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Research Article

EFFECTS OF RESTRICTION MEASURES ON MORBIDITY AND MORTALITY IMPLEMENTED DURING COVID-19 PANDEMIC IN TURKEY: A RESEARCH THROUGH NATIONAL DATA INCLUDING ONE YEAR

Hakan TÜZÜN*[1]

[1]Gazi University Medical Faculty Department of Public Health, Ankara, Turkey
* Corresponding Author: drtuzunh@yahoo.com

Abstract: *This research is aimed to determine the effects of restriction measures implemented in Turkey during the COVID 19 pandemic by detecting variations in the "number of cases per day", "test positivity rate per day", and "number of death per day" according to different restriction periods. In order to be able to analyze based on cases declared as standard, the periods of restriction measures between November 18, 2020, and November 17, 2021, were included in the research. The data of the Ministry of Health was used as the source. When making a statistical assessment for the "number of cases per day" and the "test positivity rate per day", we evaluated each restriction period to include the first 10 days after the end of this period. When comparing the "death numbers per day", we evaluated each restriction period to include the daily death numbers for the first 21 days after the end of that period. The highest means were seen for all three parameters examined during the "revised local decision-making phase". These mean are 57,396 for the number of cases per day, 18.4 for test positivity rate per day, and 351 for the number of deaths per day. This period is the only period in which the means for "number of cases" and "number of deaths" are higher than the first period, which is the reference period, and for these parameters, a statistically significant difference is detected with the reference period (p<0.001). There is a decrease in the means for all three parameters examined during "lockdown periods" and after this period that is the "gradual normalization period". Restriction measures have played a role in reducing the mortality and morbidity associated with COVID-19. The increase in morbidity and mortality during periods when epidemic management is partially decentralized can provide evidence-based data for assessments of the effects of decentralization.*

Keywords: *restriction measures, COVID-19, Turkey, decentralization*

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1. Introduction

COVID-19 pandemic has deeply affected Turkey as well as worldwide [1]. Non-pharmaceutical interventions (NPI) are widely been used in Turkey during struggling with the pandemic [2, 3]. Non-pharmaceutical interventions (NPI) are defined as public health measures that aim to control of transmission in the community by the ECDC (European Centre for Disease Prevention and Control) [4]. NPI contains individual measures such as washing hands and using mask; environmental measures such as ventilation indoors; and population-based measures including restrictions of movements. Furthermore, testing and contract tracing are another essentials items of NPI [4].

In this pandemic, the development of an effective vaccine has been relatively short compared to its counterparts in history. However, there is a significant time gap between the onset of the epidemic and the onset of widespread vaccination. Despite significant efforts, immunization rates are far from

achieving mass immunity [5]. On the other hand, it is still not possible to talk about the existence of effective treatment agents [6]. Due to all these factors, NPI emerges as the main tool set in the fight against the pandemic.

Different studies have shown that effectiveness of restriction measures including social movement restrictions which are one of the important components of NPI during the COVID-19 pandemic. Studies conducted in China, the country where the epidemic started, have shown that restriction measures are effective tools to suppress the spread of the disease [7]. The effectiveness of restriction measures in suppressing the epidemic has been demonstrated in the example of a developing country such as Nigeria and a developed country such as the UK [8, 9]. In a study examining the data of 34 countries, it was found that restriction measures in the early period of the epidemic were associated with a decrease in incidence [10].

Travel restrictions, limitation of the gathering of people, closure of primary schools, closure of universities, rules related to general social distance, shutting down public spaces such as cafes, restaurants, bars, shopping malls, and curfew are examples of implementation of restriction measures [11, 12]. Various restriction periods have occurred in Turkey throughout the periods including different restrictions of movement practices [2, 13]. Monitoring and evaluating the effectiveness of restriction measurements will contribute to more effective management of the pandemic.

This study aimed to determine the effects of restriction measures implemented in Turkey by detecting variations in the number of cases per day, test positivity rate per day, and the number of death per day according to different restriction periods.

2. Methods

2.1. Scope of the assessment

After November 25, 2020, the number of cases continued to be announced based on the standardized definition by the Ministry of Health of Turkey throughout the pandemic [1]. In this study, the number of daily cases reported since November 25 2020 was evaluated in order to ensure data standardization. Since the restriction period covering 25 November, 2020 is the period starting with 18 November 2020, the restriction period starting with 18 November was the first period examined within the scope of this research. In order to be able to analyze a one-year period, the period of restriction measures between November 18, 2020, and November 17, 2021, were included in the research.

The number of cases per day, test positivity rate per day, and mortality rate per day were achieved by the website of the Ministry of Health of Turkey[1].

2.2. Definition of restriction periods

We have defined restriction periods according to implementations of the Ministry of Internal Affairs of Turkey [2]. For restriction measures periods up to 1 June 2021, in naming these restriction periods, we used the officially announced names and the names in a review article for restriction practices in Turkey [2, 13].

