Abstract: Due to the pandemic situation caused by COVID-19 disease, there have been tremendous efforts worldwide to keep the spread of the virus under control and protect the functioning of health systems. Although governments take many actions in fighting this pandemic, it is well known that health systems play an undeniable role in this fight. This study aimed to investigate the role of health systems and government responses in fighting COVID-19. By purposively sampling Finland, Denmark, the UK, and Italy and analyzing their health systems’ performances, governments’ stringency indexes, and COVID-19 spread variables, this study showed that high-performing health systems were the main power of states in managing pandemic environments. This study also measured relations between short and medium-term measures and COVID-19 case and death numbers in all study countries. It showed that medium-term measures had significant effects on death numbers.

Keywords: COVID-19, health systems, stringency index, pandemic

1 Introduction

On March 11, 2020, the World Health Organization declared COVID-19 a pandemic (WHO 2020a), followed by the Public Health Emergency of International Concern declaration on January 30 (WHO 2020b). By creating unprecedented impacts on health systems, public health, societies, and individuals globally (The Lancet Public Health 2020), COVID-19 has been named a black swan event (Kaplan 2020).
Thus, this pandemic has been the most formidable public health challenge the world faces in the 21st century (Suresh, James, and RSj 2020).

In such a crisis era, governments have been forced to take preventive measures and actions in response to this pandemic to protect the functioning of health systems and public health (Gilson et al., 2020; Hadjidemetriou et al. 2020). Existing studies showed that highly coordinated, effective, and timely measures taken by governments were able to control the spread of COVID-19 and significantly decreased spread rates in various countries (Bryant and Elofsson 2020; Brzezinski et al. 2020; Engle, Stromme, and Zhou 2020; Mendolia, Stavrunova, and Yerokhin 2021; Sözen, Sariyer, and Ataman 2022; Yılmazkuday 2021).

While COVID-19 has been experienced globally, there is a vast difference in the degree to which countries worldwide have been affected (Ross et al. 2020). While the level of the taken measures played a crucial role in creating this difference, there are many other factors. The infrastructure of health systems stays at the top of all these factors since the exceeding capacity of health systems leads to increased spread rates of the pandemic (Bayraktar et al. 2021). It was presented in different studies that high-performing health systems are resilient against this pandemic (Legido-Quigley et al. 2020; Moisio 2020). Focusing on health system preparedness is paramount for protecting public health. Health systems must be robust and resistant in response to threats such as pandemic environments (Gostin 2020; Lal et al. 2022; Nuzzo et al. 2019). The performance of health systems should be measured and compared based on various metrics. In addition, a valid and fair scale rating of countries’ health systems may also be an essential indicator. Here, International Health Regulations (IHR) core capacity scores which rate countries’ health systems in the range of 0–100 based on the average percentage of attributes of 13 capacities that have been attained at a specific point in time, were used (WHO 2020c).

To shed light and provide implications for policymakers on managing pandemic environments, we aimed to investigate and compare the role of these two factors, health systems and government response policies, in combating COVID-19. We analyzed the role of these factors by providing a descriptive analysis of the current statistics of the health system, government response policies, and two main spread indexes of COVID-19, daily numbers of new cases and deaths. While health system metrics and COVID-19 spread indexes data were already quantitative, a reliable scale was required to assign a quantitative score for the taken response policies by governments. At this point, we used stringency index values measured with the Oxford COVID-19 government response tracker, developed by Hale et al. (2020), showing how authoritarian governments responded to this pandemic.
To make clear, fair, and valid comparisons, we purposively selected Finland, Denmark, United Kingdom-UK, and Italy as this study’s study sample. The reasons for this selection are: Since many of the other factors such as economic, geographic, cultural, technological, etc. may also cause significant differences in the spread rate of the virus between the countries while deciding on the sampled countries, our primary selection criterion was eliminating impacts of other factors as much as possible. We believed that if countries with similar economic and technological development levels were selected on the same continent, the difference in the spread rate of COVID-19 could mainly be explained by differences in health systems and governmental actions taken. Another main criterion was selecting countries having better health system performance metrics than many other countries and which differ in the levels of governmental actions taken. We also aimed to focus on the newsworthy countries in the media during the COVID-19 pandemic. By descriptively investigating and comparing data and statistics of these countries on the pre-mentioned metrics, we aimed to address the following research questions:

RQ1. Can countries having high-performing health systems manage the pandemic situations effectively even if they do not take too many government response policies?

