

IMPACT OF MITIGATION STRATEGIES: THE CASE OF THE COVID-19 TIMELINE IN PUERTO RICO

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Abstract

In 2019, the SARS-CoV-2 virus was identified as the pathogen that causes the COVID-19 pandemic. Puerto Rico has implemented mitigation strategies to control the spread of the virus throughout the population. The analyzed events and implemented measures affect how the epidemic develops. In mid-June, when the executive order was more flexible, the epidemiological curve increased. More restrictive measures are needed to decrease COVID-19 positive cases on the island.

Keywords: COVID-19, mitigation strategies, executive orders, epidemiological curve, Puerto Rico

Resumen

En el 2019 se identificó el virus SARS-CoV-2, causante de la pandemia COVID-19. Puerto Rico ha optado por implementar estrategias de mitigación para controlar la propagación del virus en su población. Hemos analizado que los eventos y medidas que se implementan cambian el comportamiento de la epidemia. A mediados de junio se identificó un aumento en la curva epidemiológica a consecuencia de la flexibilización de la orden ejecutiva. Para disminuir la incidencia y prevalencia de COVID-19 en la isla, nuevas medidas, más restrictivas son requeridas.

Palabras claves: COVID-19, estrategias de mitigación, órdenes ejecutivas, curva epidemiológica, Puerto Rico

Introduction

For more than one year, humanity has faced a battle against the pandemic of the SARS-CoV-2 virus, which causes the disease COVID-19. The origin of the pandemic took place in Wuhan, China, and spread worldwide. According to the Centers for Disease Control and Prevention (CDC), throughout history, the world has been affected by several pandemics; some were in the years: 1918, 1957-1958, 1968, and 2009 (CDC, 2019). The pandemic of 1918, better known as the Spanish influenza pandemic, caused a record of 50 million deaths in the entire world (CDC, 2019). During the 1918 health emergency, given the absence of any vaccine or treatments, non-pharmacological interventions (NPIs) were used (CDC, 2019). These NPIs were based on mitigation or suppression strategies to control a highly communicable disease. The mitigation process consists of decreasing transmission levels with measures such as social distancing, the use of face masks, quarantine, and isolation (Ferguson et al., 2020). In turn, suppression is an attempt to reverse the epidemic completely with more restrictive measures, such as elimination of person-to-person contact, the use of face masks, social distancing, quarantine, isolation, and closures of schools and universities (Baker et al., 2020; Ferguson et al., 2020). Suppression interventions must be carried out until a vaccine or treatment is available.

Since the World Health Organization (WHO) declared the SARS-CoV-2 outbreak a “Public Health Emergency of International Concern” on January 30th, 2020, it has become a priority for countries to establish mitigation measures (Cucinotta & Vanelli, 2020). On March 11th, 2020, WHO declared the COVID-19 outbreak a pandemic and urged countries to consider taking strict measures to control the spread of the virus (Cucinotta & Vanelli, 2020).

By March 12th, 2020, the governor of Puerto Rico declared a state of emergency; schools and universities initially closed for 14 days (ABC News, 2020; Exec. Order No. OE-2020-020, 2020). Scientists suspected that COVID-19 arrived earlier in the year in Puerto Rico due to an increase in deaths of patients with comorbidities (Sosa-Pascual et al., 2020). By March 8th, the National Salsa Day and the Costa Luminosa Cruise caused the first COVID-19 cases, which triggered the spread of the virus around the island (EFE, 2020a; Medicina y Salud Pública, 2020; NotiCel, 2020; Wyss, 2020).

Puerto Rico registered its first cases on March 13th, 2020, from foreigners (test date March 9th). The first case was a 68-year-old woman who presented symptoms and arrived with her husband in the Costa Luminosa. The second was a 70-year-old man

that presented symptoms (ABC News, 2020). The third case was a 71-year-old Puerto Rican resident who had family over from outside the island and then tested positive (ABC News, 2020).