The implementation dates of restriction periods are "18.11.2020-30.11.2020" for the "national partial curfews", "01.12.2020-28.02.2021" for the "national extended curfews", "01.03.2021-29.03.2021" for the "local decision-making phase", "30.03.2021-13.04.2021" for the "revised local decision-making phase", "14.04.2021-28.04.2021" for the "partial lockdown", "29.04.2021-16.05.2021" for the "full lockdown", "17.05.2021-31.05.2021" for the "gradual normalization" [2, 13].

The second phase of gradual normalization was begun on 01.06.2021. Period including "01.06.2021-31.08.2021" was named as "2nd phase of gradual normalization/summer 2021". In order to reveal the seasonal variation pattern, we defined the period that started after September 1 as a separate

period, although there was no change in this date in terms of restriction practices. Therefore, we have named "autumn 2021" the last period we have investigated.

2.3. Assessment of the number of cases per day and test positivity rate per day

In general, the incubation period for COVID-19 ranges from 2-14 days. The mean incubation time was 5.84 days (99% confidence interval: 4.8-6.8), and the median incubation time was 4.8 days [14]. According to a study including 14,618 patients from different 114 Belgian hospitals, the median time between symptom onset and diagnosis was 5 days. This time differs according to some descriptive characteristics [15]. In the statistical evaluation process, we took into account the incubation period and the time between the onset of symptoms and the application to the health institution. When making a statistical assessment for the "number of cases per day" and the "test positivity rate per day", we evaluated each restriction period to include the first 10 days after the end of this period. For this reason, the calendar intervals taken as a basis in the statistical assessment follow the calendar intervals related to the restriction applications with a ten days difference.

2.4. Assessment of the number of deaths per day

Centers for Disease Control and Prevention (CDC) says that the median time from onset of illness to acute respiratory distress syndrome (ARDS) was 8–12 days, and the median time from onset of illness to ıntensive care unit admission was 9.5–12 days [16]. World Health Organization (WHO) says that the time between symptom onset and death ranged from about 2 weeks to 8 weeks [17]. According to a study carried out in China and included 1833 deaths, the median interval for symptom onset to death was 17.0 days (12.0–22.0) [18]. We wanted to take into account the incubation period and the time between the onset of symptoms and death while making the statistical evaluation of the death numbers. When making a statistical assessment for the "number of deaths per day", we evaluated each restriction period to include the first 21 days after the end of this period. For this reason, the calendar intervals taken as a basis in the statistical assessment follow the calendar intervals related to the restriction applications with a 21 days difference. Figure 1 shows the "number of days of restriction periods"
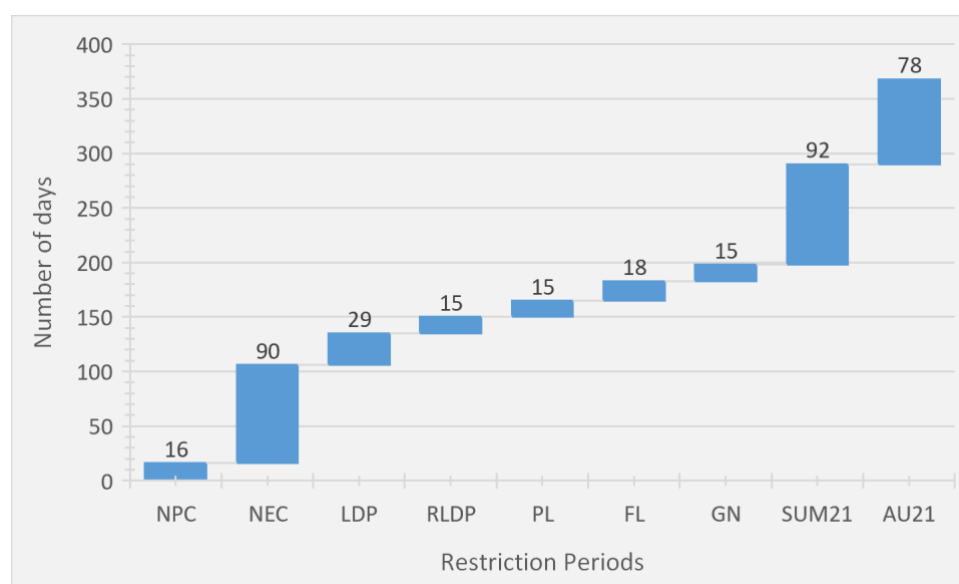

Figure 1. Number of days of statistical assessment periods of restriction periods
(NPC: National partial curfews, NEC: National extended curfews, LDP: Local decisjon-making phase, RLDP: Revised local decision-making phase, PL: Partial lockdown, FL: Full lockdown, GN: Gradual normalization, SUM21:2nd phase of gradual normalization/summer 2021, AU21: Autumn 2021)

2.5. Statistical analysis

The restriction periods were compared in terms of the number of cases per day, test positivity rate per day, and the number of deaths per day. Analysis of variance was applied in statistical analysis. Dunnett's test was used as a post hoc test. In the bivariate comparison, the first period (national partial curfews) was used as the reference period. $p < 0.05$ was used for statistical significance.

