

Effectiveness of Lockdown in Reducing the Spread of COVID-19

Adyati Satya Puspita¹, Judya Sukmana², Lestari Dewi², Erina Yatmasari³

¹Student at Faculty of Medicine, Hang Tuah University, Surabaya, Indonesia, ²Lecturers and Master of Patobiologi at Faculty of Medicine, Hang Tuah University, Surabaya, Indonesia ³Lecturers at Faculty of Medicine, Hang Tuah University, Surabaya, Indonesia

Abstract

At the end of 2019, a mysterious outbreak appeared, forming an atypical pneumonia suspected of originating from an animal market in Wuhan China. The outbreak is a new type of coronavirus which is named as COVID-19 disease (2019 – nCoV, Novel Coronavirus). COVID 19 disease is a viral infection caused by SARS-CoV-2, namely the acute respiratory syndrome coronavirus 2 which emerged in Wuhan, China. Vaccines and antiviral drugs have not been found, meanwhile COVID-19 are prevented by using non-pharmacological interventions, one of the actions taken by several countries is to create policy protocols such as lockdowns.

The results of this study indicate that lockdown is effective in reducing the spread of COVID -19, it can be seen from the significant decrease in R_0 and R_t , <1 in several countries after lockdown such as UK 0.99 (0.96–1.02), Italy 0.89 (0.87–0.91), French 0.76 (0.72–0.82) and Spain 0.74 (0.71–0.78) which means that someone who is infected cannot infect other people and the disease will die (disappear). The value of R_t also shows a consistent decline R_t to <1 (0.88) after 2 weeks of lockdown in Italy.

The conclusion from this literature show that lockdowns can reduce the spread of COVID-19 which is shown by the number of incidents before and after the lockdown which has decreased to zero cases in China. The decline in cases also occurred in Europe although at the beginning of the lockdown it was not significant but it was increasingly effective and continued to be significant after the lockdown was imposed.

Keywords: Effectiveness, COVID-19, Lockdown, Spread, R_0 , R_t

Introduction

At the end of 2019, a mysterious outbreak appeared in the form of atypical pneumonia suspected to have originated in an animal market in Wuhan China. The outbreak is a new type of coronavirus named Novel Coronavirus 2019 (2019-nCoV / COVID 19) by the World Health Organization (WHO)¹.

Novel Coronavirus disease 19 (2019 - nCoV) is a viral infection caused by SARS-CoV-2, namely the acute

respiratory syndrome coronavirus 2 which emerged in Wuhan, China².

The rapid spread of the virus has led to implementation of preventive measures in the COVID-19 outbreak, such as reducing interactions between infected, uninfected and unidentified individuals. Recent research shows preventive measures begin with quarantine of infected and possibly infected individuals and prohibiting travel to restricted areas. Previous research has shown travel restrictions or interaction restrictions have had a positive effect on past SARS, Ebola, and Pes outbreaks. The lockdown in Wuhan is strictly limiting various activities and form of home quarantine. Social distancing, namely limiting community activities but not as strict as

Corresponding Author:

Judya Sukmana

email: judya.sukmana@hangtuah.ac.id

lockdown because residents are still allowed to leave the house for a maximum of 30 minutes³.

Lockdown is a limitation of physical contact between individuals and form of instructions not to leave the house in order to avoid the outside environment including with infected people without symptoms, in this condition only urgent matters or emergencies are allowed to do general activities. Lockdowns are increasingly being applied to countries affected by the COVID-19 outbreak such as Italy, China, UK, India, France and Spain but in contrast to the strict lockdown in China, the Italian government allows its people to continue to work, leave the house within hours and must maintain minimum distance of 1 meter per person. The State of Indonesia in the context of controlling the implementation of health quarantine based on Law Number 6 of 2018, one of the measures of health quarantine is large-scale social restrictions (PSBB) instead of lockdown³⁻⁵.

Methodology

This study uses a literature study method with data from international journals (Scimago, Scopus) or national indexed (SINTA) which can be accessed completely. Articles were collected from the year 2015-2020.

Lockdown

A total of 214 countries have confirmed cases of COVID-19. With the increasing number of cases and deaths in this outbreak, many countries are taking strict restrictive measures such as school holidays, quarantine

at home, working from home to imposing lockdowns (full restrictions on international and domestic travel) to slow the spread of the COVID-19 outbreak “Flatten the curve”. Lockdowns in each country is different depending on the effect it produces, apart from functioning to reduce the spread of the outbreak, lockdowns also have a good impact on the environment^{6,7}.

