Effects of Health Policies on the COVID-19 Process

Sağlık Politikalarının COVID-19 Sürecine Etkileri

Ali Sendur¹, Zafer Cakir^{1*}, Mehmet Enes Sozen²

1. Alanya Alaaddin Keykubat University, Faculty of Education, Department of Mathematics Education, Antalya, Turkey

2. Alanya Alaaddin Keykubat University, Faculty of Medicine, Department of Histology and Embryology, Antalya, Turkey

*Corresponder author: Assoc. Prof. Dr. Zafer Cakir, Alanya Alaaddin Keykubat University, Faculty of Education, Department of Mathematics Education, 07490, Alanya, Antalya
e-mail: zafer.cakir@alanya.edu.tr

Abstract

Aim: Many people around the world are still affected by coronavirus (COVID-19) disease. The high spread rate of the COVID-19 and the number of deaths make it more important than ever to understand the behavior of the disease. In this work, the effects of health policies on the COVID-19 process is examined by taking into account various data.

Material and Methods: Official articles, circulars issued by decision makers, Worldometer and Our World in Data websites are used to study the effects of the health policies on the COVID-19 process from 10.03.2020 to 30.06.2021. The scenario in which the appropriate precautions were not taken by decision makers is also considered by simulating data with the method of least squares.

Results: It has been determined that the measures taken have positive effects with a delay of 12-15 days. We observe that the policies adopted for the COVID-19 process are effective in reducing the number of cases and deaths. We note that there were increases in the number of cases after the removal of some measures. Overall, Turkey's situation in terms of total case and mortality rates in COVID-19 process is better than the average of some European and neighboring countries.

Conclusion: The results shows that Turkey has quite disciplined and successful health policy to overcome coronavirus disease.

Keywords: COVID-19, modelling, least squares method, health policy, Turkey

Özet

Amaç: Dünya çapında çok sayıda insan hala COVID-19 sürecinden etkilenmektedir. Pandeminin yüksek yayılma hızı ve ölüm sayısı, hastalığın davranışını/seyrini anlamayı her zamankinden daha önemli hale getirmektedir. Bu çalışmada, uygulanan sağlık politikalarının COVID-19 sürecine etkileri incelenmiştir.

Materyal ve Metod: Türkiye'de virüsün ortaya çıktığı 10.03.2020 ile 30.06.2021 tarihleri arasındaki süreçte uygulanan sağlık politikalarının COVID-19 sürecine etkisinin araştırılması için ilgili yönetim organları tarafından çıkarılan genelge ve resmi yazılar ile Worldometer ve Our World In Data internet sitesi kullanılmıştır. Söz konusu politikaların uygulanmaması durumunda karşılaşılabilecek tabloya ilişkin modeller en küçük kareler yöntemi kullanılarak grafiğe dönüştürülmüştür.

Bulgular: Alınan önlemlerin 12-15 gün gecikmeli olarak olumlu etkilerinin olduğu gözlemlenmektedir. Covid-19 sürecine yönelik benimsenen politikaların vaka ve ölüm sayılarının azalmasında etkili olduğu görülmektedir. Bazı kısıtlamaların kaldırılmasıyla vaka sayılarında artışlar olmakla birlikte, sonuç olarak, Türkiye'nin durumunun toplam vaka ve ölüm oranları bakımından bazı Avrupa ülkeleri ile komşu ülkelere göre daha olumlu olduğu tespit edilmiştir.

Sonuç: Sonuçlar, Türkiye'nin koronavirüs hastalığını yenmek için oldukça disiplinli ve başarılı bir sağlık politikasına sahip olduğunu göstermektedir.

Anahtar Kelimeler: Covid-19, modelleme, en küçük kareler yöntemi, sağlık politikası, Türkiye

Received: 30/06/2021

Accepted: 01/10/2021

Published Online: 02/11/2021

Cite this article: Sendur A., Cakir Z., Sozen ME. Effects of Health Policies on the COVID-19 Process. Turk J Health S. 2021;2(3):pp.42-48.