3. Results

Table 1 shows the number of cases per day according to statistical assessment periods of restriction measures. The mean of the number of cases has increased with the "local decision-making phase". We can see the highest mean number of cases per day in the "revised local decision-making phase". The mean number of cases has declined with the "partial lockdown period". The decrease is continued throughout the "full lockdown period" and "gradual normalization period". On the other hand, the number of cases has increased with 2nd phase of gradual normalization and autumn of 2021.

Table 1. Number of cases per day according to statistical assessment periods of restriction measures

Statistical assessment periods of restriction measures (nª)	Number of cases per day		Mean difference	p
	Mean	Min-max		
National partial curfews (n=16)	30,928	28,351-33,198		
National extended curfews (n=90)	11,894	5,277-3,2106	-19,033	0.000**
Local decision-making phase (n=29)	29,928	13,378-55,941	-999	0.996
Revised local decision-making phase (n=15)	57,396	49,438-63,082	26,468	0.000**
Partial lockdown (n=15)	31,021	18,052-43,301	93	1.000
Full lockdown (n=18)	10,887	7,523-15,191	-20,040	0.000**
Gradual normalization (n=15)	6,731	5,386-8,426	-24,196	0.000**
2th phase of gradual normalization/summer 2021 (n=92)	14,139	4,418-27,356	-16,788	0.000**
Autumn 2021 (n=78)	27,056	21,177-33,860	-3,871	0.154

ª: number of days included in the statistical assessment, **:$p < 0.001$

Figure 2 is a box plot graphic that shows the number of cases per day according to statistical assessment periods of restriction measures
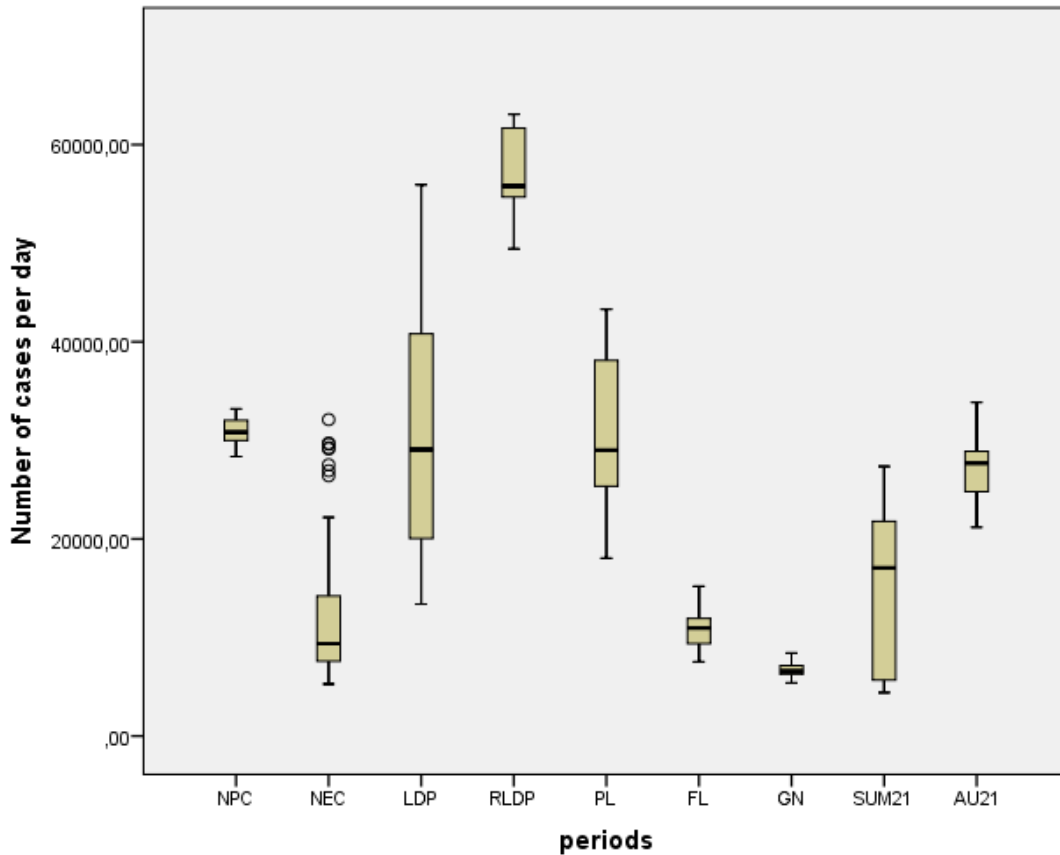
Figure 2. Number of cases per day according to statistical assessment periods of restriction measures.
(NPC: National partial curfews, NEC: National extended curfews, LDP: Local decision-making phase, RLDP: Revised local decision-making phase, PL: Partial lockdown, FL: Full lockdown, GN: Gradual normalization, SUM21: 2nd phase of gradual normalization/summer 2021, AU21: Autumn 2021)

