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A comparative analysis of world health systems and Covid-19

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Abstract

Coronavirus disease 2019 (COVID-19), which causes severe airway problems, first emerged in the Chinese city of Wuhan. The virus led to a pandemic that affected the entire world. COVID-19 affects not only health, but also economic and social life. The emergence of this pandemic has led to health systems across the world being questioned. The aim of this study was to assess the adequacy of world health systems in the face of this pandemic. Twelve countries were selected and analyzed in the study. The choice of these countries was determined by the number of COVID-19 cases and deaths. Information concerning health systems and COVID-19 was obtained from Organization for Economic Co-operation and Development 2018, World Health Organization 2020 and Deep Knowledge Group data and was subjected to statistical analysis. According to the analysis, the country with the highest investment in health expenditures is the United States (10586 US dollars/capita), and Germany stands out as the best in health services. Another finding is the first and second wave of COVID-19 was identified as the USA with the highest case and death rate (First wave cases 1.942.363 and deaths 110.514; second wave cases at 7.419.230 and deaths 2.09.450). As a result of the meta-analysis, it is revealed that only socio-economic power is not enough, countries with good health systems are more successful in the pandemic. In addition, the analysis once again reveal how important health systems are in the face of such a pandemic.

Keywords: meta-analysis, health system, Covid-19, coronavirus, pandemic, wave

1. Introduction

Coronavirus disease emerged in the Chinese city of Wuhan in 2019, and is a viral disease progressing with weakness, dry cough, shortness of breath, and respiratory distress (Hui et al., 2020). The disease was given the name Coronavirus disease 2019 (Covid-19) by the World Health Organization (WHO), and was declared to be a viral pandemic on 11 March, 2020 (WHO, 2020 (a)). Without skipping the first covid-19 effects, the second wave of covid-19 began to appear in many countries (Vuong et al., 2020; Win, 2020). Age, and conditions such as cardiovascular diseases, diabetes, chronic respiratory disease, hypertension, and cancer have been reported to increase the risk of both contracting the disease and of mortality (Vlachakis et al., 2020).

Covid-19 affects not only health, but also economic and social life. Preventing the spread of, controlling, and treating the virus has become countries' main priority. Such a major pandemic with worldwide impacts has also led to health systems being questioned. The pandemic clearly cannot be suppressed solely through the adequacy of health systems. This is linked to states' socioeconomic strength. However, health systems are also having a major impact. Health systems can therefore be analyzed in order to reveal their associations with Covid-19.

The purpose of this study was to examine and identify the adequacy of the health systems of countries in which Covid-19 cases and deaths have been seen. These comparisons will reveal the effects of health policies and systems on the pandemic, and are presented as an opportunity for enhancing the ability to be prepared to meet another such situation

2. Materials and methods

2.1. Determining the countries to be analyzed

Twelve countries were included in this study (Turkey, Korea, Japan, Russia, China, Israel, France, Spain, Italy, Germany, the USA and the United Kingdom). The selection of these countries was based on Covid-19 case numbers and death rates. Covid-19 disease patient and death rates obtained from WHO 2020 and Deep Knowledge Group (DKG) data were employed.

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2.2. Evaluation criteria used for countries

Various criteria capable of affecting Covid-19 disease were also analyzed. The funds set aside by countries for health spending (private and public health support), health service provision (health personnel numbers, hospital numbers, lengths of hospitalizations), general health evaluation criteria (infant death rates, immunity rates, smoking, chronic diseases), equipment used in health provision, general population numbers, and changes in the elderly populations were compared. Information concerning health systems was obtained from Organization for Economic Co-operation and Development (OECD) 2018 (https://data.oecd.org/) data, and was subjected to statistical analysis.

3. Results

3.1. Health spending (private and public health support)

The finance structures of health systems in many countries are complex. Financing comes from taxation, and public, private, and individual payments. These can be divided into the private and public sectors. The public sector consists of state financing, while the private sector is financed by private health insurance, out-of-pocket payments, and payments made by employers on behalf of employees (Özbay et al., 2007).