Result

The cases in Italy before the lockdown were 9,172 cases a day later to 10,149 cases. The number of cases in India before the lockdown was 492 which then continued to increase. The country of Paris before the lockdown numbered 2,281 cases while the UK country had 2,630 cases before the lockdown⁸. China on February 29, 2020 there were 79,394 confirmed cases and 2,838 deaths from COVID-19, 48,557 cases came from Wuhan⁹. WHO data shows that as of May 12, 2020, more than 4 million confirmed cases, around 280,000 deaths and around 215 countries, regions or areas were confirmed infected. Europe and North America starting in May, were the continents worst affected by COVID-19, namely 1,755,790 and 1,743,717 cases as of 12 May 2020, Spain with 224,000 confirmed cases, followed by Russia 221,334 cases, England 219,187 cases, Italy 219,070 and Germany 169,575 which continues to grow rapidly^{8,10}.

European countries report the number of cases up to 6.6 million cases (1.46% of the population), 1.2 million cases in Africa (0.10%) and 90,000 cases in China (0.01% of the population)¹¹.

Table 1. R0 Value Before and After Lockdown in Several Countries

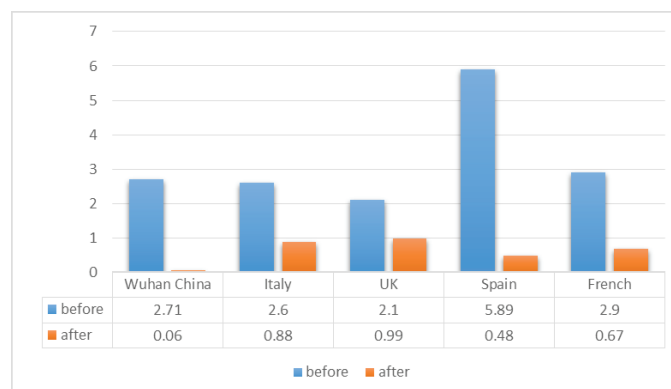
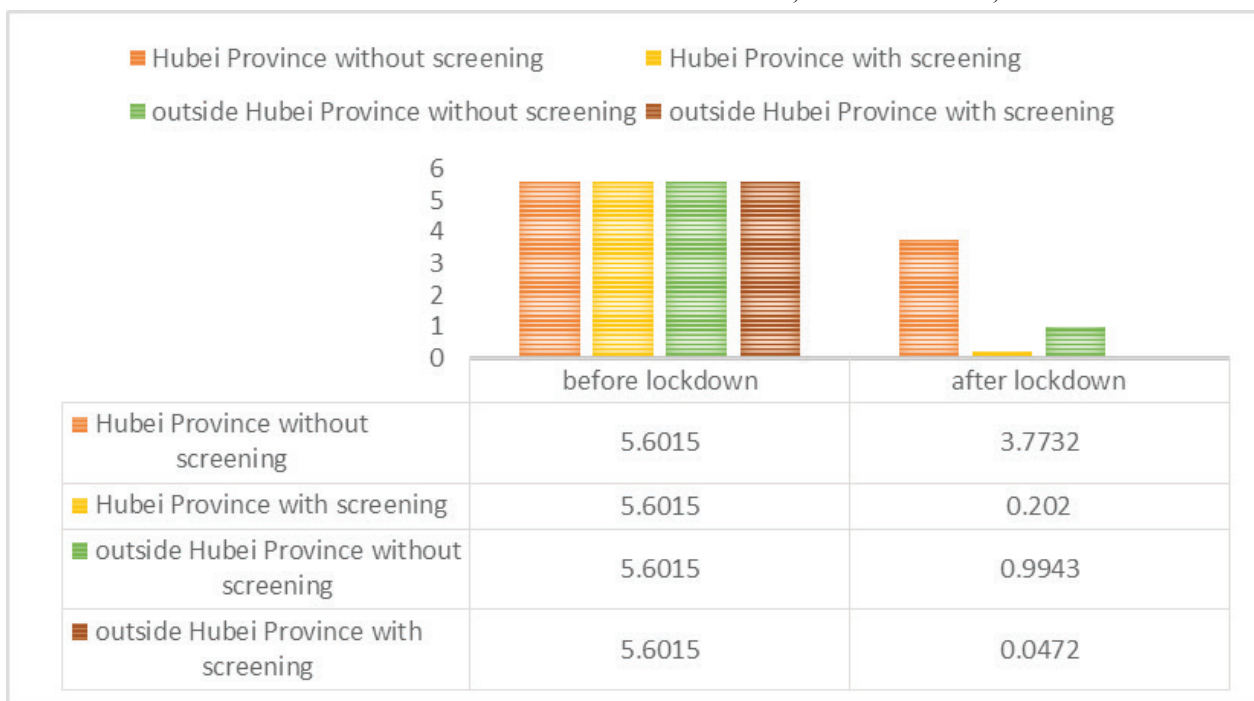