RQ2. Which indicators of COVID-19 can be linked with the health system performance of countries?

RQ3. How can the effects of short and medium-term measures on the numbers of COVID-19 cases and deaths be analyzed?

In the remainder of this paper, we first presented the primary health system structures and government response policies against COVID-19 for the sampled countries. Later we presented the data set and study methodology to present how these research questions are addressed. We showed results and essential findings followed by further discussions and conclusions.

2 Health Systems and Government Response Policies of Study Countries: an Overview

2.1 Finland

Finland was mainly selected due to its high-performing health system. Existing studies also highlighted the role of the health system as a crucial constituent of Finnish government power in fighting against COVID-19 (Moisio 2020; Tiirinki et al. 2020).
Finland has better values than European countries’ average for almost all previously mentioned health system performance indicators. In terms of IHR core capacity rating, Finland has a score of 94, which is very close to the top score.

The First COVID-19 case was seen in Finland in mid-March, soon after the WHO had announced the COVID-19 as a pandemic. On March 16, 2020, the Finnish government declared a state of emergency due to this pandemic and consequently adopted several physical distancing measures to slow the spread rate of the virus and protect risk groups. Much of Finland’s response has been based on legal actions other than actual emergency powers. “Soft” recommendations to the public and employers were implemented. Implementation of lockdown early compared to many other countries was also the strength of this country in fighting COVID-19.

2.2 Denmark

While Denmark was also selected due to its high-performing health system, it was also chosen for effective governmental actions. As in Finland, Denmark’s health system performance indicators were also better than the European average, and Denmark’s IHR core capacity score is 95.

The First COVID-19 case was seen in Denmark at the end of February 2020. Denmark’s government’s approach to fighting this pandemic could be best summarized as “Act fast and act with force” (Olagnier and Mogensen 2020). The Danish government was among the first European countries to act against the virus by declaring a national lockdown and closing its borders. The government approach was more strict than in other Scandinavian countries such as Finland. Denmark banned large public gatherings, closed all unnecessary venues across its cities, and discouraged the use of public transportation and all manner of travel unless essential. Daycares, schools, and universities were quickly shut down, and air travel was severely restricted – and while these restrictions have become the ‘new normal’ across the continent, Denmark was among the first countries to impose such restrictions.

2.3 United Kingdom

Although the UK had a high-performing health system compared to many other countries, it had lower statistics than the European average in some previously mentioned health system indicators. The main criticism of the UK health system
was inadequate healthcare workers and physical capacities such as hospital beds and ICU units (Hunter 2020).

Following the first case of COVID-19 in the UK on January 30, 2020, the UK government focused on containment with early detection and case isolation, such as monitoring arrivals from Wuhan province. Then, the government introduced voluntary mitigation restrictions such as self-isolation for those with symptoms and social distancing advice for those most at risk. Later, official UK government policy could be described as a strategy of enforced suppression, defined as case isolation and home quarantine, general social distancing (including a social venue ban), and school and university closures. Thus, the UK government adopted relatively higher measures and actions than many other countries (Zala et al. 2020).

2.4 Italy

In COVID-19, Italy has been hit very hard (Remuzzi and Remuzzi 2020). The main factor relates to demographics, where Italy has the most elderly population in Europe (Boccia, Ricciardi, and Ioannidis 2020). The insufficient capacities of the health system are the other factor; the IHR capacity score of Italy was 85.

The First COVID-19 case was seen at the end of January 2020. The Italian government has taken strict policies in fighting COVID-19. The Italian government implemented a wide range of measures to balance the complex trade-offs of health system problems. While in the early stages of the pandemic, the Italian government applied targeted measures to the most affected areas, starting from mid-March 2020; the policy interventions were extended homogeneously to all the regions despite the varying severity of the spread (Berardi et al. 2020).

3 Materials and Methods

3.1 Sampling

Sampled four countries were advanced income level European countries. However, they differed based on the leading indicators of their health systems. While evaluating the performance of health systems, we mainly considered eight indicators. These indicators and regarding statistics of the study countries on these indicators are presented in Table 1.