Once the first COVID-19 cases were registered, the government of Puerto Rico acted promptly. Three days after the emergency declaration for COVID-19 on the island, the first curfew began (Exec. Order No. OE-2020-023, 2020). In a United States media column, politician Bill Scher acknowledged that "Puerto Rico was the first territory to enact a curfew, closing businesses, and schools" (Telemundo PR, 2020b). On March 19th, 2020, the Medical Task Force was appointed to work with the Puerto Rico Department of Health (PRDOH) as part of efforts to control the emergency in Puerto Rico. By March 23rd, 2020, they started to implement closures with more restrictive measures as needed (Puerto Rico Medical Task Force COVID-19, Exec. Order No. OE-2020-026, 2020). Every health institution needed to report suspected, confirmed, and negative COVID-19 cases (Exec. Order No. OE-2020-031, 2020). It is important to consider that this was established a few weeks after Puerto Rico already had more than a dozen cases. Reports of double-counting issues were identified by mid-April, including a delay in case reporting from labs (EFE News, 2020b). A lockdown and license plate restriction were issued for Holy Week Weekend (April 10, 11, and 12), and more strict measures were established (Exec. Order No. OE-2020-029, 2020).

In this research, the focus was to analyze and study the executive orders emitted by the government and the social events that occurred on the island to measure the effect on the epidemic curve each month.

Methodology

To analyze the incidence of positive cases in Puerto Rico and study the effectiveness of the mitigation measures implemented each month, an extensive database from news, articles, studies, and executive orders was created. This database also includes the statistics from COVID-19 on the island. Puerto Rico's data was retrieved directly from the Health Department daily data reports and the COVID-19 Dashboard. The data was used to determine the incidence of positive cases and deaths and run active cases analysis. The final goal is to determine the effectiveness of the executive orders implemented based on data behavior. The effect of the events and executive orders are measured by overlaying the ongoing infections with the events at a particular time.

To determine the effectiveness of the executive orders it is necessary to analyze and compare the prevalence of cases from the date of the event to 14-20 days later. This analysis was made visually using the graph and numerically by determining the difference percent of cases given by:

$$\frac{\text{Total cases from day 15} - \text{Total cases from day 1}}{\text{Total cases from day 1}} * 100\%.$$

These graphs make a complete validation and analysis of the effectiveness of more rigorous or more flexible measures, thus causing an increase or decrease in positive cases. If there is a decrease in the percent of cases, it is assumed that the measure was effective, and if there is an increase in the percent of cases, it was not effective. It is crucial to consider the number of tests available and administered in the month, hospitalized individuals, and deaths by a specific date.