Table. 1 shows the estimation of R0 according to Lonergan and Chalmers that lockdown can reduce R0 below the number 1, even if only in some countries. In USA, the number of cases (n) 1,551,853 had R0 before 3.6 (3.4–3.8) and R0 after 0.97 (0.94–1.00), UK n 248,818 with R0 before 2.1 (1.8–2.3) and R0 after

0.99 (0.96–1.02), Italy with 227,364 cases and having R0 before 2.2 (2.0 –2.4) and R0 after 0.89 (0.87–0.91), France with n 143,845 and R0 before 2.0 (1.8–2.1) and R0 after 0.76 (0.72–0.82), Spain with 233,286 cases with R0 before 2.2 (2.1–2.4) and R0 after 0.74 (0.71–0.78)¹².

Table 2. R0 Before and After Lockdown in Wuhan, Hubei Province, China



Y. Li and friends’ research in China before Wuhan lockdown (before 23 January 2020) R0: 5,6015 in mainland China, after Wuhan lockdown and before the Hubei Province lockdown (23-26 January) R0: 6, 6037. Hubei Province in lockdown and without large-scale case screening, R0 in Hubei: 3.7732 and R0 outside Hubei Province: 0.9943, but after lockdown and large-scale case screening, R0 in Hubei becomes: 0.2020 and R0 outside Hubei province becomes: 0.0472 so that the average R0 in Hubei Province is 3.4094 until February

25, 2020¹³. Fang, Wang and Yang’s research shows that the lockdown in Wuhan shows a decrease in inflow into Wuhan by 76.64% and outflow from Wuhan by 56.35%, besides that with counterfactual simulations show that lockdown in the city of Wuhan has contributed to reducing the total infected cases outside of Wuhan, where if it is not carried out the lockdown shows the case rate was 64.81% higher in 347 cities in China outside Hubei Province and 52.64% higher in 16 cities outside of Wuhan that you are in Hubei Province ¹⁴.