1. Introduction

The coronavirus disease 2019 (COVID-19), which was first seen in the city of Wuhan (China) at the end of December-2019 and spread rapidly all over the world, has been announced as an international pandemic by the World Health Organization (WHO) in March-2020 [1, 2]. So far, the pandemic in China appears to be basically under control, but many people around the world are still affected. The high spread rate of the pandemic and the number of deaths make that more important than ever to understand the current mathematical models. For this reason, the course of the disease (the rate of spread, duration of the disease, etc.) and its possible effects are among the most discussed and studied subjects by scientists in all countries around the world [3, 4, 5].

In the initial phase of COVID-19, countries have developed different policies in the health sector [6, 7]. In this context, countries generally adopted suppression or pacification strategies [8, 9]. The suppression strategy is a policy in which the government is effective and various restrictive measures are taken. On the other hand, the pacification strategy is characterized by slowing down the pandemic in the long term and protecting certain groups against the pandemic during periods when the need for health services is high [8, 10]. Turkey has adopted the suppression strategy and several restrictions have been applied in this context. In addition, the coronavirus scientific committee and filtration teams were formed, pandemic hospitals and the characteristics of these hospitals were determined. Moreover, financial support to the health system has been increased and government support has been provided strongly for vaccine studies.

This study aims to investigate the effect of health policies in the process of managing the COVID-19 pandemic in Turkey on components such as total number of cases, number of daily cases, total death, daily death, number of active cases, and number of cases at risk of death. In the study, especially critical dates regarding the policies applied during the pandemic process are discussed. The determinations are made by applying the sources such as circulars and official articles issued by decision makers, Worldometer and Our World in Data websites [11, 12]. The study consists of the data and health policies applied during the COVID-19 process from 10.03.2020 to 30.06.2021.

2. Material and Methods

2.1. The COVID-19 Process and Policies

In this section, we summarize some critical measures and decisions during the COVID-19 pandemic process for Turkey in chronological order in Table 1.

2.2. Effects of Adopted Policies on the Course of the Pandemic

In this section, the impact of the policies adopted during the COVID-19 process on the course of the pandemic in terms of various variables (such as daily number of cases, daily deaths, number of active cases and number of cases at risk of death) are examined and some inferences are made by taking into account some critical measures, decisions, and implementations on the dates indicated in Table 1. In order to visualize the data more clearly with graphics, we extend the timeline by including the dates before and after the critical decisions. Simulations when the mentioned policies are not implemented have also been discussed by applying the method of least-squares using appropriate polynomials [13] and converted into graphs via Microsoft Excel.

2.3. A Comparison of Some Developed Countries with Turkey

In this section, we aim to investigate the struggle in Turkey with a reliable and holistic approach. Therefore, the situation in Turkey during the fight against COVID-19 is compared with the developed countries of Europe or neighboring countries such as Russia and Iran in terms of the indicators such as the rates of total number of cases and deaths.

3. Results

3.1. Effects of Adopted Policies on the Course of the Pandemic

The impact of the policies adopted during the COVID-19 process on the course of the pandemic in terms of various variables are examined. In order to visualize the data more clearly, the timeline is extended including the dates before and after the critical decisions

3.1.1. Effects of Decisions on Daily Cases and Deaths

In Figure 1, we observe that the policies which were taken on 3-4 April 2020 and implemented as a curfew on 11, 17-19 April 2020 reduced the rapid increasing number of cases and deaths since mid-March and showed a positive effect with a delay of 12-15 days. The number of daily cases, which was 5138, decreased to around 2600 at the end of April by taking appropriate precautions. In Figure 1, we also focus on the case: What would happen if the precautions were not taken? According to the linear simulation by the method of least squares, the number of daily cases could reach over 8000 at the end of April if there were not any precautions and if the increasing trend that started in mid-March was continued. In addition, the number of daily deaths was under 100 at the end of April which could exceed 200 if there were not any precautions. We note that, the simulation is obtained by extending the behavior of actual data from March 25 to April 11, 2020, beyond April 11, 2020.