Table 2 shows the test positivity rate per day according to statistical assessment periods of restriction measures. The mean test positivity rate has increased with the "local decision-making phase". We can see the highest mean test positivity rate in the "revised local decision-making phase". The mean test positivity rate has decreased with the "partial lockdown". The decrease is continued throughout the "full lockdown period" and the "gradual normalization period". On the other hand, the test positivity rate per day has increased with 2nd phase of gradual normalization and autumn 2021.

Table 2. Test positivity rate per day according to statistical assessment periods of restriction measures

Statistical assessment periods of restriction measures (n[b])	Test positivity rate per day		Mean difference	p
	Mean	**Min-max**		
National partial curfews (n=16)	16.9	14.7-17.8		
National extended curfews (n=90)	7.3	3.5-15.4	-9.5	0.000**
Local decision-making phase (n=29)	13.5	9.6-18.3	-3.3	0.000**
Revised local decision-making phase (n=15)	18.4	16.3-20.2	1.5	0.230
Partial lockdown (n=15)	11.9	7.8-15.3	-4.9	0.000**
Full lockdown (n=18)	5.1	3.4-7.7	-11.8	0.000**
Gradual normalization (n=15)	3.1	2.6-3.8	-13.9	0.000**
2th phase of gradual normalization/summer 2021 (n=92)	5.4	2.0-10.2	-11.5	0.000**
Autumn 2021 (n=78)	7.7	6.1-9.5	-9.3	0.000**

[b]: number of days included in the statistical assessment; **:$p < 0.001$

Figure 3 is a box plot graphic that shows the test positivity rate per day according to statistical assessment periods of restriction measures.
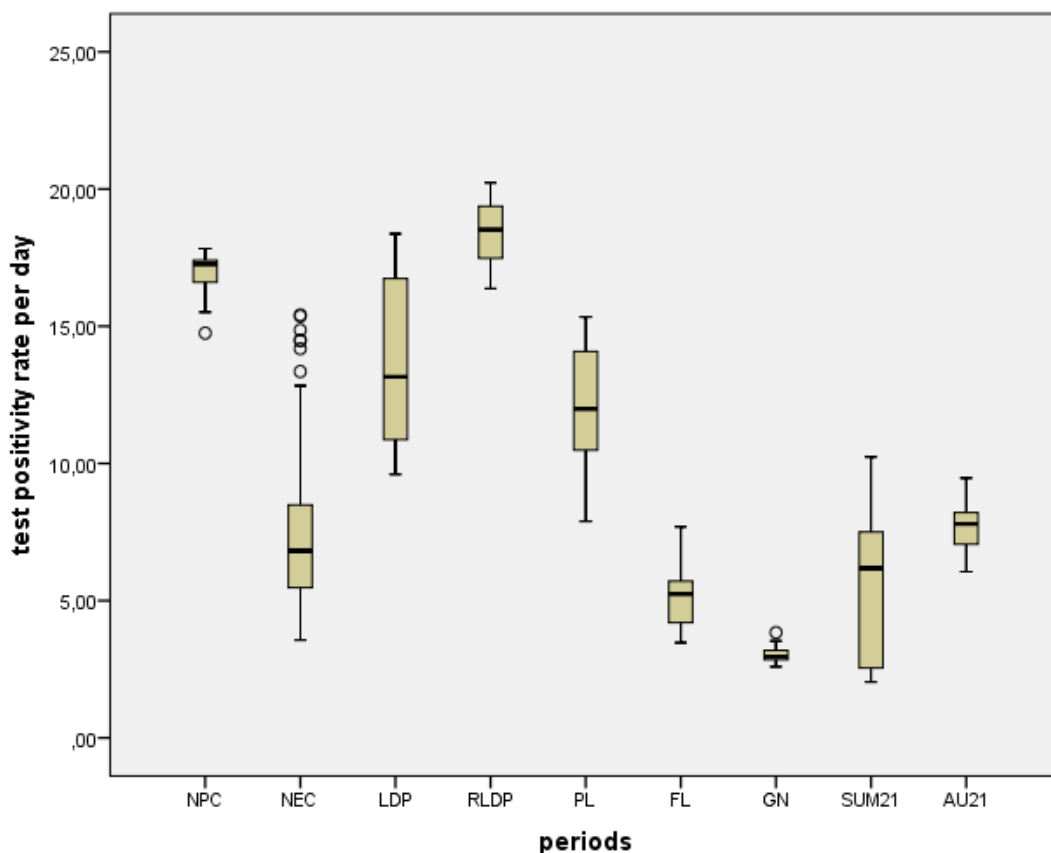