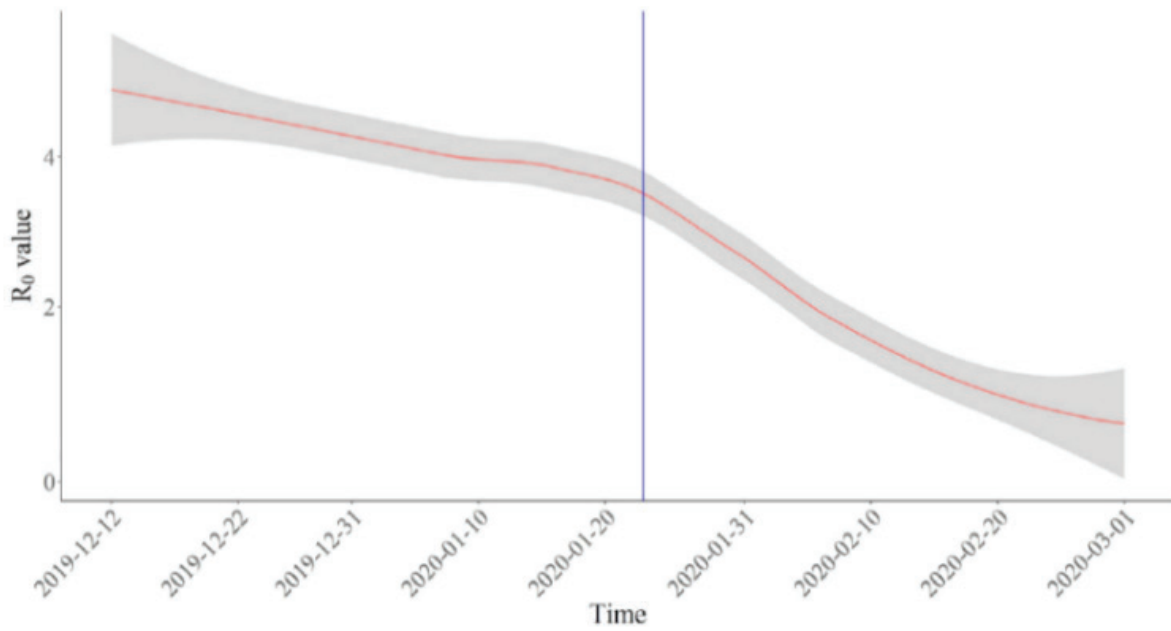


Figure 1. R0 value curve for the city of Wuhan China

Figure 1. shows the curve of R0 after control measures in Wuhan on January 23, 2020. Lockdown shown by a blue vertical line, R0 begins to decline. The epidemic is slowly dying, seen from R0 starting at 2.71 on 23 January then dropping to below 1 on 8 February 2020 and dropping to 0.06 on 6 March 2020¹⁵.

Another study showed complete lockdowns in Kensington and Chelsea without movement would reduce infections by 97%. Lockdown starts from March 9, 2020 in London. Based on several scenarios and baseline cases, it shows when the lockdown is eliminated on May 8, 2020 without any additional intervention R0: 2.56, while when weekly checks under lockdown conditions R0 shows 0.50¹⁶.

COVID 19 resurfaced in the UK starting in late summer after most restrictions were lifted. In October, a large population-based study found 50,000-100,000 new infections each day. The British government on 12 October 2020 announced a social distancing program that is differentiated by each region which consists of

3 levels. The least restrictive grade 1 areas change to grade 2 or 3 as the incidence of infection increases. Tier 1 regions have a 10pm curfew and restrictions on the number of individuals when meeting. Region 2 is restrictions on individuals from neighbors and it is advisable not to travel if it is not important, while in region level 3 there are restrictions on closing places such as hotels and recreation areas such as pubs and restaurants. Incidence continues to increase in all regions of the UK despite these steps¹⁷.

The national lockdown will be carried out starting 5 November 2020 for 4 weeks. The 2nd lockdown is similar to the first one but schools and universities can be opened. Northern Ireland and Wales went into lockdown in mid-October. Lockdown in Northern Ireland allows retail can open and its citizens can gather with neighbors of up to 2 neighbors while in the country of Wales retail non-essential retail cannot open and residents are expected to always be at home and not make contact with neighbors.

Table 3. Types of Preventive Measures in the UK

Type of intervention	Decrease of Rt (%)
tier 2	2% (0-4)
tier 3	10% (6-14)
LOCKDOWN IN NORTH IRELAND	
School closed	35% (30-41)
School opened	22% (15-27)
LOCKDOWN IN WALES	
School closed	44% (37-49)
School opened	32% (25-39)
LOCKDOWN IN LONDON	
School closed	36% (29-42)
School opened	22% (15-29)

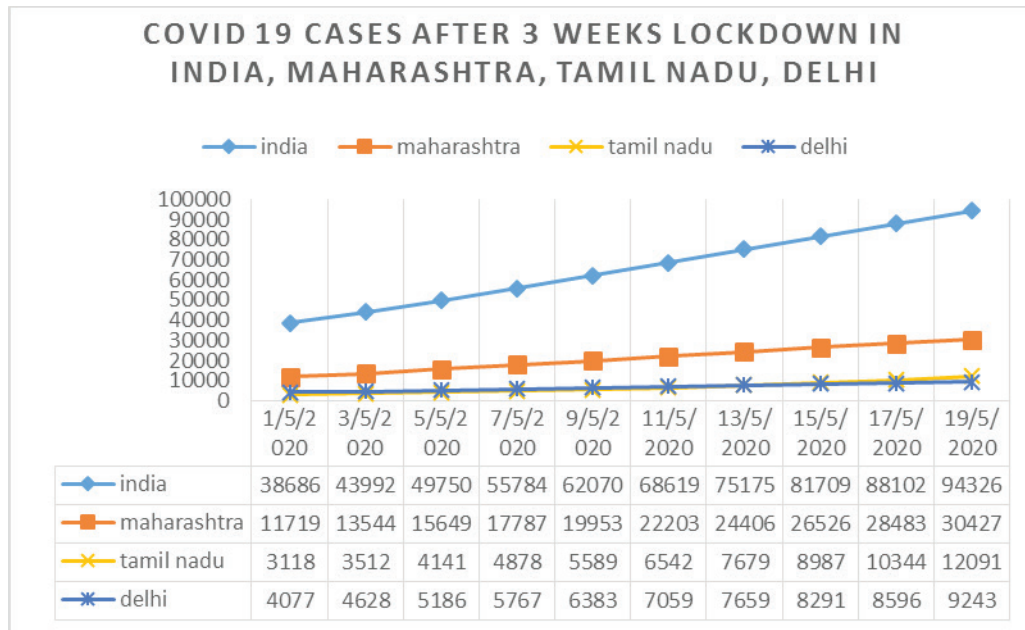
Research by Davies and colleagues showed that the Rt value decreased after various interventions such as: level 2 areas decreased by 2% (0 - 4), level 3 decreased by 10% (6 - 14), the type of lockdown in Northern Ireland, when schools were closed: 35% (30 - 41), schools opened: 22% (15 - 27), lockdown in Wales when schools closed: 44% (37 - 49), schools opened: 32% (25 - 39) and lockdowns in England decreased when the school was closed 36% (29 - 42), when the school was opened 22% (15 - 29)¹⁸.