Table 1. The timeline of the decisions and practices to take the COVID-19 pandemic under control in Turkey (The dates were collected by following the reports from the Republic of Turkey Ministry of Health)

Date	Event
10.Mar.20	The first coronavirus case in Turkey.
14.Mar.20	Stopping the two-way flights to Germany, France, Spain, Norway, Denmark, Belgium, Austria, Sweden and Netherlands unilaterally from 08:00 on 14 March until 17 April 2020.
15.Mar.20	Stopping Umrah departures as of February 27, 2020, and planning for an early return for citizens who have already gone.
16.Mar.20	Taking a break in primary, secondary and high school education for one week and university education for three weeks.
23.Mar.20	Initiation of administration of the favipiravir to patients in intensive care.
24.Mar.20	All local and intercity public transportation vehicles, accepting passengers at a rate of 50% of the passenger carrying capacity specified in the vehicle license for a temporary period.
25.Mar.20	Extension of the break in education until April 30, 2020.
3.Apr.20	Expanding the scope of the curfew: imposing a curfew for those born on January 1, 2000 and above, introducing a mask requirement in public areas such as markets and bazaar. Suspension of entry and exit from 30 metropolitan cities and Zonguldak for 15 days.
4.Apr.20	Turkish Airlines' domestic flights were suspended until 20 April 2020.
11.Apr.20	Comprehensive curfew: Declaring a curfew in 30 metropolitan cities and Zonguldak for 48 hours starting from 00:00 on Saturday, April 11, 2020.
	Implementation of the same curfew decision for 17-19 April 2020 and 22-26 April 2020.
4.May.20	Partial prohibitions: Controlled Social Life.
1.Jun.20	After the first period of the measures, the removal of certain bans starting from 1 June 2020.
26.Aug.20	Allowing alternate, flexible and remote working in public institutions and organizations.
21.Sep.20	The beginning of face-to-face education in kindergarten and primary school (1st grades).
12.Oct.20	Opening of all primary schools, village schools, 8th and 12th grades and schools for children with special needs.
18.Nov.20	Restrictions and the introduction of various prohibitions again
25.Nov.20	Initiation of disclosure of previously unexplained asymptomatic (asymptomatic, mild) cases.
13.Jan.21	Approval for emergency use of CoronaVac vaccine in Turkey.
1.Mar.21	Application of the on-site decision period within the scope of controlled normalization. Categorizing the provinces in four different risk groups (low, medium, high, very high).
	Cancellation of the ban on people over 65 and under 20 years old, starting education at all education levels, and cancellation of the weekend curfew in low and medium-risk cities. In high and very high-risk cities, only 8, 12, primary schools and pre-school education institutions are opened. Increasing the curfew period for those over 65 and under 20 years old. Businesses such as cafes and restaurants starting to accept customers again with 50% capacity in all provinces except very high-risk provinces. Continuation of the curfew between 21.00-05.00 throughout Turkey.
29.Mar.21	58 provinces turning into very high-risk groups, reintroducing weekend curfews.
2.Apr.21	Application of the first dose of Biontech vaccine in Turkey.
14.Apr.21	Extending restrictions: Two-weeks partial closure implementation. Limitation in many areas, especially the curfew implementation between 19.00-05.00 on weekdays and the entire weekend.
26.Apr.21	Suspension of education at all levels and postponement of exams to a later date.
29.Apr.21	Announcement of full closure until May 17, 05:00. Suspension of education at all levels and postponement of exams. Announcement that intercity public transportation vehicles will operate at 50% capacity. Announcement that chain markets will be closed on Sunday.
4.May.21	The number of vaccines made in Turkey exceeds 23 million doses.
16.May.21	Curfew between 21.00-05.00 on weekdays and full day on weekends. Cancellation of the curfew for citizens under age 18 and aged 65 years old who has received two doses of vaccination. Prohibition of using public transport for citizens under 18 and over 65 years old, regardless of whether they are exempt from the restriction. Opening of shopping centers between 10.00-20.00 on weekdays and completely closed on weekends. Extension of the current visitor restriction in social protection/care centers such as nursing homes, rehabilitation centers, children's homes until June 1, 2021. Starting of international flights from abroad to Turkey.