Figure 3. Test positivity rate per day according to statistical assessment periods of restriction measures.
(NPC: National partial curfews, NEC: National extended curfews, LDP: Local decision-making phase, RLDP: Revised local decision-making phase, PL: Partial lockdown, FL: Full lockdown, GN: Gradual normalization, SUM21: 2nd phase of gradual normalization/summer 2021, AU21: Autumn 2021)

Table 3 shows the number of deaths per day according to statistical assessment periods of restriction measures. This means the number of deaths per day has increased with the "local decision-making phase". We see the highest mean number of deaths per day in the "revised local decision-making phase". The mean number of deaths per day has decreased with the "partial lockdown". Decreasing has continued further periods. We have seen the lowest mean during the period of gradual normalization. Unfortunately, the mean number of deaths has increased with 2nd phase of gradual normalization.

Table 3. Number of deaths per day according to statistical assessment periods of restriction measures

Periods of restriction (n^c)	Number of deaths per day		Mean difference	p
	Mean	Min-max		
National partial curfews (n=27)	210	168-254		
National extended curfews (n=90)	130	62-259	-80.2	0.000**
Local decision-making phase (n=29)	214	117-341	3.7	1.000
Revised local decision-making phase (n=15)	351	336-394	140.3	0.000**
Partial lockdown (n=15)	259	203-356	49.1	0.057
Full lockdown (n=18)	153	92-231	-57.8	0.009*
Gradual normalization (n=15)	71	51-96	-138.9	0.000**
2nd phase of gradual normalization/summer 2021 (n=92)	139	35-290	-70.9	0.000**
Autumn 2021 (n=78)	209	175-248	-0.8	1.000

^{c}: number of days included in the statistical assessment; *:p<0.01; **:p<0.001

Figure 4 is a box plot graphic that shows the number of deaths per day according to statistical assessment periods of restriction measures.
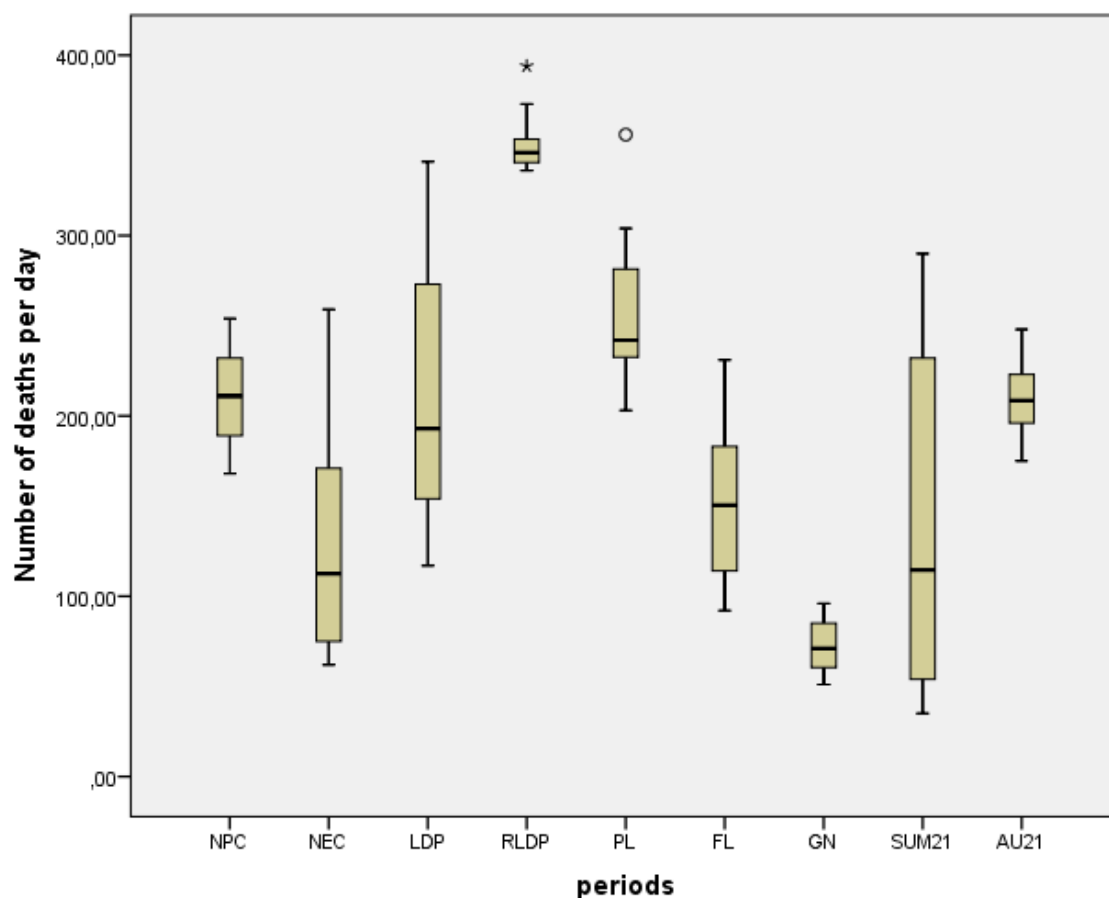

