



INVESTIGATION OF MORTALITY AND MORBIDITY RATES IN THE COVID-19 PANDEMIC PROCESSⁱ

Mustafa Demir¹ⁱⁱ,

Alaattin Altın²

¹Ondokuz Mayıs University,
Faculty of Health Sciences,
Department of Health Management,
Samsun, Turkey

²Ondokuz Mayıs University,
Faculty of Health Sciences,
Department of Nursing,
Samsun, Turkey

Abstract:

Aim: In this study, it was aimed to systematically examine the studies on mortality and morbidity rates during the Covid-19 pandemic process. **Materials and Methods:** In the study, articles published in Ulakbim Turkish Medical Directory, Google Scholar, Scopus, Medline, Web of Science, Ebsco, PubMed, and Türk Medline databases between January 2020 and January 2021 were examined. The keywords 'morbidity', 'mortality', 'Covid-19', 'pandemic' were used in English and Turkish during the review. By examining the studies on reported morbidity and mortality rates due to Covid-19, 3509 articles were reached in the first stage, and eight articles were included. **Results:** When the studies were examined, it was concluded that the risk of death increased according to age. In some studies, the risk factor was higher in male patients than in female patients. On the other hand, it was found to be associated with age, cardiovascular diseases, diabetes, and neurological diseases. The patients in the highest-risk group were identified as those with cardiovascular disease. Patients with cardiac damage were 4.5 times riskier than those without. **Conclusion:** When Covid-19 mortality rates are examined, the common result in all studies is that mortality rates according to age increase exponentially in each country. In addition, it has been observed that comorbidities increase the risk of death. Obesity has been observed to increase the risk factor. It is important to examine the mortality and morbidity numbers in this process. It is also very important to conduct studies on health workers. Healthcare workers have been very worn out in the last year during the Covid-19 process. As a result, they have experienced a loss of resilience both psychologically and physically. It is important to carry out studies comparing the number

ⁱ This research was presented as an oral presentation at the 5th International 15th National Health and Hospital Administration Congress, Samsun, Turkey.

ⁱⁱ Correspondence: email mb0dmr@gmail.com

of cases and deaths in healthcare workers with the overall number of cases and deaths, considering the average age of the workers.

Keywords: ASD, mirror therapy, behavior, developing guidelines, nursing, effects

1. Introduction

The emergence of the SARS-CoV-2 virus, which we know as coronavirus, in December 2019 in Wuhan, China, affected the whole world (Yuki et al., 2020; Rodríguez-Morales and MacGregor, 2020). As of March 2020, the epicenter of the virus became Europe, and a severe increase was observed in the United States (Holshue and DeBolt, 2020). Each country follows the number of Covid-19 cases and deaths daily (Bastola et al., 2020; Biscayart et al., 2020). It is also important to determine which group of people Covid-19 affects and which groups are at risk (Silverstein et al., 2020; Millan-Oñate et al., 2020).

The Covid-19 morbidity rate expresses the ratio of the number of Covid-19 in a given population to the population. The Covid-19 mortality rate expresses the ratio of the number of Covid-19 deaths in a given population to the population (Mehra et al., 2020; Zhou et al., 2020). The Covid-19 fatality rate expresses the ratio of the number of Covid-19 deaths in a given population to those who contract the disease (Shi et al., 2020; Holt-Lunstad et al., 2020).

It is very important to examine the mortality and morbidity rates of Covid-19, and it is very important to examine whether these rates differ according to age, gender, and certain diseases (Onder et al., 2020; Jin et al., 2020). In this study, eight studies were examined by review. The aims, samples, data used, analyses, and results of the studies were examined during the examination. This systematic review aims to examine the studies on reported morbidity and mortality rates due to Covid-19 and to reveal whether morbidity and mortality rates differ according to some variables.