Evaluating the progressive result of transmission reduction through Rt which are divided into: 1) before lockdown, 2) the first week and 3) the second week after lockdown (18 and 25 March). Average R0 2.83 – 3.10 in 8 region in Italy. March 10, 2020 Rt 1.79 – 3.36, then 1

week after the lockdown (March 18) Rt fell consistently (Rt 1.28) and in the second week (March 25) Rt <1 (0.88) consecutively for 3 weeks in almost all regions¹⁹.

Lockdown show high effectiveness in reducing spread and mortality, but has a negative effect if it continues to be prolonged in the form of economic and social instability of the country¹⁶. Journals about lockdown show when a country is late in lockdown the number of infected cases will be more and increase rapidly than countries that lockdown earlier. Countries that apply lockdowns with additional interventions or variables have better lockdown results besides that individual compliance with lockdowns shows a decrease in the spread of COVID -19 which is in accordance with the objectives of the lockdown itself.

Table 4. Covid 19 Cases After 3 Weeks Lockdown at several city in India



Other studies showed no significant decrease in the number of daily cases after the lockdown instead an increase in the number of daily cases after 3 weeks during the lockdown. Cases are increasing rapidly possibly due to a lot of migration in various regions, besides that the failure of the lockdown in India during the lockdown period could be the result of several groups of individuals who did not follow the restrictions in India or because the number of tests carried out during a certain period has increased significantly which causes some studies have different results especially in some Indian country studies²⁰.

Conclusion

Lockdown is effective in reducing the spread of COVID-19 in several countries. Incidence of the spread of COVID-19 from several journals shows that after lockdown the case is lower than before the implementation of the lockdown, especially in China and European. Lockdown has the effectiveness in reducing the spread of COVID-19.

Ethical Clearance – Not required since it is a literature review

Source of Funding – nil

Conflict of Interest – nil

References

1. Chan JFW, Kok KH, Zhu Z, Chu H, To KKW, Yuan S. et al. Genomic characterization of the 2019 novel human-pathogenic coronavirus isolated from a patient with atypical pneumonia after visiting Wuhan. *Emerg Microbes Infect.* (2020) 9, 221–236.
2. Shereen MA, Khan S, Kazmi A, Bashir N, Siddique R. COVID-19 infection: Origin, transmission, and characteristics of human coronaviruses. *Journal of Advanced Research.* (2020) 24, 91–98.
3. Lau H, Khosrawipour V, Kocbach P, Mikolajczyk A, Schubert J, Bania J, et al. The positive impact of lockdown in Wuhan on containing the COVID-19 outbreak in China. *Journal of Travel Medicine.* (2020) 27, taaa037.
4. Paital B, Das K, Parida SK. Inter nation social lockdown versus medical care against COVID-19, a mild environmental insight with special reference to India. *Science of the Total Environment.* (2020) 728, 138914.
5. Wang K, Ding L, Yan Y, Dai C, Qu M, Jiayi D, et al. Modelling the initial epidemic trends of COVID-19 in Italy, Spain, Germany, and France. *PLoS One.* (2020) 15, e0241743.
6. Atalan A. Is the lockdown important to prevent the COVID-9 pandemic? Effects on psychology,