As seen in Table 1, Finland had almost the best statistics in terms of the first four indicators and had the highest values in terms of the other four statistics after Italy. Besides, UK and Italy had lower values on many of the considered indicators.
### 3.2 Data Sources and Variables

Health systems’ performance statistics were collected from the WHO database presenting Global Health Workforce Statistics (WHO 2020c).

For evaluating and quantitatively measuring government response policies against COVID-19, the Oxford COVID-19 government response tracker (Hale et al. 2020) was used. By evaluating nine different policies (school closures, workplace closures, cancellation of public events, restrictions on public gatherings, closures of public transport, stay-at-home requirements, general information campaigns, restrictions on internal movements, and international travel controls), this scale assigns a score between 0 and 100 to measure stringency levels of governments in fighting with this outbreak.

Daily values of governments’ stringency index levels were collected from the end of January 2020 to the end of March 2021. This data was collected from the Our World in Data database (OWID 2020).

Data on COVID-19 spread was mainly collected based on daily numbers of new cases and deaths. In addressing RQ2, additional data on hospital cases, total numbers of cases, and deaths were required. These statistics were also collected from the Our World in Data database reporting COVID-19 statistics (OWID 2020).

### 3.3 Statistical Analysis

Data were descriptively analyzed. First, for all study countries, the daily values of study variables were shown comparatively in a graphical form. Main descriptive statistics on the study variables were also presented comparatively for the study countries. Short and medium-term relations between government response...
measures and numbers of cases/deaths were also analyzed by correlation analysis. The strength and direction of the correlation statistics were presented in a heat map form.

4 Results

During the study period, the study countries’ daily values of study variables, stringency index, new cases, and new deaths were comparatively presented in Figure 1.

In Figure 1(a), we observed that until the end of April, Italy had the highest stringency values. Until mid-March, the other three study countries had very similar levels. But after this date, stringency index values of the UK started to differ from Finland and Denmark, where levels of the UK were significantly higher than these countries. In early May, values sharply decreased in Italy and remained at similar moderate levels until late October. The stringency index of the UK achieved the highest values among all of the study countries. During these periods, the stringency values of Italy and Denmark had similar values. Between early October and the end of December, the stringency index had the highest levels in Italy, followed closely by the UK. The UK had the highest values from early January to the end of the study period, followed closely by Italy. From early October to the end of the study period, stringency index levels differed significantly between Denmark and Italy, where Italy had the higher values. After mid-March, Finland’s stringency index had almost the lowest levels among all study countries.

Figure 1(b) presents standardized values of daily numbers of new cases comparatively for the study countries, where Figure 1(b1) represents the values in the first part of the study period, and Figure 1(b2) depicts the second part. For the whole study period, we observed that daily standardized values of numbers of cases were almost the lowest in Finland. While until the beginning of April, and between late October to early December, Italy had the highest cases values. The UK had the highest importance on most of the remaining dates. However, some periods existed where Denmark had the highest values instantly or for a short period.

On the other hand, when the y-axis of Figure 1(b1) and (b2) were compared, a worth-highlighting difference was seen. In Figure 1(b1), the highest values of numbers of cases per million exceed 100s in Italy, 80s in the UK, and 60s for Denmark. In the second period, the highest values of these three countries reached or exceeded 600, 1000, and 800s respectively. Finland was more able to maintain its success even in the second part. The number of cases per million did not reach 200s during the study period.
Figure 1: Daily values of study variables.
When statistics for standardized values of daily numbers of deaths were analyzed, Finland had almost the lowest values during the study period. While until early April, and between early November to late December, Italy had the highest values, UK had the highest values in the remaining. While instantly or just for short periods, Denmark had higher values of cases compared to Italy and UK (as seen in Figure 1(b1) and (b2)), in terms of numbers of deaths, it had lower values compared to these countries in the whole study period.

To summarize the existing data on the study variables, we also presented the main descriptive statistics of the variables comparatively for the study countries. Table 2 shows these descriptive results.