3. Materials and Methods

3.1. Reviewing Process

The studies included in the study are expressed as Research Flow Chart in Figure 1. Each study quantitatively expressed in the Flow Chart includes studies performed between January 2020 and January 2021. The literature review process was carried out through the library resources of various universities through the databases shown in Figure 1. The keywords 'morbidity', 'mortality', 'Covid-19', 'pandemic' were used in English and Turkish during the review process. In this way, Ulakbim Turkish Medical Directory, Google Scholar, Scopus, Medline, Web of Science, Ebsco, PubMed, and Türk Medline databases were searched, and 3509 studies were reached in the first stage.

3.2. Inclusion Criteria

The studies included the subjects of the number (or rate) of patients who contracted and were diagnosed with a specific disease between January 2020 and January 2021, during

the Covid-19 process and in a specified period, that is, the morbidity and the number (rate) of deaths due to a specific disease in the general population, that is, the mortality and they have to be published in national and international journals. Thesis studies, oral presentations, reviews, and posters are not included in the study. The studies included in the research also constitute original and quantitative research.

3.3. Evaluation of Methodological Quality

As a result of the examination of the research, 12 criteria for evaluating the quality of the research proposed by Polit and Beck were used for the remaining eight studies (Polit and Beck, 2009). Using these criteria provides an opportunity to make a general evaluation of the aims of the research, the sample group, the findings, and the results. Each of the studies was evaluated separately by all criteria and researchers, and "1 point" was given if it met each item, and "0 point" was given if it did not.

3.4. Extraction of Data

In this study, 3509 studies reviewed through various databases were reached. Of these studies, 3450 were excluded due to title and abstract inconsistency, and 59 due to duplicate articles. Afterward, the remaining eight studies were evaluated as content. In this context, eight studies examined were found to be suitable for the study criteria, and related studies were included in the scope of the study.

4. Results

As a result of the review, eight studies that met the inclusion criteria were included in the systematic review. The research flowchart is shown in Figure 1.

4.1 Evaluation of Methodological Quality

Methodological quality evaluations of 8 studies included in the study in the systematic review were evaluated by two independent researchers. Each item was given "1 point" if it met the criteria and "0 point" if it did not. As a result of the evaluation, the highest score was 11, and the lowest was 9. For inter-rater reliability, the "fit analysis kappa" value was checked for eight studies in the SPSS-25 program. The kappa value for the sum of all items was 0.761, and it was determined that the inter-rater reliability was high. For each assessment criterion, the inter-rater reliability fit analysis kappa values ranged from 0.716 to 0.782. The number of studies evaluated at the last stage was determined as 8. The mean scores given by the researchers for each study are presented in Table 1.

4.2 Characteristics of the Evaluated Studies

Of the included studies, five were cohort studies, two were retrospective, and one was an indirect standardization study. Since all of the studies are related to Covid-19, they all belong to the year 2020 and are newly published studies.