In Figure 2, we observe the continuity of the decreasing trend (starting around mid April) in the number of daily cases and deaths until the end of May despite the controlled social life policies on May 4, 2020. Although there was a partial increase after the removal of certain bans on June 1, 2020, the number of daily cases and deaths was within controllable limits with the adaption of the controlled social life. In Figure 3, we also focus on the situation if the administrative implementations continued in a similar way. The linear simulation obtained by the method of least squares shows that the number of daily cases, which were around 1200, could be around 800, and the

number of daily deaths due to COVID-19 could be lower than actual data.

Decisions such as “Allowing alternate, flexible and remote work in public institutions and organizations - August 26, 2020”, and “Starting face-to-face education in kindergarten and primary school (1st grades) - September 21, 2020” caused a slight increase in the number of daily cases and deaths from the beginning of October 2020. With the decision of “opening all primary schools, village schools, schools for 8th and 12th grades and children with special needs - October 12, 2020”, the increasing trend accelerated, and the number of daily cases

were around 2200 and the number of daily deaths were at the level of 75 by the end of October 2020. In order to control this situation, a couple of decisions including various restrictions and prohibitions were taken on November 18, 2020 and therefore a favorable process continued until the beginning of March 2021 with the sensibility of the society on obeying the recommendations. After the “controlled normalization” decision on March 1, 2021, the number of cases and deaths increased again and the cases on a daily basis reached to 63000 and deaths to over 350 by mid-April 2021.

Figure 1. (a) The impact of the decisions (3-4 April 2020) on the number of daily cases. (b) The impact of the decisions (3-4 April 2020) on the number of daily deaths

Here, we also focus on the case: What would happen if the administrative implementations and social reflexes until March 1, 2021, continued in a similar way? Using the actual data from January 15 to March 1, 2021 for the method of least squares with quadratic polynomials, we observe that the number of cases might be around 15000 instead of 40000 and the number of deaths at the level of 50 instead of 180 by the end of March 2021 (Figure 4. (a)-(b)).

The reimposition of the curfew on the weekend of 29 March 2021 did not provide the desired level of improvement to change the negative situation in which the number of cases and deaths increased rapidly and 58 provinces turned into very high-risk groups. The increase in the number of daily cases and deaths was stopped at high numbers with the extension of restrictions on April 14, 2021 and a two-week partial closure. It is well known that the number of daily cases decreased to 7000 and deaths decreased to 120 by the end of May 2021 with the effect of some measures accompanying the radical decisions such as “suspending education at all levels” on April 26, 2021,

and “declaring a full closure until 05:00 on May 17, 2021” on April 29, 2021. In Figure 5, we focus on the situation when these measures are not taken or applied. The linear simulation obtained by the method of least squares show that the number of daily cases that occurred around 11,400 might reach 100,000 and the number of daily deaths, which were around 240, could exceed 500 in mid-May 2021.

Figure 2. (a) May 4, 2020: Daily cases in the period of controlled social life (b) May 4, 2020: Daily deaths in the period of controlled social life

In addition to administrative measures, there are also some policies in the control of coronavirus: Vaccination began on April 2, 2021 and the number of vaccination exceeded 23 million doses by May 4, 2021. In Figure 6, we observe a stable process that continued until the end of June 2021 by taking revised precautions on May 16, 2021.