As seen in Table 2, for the three study variables, Finland had the lowest values in all of the presented statistics, excluding standard deviation. Although Finland had relatively higher variations in stringency index, it had more stable data on the numbers of cases and deaths. While the maximum number of cases was higher in Denmark than in Italy, the maximum number of deaths was lower in Denmark compared to Italy and the UK. Another noticeable result relates to the standard deviation statistics of the UK. We found out that the UK had the highest deviation levels in all study variables. Among the study countries, Italy had almost the highest levels in stringency index, except 25 and 50%, which the UK followed. While the average stringency index was the highest in Italy, the average values of numbers of cases and deaths were the highest in the UK.

To address RQ2, we calculated scores on some other indicators of COVID-19. We first checked the total numbers of deaths (per million), hospital patients (per million), and intensive care unit-ICU-patients (per million) when the whole number of cases (per million) achieved 5000, 10,000, 30,000, and 50,000s in study countries. We also analyzed the number of days until these values were committed. Table 3 presents the results.

In Table 3, we mainly observed that during the study period, while the total number of cases (per million) did not reach 30,000s and 50,000s in Finland, this value did not come to 50,000s in Denmark. It was also observed that the most
Table 2: Descriptive statistics on the study variables.

<table>
<thead>
<tr>
<th>Variable</th>
<th>Country</th>
<th>Statistics</th>
<th>Mean</th>
<th>Std</th>
<th>Min</th>
<th>25%</th>
<th>50%</th>
<th>75%</th>
<th>Max</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stringency index</td>
<td>Finland</td>
<td></td>
<td>42.43</td>
<td>14.42</td>
<td>5.56</td>
<td>32.41</td>
<td>40.74</td>
<td>52.31</td>
<td>67.59</td>
</tr>
<tr>
<td></td>
<td>Denmark</td>
<td></td>
<td>55.76</td>
<td>12.05</td>
<td>11.11</td>
<td>50.93</td>
<td>54.63</td>
<td>66.67</td>
<td>72.22</td>
</tr>
<tr>
<td></td>
<td>UK</td>
<td></td>
<td>65.60</td>
<td>21.68</td>
<td>8.33</td>
<td>64.35</td>
<td>69.91</td>
<td>79.63</td>
<td>87.96</td>
</tr>
<tr>
<td></td>
<td>Italy</td>
<td></td>
<td>66.10</td>
<td>18.57</td>
<td>19.44</td>
<td>54.63</td>
<td>66.67</td>
<td>79.63</td>
<td>93.52</td>
</tr>
<tr>
<td>New_cases (per million)</td>
<td>Finland</td>
<td></td>
<td>28.91</td>
<td>29.67</td>
<td>0</td>
<td>3.971</td>
<td>17.597</td>
<td>47.873</td>
<td>151.605</td>
</tr>
<tr>
<td></td>
<td>Denmark</td>
<td></td>
<td>103.63</td>
<td>139.88</td>
<td>0.173</td>
<td>13.984</td>
<td>49.031</td>
<td>133.455</td>
<td>778.288</td>
</tr>
<tr>
<td></td>
<td>UK</td>
<td></td>
<td>160.27</td>
<td>208.46</td>
<td>0.015</td>
<td>14.819</td>
<td>56.86</td>
<td>268.995</td>
<td>1004.507</td>
</tr>
<tr>
<td></td>
<td>Italy</td>
<td></td>
<td>128.68</td>
<td>160.03</td>
<td>0</td>
<td>8.745</td>
<td>43.8045</td>
<td>224.34375</td>
<td>676.493</td>
</tr>
<tr>
<td>New_deaths (per million)</td>
<td>Finland</td>
<td></td>
<td>0.84</td>
<td>0.91</td>
<td>0</td>
<td>0.361</td>
<td>0.6315</td>
<td>1.083</td>
<td>7.761</td>
</tr>
<tr>
<td></td>
<td>Denmark</td>
<td></td>
<td>1.53</td>
<td>1.65</td>
<td>0</td>
<td>0.345</td>
<td>0.863</td>
<td>2.244</td>
<td>10.359</td>
</tr>
<tr>
<td></td>
<td>UK</td>
<td></td>
<td>5.08</td>
<td>5.69</td>
<td>0.015</td>
<td>0.457</td>
<td>3.049</td>
<td>7.851</td>
<td>26.898</td>
</tr>
<tr>
<td></td>
<td>Italy</td>
<td></td>
<td>4.32</td>
<td>4.30</td>
<td>0</td>
<td>0.28525</td>
<td>2.9275</td>
<td>7.856</td>
<td>16.424</td>
</tr>
</tbody>
</table>
Table 3: Further analysis for other COVID-19 spread variables.