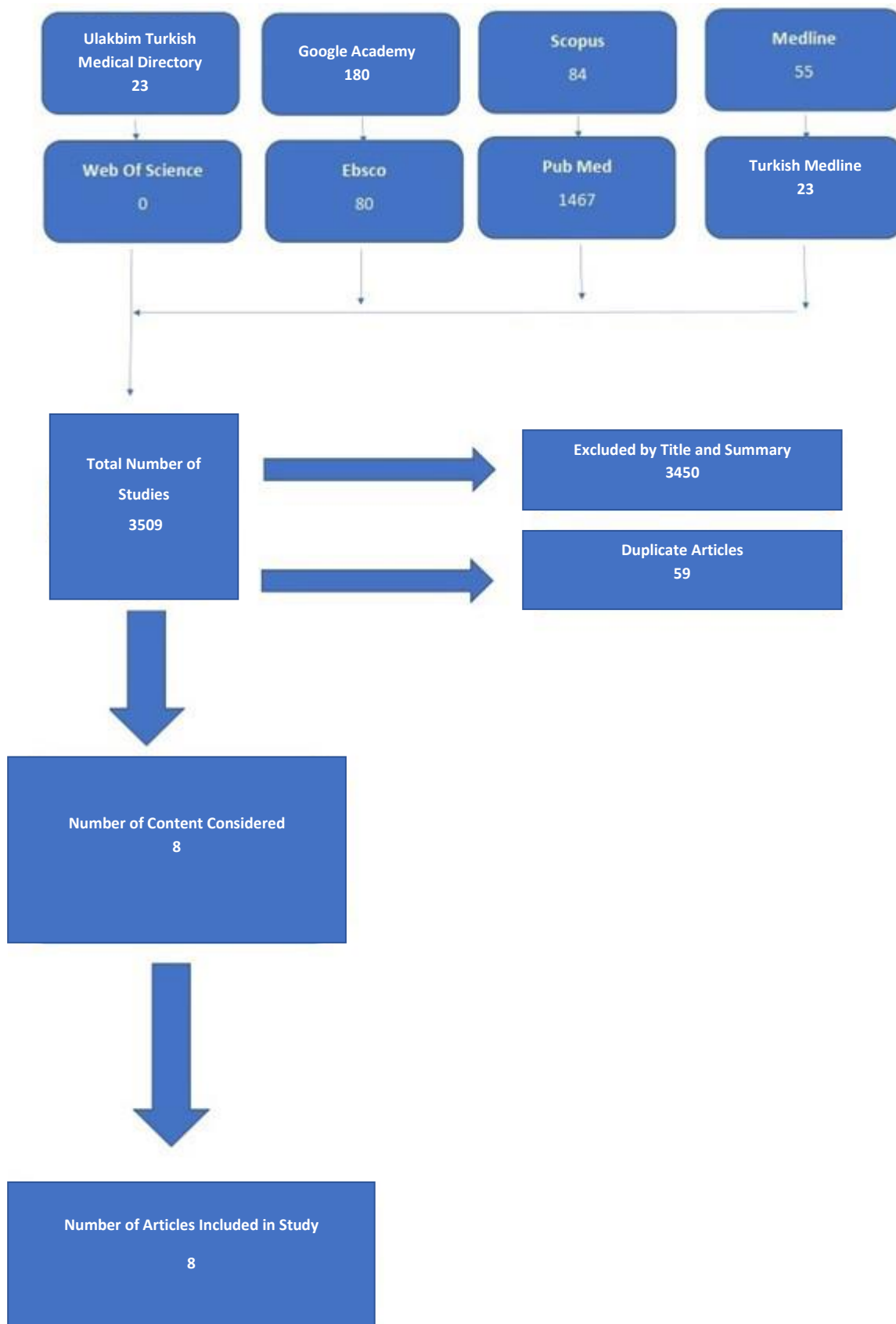


Figure 1: Research Flow Chart

Table 1: Type of Study, Purpose, Method of Measurement, Sample Size, Database, and Evaluation Score

No	Authors	Type of Study	Purpose	Method of Measurement /Tools Used	Sample Size	Database	Evaluation Score of the Study
1	Sara Y. Tartof Lei Qian Vennis Hong Rong Wei (2020)	Retrospective cohort study	To determine the adjusted impact of body mass index (BMI), associated comorbidities, time, neighborhood-level sociodemographic factors, and other factors on the risk of death due to Covid-19.	Evaluated according to laboratory test results.	6916	(Google Scholar)	11
2	E. Eser (2020)	Indirect standardization	Comparison of Covid-19 deaths in Turkey with death data from other countries using Standardized Mortality Rates (SMR).	Evaluated according to Standardized Mortality Rate (SMR).	4642	(Ulakbim TR Directory)	11
3	E. B. Ing, Q. A. Xu A. Salimi, N. Torun (2020)	Retrospective study	It is intended to tabulate cases of COVID-19-related physician deaths associated with front-line work in the hope of mitigating future events.	Evaluated according to Standardized Mortality Rate (SMR).	278	Google Scholar	10
4	Daniel E. L. Promislow, D. Phil (2020)	Retrospective study	It is aimed to examine the effects of age and gender on mortality rates due to COVID-19 and the effects of aging on the causes of death.	Evaluated according to the results of examining the data On Infection Fatality Rate (IFR) and Case Fatality Rate (CFR).	100.000	Google Scholar	10
5	G. J. B. Sousa, T. S. Garces, V. R. F. Cestari, R. S. Florêncio, T. M. M. Moreira M. L. D. Pereira (2020)	Cohort study	This study aims to identify risk factors associated with mortality and survival of COVID-19 cases in the Northeastern state of Brazil.	Conducted in 2020 in Fortaleza (capital of Ceará) using IntegraSUS data (https://integrasus.saude.ce.gov.br/).	2070	Google Scholar	10
6	Shaobo Shi, Mu Qin, Bo Shen (2020)	Cohort study	To investigate the relationship between cardiac damage and mortality in patients with COVID-19.	Performed using clinical laboratory, radiology, and treatment data.	416	Google Scholar	12
7	A. V. Fateeva, L. I. Gurina (2020)	Cohort study	The study presents the results of the morbidity analysis. To investigate the mortality and mortality rate in cancer patients with COVID-19 in the Primorsky Territory from 31 March to 31 August 2020.	Evaluated using outcomes of COVID-19-related morbidity and mortality rates of patients with cancer in Primorskiy.	100000	Scopus	9
8	D. V. Melik-Huseynov, N. N. Karyakin (2020)	Cohort study	Testing originally developed mathematical algorithms to predict the development of COVID-19.	Evaluated using information from sources available on official websites to assess the situation in China, Italy, and the USA.	536.669	Scopus	9