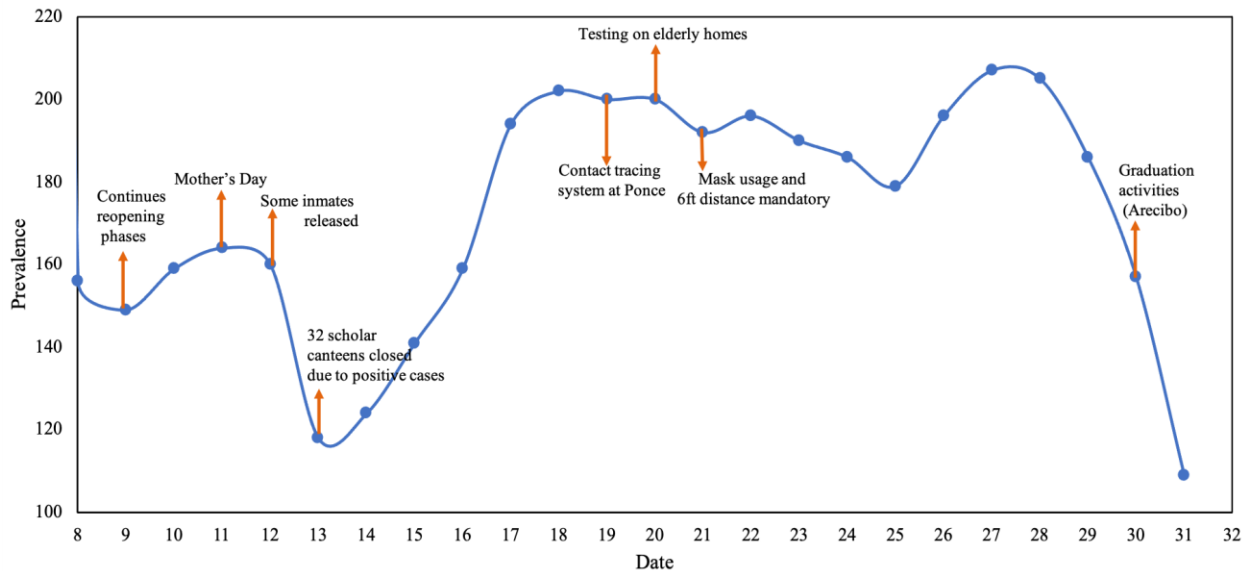
Results and Discussion

This section presents the months with more significant changes in epidemic behavior: May, July, and September 2020.

May

May started with 973 confirmed cases, and at the beginning, Governor Wanda Vázquez Garced emitted a new executive order in which the lockdown remained, and the citizens could only go out from 5:00 am–7:00 pm for essential activities (Exec. Order No. OE-2020-038, 2020). Although it had been two months since the pandemic started in Puerto Rico, based on test reporting, this was the first time an executive order specified the cautionary measures that citizens should be taking. Before this, measures like covering mouth and nose with masks, washing hands, maintaining six feet of distance between people, and avoiding crowded places were mentioned throughout social media and other sources, but they had never been stated in an executive order. By this time, people could exercise outdoors, maintaining a minimum of six feet from others; but gyms, beaches, movie theaters, casinos, and other places that promote crowding had to remain closed. Maintaining the lockdown and emphasizing cautionary measures is a possible explanation for the positive case decrease by May 13th. This executive order was effective because the increase in cases was no longer exponential. It changed to a slight increase, keeping the curve constant. After this implementation, daily cases were between 180-200 for more than ten days helping to control infections.

Later on, the increase in positive cases on the reports matches the delay in case reporting of 44.96 days on average; therefore, the increase refers to tests done in April, and infections originated from Holy Week celebrations (see Graph 1).



GRAPH 1: COVID-19 ACTIVE CASES: MAY 2020

SOURCE: OWN ELABORATION BASED ON THE *POSITIVE CASES COVID-19 REPORTS* FROM THE PUERTO RICO DEPARTMENT OF HEALTH (2020B).