<table>
<thead>
<tr>
<th>Country</th>
<th>Days passed</th>
<th>Total_cases_per_million</th>
<th>Hosp_patients_per_million</th>
<th>ICU_patients_per_million</th>
<th>Total_deaths_per_million</th>
</tr>
</thead>
<tbody>
<tr>
<td>5K</td>
<td>Finland</td>
<td>314</td>
<td>5032.02</td>
<td>40.25</td>
<td>5.41</td>
</tr>
<tr>
<td></td>
<td>Denmark</td>
<td>219</td>
<td>5078.90</td>
<td>18.30</td>
<td>2.24</td>
</tr>
<tr>
<td></td>
<td>UK</td>
<td>216</td>
<td>5022.08</td>
<td>11.83</td>
<td>1.19</td>
</tr>
<tr>
<td></td>
<td>Italy</td>
<td>237</td>
<td>5003.77</td>
<td>48.00</td>
<td>4.04</td>
</tr>
<tr>
<td>10K</td>
<td>Finland</td>
<td>394</td>
<td>10,050.50</td>
<td>35.01</td>
<td>6.50</td>
</tr>
<tr>
<td></td>
<td>Denmark</td>
<td>259</td>
<td>10,093.91</td>
<td>37.29</td>
<td>6.91</td>
</tr>
<tr>
<td></td>
<td>UK</td>
<td>260</td>
<td>10,195.24</td>
<td>92.74</td>
<td>8.72</td>
</tr>
<tr>
<td></td>
<td>Italy</td>
<td>273</td>
<td>10,198.09</td>
<td>291.34</td>
<td>27.31</td>
</tr>
<tr>
<td>30K</td>
<td>Finland</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td></td>
<td>Denmark</td>
<td>315</td>
<td>30,327.49</td>
<td>152.96</td>
<td>23.65</td>
</tr>
<tr>
<td></td>
<td>UK</td>
<td>325</td>
<td>30,141.18</td>
<td>294.60</td>
<td>21.24</td>
</tr>
<tr>
<td></td>
<td>Italy</td>
<td>317</td>
<td>30,197.15</td>
<td>517.10</td>
<td>52.91</td>
</tr>
<tr>
<td>50K</td>
<td>Finland</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td></td>
<td>Denmark</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td></td>
<td>UK</td>
<td>353</td>
<td>50,168.57</td>
<td>562.16</td>
<td>57.02</td>
</tr>
<tr>
<td></td>
<td>Italy</td>
<td>400</td>
<td>50,000.62</td>
<td>378.74</td>
<td>41.76</td>
</tr>
</tbody>
</table>
extended number of days passed in Finland until the total number of cases was reached to 5000 and 10,000s. While total deaths were also the lowest in Finland when the total cases came to 5000s, it was lowest in Denmark, when the total cases reached 10,000s. The number of hospital patients, ICU patients, and total deaths was comparatively higher in the UK and Italy. Until the total number of cases achieved five and ten thousand, while numbers of hospital patients and ICU patients were lower in the UK, total deaths were lower in Italy. In terms of hospital and ICU patients, the comparison was in the same direction when the total number of cases reached 30,000s. However, the total number of deaths was also higher in Italy. When the total cases achieved to 50,000s, while the numbers of hospital and ICU patients were lower in Italy compared to the UK, the total number of deaths was higher.

Although Finland had comparatively better statistics in Table 3, the total number of deaths was higher in Finland than in Denmark when the total cases came to 10,000s, which was unexpected. In Figure 2, we presented the total numbers of deaths in the second part of the study period for the study countries. To compare Finland and Denmark, we also figured out the exact dates when the total numbers of cases reached 5000 and 10,000s in these countries.

In Figure 2, we mainly observed that when the total number of cases reached 10,000s in Finland, the second peak period was already exceeded. However, in Denmark, when the total number of cases came to 10,000s, the second peak period did not even begin. Thus, when the total number of cases reached 10,000s, the second peak was gone over in Finland, and it was not started yet in Denmark. We observed that the total number of deaths (per million) was almost the same in these two countries.