4.3 Characteristics of the Sample Group in the Evaluated Studies

Sample sizes are much larger than normal studies, as the evaluated examined the Covid-19 mortality and morbidity rates. The number of samples in the evaluated studies was at least 278 and at most 536669.

Sara et al. (2020) studied 6916 patients in Southern California, USA. They examined the adjusted effect of body mass index (BMI), associated comorbidities, sociodemographic factors at the time neighborhood level, and other factors on the risk of death from Covid-19 in these patients. In Eser's (2020) study, Covid-19 deaths in Turkey were compared with the Standardized Mortality Rate in other countries (Germany, Italy, South Korea, China, Australia, Netherlands, United Kingdom). The study compared mortality rates in Turkey and Germany in detail, and 2259 Covid-19 death cases in Turkey and 4642 Covid-19 death cases in Germany were examined. In the study of Ing et al. (2020), general mortality rates were not examined; only doctor deaths due to Covid-19 were examined. Within the scope of the study, 278 doctor deaths due to Covid-19 in 7 countries (Italy, Iran, Indonesia, China, Spain, America, and the United Kingdom) were examined. Promislow and Dphil (2020) examined the Covid-19 mortality rates by age and gender in their study. The study examined the mortality rates per 100000 population in China, Italy, and New York City, USA, by age and gender. In their study, Sousa et al. (2020) examined the Covid-19 death cases in the Northeastern state of Brazil according to age, gender, and presence of different diseases. Shi et al. (2020) examined the relationship between cardiac damage and mortality in 416 Covid-19 patients in Wuhan, China. Fateeva and Gurina (2020) examined the mortality and morbidity rates in Covid-19 patients with cancer in the Primorskiy region of Russia in their study. Huseynov et al. (2020) used countries' mortality and morbidity rates to predict the development of Covid-19 in China, Italy, America, and Russia.

4.4 Methods Used in Evaluated Studies

Sara et al. (2020) examined the adjusted effect of body mass index (BMI), associated comorbidities, time-neighborhood sociodemographic factors, and other factors on the risk of death due to Covid-19 in patients in Southern California, USA. Sara et al. used Fisher's Exact Probability Test and Chi-square Test to examine whether there was a significant difference between living and deceased patients in their study. The Kruskal-Wallis Test was used for continuous variables. Multiple Poisson regression analysis was used to measure the adjusted relative risk of death for different BMI categories. Risk factor analysis was also performed in the study according to the interaction of age and BMI and gender and BMI index. According to the analysis results, a significant difference was obtained in mortality rates regarding ethnicity, age, BMI index, smoking, and most comorbidities according to a reliability coefficient of 0.001. In addition, in the risk factor analysis, the risk ratios of the group with a BMI index below 18.5 and 40 and above and the risk ratios over 60 years of age were found to be high. An interesting result of the study is that the risk factor is very high for men with a BMI over 40. In the study, it was examined whether there is a significant difference between many variables such as gender, ethnicity, age, BMI, comorbidities, alcohol and drug use, and Covid-19 mortality

rates, and it is a very comprehensive study in terms of risk factor analysis for different variables, and very important findings were reached. With this study, normal mortality rates and post-Covid-19 mortality rates can be examined according to the BMI index. Here, if the death data between the same months in 2019 (pre-Covid-19) can be obtained according to the BMI index, it can be examined whether there is a difference between the mortality rates compared to the previous year.