3.1.2. Effects of Vaccinations

In Figure 7, we observe high number of cases in mid-April 2021 and therefore the number of severe patients and the number of daily deaths reached its maximum value in this period. The growth rate of the number of vaccinations, together with the measures taken in May 2021, played an important role in the reduction of cases and deaths to relatively normal numbers at the end of May 2021. The fact that the priority of first dose or second dose vaccination was started for people who are at a high-risk of being affected by COVID-19 (i.e. over 65 years old or people with chronic disease) is an evidence that strengthens this assessment. The total number of vaccines administered in Turkey is given in Figure 7 as a column chart.

Figure 3. (a) The impact of the decisions (1 June 2020) on the number of daily cases. (b) The impact of the decisions (1 June 2020) on the number of daily deaths.

Figure 4. (a) Reflection of the decisions on 1 March 2021 and implementations on the number of daily cases. (b) Reflection of the decisions on 1 March 2021 and implementations on the number of daily deaths.

Figure 5. (a) The impact of the decisions taken on 14, 26, 29 April 2021 on the course of daily cases. (b) The impact of the decisions taken on 14, 26, 29 April 2021 on the number of daily deaths.

Figure 6. (a) The impact of decisions and implementations in May 2021 on daily case numbers. (b) The impact of decisions and implementations in May 2021 on the number of daily deaths

Figure 7. The effect of vaccination on the number of seriously ill patients and deaths

3.2. A Comparison of Some Developed Countries with Turkey

The situation in Turkey during the fight against COVID-19 is compared with the developed countries of Europe or neighboring countries such as Russia and Iran in terms of the indicators such as the rates of total number of cases and deaths.

3.2.1. Turkey's Position in Europe

We start with a comparison in terms of number of total case (Figure 8. (a)) and total death (Figure 8. (b)) rates for Turkey and developed countries of Europe such as Germany, England, France, and Italy. Here, the ratio of the number of cases (or deaths) to the population for each country is calculated as a percentage. Then, the weighted average of the four European countries was again obtained as a percentage and compared with the change in Turkey.

In Figure 8. (a), we observe that the total case rates in Turkey are lower than the average of the leading European countries, but the difference is small. The Figure 8. (b) shows that the average death rate in Europe is three times higher than in Turkey which can be seen as the most striking point of the process. These results reveal that we cannot draw parallels between the economic development levels of countries and the results received in the struggle with COVID-19. Republic of Turkey has one of the most disciplined and successful health policies in fighting against COVID 19 pandemic.

3.2.2. Turkey's Position in the Region

In Figure 9, the course of the pandemic in Turkey is compared with the leading countries in the region such as Russia and Iran in terms of the rates of total number of cases and deaths. Here, we consider the percentage of the total number of cases and deaths in each period and the ratio of the country's population as in previous section.

Figure 8. (a) Rates of total cases in Turkey and some developed European countries. (b) Rates of total deaths in Turkey and some developed European countries

In Figure 9. (a) we observe that the overall case rates in Turkey are higher than the neighboring countries such as Russia and Iran, especially after the addition of “asymptomatic cases” to the daily cases on 25 November 2020. However, the Figure 9. (b) shows that the death rates in Turkey are almost half of those in Iran and Russia. In the light of these data, it can be said that the implementations in Turkey give better results

than the leading countries in the region.

Figure 9. (a) Comparison of Turkey, Iran, and Russia in terms of total case rates. (b) Comparison of Turkey, Iran, and Russia by total death rate

4. Conclusion

In this study, the health policies implemented by Turkey in the fight against COVID-19 in the period of 10.03.2020-30.06.2021 are discussed. We observe that the policies adopted for the COVID-19 process are effective in reducing the number of cases and deaths. We also consider the scenario when the mentioned precautions were not taken.

It is clear that, it will not be realistic to interpret the COVID-19 pandemic process on the basis of one or two variables such as “number of case and death”. As almost every sector such as education, production, transportation, agriculture, tourism, service, supply, etc. are affected in the current process, decision makers have been taking into account many parameters to find an optimum solution. In this context, it can be said that the Ministry of Health has adopted the “occupation rate of intensive care capacities” as a red line and has adopted an attitude of increasing or decreasing the restrictions depending on this rate. In other words, a balanced policy was followed, centered on “providing a sustainable health service”. In this way, the opportunity was given to the continuation of economic activities under certain conditions.

