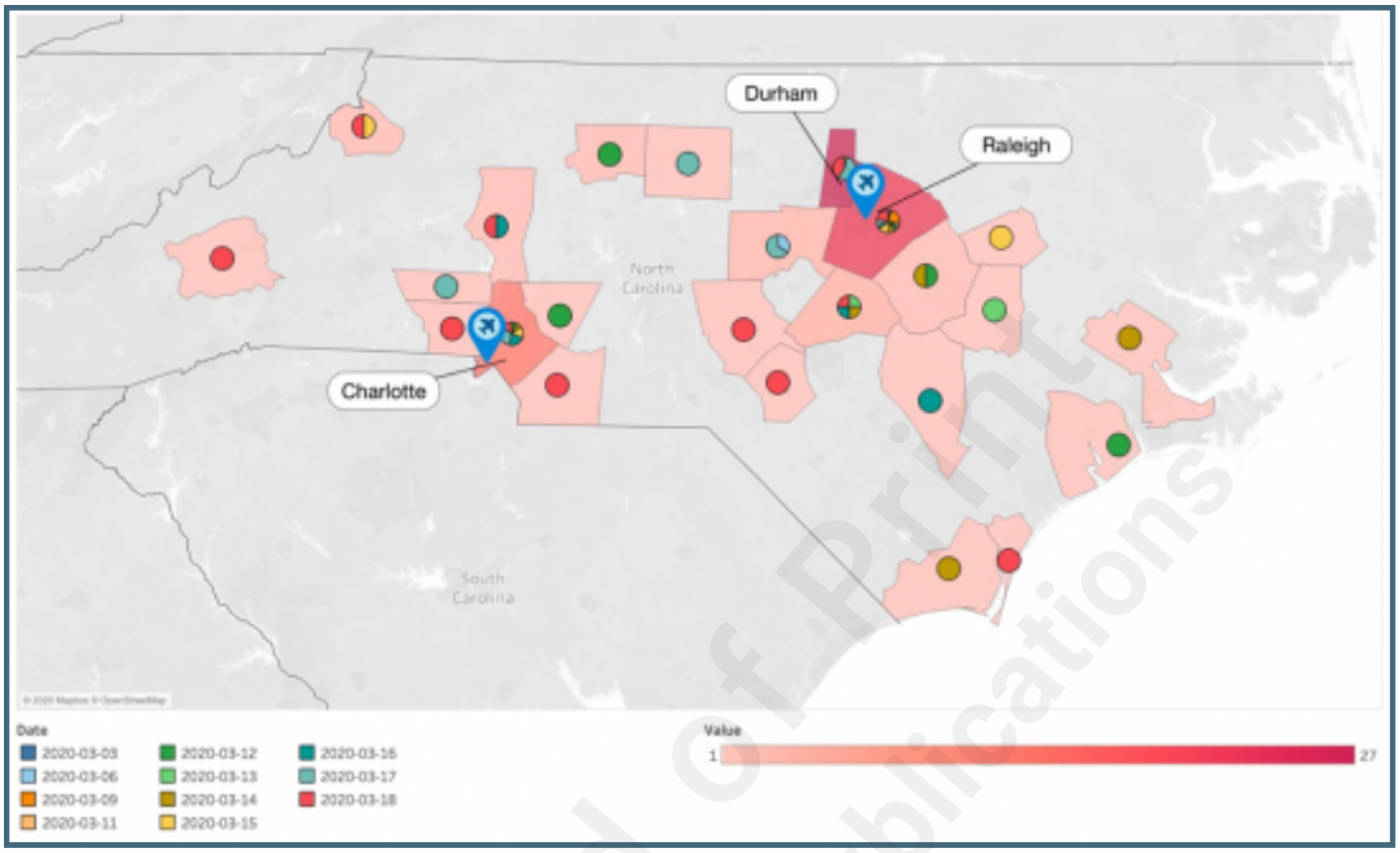


Figures

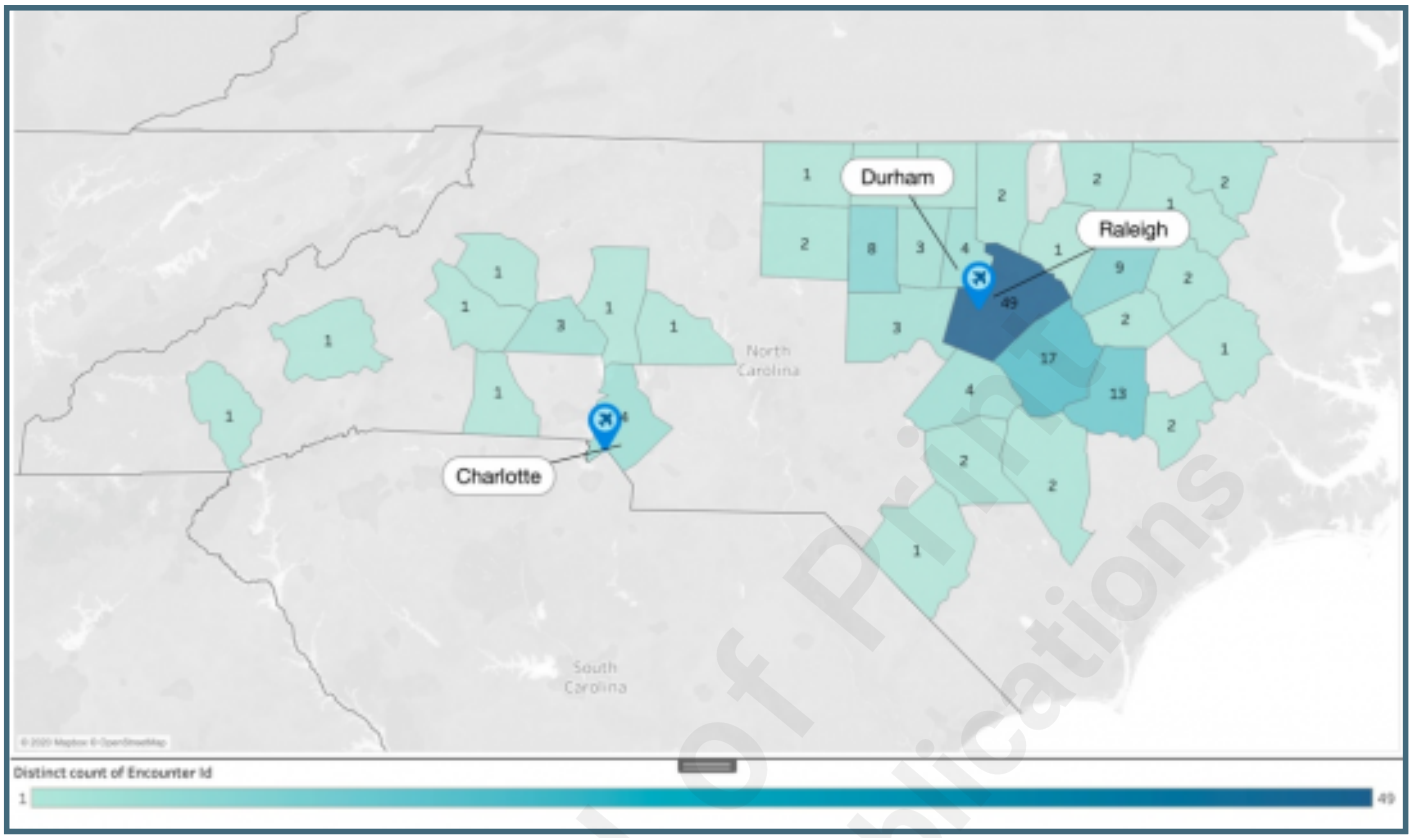
Mapping of North Carolina confirmed coronavirus disease cases with airport locations.



Time-motion analysis of confirmed coronavirus disease cases from March 3 to March 18, 2020.



Quantification of virtual care visits from February 1 to 28, 2020.



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