5. Discussion

When the studies on the reported morbidity and mortality rates due to Covid-19 are examined, in Eser's (2020) study, Covid-19 deaths in Turkey were compared with the Standardized Mortality Rate in other countries (Germany, Italy, South Korea, China, Australia, Netherlands, United Kingdom). Standardized Mortality Rate (SMR) was calculated by the indirect standardization method, where the SMR is the coefficient obtained by dividing the observed mortality rates by the expected mortality rates. Since the age distribution in the countries is different in the study, the age distribution is balanced with this calculation; that is, when comparing Turkey and Germany, the question "how many deaths would be expected in Turkey if the age distribution in Turkey were the same as in Germany" was answered. According to the data obtained, the mortality rates in Turkey are 37% more than Germany (as of 21 April 2020), 529% more than South Korea (as of 15 April 2020), 2880% more than Australia (as of 15 April 2020), it is 339% less than Italy (as of 22 April 2020), 265% less than the Netherlands (as of 22 April 2020) and 387% less than the UK (as of 14 April 2020). This study is a good one to examine the Covid-19 mortality rates in countries more healthily. Here, a comparison can also be made by making a ratio according to the number of deaths in each country in the same periods before Covid-19. For example, the ratio of the number of deaths in Turkey between 1 March and 1 June 2019 to the population in that period is taken. The same rate is calculated for the year 2020. In this way, it can be calculated how much the mortality rate increased in the same period. This ratio can be calculated for different countries, and a comparison can be made. A conclusion can be reached by comparing it with the calculation in this study. Since countries have standard differences in determining the number of Covid-19 cases, these standards can also be discussed in such a study.

The study of Ing et al. (2020) differs slightly from these two studies. Ing et al. examined 278 Covid-19 doctor deaths in 7 countries (Italy, Iran, Indonesia, China, Spain, America, and the United Kingdom). According to the study, the highest number of doctor deaths between 7 February and 15 April were seen in Italy and then Iran among these seven countries. According to the departments, the death cases were mainly seen in the general practitioners working in the emergency department. The average age of the deceased doctors was 63.5, and doctors over 90 were excluded from the study. Based on this study, such a study can be conducted for a more comprehensive process and for all health workers. This study can be done separately for different countries. For each country, the ratio of the number of deaths of health workers to the total number of deaths

can be calculated, and a comparison can be made between countries over this number. While making this calculation, the average age of the deceased health workers should also be considered.

Promislow and Dphil (2020) examined the Covid-19 mortality rates by age and gender in their study. They examined the mortality rates per 100000 population in China, Italy, and New York City, USA, by age and gender. Regression curves were created using the least square method. Age and \log_{10} (mortality rate) variables were used to construct these curves. In the study, the mortality rate in men and women increases exponentially with age. This situation does not differ from country to country. According to gender, men are in a riskier group than women in all age groups. The study shows this situation in Italy and New York City in the USA.

