Selective perimeter lockdowns in Madrid: a way to bend the COVID-19 curve?

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Abstract

Lockdowns have been widespread used to limit social interaction and bend the epidemic curve. However, their intensity and geographical delimitation have been variable across different countries. Madrid (Spain) implemented perimeter lockdowns in September with the purpose of bending the COVID-19 curve. In this paper we compared, using join point regressions, the evolution of COVID-19 cases in those areas where this intervention was implemented and those where it was not. According to our analysis, the decrease in the epidemic curve started before the impact of the perimeter lockdown could be reflected.

Keywords: COVID-19, SARS-CoV-2, pandemics, non-pharmaceutical intervention, lockdown.

Introduction

The use of interventions aiming to limit mobility and economic activity has been a widespread non-pharmaceutical intervention (NPI) to control the transmission of SARS-CoV-2.¹ Lockdown interventions have been seen as one of the most effective ways to bend the epidemic curve.² However, their intensity and geographical delimitation have been variable. Thus, an individual evaluation of each strategy is required to determine their effectiveness in order to design future NPI to mitigate the effect of COVID-19 transmission.³

Madrid is one of the most affected european regions throughout the pandemic, and the spanish region with the highest number of cases and deaths: until December 16th, 369,522 COVID-19 cases and 11,619 deaths have been declared, meaning an estimated seroprevalence of 18.6% since the beginning of the pandemic, as shown in a recent report⁴. One study showed that Madrid was the spanish region with the largest drop in weekly life expectancy during the first wave of the pandemic⁴.

In September 21st, in the middle of the second wave of the pandemic, Madrid regional government implemented the so-called “perimeter lockdowns” in the Basic Health Zones (BHZ)⁶ (the smallest health territorialization units, composed of a mean population of 22,290 inhabitants) where community transmission was reaching critical levels (14-day COVID-19 cases rate per 100,000 > 1,000 on September 15th). This perimeter lockdowns restricted mobility in-and-out of the BHZ except for essential purposes (work or academic activities, caring for dependent people or carrying out administrative procedures) as well as limited capacity of business but without closing restaurants or restricting other types of economic activity. This type of lockdown was only comparable to the “dynamic confinements” in Chile, whose effectiveness has been questioned⁷. Thus, we want to assess whether the trend of 14-day COVID-19 rate changed in the BHZ affected by perimetral lockdown with respect to other BHZ in the city of Madrid that were not affected by the perimetral lockdown.

Methods

Data source

We collected publicly available weekly data on the 14-day COVID-19 rate per 100,000 population between July 7th and 1st December from the open COVID-19 open portal dataset of the Health Department of the regional government.

First, we selected all BHZ within the city of Madrid, excluding the rest of the region to avoid the potential bias of the rural areas. From this, we selected the 26 BHZ that were affected by the perimeter lockdowns and a control group of 29 BHZ that had a 14-day COVID-19 rate above 700 cases per 100,000 on September 15th (when first perimeter lockdown was decided). We chose this cut-off point for the control group in order to have a comparable group in terms of similar COVID-19 transmission at the time of the lockdown decision.

Statistical analysis

We conducted a descriptive analysis of the trends of 14-day COVID-19 rate of the city of Madrid, and the BHZ within the city with and without the perimeter lockdown implemented. To identify changes in 14-day COVID-19 rate trends, joinpoint analysis was performed for the entire city of Madrid. Secondly, the same analysis was performed separately for those BHZ with and without perimeter lockdown. The time period of analysis comprises between July 7th and 1st December. The software used was the Joinpoint Trend Analysis, Version 4.8.0.1 (Statistical Research and Applications Branch, National Cancer Institute).

