Lockdown effect on COVID-19 incidence and death: Iran experience

Sajad Delavari, PhD¹; Zahra Jamali, MSc Student (Biostatistics)¹; Mohsen Bayati, PhD²;*  

¹ Health Human Resources Research Center, School of Health Management and Information Sciences, Shiraz University of Medical Sciences, Shiraz, Iran  

² Department of Biostatistics, School of Medicine, Shiraz University of Medical Sciences, Shiraz, Iran  

* Corresponding Author: Mohsen Bayati; E-mail: bayatim66@gmail.com  

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Abstract

Background: Countries are trying several policy options for decreasing the incidence and burden of the COVID-19. One of these strategies is a lockdown, complete closure, to reduce the risk of distributing disease via social interactions. This study aimed to analyze the effect of a three-week lockdown on the mortality and morbidity of the COVID-19 in Iran.

Methods: Official daily data on COVID-19 incidence and death reported on the COVID-19 by the World Health Organization (WHO) were extracted from September 1, 2020, to January 14, 2021. Data were analyzed using interrupted time series analysis via STATA 14 software.

Results: Lockdown resulted in a significant reduction in the daily death from Covid-19 in the short-term (β=−139, P<0.01) and in the long-term (β=−12, P<0.01). Moreover, lockdown in the short-term insignificantly (β=−21.58, P=0.969), and in the long-term significantly (β=−317.31, P<0.01) reduced the Covid-19 daily incidence.

Discussion: The results showed that the lockdown has a significant effect on incidence and death numbers. Therefore, it could be a suitable short-term strategy for controlling the COVID-19 outbreak. On the other hand, its negative effects on households and businesses should be considered.

Keywords: COVID-19, SARS COV-2, Coronaviruses, lockdown, death, incidence, mortality, morbidity
Introduction

COVID-19 pandemic has become a major global health problem in recent years. It changes lifestyles and working life. It also resulted in changing the economic situations of individuals and companies (1, 2). Therefore, the governments are trying to change the situation and do all their best to defeat COVID-19.

The health systems and government are planning and initiating different actions in battle with the COVID-19 epidemic (2). Using personal protection equipment, handwashing, and social distancing are the core strategies in nearly all health systems (3, 4). But since the prevalence of disease changes over time in some periods, some governments impose restrictions on population movement and restrict unnecessary trips (5).

Iran is one of the countries that is The first case of COVID-19 infection was officially reported on February 19, 2020. From then to January 14, 2021, near 1,311,810 people were infected and 56,538 deaths were happened. Iran has experienced three waves of the COVID-19 outbreak. The third one was started around the beginning of October 2020. The highest reported number of daily cases was 14,051 reported on November 27, 2020 (6).

Iran has tried several policy options to decrease COVID-19 prevalence from the beginning of the outbreak. After increasing the trend of death and incidence of the COVID-19 cases in the third wave, Iran initiated a two-week lockdown as the main peak happened. It extends for one more week in some provinces, which was from November 21 to December 11, 2020. In this lockdown, most governmental and private organizations, shopping centers, and stores that do not provide essential products were closed. Besides, all mass gatherings were canceled or held in an online format. This widespread lockdown was the most long-lasting and rigid lockdown from the beginning of COVID-19 emergence in Iran.

Many countries employ the lockdown intervention for controlling the COVID-19. Therefore, this report aimed to analyze the effect of a three-week lockdown strategy on the incidence and death numbers of the COVID-19 in Iran. The results could help policymakers with their future actions toward controlling the COVID-19 outbreak.
Methods:

In this time series analysis, we used Iran's official statistics on COVID-19 incidence and death from September 1, 2020, to January 14, 2021. The beginning of the period was between the second and third waves of the outbreak in Iran. The end of the period was selected based on the last data (January 14, 2021). Therefore, the time span covers around 120 time points (70 days before and 50 days after the intervention). We considered one week after lockdown as the initial effect of the intervention in the model. This is determined according to the change in behavior of incidence and death data. The lockdown was started from 21 November 2020. Daily incidence and death data were extracted from the Iran Ministry of Health and Medical Education reports published on the World Health Organization (WHO) website (6). We also compare the actual trend with the projected trends of the Institute for Health Metrics and Evaluation at (IHME) on October 29, 2020, before the intervention (7, 8). Data were analyzed using interrupted time series analysis using STATA 14 software (4905 Lakeway Drive, College Station, Texas 77845 USA).