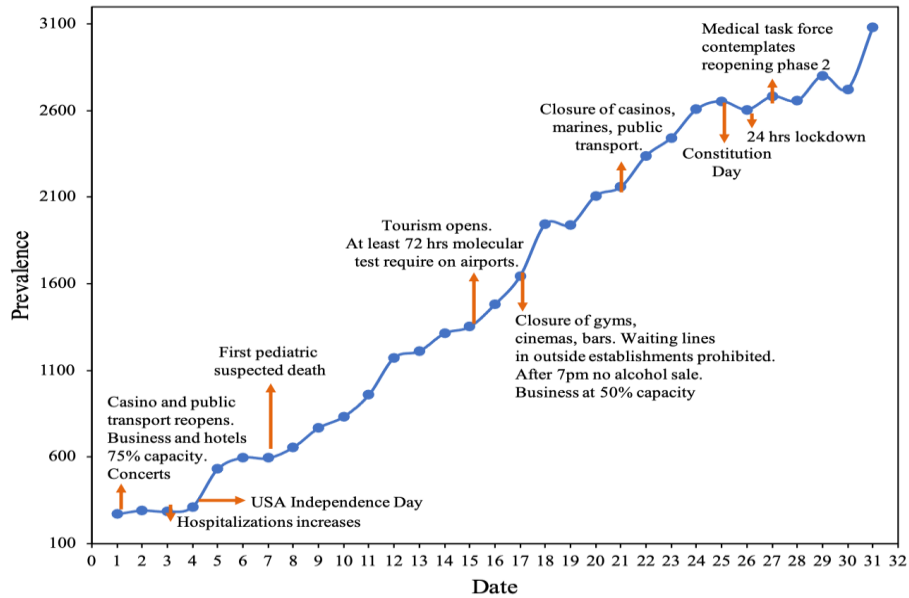
The social and economic sectors started to pressure the government to adjust the lockdown and issue a more flexible executive order because the economy was gravely affected. On May 21st, restaurants could start receiving up to 25% of customers while maintaining all the cautionary measures such as social distancing, disinfecting, mandatory masks, and frequent hand washing (Exec. Order No. OE-2020-041, 2020). Barbershops, beauty salons, pet grooming, and other services had been granted permission to start the reopening process. Simultaneously, malls had to train employees and make arrangements to start reopening on June 8th. Beaches and golf courses were only open for exercise or sports purposes, with no crowding, sunbathing, or swimming allowed (R. Rivera, 2020). By May 26th, cases began to increase, this could be due to Mother's Day celebrations during May 11th and restaurants reopening. To avoid big gatherings that could result in an outburst of COVID-19 positive cases, most of the graduations were canceled and reinvented to car rallies and celebrated together but stayed inside their cars (El Vocero, 2020a). Although this activity was safer than traditional graduation, it could also give a sense

of false security since people started taking pictures together, therefore, taking their masks off. Throughout the whole island, schools were finding different ways to celebrate, but even though safety measures were in place, an increase of 647 new infections were reported in June (PRDOH, 2020a). For example, a private school in Corozal celebrated its senior graduation outdoors with separation between chairs and limited guests (González, 2020). Although they separated the chairs, took the temperature, and everyone washed their hands, students took off their masks to take pictures. Understandably, students may have the urge to do these things knowing that they are celebrating, but this being repeated so often throughout the island could have been a significant factor in the positive cases reported in June in this age group.

July

The prevalence of COVID-19 during July adopts a surprisingly upward behavior, unlike the other months, closing with 8,860 accumulated confirmed cases. During this month, there is not a decrease in cases at any point due to the events that took place at the end of June and the first weeks of July. In Graph 2, the effects of several events can be seen. An increase of cases was visible on July 4th, which could be the effect of the movie theaters reopening on June 18th (El Vocero, 2020c). Father's Day on June 21st and beaches and pools reopen for Saint John's Eve on June 23rd (El Vocero, 2020b). Then, two outbreaks were contact traced in Canóvanas (M. Rivera, 2020a) and Guayanilla for that same date (M. Rivera, 2020b). Likewise, for July 17th, a more significant increase is observed after implementing a more flexible executive order on July 1st. The government decided to have a rapid reopening phase instead of doing it gradually (Exec. Order No. OE-2020-048, 2020). In this executive order, the maximum capacity of shops, casinos, and hotels increased drastically from 25% up to 75%, collective transportation was resumed, and outdoor events and concerts were allowed (Exec. Order No. OE-2020-048, 2020). Combined with the effects of the US Independence Day celebrations on July 4th, the increase in cases during this month was exponential.

Lastly, on July 30th, there is a significant increase shown on the graph, reflecting the effects of reopening tourism during July 15th conditioned to compulsory COVID-19 molecular tests upon arrival on the island (M. Rivera, 2020c). Infected individuals that arrived on the island must be on mandatory quarantine but without guarding. After the rapid increase in cases (1543 new infections in the first two weeks), the government started to minimize the capacity to 50%, made effective in the executive order of July 17th (Exec. Order No. OE-2020-054, 2020).