Sousa et al. (2020) examined the Covid-19 death cases in Fortaleza in the Northeastern state of Brazil, according to age, gender, and presence of different diseases. Data are taken from IntegraSUS data. Sousa et al. stated that the data consisted of cases tested by doctors and tested positive, and the normal number was higher than this. They used the Chi-square test at a 95% confidence interval to compare categorical variables and the Poisson regression model for variables with $p < 0.2$. They also performed a survival analysis. In the study, 2070 death cases were examined. Although male mortality rates were higher than female, no significant difference was found between the groups. On the other hand, significant differences were found in age, cardiovascular diseases, diabetes, and neurological diseases ($p < 0.001$). The survival analysis identified risk factors as patients over 60 years of age, patients with neurological disease, and pneumopathies. Afterward, the Cox regression model was applied, and the risk factors according to this model were elderly patients (3.6 times more at risk), patients with neurological disease (3.9 times more at risk), pneumopathies (2.6 times more at risk) and patients with cardiovascular disease (8.9 times more at risk). According to this analysis, patients in the highest-risk group were identified as those with cardiovascular disease. According to Cox regression analysis, obese patients, kidney patients, diabetes patients, and hematological patients were not in the risk group. This study is very comprehensive in terms of analysis.

Shi et al. (2020) examined the relationship between cardiac damage and mortality in 416 Covid-19 patients in Wuhan, China. The patients are at the Renmin Hospital of the Wuhan University of China, and data were obtained from the hospital's demographic, clinical, laboratory, and cardiac practices. Cardiac damage was present in 82 (19.7%) of 416 patients. In the study, Fisher's Exact Probability Test and Chi-square Test were used to compare categorical data, and the t-test and Mann-Whitney U test were used to compare continuous variables. The significance level was taken as $p < 0.05$ in all analyzes. Shi et al. compared the blood values, other diseases, demographic data, and length of hospital stay of patients with and without cardiac damage. Then, survival analysis was performed, and Kaplan-Meier survival curves were created. Accordingly, patients with cardiac damage were found to be riskier (51.2% of patients with cardiac damage and 4.5% of patients without cardiac damage). In addition, patients with cardiac damage were

found to be 4.5 times riskier than patients without cardiac damage in the Cox regression model ($p < 0.001$).

Fateeva and Gurina (2020) examined mortality and morbidity rates in 366 Covid-19 patients with cancer in the Primorskiy region of Russia. Similar to other studies, it was concluded in the study that the risk of death increased according to age. In addition, the Covid-19 death rates of cancer groups with a high risk of death were low, on the contrary. No analysis was made in the study, and only death rates were examined. In the study, cancer groups with more than a certain number of patients could be compared with tests such as Fisher's Exact Probability Test and Chi-square Test.

Huseynov et al. (2020) used the mortality and morbidity data of countries from January to April 2020 to predict the development of Covid-19 in China, Italy, America, and Russia and developed two regression models to estimate the new Covid-19 cases. In the first model, the regression coefficient for the new case related to the increase in Covid-19 cases was calculated as 0.02 ($p < 0.05$). In the second model, estimations were made for new and severe Covid-19 cases, and the regression coefficients were calculated as 0.017 and 0.01, respectively ($p < 0.05$). In addition, Huseynov et al. used the Kolmogorov-Smirnov criterion to test the data for normality, the Mann-Whitney U test to examine the differences between groups, and Spearman's correlation analysis to examine the correlation between them. They performed the analyzes at a 95% confidence interval. According to the analysis results, a significant difference was found between Italy, China, and America according to the number of new cases.

6. Conclusion and Recommendations

This study examined eight articles investigating Covid-19 mortality and morbidity rates. Some articles examine mortality rates in a particular country, while cross-country comparisons are made in some articles. The data used in all of the articles include data in a specific interval between January 2020 and June 2020; that is, the data includes data showing the first six months of the disease. While four studies included data only in a specific region of a particular country (USA Southern California; Brazil Fortelaza; Russia Primorskiy; China Wuhan), other studies included data from different countries. All but one of the studies examined overall cases of Covid-19, with only one study examining Covid-19 doctor deaths.

Fisher's Exact Probability Test and Chi-square Test were used to compare categorical variables in the studies. T-test, Mann-Whitney U test, and Kruskal-Wallis test were used to compare continuous variables. In addition, survival analysis and the Cox regression model were used to determine the risk factors of the variables in the studies. In addition, regression models have been developed to predict the course of the disease. When Covid-19 death rates are examined, the common result in all studies is that death rates according to age increase exponentially in each country. In addition, it has been observed that comorbidities increase the risk of death. Obesity has been observed to increase the risk factor. In addition, in some studies, the risk factor was higher in male patients than in female patients.