Results:

According to the previous projections, on October 29, 2020, by IHME, death from Covid-19 increased and reached more than 800 cases per day. However, the actual trend showed that lockdown has noticeably changed the previously projected trend (figure 1).
Findings from interrupted time series analysis (Table 1) indicate that although the immediate (after one week) decrease in daily incidence after lockdown is insignificant ($\beta=-21.58$, P=0.969), in the long-term, the reduction in the daily case is very considerable and significant ($\beta=-317.31$, P<0.01). Estimates also show that lockdown resulted in a significant decrease in daily death from COVID-19 at short-term and long-term (Table 1). In other words, immediately (one week) after lockdown, 139 (P<0.01) and continuing 12 (P<0.01) death per day has been decreased.

It should be asserted that in our research short-term means one week after lockdown and long-term means from after one week until January 14, 2021 (about 50 days).

Results also can be found in the figure 2. Dashed lines shows actual values of daily incidence and death from Covid-19. Red and green lines indicate the fitted regression lines before and after of lockdown, respectively.
Table 1: The interrupted time series analysis of lockdown effects on the Covid-19 daily death and incidence in Iran

|                  | Daily incidence (number of new cases in a day) | Daily death (number of deaths in a day) |
|------------------|-------------------------------------------------|----------------------------------------|
| Pre-lockdown     |                                                 |                                        |
| Initial level*   | -33.16 (0.898)                                  | 74.07 (0.000)                          |
| Initial trend**  | 143.28 (0.000)                                  | 4.99 (0.000)                           |
| Post-lockdown    |                                                 |                                        |
| Change in level after lockdown (short-term)*** | -21.58 (0.969)                                | -139.13 (0.000)                        |
| Change in trend after lockdown (long-term)**** | -317.31 (0.000)                               | -12.00 (0.000)                         |
| Trend after lockdown***** | -174.03 (0.000)                             | -7 (0.000)                              |
| Model significance | F-statistics                                   |                                        |
|                  | 280.72 0.000                                    | 871.68 0.000                           |

*Constant term (y-intercept) of regression line before lockdown.

**Slope of regression line before lockdown.

***Changes in constant term of regression line after lockdown rather than before lockdown.

****Changes in slope of regression line after lockdown rather than before lockdown.

*****Slope of regression line after lockdown.
Figure 2. The trend of covid-19 daily cases and death from September 1, 2020, to January 14, 2021 (before and 50 days after the lockdown)

Discussion

This study found that the lockdown could be an effective intervention for decreasing the incidence and death numbers in the COVID-19 outbreak. This finding is in line with other reports in different countries. As Alfano and Ercolano 2020 showed in a cross-country panel analysis, lockdown is an effective strategy, especially around ten days after implementation (9).
Lockdown also could significantly decrease the spread of COVID-19 in Greece (10), Portugal (11), and Italy (5). Studies showed that lockdown interventions could be more effective if they accompanied other strategies, such as wearing masks (4).

In Iran, like many other countries, lockdown intervention is accompanied by other interventions such as increasing number of tests, patient follow-up, financial support of vulnerable households, restrictions on population movement and mass-gatherings, and schools and universities closure from the beginning of the outbreak. Therefore, maybe other interventions played a role in this decrease, but the lockdown played the main role according to analysis and literature, especially when it is more than ten days (9).

It should be considered that the effect of lockdown intervention could be seen in the short-term (9, 10). Usually, after the lockdown, the trend could become increasing. Therefore, the policymakers should be alert and apply other effective interventions to preserve lockdown success.

As an effective intervention in controlling the COVID-19 outbreak, lockdown could have a negative economic impact on the households, especially their mental health (12-14) and businesses (1). Therefore, the health systems could not rely on it as a long-term and repetitive intervention (2). The cost-effectiveness of the lockdown and other interventions should be analyzed and considered by the researchers and policymakers.

Authors Contribution:

MB designed the research and did the analysis. ZJ gathered the data and help in analysis. SD draft the manuscript. All authors reviewed the final version.
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