GRAPH 2: COVID-19 ACTIVE CASES: JULY 2020

SOURCE: OWN ELABORATION BASED ON THE *POSITIVE CASES COVID-19 REPORTS* FROM THE PUERTO RICO DEPARTMENT OF HEALTH (2020B).

September

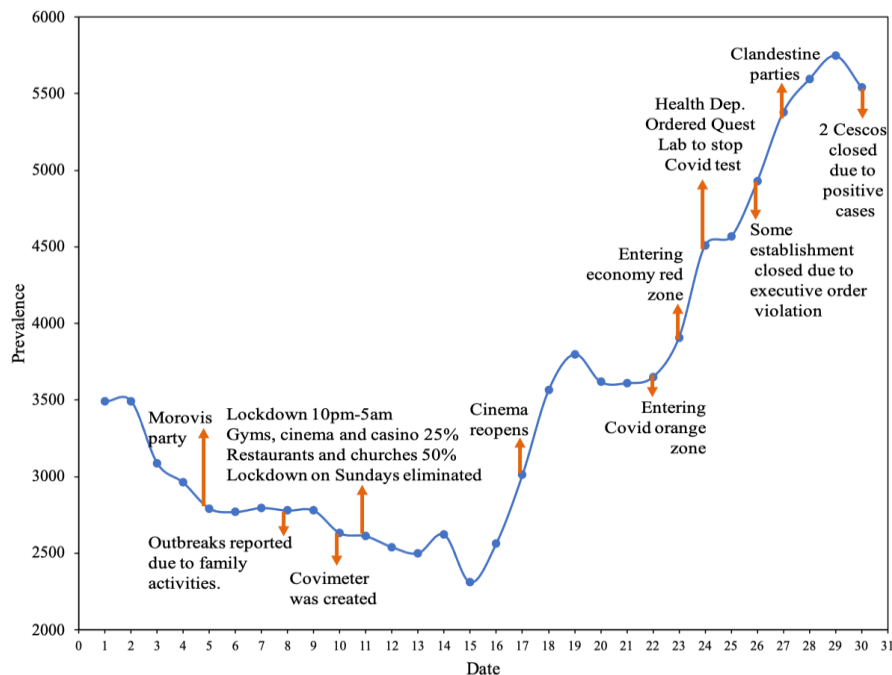
Cases decreased from the end of August to mid-September. This could be because of the executive order.

OE-2020-062 on August 22nd (see Graph 3). The OE-2020-062 is one of the most restrictive orders to reinstate the effect of the two rounds of primary elections held on August 9th and August 16th. Lack of preventive measures during this process and a high number of political rallies around the island contributed to the rise of cases throughout the rest of the months (6,650 new infections from August 9th to August 30th). Some of the measures imposed by the order included: the reduction of the maximum capacity to 25%, total lockdown and a ban on alcohol sales on Sundays, appointments were needed to receive any services, and car rallies, parades, or crowded activities were prohibited.

However, it is important to emphasize that anyone exposed to the virus had to be tested 5 days after the suspected exposure; in case of receiving a positive result to the virus, they should report it to the case tracking system of their municipality. In addition to this, Humberto Guiot, an infectious disease specialist and member of the government's medical advisory group, recommended making molecular testing more accessible to identify those who were asymptomatic; thus, an increase in positive

cases was expected (Rivera, 2020d, August 29th). On the other hand, after September 15th, cases kept increasing, reporting 5,970 new infections at the end of the month. The Puerto Rico Department of Health closed several businesses for violations of the executive order (El Vocero, 2020j; InterNewsService, 2020a).

The executive order OE-2020-066 permitted the opening of beaches and outdoor activities; their effects are seen on September 25th. Among the flexibilizations that were part of this order are eliminating full lockdowns during Sundays, the opening of gyms, casinos, and movie theaters to 25% capacity, and the increase to 50% capacity in restaurants and churches; an increase in the incidence is expected. In September, Puerto Rico reached the orange zone, close to the critical state (M. Rivera, 2020f). On September 24th, the General Secretary of the United Nations, Antonio Guterres, said that humanity did not pass the test of COVID-19, exposing a lack of preparation, union, and solidarity (InterNewsService, 2020b).