Table 1: Health spending (total, public/compulsory, voluntary and out-of-pocket) (OECD Health Statistics)

Country	Health Spending (US dollars/capita, 2018)			
	Public/ compulsory	Voluntary	Out-of-pocket	Total
France	4141	824	463	4965
Spain	2341	981	760	3323
Italy	2545	883	791	3428
Germany	5056	930	738	5986
United States	8949	1637	1122	10586
United Kingdom	3138	931	629	4070
Turkey	957	269	206	1227
Korea	1908	1284	1048	3192
Japan	4008	758	608	4766
Russia	846	650	612	1514
China	399	277	247	688
Israel	1773	960	593	2780

Heath spending includes therapeutic care, rehabilitative care, long-term care, additional services, medical products, prevention, and public health services. Investment in the field of health is not included (OCED, 2020). Within this context, health services consist of public spending and compulsory health insurance (public/compulsory), voluntary health insurance, and out-of-pocket payments.

Analysis showed that among the countries investigated, the USA achieved the highest payments in terms of public/compulsory, voluntary, and out-of-pocket health insurance. This shows that in addition to public/compulsory insurance occupying a significant place in terms of payments, a major burden is also placed on the public. The country with the lowest out-of-pocket spending among the public was Turkey (Table 1).

3.2. Health care use in countries

This section assessed data for total hospital bed capacity and personnel numbers. Japan emerged as superior to other countries with a value of 13.1 (per 1000 inhabitants) in terms of total hospital bed capacity (Table 2). Health personnel (physicians and nurses), who play the most important role in the health system, were also compared among the countries. Germany had the highest number of health personnel per capita, at 4.3 physicians and 12.9 nurses (per 1000 inhabitants) (Table 2).

Table 2. Total numbers of doctors, nurse and hospital beds (per 1000 inhabitants) (2018, OECD Health Statistics)

Numbers of hospital beds and personnel			
Country	**Hospital beds**	**Doctors**	**Nurses**
France	6	3.4	10.8
Spain	3	3.9	5.7
Italy	3.2	4	6.7
Germany	8	4.3	12.9
USA	2.8	2.6	11.7
United Kingdom	2.5	2.9	7.8
Turkey	2.8	1.9	2.1
Korea	12.3	2.3	6.9
Japan	13.1	2.4	11.3
Russia	8.1	4	8.5
China	4.3	2	2.7
Israel	3	3.1	5.1

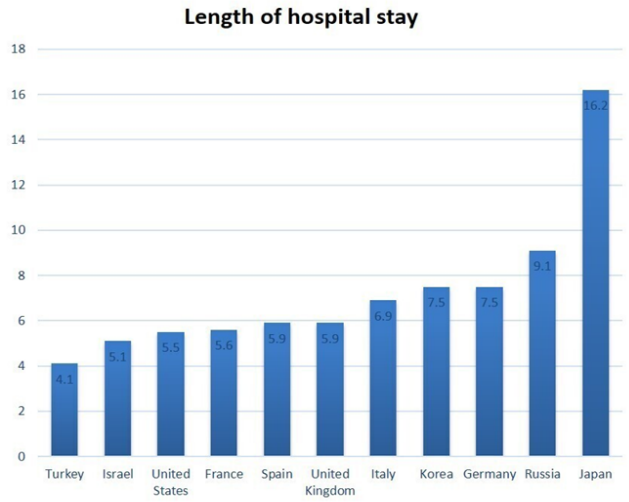

Fig. 1. Lengths of hospital stay (2018, OECD Health Statistics)

Following comparison of hospital bed capacities and health personnel, another criterion used to assess health services, length of hospital stay, was then investigated. Mean length of hospitalization is known to play an important role in the assessment of the service provided. Studies have reported links between nosocomial infections and hospital stay (Bradley and Ayliffe, 2018). Longer hospital stays increase the rate of contraction of nosocomial infections. The shortest and longest lengths of hospital stay were therefore compared in the form of length of hospital stay/day. Comparison between countries showed that Turkey had the shortest average hospital stay at 4.1 (per 1000 inhabitants), and Japan had the longest at 16.2 (per 1000 inhabitants) (Figure 1). The

fact that Japan, the country with the longest hospital stays, also had the highest bed capacity, is particularly thought-provoking.

3.3. Evaluation of communities' general health criteria of communities

Infant mortality rates, immunity levels, smoking, and chronic diseases were considered under this heading. Health systems are constantly changing depending on needs, and these changes also allow treatments to evolve. With the growth in the elderly population, acute diseases have been replaced by combatting chronic diseases such as cancer, diabetes, and hypertension. Comparison of cancer-related mortality rates among countries showed higher mortality in countries with greater elderly populations, such as the United Kingdom (Figure 2).