In addition, countries were also compared in the studies. While comparing Covid-19 mortality between Turkey and other countries in Eser's (2020) study, Promislow and Dphil (2020) estimated mortality rates in different countries by age and gender. Huseynov et al. developed estimates for China, Italy, and the United States using mortality rates. The second half of 2020 is an important process for the increase of Covid-19 cases, and it differs a lot compared to the first half of 2020. Especially in the last four months of 2020, severe increases were observed in the number of cases and deaths, which has also been observed in our country in the last three months. Therefore, it is important to examine this process's mortality and morbidity numbers. It is also very important to conduct studies on health workers. Healthcare workers have been very worn out in the last year during the Covid-19 process. As a result, they have experienced a loss of resilience both psychologically and physically. It is important to carry out studies comparing the number of cases and deaths in health workers with the overall number of cases and deaths, considering the average age of the workers.

In addition to these, it is very important to follow the data on the Covid-19 vaccine and to carry out studies on it. This study includes January 2020 and January 2021, so content analysis studies can be done after that date. In order to understand the course and effects of the Covid-19 pandemic, it may be recommended to plan more extensive studies.

Conflict of Interest Statement

There is no conflict of interest among the authors.

About the Authors

Mustafa Demir is a lecturer at the Ondokuz Mayıs University, Faculty of Health Sciences Department of Health Management, Turkey.

Alaattin Altın is doctoral lecturer Ondokuz Mayıs University Faculty of Health Sciences Department of Nursing, Turkey.

References

- Bastola A., Sah R., Rodriguez-Morales A. J., Lal B. K., Jha R., Ojha H. C., et al. (2020). The first 2019 novel coronavirus case in Nepal. *Lancet Infect Dis*;20(3):279–80.
- Biscayart C., Angeleri P., Lloveras S., Chaves T., Schlagenhauf P., Rodriguez-Morales A. J. The next big threat to global health? 2019 novel coronavirus (2019-nCoV): what advice can we give to travellers? - interim recommendations January 2020, from the Latin-American Society for Travel Medicine (SLAMVI). *Trav Med Infect Dis* 2020:101567.
- Eser E. (2020). Türkiye'deki Covid-19 Ölümünün Diğer Bazı Ülkelerle, Standardize Ölüm Oranları (SÖO) İle Karşılaştırılması. *Sağlık ve Toplum Özel Sayı*.
- Fateeva A. V., Gurina L. I. (2020). Cancer patients having COVID-19 in Primorsky region: Morbidity and mortality. *Pacific Medical Journal*;4(4):5-9. (In Russ.)