Results

In the city of Madrid, the 14-day COVID-19 rate increased in the second wave until a maximum peak of 770.5 cases per 100,000 inhabitants on September 22nd (Figure 1). Three join points were described, delimiting four periods for the epidemic curve of the city of Madrid (Figure 1; Supplementary File 1): Jul 7th-Jul 21st, Jul 21st-Aug 18th, Aug

18th-Sep 15th, and Sep 15th onwards. The first three periods showed 14-day COVID-19 rate weekly increases: 5.45%, 111.42%, and 31.68% respectively. However, the last one showed a 11.10% weekly decrease. A similar pattern was observed in the BHZ without perimeter lockdown: the first three periods experienced weekly increases (10.89%, 112.42%, and 31.05%), but the trend started to decline on September 15th (11.52% weekly decrease). For the BHZ affected by perimeter lockdowns, four join points were described, delimiting five trend periods: Jul 7th-Jul 21st, Jul 21st-Aug 25th, Aug 25th-Sep 22nd, Sep 22nd-Oct 20th, and Oct 20th-Dec 1st. The first three periods showed weekly increases: 12.03%, 116.79%, and 9.94% respectively. The last two periods experienced weekly decreases: 22.05% and 11.34%.

Discussion

In this analysis, we identified trend changes in the 14-day COVID-19 rate in Madrid using a joinpoint analysis in order to identify if these changes are associated with the selective perimeter lockdowns implemented on September 22nd. The change in the COVID-19 rate trend occurred around the 15th for the entire city of Madrid and the BHZ not affected by the perimeter lockdown, and around the 22th for those BHZ with perimeter lockdown implemented. Considering the incubation period and notification delay, it is required a minimum of 6-9 day lag period since the implementation of a NPI to detect any potential effect⁸. Our results showed that the decrease in the epidemic curve, both in the entire city and the BHZ of the analysis, started before the impact of the perimeter lockdown could be reflected. Also, our results showed that the perimeter lockdowns did not increase the velocity at which cases were decreasing. Thus, the observed decrease might be associated with other NPI implemented in previous weeks, such as social meetings limitation, night clubs closure, or restaurant capacity limitation.

There are many reasons why perimeter lockdowns seemed not effective in reducing COVID-19 cases. First, the curve started to decrease before measures were taken. Second, perimeter lockdowns were focused on mobility rather than preventing high-risk

situations (e.g. indoor activities⁹). Third, mobility was allowed for essential activities such as working, which represent most of the mobility of residents living in the affected areas¹⁰. Fourth, boundaries of BHZ were unknown to many residents, as they are used just for healthcare territorialization. As it has been discussed regarding the Chilean experience, the “spillover” effect of neighboring areas that are not under lockdown limits its potential effectiveness in high-interconnected cities⁷.

This analysis has some limitations. First, our area-level analysis is sensible to ecological fallacy. Second, there are potential unmeasured confounders that were not under control (e.g. changes in personal awareness or personal attitudes). Third, there is a potential bias due to notification delay, which is more likely to happen when COVID-19 cases are higher.

The perimeter lockdown implemented during the peak of the second wave had no effect in the COVID-19 rate trend. Evaluation of NPI is key to elucidate its effectiveness to control the SARS-CoV-2 transmission, and to gather relevant information to design policies during a public health emergency.

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Conflicts of interest

The authors declare no conflict of interest

Key-points

- NPI effectiveness evaluation is necessary for a better response during public health emergencies.
- Lockdown implementation should be adapted to the social patterns of mobility in urban settings.
- Public health measures during pandemics should consider not only factors related to mobility but also high-risk transmission activities.

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Figures

Figure 1: 14-day COVID-19 rate from July 7th to December 1st in the whole city of Madrid (upper panel) and the Basic Health Zones (BHZ) affected by perimeter lockdowns and control BHZ not affected by perimeter lockdowns (down panel).

Figure S1: Join point regression of the 14-day COVID-19 rate from July 7th to Decembter 1st in the whole city of Madrid.

Figure S2: Join point regression of the 14-day COVID-19 rate from July 7th to Decembter 1st in the Basic Health Zones (BHZ) affected by perimeter lockdowns.

Figure S3: Join point regression of the 14-day COVID-19 rate from July 7th to Decembter 1st in the control Basic Health Zones (BHZ) not affected by perimeter lockdowns.