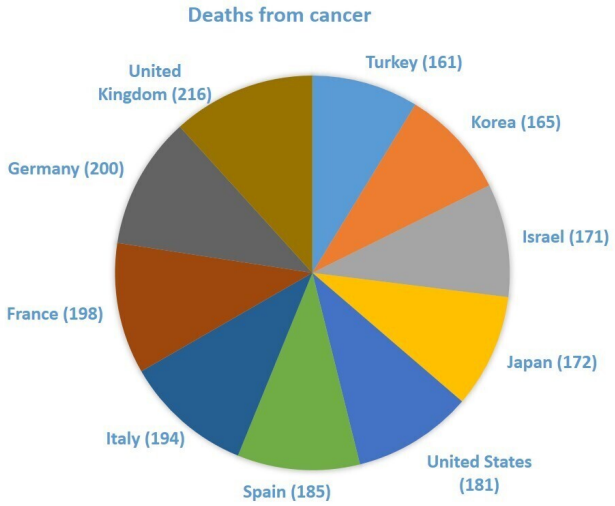

Fig. 2. Total numbers of death from cancer (Per 100,000 individuals) (2017, OECD Health Statistics)

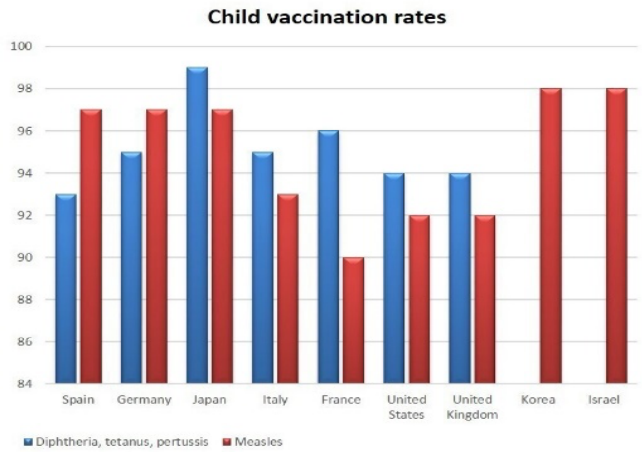

Fig. 3. Diphtheria, tetanus, pertussis, and measles vaccination rates

A rise in the elderly population will directly impact on chronic diseases, health services, and financing. One of the most successful assessment criteria in preventive medicine is vaccination. Diseases that can be prevented by vaccination are found all over the world, and these have been significantly reduced through routine vaccination programs. Major epidemics have thus been prevented. Comparative analyses have examined the applicability of diphtheria, tetanus, pertussis, and measles vaccines. High vaccination rates were observed in the all countries in this study. However, complete data were not available for some (Korea, Japan, People's Republic of China, and Israel) (Figure 3).

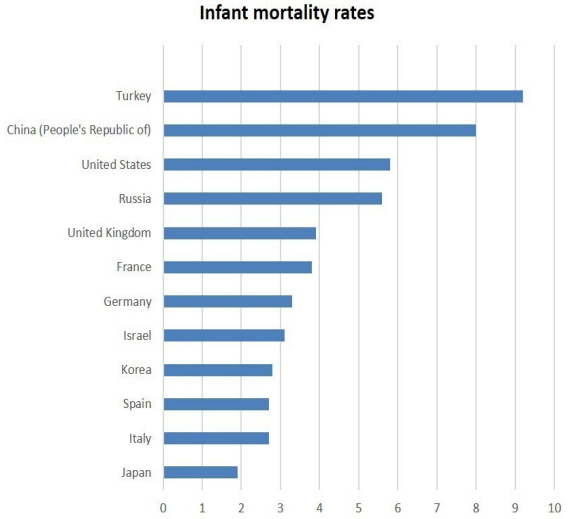

Fig. 4. Total numbers of infant deaths (1000 live births, 2018 OECD Health)

Infant mortality rates are defined as the number of deaths of children under one year of age per 1000 live births. A low rate indicates successful health services. The lowest infant mortality rate in the countries in this study was in Japan, at 1.9 (Figure 4). Another indicator employed in assessing protective medicine services is smoking among individuals aged 15 or above. Comparison of the countries in this study revealed that the highest level was in Turkey at 26.5% (of the population aged 15+) (Figure 5).