- Holshue M. L., DeBolt C., Lindquist S., Lofy K. H., Wiesman J., Bruce H., et al. (2020). First case of 2019 novel coronavirus in the United States. *N Engl J Med*.
- Holt-Lunstad, Julianne, Timothy B. Smith, and J. Bradley Layton (2010). Social relationships and mortality risk: a metaanalytic review. *PLoS med* 7.7 (2010): e1000316.
- Ing E. B., Xu Q. A., Salimi A., Torun N. (202). Physician deaths from corona virus (COVID-19) disease. *Occup Med (Lond)*. Jul 17;70(5):370-374.
- Jin, J. M., Bai, P., He, W., Wu, F., Liu, X. F., Han, D. M., ... & Yang, J. K. (2020). Gender differences in patients with COVID-19: focus on severity and mortality. *Frontiers in public health*, 152.
- Mehra M. R., Desai S. S., Kuy S., et al. (2020). Cardiovascular Disease, Drug Therapy, and Mortality in Covid-19. *N Engl J Med* 2020; 382:e102
- Melik-Huseynov, D. V. & Karyakin, N. N. & Blagonravova, Anna & Klimko, V. I. & Bavrina, Anna & Drugova, O. & Saperkin, Nikolay & Kovalishena, O. V. (2020). Regression Models Predicting the Number of Deaths from the New Coronavirus Infection. *Sovremennye tehnologii v medicine*. 12. 6.
- Millan-Oñate J, Rodríguez-Morales A. J., Camacho-Moreno G., Mendoza-Ramírez H., Rodríguez-Sabogal I. A., Álvarez-Moreno C. (2020). A new emerging zoonotic virus of concern: the 2019 novel Coronavirus (COVID-19). *Infectio*;24(3).
- Polit D. F., Beck C. T. (2009). Literature Reviews: Finding and Reviewing Research Evidence. In: Polit D. F., Tatano B. C., Eds. *Essentials of Nursing Research: Appraising Evidence for Nursing Practice*. 7th ed. Philadelphia: Lippincott Williams & Wilkins; 2009. P.169-93.
- Promislow D. E. L. (2020). A Geroscience Perspective on COVID-19 Mortality. *J Gerontol A Biol Sci Med Sci*. 2020 Sep 16;75(9):e30-e33.
- Rodríguez-Morales A. J., MacGregor K., Kanagarajah S., Patel D., Schlagenhauf P. (2020). Going global – travel and the 2019 novel coronavirus. *Trav Med Infect Dis*:101578.
- Shi S., Qin M., Shen B., Cai Y., Liu T., Yang F., Gong W., Liu X., Liang J., Zhao Q., Huang H., Yang B., Huang C. (2020). Association of Cardiac Injury with Mortality in Hospitalized Patients with COVID-19 in Wuhan, China. *JAMA Cardiol*. Jul 1;5(7):802-810.
- Shi S., Qin M., Shen B., et al. (2020). Association of Cardiac Injury with Mortality in Hospitalized Patients With COVID-19 in Wuhan, China. *JAMA Cardiol*.
- Silverstein W. K., Stroud L., Cleghorn G. E., Leis J. A. (2020). First imported case of 2019 novel coronavirus in Canada, presenting as mild pneumonia. *Lancet*. Volume 395, Issue 10225, P734, February 29, 2020
- Sousa G. J. B., Garces T. S., Cestari V. R. F., Florêncio R. S., Moreira T. M. M., Pereira M. L. D. (2020). Mortality and survival of COVID-19. *Epidemiol Infect*. Jun 25;148:e123.
- Tartof S. Y., Qian L., Hong V., Wei R., Nadjafi R. F., Fischer H., Li Z., Shaw S. F., Caparosa S. L., Nau C. L., Saxena T., Rieg G. K., Ackerson B. K., Sharp A. L., Skarbinski J., Naik T. K., Murali S. B. (2020). Obesity and Mortality Among Patients Diagnosed

- with COVID-19: Results from an Integrated Health Care Organization. *Ann Intern Med.* Nov 17;173(10):773-781.
- Yuki, K., Fujiogi, M., & Koutsogiannaki, S. (2020). COVID-19 pathophysiology: A review. *Clinical immunology*, 108427.
- Zhou F, Yu T, Du R, et al. (2020). Clinical course and risk factors for mortality of adult inpatients with COVID-19 in Wuhan, China: a retrospective cohort study. *Lancet*; 395:1054.

Creative Commons licensing terms

Author(s) will retain the copyright of their published articles agreeing that a Creative Commons Attribution 4.0 International License (CC BY 4.0) terms will be applied to their work. Under the terms of this license, no permission is required from the author(s) or publisher for members of the community to copy, distribute, transmit or adapt the article content, providing a proper, prominent and unambiguous attribution to the authors in a manner that makes clear that the materials are being reused under permission of a Creative Commons License. Views, opinions and conclusions expressed in this research article are views, opinions and conclusions of the author(s). Open Access Publishing Group and European Journal of Public Health Studies shall not be responsible or answerable for any loss, damage or liability caused in relation to/arising out of conflicts of interest, copyright violations and inappropriate or inaccurate use of any kind content related or integrated into the research work. All the published works are meeting the Open Access Publishing requirements and can be freely accessed, shared, modified, distributed and used in educational, commercial and non-commercial purposes under a [Creative Commons Attribution 4.0 International License \(CC BY 4.0\)](https://creativecommons.org/licenses/by/4.0/).