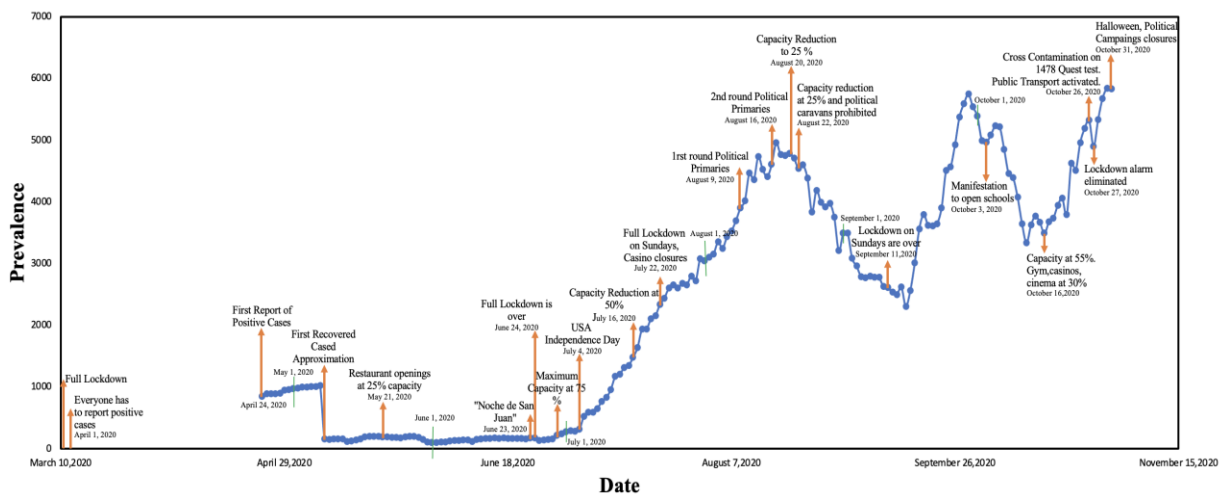


GRAPH 3: COVID-19 ACTIVE CASES: SEPTEMBER 2020

SOURCE: OWN ELABORATION BASED ON THE *POSITIVE CASES COVID-19 REPORTS* FROM THE PUERTO RICO DEPARTMENT OF HEALTH (2020B).

In general, Graph 4 represents an estimation of the active cases since the beginning of the pandemic in Puerto Rico until the end of October. It shows an exponential increase in cases after June directly related to the curfew and total lockdown

elimination. There are two waves represented and a third coming in by the end of October. The behavior represented on the graph depends on the number of available tests and people that got tested on a specific day; for these reasons, further analysis is required to determine the wave nature. Once it reaches October 31st, the tendency indicates that active cases will not decrease.



GRAPH 4: COVID-19 ACTIVE CASES: APRIL-OCTOBER 2020

SOURCE: OWN ELABORATION BASED ON THE *POSITIVE CASES COVID-19 REPORTS* FROM THE PUERTO RICO DEPARTMENT OF HEALTH (2020B).

Conclusion

Eight months into the pandemic, Puerto Rico reported 52,009 confirmed cases, 1,699 probable cases, 41,505 suspected cases, 1,144 fatalities, and 44,947 convalescent cases having roughly 49,122 active infections (PRDOH, 2020 a). Executive orders with more restrictive measures are essential to manage the pandemic and control the rapid increase of new infections. As previously discussed, the positive case prevalence is proportional to how restrictive cautionary measures are. If the measures are more restrictive cases will decrease and if measures are more flexible, the cases will increase. Non-pharmaceutical interventions, social-distancing, and mask usage interventions must be reinforced until further treatments or vaccines are available for the entire population. In general, the events and executive orders implemented in the Puerto Rican population will shape the epidemic curve.

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