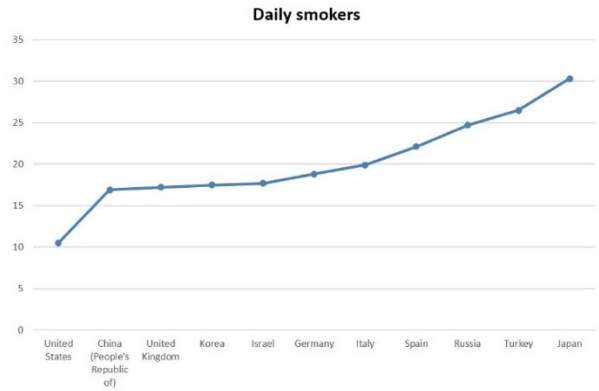

Fig. 5. Total number of daily smokers aged 15+ (% of population, 2018, OECD Health Statistics)

3.4. Health equipment used in health service delivery

One of the most important steps in health service provision is rapid and accurate diagnosis. Data concerning the health technologies possessed by the countries in this study were therefore considered under this heading. However, data for some countries were found to be incomplete during the analysis. Comparisons based on the available data revealed that the greatest numbers of diagnostic devices were in Germany and France (Table 3).

3.5. Countries' total populations and changes in the elderly population

The total population and the elderly population need to be examined when comparing health systems in different countries. The country with the largest total population was China (Figure 6). An increase in the elderly population also predicts an increased demand for health services. The country with the largest elderly population as a percentage of the total population was Japan at 28.14% (Figure 6).

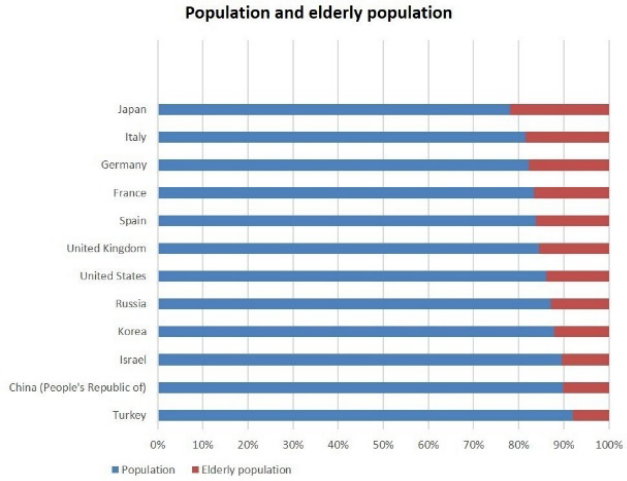

Fig. 6. Countries' total and elderly populations (million individuals, 2018, OECD Health Statistics)

Table 3. Total numbers of computed tomography (CT), magnetic resonance imaging (MRI) and mammography devices (Per 1000 inhabitants) (2018, OECD Health Statistics)

Country	CT	MRI	Mammography machines
France	14	14.8	7
Spain	19	16.3	16.1
Italy	35	28.6	33.7
Germany	35	34.7	-
United States	44	39.1	59.7
United Kingdom	-	62	-
Turkey	15	11	11.8
Korea	38	29.1	59.5
Japan	111	55.2	34.3
Russia	14	4.9	-
China	-	-	-
Israel	10	5.2	-

3.6. Total numbers of first and second waves COVID-19 cases and deaths in the countries included in the study

The total numbers of Covid-19 cases and deaths were compared among the countries involved in this study. The first and second waves of COVID-19 were examined separately. The first waves of COVID-19, the USA had the highest numbers of both cases at 1.942.363, and deaths, at 110.514 (OCED, 2020). Comparisons of death rates and cases numbers showed that Russia and Israel were in quite good positions. This also reflects good healing rates among patients contracting the disease. Russia, Israel, South Korea, Turkey and Germany emerged as countries with good health systems and national policies on this subject (Figure 7).

The second waves of COVID-19, it is observed that the country in the first three places has not changed. The USA had the highest numbers of both cases at 7.419.230, and deaths, at 2.09.450 (WHO, 2020 (b)) (Figure 7).

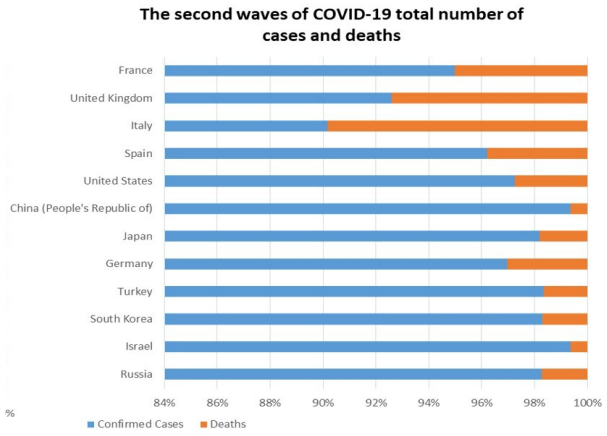

Fig. 7. Total numbers of COVID-19 cases and deaths in the countries included in the study (Second waves of COVID-19)

4. Discussion

Countries applied several strategies, such as careful infection control, isolation of patients, and social distancing in order to prevent the pandemic. Some of these were successful, others less so. However, there can be no doubt that the state of countries' health systems plays an important role in this pandemic (Nicola et al., 2020).