- environment and economy-perspective. *Annals of Medicine Surgery*. (2020) 56, 38–42.
7. Ghosal S, Bhattacharyya R, Majumder M. Impact of complete lockdown on total infection and death rates: A hierarchical cluster analysis. *Diabetes Metab Syndr Clin Res Rev*. (2020) 14, 707–711.
 8. Verma BK, Verma M, Verma VK, Abdullah RB, Nath DC, Khan HTA, et al. Global lockdown: An effective safeguard in responding to the threat of COVID-19. *Journal of Evaluation Clinical Practice*. (2020) 26, 1592–1598.
 9. Wu JT, Leung K, Bushman M, Kishore N, Niehus R, de Salazar PM, et al. Estimating clinical severity of COVID-19 from the transmission dynamics in Wuhan, China. *Nature Medicine*. (2020) 26, 506–510.
 10. Alfano V, Ercolano S. The Efficacy of Lockdown Against COVID-19: A Cross-Country Panel Analysis. *Applied Health Economics Health Policy*. (2020) 18, 509–517.
 11. Lilleri D, Zavaglio F, Gabanti E, Gerna G, Arbustini E. Analysis of the SARS-CoV-2 epidemic in Italy: The role of local and interventional factors in the control of the epidemic. *PLoS One*. (2020) 15, e0242305.
 12. Lonergan M, Chalmers JD. Estimates of the ongoing need for social distancing and control measures post-“lockdown” from trajectories of COVID-19 cases and mortality. *European Respiratory Journal*. (2020) 56, 2001483.
 13. Li Y, Wang LW, Peng ZH, Shen HB. Basic reproduction number and predicted trends of coronavirus disease 2019 epidemic in the mainland of China. *Infectious Diseases of Poverty*. (2020) 9, 94.
 14. Fang H, Wang L, Yang Y. Human mobility restrictions and the spread of the Novel Coronavirus (2019-nCoV) in China. *Journal of Public Economics*. (2020) 191, 104272.
 15. Rahman B, Sadraddin E, Porreca A. The basic reproduction number of SARS-CoV-2 in Wuhan is about to die out, how about the rest of the World?. *Reviews in Medical Virology*. (2020) 30, e2111.
 16. Goscé L, Phillips PA, Spinola P, Gupta DRK, Abubakar PI. Modelling SARS-COV2 Spread in London: Approaches to Lift the Lockdown. *The Journal of Infection*. (2020) 81, 260–265.
 17. Davies NG, Barnard RC, Jarvis CI, Russell TW, Semple MG, Jit M, et al. Association of tiered restrictions and a second lockdown with COVID-19 deaths and hospital admissions in England: a modelling study. *The Lancet Infectious Diseases*. (2021) 21, 482–492.
 18. Guzzetta G, Riccardo F, Marziano V, Poletti P, Trentini F, Bella A, et al. Impact of a nationwide lockdown on sars-cov-2 transmissibility, Italy. *Emerging Infectious Diseases*. (2021) 27, 267–270.
 19. Malavika B, Marimuthu S, Joy M, Nadaraj A, Asirvatham ES, Jeyaseelan L. Forecasting COVID-19 epidemic in India and high incidence states using SIR and logistic growth models. *Clinical Epidemiology and Global Health*. (2021) 9, 26–33.
 20. Ji T, Chen HL, Xu J, Wu LN, Li JJ, Chen K, et al. Lockdown contained the spread of 2019 novel coronavirus disease in Huangshi City, China: Early epidemiological findings. *Clinical Infectious Diseases*. (2020) 71, 1454–1460.
 21. Yuan Z, Xiao Y, Dai Z, Huang J, Zhang Z, Chen Y. Modelling the effects of wuhan’s lockdown during covid-19, China. *Bulletin of The World Health Organization*. (2020) 98, 484–494.
 22. Zhou Y, Xu R, Hu D, Yue Y, Li Q, Xia J. Effects of human mobility restrictions on the spread of COVID-19 in Shenzhen, China: a modelling study using mobile phone data. *Lancet Digital Health*. (2020) 2, e417-e424.
 23. Dropkin G. COVID-19 UK Lockdown Forecasts and R0. *Frontiers in Public Health*. (2020) 8, 256.
 24. Mahajan P, Kaushal J. Epidemic Trend of COVID-19 Transmission in India During Lockdown-1 Phase. *Journal Community Health*. (2020) 45, 1291–1300.
 25. Singh BP, Singh G. Modeling tempo of COVID-19 pandemic in India and significance of lockdown. *Journal of Public Affairs*. (2020) e2257.