Figure 4. number of deaths per day according to statistical assessment periods of restriction measures.
(NPC: National partial curfews, NEC: National extended curfews, LDP: Local decision-making phase, RLDP: Revised local decision-making phase, PL: Partial lockdown, FL: Full lockdown, GN: Gradual normalization, SUM21: 2nd phase of gradual normalization/summer 2021, AU21: Autumn 2021)

4. Discussion

Various restriction measures have been implemented in Turkey since the beginning of the pandemic. The first restriction measures started in March 2020, when the first case was seen in Turkey. In June 2020, the start of the "new normal" period was declared, and the restrictions were greatly relaxed [19]. Parallel to the course of the epidemic, the scope of restriction measures in Turkey, as well as in the whole world, has undergone various changes over time. Depending on these changes, the periods of restriction measures were named with different names [13, 19, 20].

With the implementation of new restriction measures in the autumn of 2020, a series of restriction periods that will last until the summer of 2021 has begun. The first restriction period of the autumn semester has started with the new measures that are implemented on November 18, 2020 (National partial curfews). Restrictions were increased in the "National extended curfews" period. In the next period, local public authorities were authorized to implement the measures (local decision-making phase). The next period continued with some revisions to the measures (revised local decision-making

phase). Later, "partial lockdown" was declared on April 14, and "full lockdown" was announced on April 29 [2, 13, 19].

Because this research covers a one-year evaluation, the last taken into account restriction measurement implementation day is 17 November 2021. Therefore, the last date is taken into account for the number of cases and the test positivity rate in the statistical evaluation is 27 November 2021. The last date taken into account for the number of deaths in the statistical evaluation is 8 December 2021. The date of the first Omicron Virant case in Turkey is stated as 12 December 2021 [21]. Various variants have been seen since the beginning of the pandemic. The latest variant was Omicron [22]. It is known that the Omicron variant spreads more easily than the original virus and the Delta variant [23]. The fact that the data included in this study included the periods before the Omicron variant appeared, provided the opportunity to make standard comparisons.

It is noteworthy that the highest values for all three parameters examined within the scope of this research were observed in the "revised local decision-making phase". Among the reasons for the increase in this period may be the partial relaxation of the measures. However, disruptions in the decision-making processes of local public authorities regarding the implementation of the measures may also be among the potential causes. It is generally suggested that the effectiveness of the health system is also correlated breadth of scope of the local authority's decision-making power [24]. On the other hand, it is mentioned that the effects of decentralization on health systems are complicated, and there are factors related positive and negative impacts of decentralization [25]. The effects on the health outcomes of the period in which the decisions regarding the restriction measures were decentralized in Turkey can be considered as an example of the possible consequences of decentralization. Experiences in pandemic management can provide evidence-based data for discussions on health policy.

The lowest mean for the "number of cases per day" and "test positivity rate" parameters are seen in the "gradual normalization" and "full lockdown" periods. The lowest mean for the "number of deaths per day" is in the "gradual normalization" period. These results show the effectiveness of restriction measures. A study aimed to investigate NPI that includes 175 countries have shown that restriction measurement was effective for reducing cases [26]. In different studies, the effectiveness of restriction measures in suppressing the epidemic has been demonstrated [27-29].

It has been shown that restriction measures can be effective in limiting mobilization. A study including Australia, Japan, Hong Kong, and Singapore has shown that the largest declines in mobility were seen in places that enforced mitigation policies. Furthermore, this study emphasizes that the increase in the number of cases is observed despite the existence of the stay-at-home rule due to the inability of migrant workers to be adequately quarantined [30]. The fact that the restriction measures for Turkey did not include people who have to continue to work may have been a factor that reduced the effectiveness of the measures[31].

In this study, the statistical analysis includes numbers for the first 10 days of the next restriction period for "number of cases", and "test positivity rate". Statistical analysis includes numbers for the first 21 days of the next restriction period for the "number of deaths". However, the periods based on the statistical assessment may not exactly reflect the implementation dates of the restrictions. For example, for all three parameters examined, the means in the "gradual normalization" period are lower than in the "full lockdown" period. This result may indicate that the effects of the restriction periods continue in the next period.

4.1. Limitations

Restriction measures aim to flatten the curve by decreasing R-value. We did not use the change in R-value to evaluate the effects of restrictions in this study. This point is a limitation of our assessment.