Studies have reported that all humans are susceptible to Covid-19 infection. However, the risk is higher among certain groups. The world population stood at 7.6 billion in 2018, of which the elderly constituted 8.92%. A growing elderly population will also increase the demand for health services. Previous studies have reported that old age is one of the factors increasing the risk of contracting Covid-19 disease (Vlachakis et al., 2020). At the same time, a higher death rate has been reported in patients aged ≥60 (Velavan and Meyer, 2020). Death rates are high in some countries with high Covid-19-related mortality rates, but lower in others. In Turkey, a country with low Covid-19-related mortality, the elderly population is 8.65%, while in Italy, with a high mortality rate, the elderly constitutes 22.68% of the population.

However, although Germany has the third higher elderly population in proportion to the total population, Covid-19-related mortality rates are lower. Considering the adverse impact of old age on the disease, the fact that Germany has coped well with the situation shows that its health system is in a robust condition. Adjusting health services to an aging people population will be one step toward to a fitting health service.

Another factor affecting Covid-19 is chronic diseases. This phenomenon, resulting from factors such as a growing elderly population, inadequate protective services, and the effects on health of rapidly developing technological devices, unfortunately places a strain on health services (Şahin et al., 2015; Keleş et al., 2019; OCED, 2020). However, this does

not necessarily imply that health services are inadequate. Health systems can be effective in the prevention of chronic disease, and also play an important role in care provision after the development of such diseases. Previous studies have shown higher Covid-19-related death rates among individuals with chronic disease (Özbay et al., 2007). Cancer cases, regarded as particularly difficult to prevent, were therefore subjected to analysis. The analysis showed that the UK has the highest number of cancer-related deaths, followed by Germany in second place. Despite having a low number of cases, the UK has the second highest Covid-19 death rate, showing that health services are not sufficiently effective in that country. However, the fact that Germany, in second place in terms of cancer-related deaths, was in eighth place in terms of deaths from this virus showed the quality of the country's health services. The four last-placed countries, Russia, Israel, North Korea, and Turkey, had low numbers of cancer-related deaths.

The most important foundation of health services is the competency of protective health services. The first component of these is vaccination. Unfortunately, no vaccine for Covid-19 has yet been developed. However, looking at countries' general policies, it appears that they do in fact attach due importance to vaccination. Reducing substance abuse can also be considered under the heading of protective services. Covid-19 particularly affects the lungs 12 and will thus have a greater impact on smokers. Looking at smoking rates in the countries in this study, deficiencies can be seen in protective health systems. Death rates from Covid-19 are thought to be higher among smokers (Vardavas and Katerina, 2020). However, the low Covid-19-related death rates in countries such as Turkey, Russia and Germany with high smoking rates, show that their health systems or health policies are robust.

Another important factor in the fight against the pandemic are health and national policies. The path to be followed in pandemics involves the determination of patient numbers, evaluation (in or out-patient status), and finally treatment. Since there is to date no treatment or vaccine for Covid-19, the important things are identifying, testing and isolating cases. Some countries have applied general quarantine in this context (of schools and social spaces, the closure of national borders, etc.). Others have applied scrupulous infection control, but have failed to achieve success. Patient isolation and social distance policies are currently being applied.

Covid-19 is now a global threat to health. According to WHO data, the total Covid-19 case number stands at 35.897.739 and new case 238.732 with a total death rate of 1.048.781(WHO,2020 (b)). However, more cases and deaths are occurring every day. In the light of the foregoing, the most important factors in coping with the Covid-19 pandemic are health policies applied through a strong health system. States can achieve greater success in such a pandemic when they work together in collaboration.

Acknowledgment

We would like to thank all health professionals who have been fighting with covid-2019. The results published in this study are based upon data generated by the Organisation for Economic Cooperation and Development (OECD), World Health Organization (WHO) and Deep Knowledge Group (DKG).

Conflict of interest

The authors declare that there are no conflicts of interest.

Informed consent

The authors declare that they have no relevant financial interests. This study is not presented anywhere.

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