Although Turkey's overall situation in terms of total case rates in COVID-19 process is better than the average of some developed European countries, it is worse than the neighboring

countries such as Iran and Russia. However, mortality rates due to COVID-19 in Turkey are one-third of the European average and about a half of Iran and Russia. With a holistic approach that considers both the health policies in Table 1 and the figures which demonstrate the impacts of decisions, we can conclude that Turkey has a dynamic decision-making process for COVID-19. Moreover, the results obtained from these data points out that the health policy implemented in Turkey is quite successful and the provided health service is of high-quality.

Acknowledgment

The authors (A. Sendur and Z. Cakir) would like to acknowledge the support provided by Alanya Alaaddin Keykubat University, BAP Project No 2021-03-01-MAP01 for its funding a part of this research.

REFERENCES

1. WHO, «World Health Organization,» 2020b. [Çevrimiçi]. Available: Retrieved from "https://www.who.int/director-general/speeches/detail/who-director-general-s-opening-remarks-at-the-media-briefing-on-covid-19".
2. WHO, «World Health Organization,» 2020a. [Çevrimiçi]. Available: Retrieved from "https://www.who.int/news/item/30-01-2020-statement-on-the-second-meeting-of-the-international-health-regulations-(2005)-emergency-committee-regarding-the-outbreak-of-novel-coronavirus-(2019-ncov)".
3. A. L. Bertozzi, E. Franco, G. Mohler, B. M. Short and D. Sledge, "The challenges of modeling and forecasting the spread of COVID-19," *Proceedings of the National Academy of Sciences*, vol. 117, no. 29, pp. 16732-16738, 2020.
4. Z. Cakir ve H. B. Savas, «A Mathematical Modelling Approach in the Spread of the Novel 2019 Coronavirus SARS-CoV-2 (COVID-19) Pandemic,» no. 17, 2020.
5. Z. Cakir ve H. B. Savas, «A mathematical modelling for the COVID-19 pandemic in Iran,» *Ortadoğu Tıp Dergisi*, cilt 12, no. 2, pp. 206-210, 2020a.
6. O. Bargain and U. Aminjonov, "Trust and compliance to public health policies in times of COVID-19," *Journal of Public Economics*, vol. 192: 104316, 2020.
7. T. Hale, N. Angrist, R. Goldszmidt, B. Kira, A. Petherick, T. Phillips, ... and H. Tatlow, "A global panel database of pandemic policies (Oxford COVID-19 Government Response Tracker)," *Nature Human Behaviour*, vol. 5, no. 4, pp. 529-538, 2021.
8. H. Duran, «Devletlerin koronavirüsle karşılaştırmalı mücadele stratejileri,» SETA Yayınları, 2020.
9. A. Turan ve H. H. Çelikyay, «Türkiye'de KOVID-19 ile mücadele: politikalar ve aktörler,» *Uluslararası Yönetim Akademisi Dergisi*, cilt 3, no. 1, pp. 1-25, 2020.
10. A. Ward, «Sweden's government has tried a risky coronavirus strategy. It could backfire,» *Vox*, 2020.
11. H. Ritchie, E. Mathieu, L. Rodés-Guirao, C. Appel, C. Giattino, E. Ortiz-Ospina, J. Hasell, B. Macdonald, D. Beltekian and M. Roser, "Coronavirus Pandemic (COVID-19)," 2020. [Online]. Available: Retrieved from "https://ourworldindata.org/coronavirus" [Online Resource].
12. Worldometer, «Worldometer,» 2020. [Çevrimiçi]. Available: Retrieved from "https://www.worldometers.info/coronavirus/".
13. E. Suli ve F. D. Mayers, *An introduction to numerical analysis*, Cambridge university press, 2003.