The intertwining of the measures applied in different restriction periods makes it difficult to compare different types of measures. A limitation is that the effectiveness of different restraint measures was not compared in this study.

The different PCR testing policies applied at different times of the epidemic may be a factor that makes standard comparison difficult.

COVID-19 vaccination in Turkey started on January 13, 2021[32]. On November 17, 2021, the last day to be evaluated within the scope of this study, the rate of those who received two doses of vaccine, which was accepted as the initial protocol for Turkey, was 59%[33]. Another limitation of the study is that vaccination status was not taken into account.

5. Conclusions

Restriction measures have played a role in reducing the mortality and morbidity associated with COVID-19. The experience of the COVID-19 pandemic shows that public health interventions continue to function as effective tools in limiting the effects of the epidemic. On the other hand, the increase in the number of cases during periods when epidemic management is partially decentralized can provide evidence-based data for assessments of the effects of decentralization.

Ethical Consideration
Ethics committee application was not made because the research was conducted based on publicly available and, anonymized data sources that were produced by the Ministry of Health of Turkey.
Conflict of Interest
The author declares no conflict of interest.

References

[1] T.C Sağlık Bakanlığı. (2022, Feb 2) TC Sağlık Bakanlığı COVID-19 Bilgilendirme Platformu Genel Koronavirüs Tablosu. [Online]. Available: https://covid19.saglik.gov.tr/TR-66935/genel-koronavirus-tablosu.html

[2] T.C İçişleri Bakanlığı. (2022, Feb 2) TC İç İşleri Bakanlığı Duyuruları [Online]. Available: https://www.icisleri.gov.tr/duyurular

[3] T.C Sağlık Bakanlığı. (2022, Feb 2) COVID-19 (SARS-CoV-2 Enfeksiyonu) Temaslı Takibi, Salgın Yönetimi, Evde Hasta İzlemi ve Filyasyon. [Online] Available: https://covid19.saglik.gov.tr/Eklenti/41623/0/covid-19rehberitemaslitakibievdehastaizlemivefilyasyon-021021pdf.pdf

[4] ECDC (2022, Feb 2) Guidelines for non-pharmaceutical interventions to reduce the impact of COVID-19 in the EU/EEA and the UK. [Online]. Available: https://www.ecdc.europa.eu/sites/default/files/documents/covid-19-guidelines-non-pharmaceutical-interventions-september-2020.pdf

[5] World Health Organization. (2022, Feb 2) Vaccine Equity. [Online]. Available: https://www.who.int/campaigns/vaccine-equity

[6] World Health Organization (2022, Feb 2) Therapeutics and COVID-19: living guideline: [Online]. Available: https://www.who.int/publications/i/item/WHO-2019-nCoV-therapeutics-2022.1.

[7] Oka T., Wei W., Zhu D., "The effect of human mobility restrictions on the COVID-19 transmission network in China," *PloS one,* 16 (7), e0254403, 2021.

[8] Erim, D. O., Oke, G. A., Adisa, A. O., Odukoya, O., Ayo-Yusuf, O. A., Erim, T. N. et all. "Associations of Government-Mandated Closures and Restrictions With Aggregate Mobility Trends and SARS-CoV-2 Infections in Nigeria," *JAMA Netw Open,* 4 (1), e2032101, 2021.

[9] Li Y., Wang X., Campbell H., Nair H. "The association of community mobility with the time-varying reproduction number (R) of SARS-CoV-2: a modeling study across 330 local UK authorities," *Lancet Digit Health,* 3 (10), e676-e683, 2021.

[10] Oh, J., Lee, H. Y., Khuong, Q. L., Markuns, J. F., Bullen, C., Barrios, O. E. A. et all. "Mobility restrictions were associated with reductions in COVID-19 incidence early in the pandemic: evidence from a real-time evaluation in 34 countries," *Sci Rep,* 11(1), 13717, 2021.

[11] Kayı İ., Sakarya S. "Policy analysis of suppression and mitigation strategies in the management of an outbreak through the example of COVID-19 pandemic," *Infect Dis Clin Microbiol,* 2(1), 30-41, 2020.

[12] Güner R., Hasanoğlu I., Aktaş F. "Evaluating the efficiency of public policy measures against COVID-19," *Turk J Med Sci,* 51(1), 3229-3237, 2021.

[13] Ilhan M. N., Tüzün H., Kılıç R., Yıldırım N., "Nonpharmaceutical interventions in Turkey and worldwide during COVID-19 pandemic," *Turk J Med Sci,* 51 (1) 3207-3214, 2021.

[14] T.C Sağlık Bakanlığı. (2022, Feb 13) Covid-19 Genel Bilgiler, Epidemiyoloji ve Tanı. [Online] Available: https://covid19.saglik.gov.tr/Eklenti/39551/0/covid-19rehberigenelbilgilerepidemiyolojivetanipdf.pdf

[15] Faes C., Abrams S., Van Beckhoven D., Meyfroidt G., Vlieghe E., Hens N., "Time between symptom onset, hospitalisation and recovery or death: statistical analysis of Belgian COVID-19 patients," *International journal of environmental research and public health,* 17(20), 7560, 2020.

[16] Centers for Disease Control and Prevention. (2022, Feb 13) Interim Clinical Guidance for Management of Patients with Confirmed Coronavirus Disease (COVID-19). [Online]. Available: https://www.cdc.gov/coronavirus/2019-ncov/hcp/clinical-guidance-management-patients.html

[17] World Health Organization (2022, Jan 31) Report of the WHO-China Joint Mission on Coronavirus Disease 2019 (COVID-19) [Online]. Available: https://www.who.int/docs/default-source/coronaviruse/who-china-joint-mission-on-covid-19-final-report.pdf

[18] Bai, J., Shi, F., Cao, J., Wen, H., Wang, F., Mubarik, S. et all."The Epidemiological Characteristics of Deaths with COVID-19 in The Early Stage in Wuhan, China," *Global Health Research and Policy* 5, 54, 2020.

[19] Wikipedia (2022, Feb 15) COVID-19 pandemic in Turkey. [Online]. Available: https://en.wikipedia.org/wiki/COVID-19_pandemic_in_Turkey

[20] Barlas G., Öztürk H., Pehlivantürk G., Aydin S. "Turkey's response to COVID-19 pandemic: strategy and key actions," (in eng), *Turk J Med Sci,* 51 (1), 3150-3156, 2021.

[21] BBC Türkçe (2022 March 1) Omicron, Türkiye'de de tespit edildi: Varyant ne kadar tehlikeli? [Online]. Available: https://www.bbc.com/turkce/haberler-dunya-59594178

[22] World Health Organization (2022, March 1) Tracking SARS-CoV-2 variants. [Online]. Available: https://www.who.int/en/activities/tracking-SARS-CoV-2-variants/

[23] Centers for Disease Control and Prevention (2022, March 1) Omicron Variant: What You Need to Know." [Online]. Available: https://www.cdc.gov/coronavirus/2019-ncov/variants/omicron-variant.html

[24] Panda B., Thakur H. P. "Decentralization and health system performance - a focused review of dimensions, difficulties, and derivatives in India," *BMC Health Serv Res,* 16 (6), 561, 2016.

[25] Abimbola S., Baatiema L., Bigdeli M. "The impacts of decentralization on health system equity, efficiency and resilience: a realist synthesis of the evidence," *Health Policy Plan,* 34(8), 605-617, 2019.

[26] Askitas N., Tatsiramos K., Verheyden B. "Estimating worldwide effects of non-pharmaceutical interventions on COVID-19 incidence and population mobility patterns using a multiple-event study," *Sci Rep,* 11 (1), 1972, 2021.

[27] Liu Y., Morgenstern C., Kelly J., Lowe R., Jit M. "The impact of non-pharmaceutical interventions on SARS-CoV-2 transmission across 130 countries and territories,", *BMC Med,* 19 (1), 40, 2021.

[28] Teslya A., Pham T. M., Godijk N. G., Kretzschmar M. E., Bootsma M. C. J., Rozhnova G., "Impact of self-imposed prevention measures and short-term government-imposed social distancing on mitigating and delaying a COVID-19 epidemic: A modeling study,", *PLoS Med,* 17 (7), e1003166, 2020.

[29] Caristia, S., Ferranti, M., Skrami, E., Raffetti, E., Pierannunzio, D., Palladino, R. et all. "Effect of national and local lockdowns on the control of COVID-19 pandemic: a rapid review," *Epidemiol Prev,* 44 (6) 60-68, 2020. S2.104.

[30] Hakim, A. J., Victory, K. R., Chevinsky, J. R., Hast, M. A., Weikum, D., Kazazian, L. et all. "Mitigation policies, community mobility, and COVID-19 case counts in Australia, Japan, Hong Kong, and Singapore," *Public Health,* 194, 238-244, 2021.

[31] DİSK (2022 July 02) "Tam kapanma" yok, on milyonlar çalışmaya devam ediyor! ." [Online]. Available: http://arastirma.disk.org.tr/?p=5712

[32] T.C Sağlık Bakanlığı (2022 July 2) İlk Koronavirüs Aşısı Sağlık Bakanı Fahrettin Koca'ya Yapıldı. [Online]. Available: https://www.saglik.gov.tr/TR,78148/ilk-koronavirus-asisi-saglik-bakani-fahrettin-kocaya-yapildi.html

[33] Ourworldindata (2022 July 2) Coronavirus (COVID-19) Vaccinations. [Online]. Available: https://ourworldindata.org/covid-vaccinations