To address RQ3, we analyzed the relationship between daily values of stringency index and numbers of cases and stringency index and numbers of deaths for all of the study countries. We investigated how the stringency level of the current...
day \((t)\) affected the case and death numbers of the same day \((t)\). We then respectively explored how one week earlier \((t-7)\), ten days earlier \((t-10)\), two weeks earlier \((t-15)\), and one month’s earlier stringency index levels affected current day’ \((t)\) case and death numbers. However, in this analysis, since the whole study period was too long, we limited our analysis to the second peak periods’ of the countries. Thus, the analysis’s dates changed since peak periods differ between these countries. The correlation matrix between all study variables is represented in a heat map form in Appendix A. To highlight the significance of the relations between the numbers of COVID-19 cases/deaths and the stringency index values on different days, corresponding values were presented in Table 4.

From the results of Table 4, first of all, we found out that while stringency levels at days \(t\), \(t-7\), \(t-10\), and \(t-15\) had no significant relation to the numbers of cases at day \(t\) in Finland, stringency levels at days \(t-15\), and \(t-30\) were significantly related with numbers of deaths in 95% confidence interval. In Denmark, the stringency index in taken days was significantly associated with the number of cases, where the strength of the relationship was the highest for days \(t-10\) and \(t-15\). As in Finland, numbers of deaths were only related to the stringency index on days \(t-15\) and \(t-30\), where day \(t-30\) had the highest relation level. An unexpected finding was observed in the UK. While stringency index at days \(t\), \(t-10\), \(t-15\), and \(t-30\) were all significantly related to numbers of cases at day \(t\), stringency index at day \(t-7\) had no relation. In addition, while stringency index at days \(t\), \(t-7\), \(t-15\), and \(t-30\) were all significantly related to numbers of deaths at day \(t\), stringency index at day \(t-10\) had no relation in the UK. Another unexpected finding was due to the direction of the association for day \(t\). While, in general, the numbers of cases and deaths were negatively correlated with the stringency index, in the UK, these values were positively related on the same day. Finally, in Italy, while the stringency index on days \(t-10\), \(t-15\), and \(t-30\) had significant relations with the numbers of new cases on day \(t\), the stringency index for each of the taken days was significantly related to the numbers of deaths on day \(t\).

5 Discussion & Conclusion

We firstly aimed to analyze the role of the health system in the fight against the COVID-19 in this study. We identified eight crucial metrics for evaluating countries’ health systems and purposively selected four countries to make a comparative analysis. Although all sampled countries had relatively higher statistics in these metrics, Finland generally had the highest statistics, which Denmark followed. We also aimed to investigate the role of governmental responses. From the findings of
<table>
<thead>
<tr>
<th>Stringency index (t)</th>
<th>Finland</th>
<th>Denmark</th>
<th>UK</th>
<th>Italy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stringency index (t-0)</td>
<td>-0.13</td>
<td>0.202195</td>
<td>-0.03</td>
<td>0.793582</td>
</tr>
<tr>
<td>Stringency index (t-7)</td>
<td>-0.07</td>
<td>0.480633</td>
<td>-0.07</td>
<td>0.501259</td>
</tr>
<tr>
<td>Stringency index (t-10)</td>
<td>-0.03</td>
<td>0.784965</td>
<td>-0.14</td>
<td>0.144605</td>
</tr>
<tr>
<td>Stringency index (t-15)</td>
<td>0.07</td>
<td>0.451782</td>
<td>-0.19</td>
<td>0.048985</td>
</tr>
<tr>
<td>Stringency index (t-30)</td>
<td>0.36</td>
<td>0.000132</td>
<td>-0.24</td>
<td>0.012549</td>
</tr>
</tbody>
</table>
this study, we found out that the stringency index had comparatively higher values in UK and Italy compared to Finland and Denmark.

On the other hand, when COVID-19 indicators of daily numbers of cases and deaths were descriptively analyzed, we found out that Finland and Denmark could fight against the COVID-19 effectively by having significantly lower statistics on these variables. Based on these findings, we concluded that health systems play a crucial role in fighting against pandemic situations, as supported in the literature (Bayraktar et al. 2021; Legido-Quigley et al. 2020; Moisio 2020). However, for further contribution, we compared the role of health systems and governmental measures to find an answer to our RQ1. We concluded that high-performing health systems were the leading state powers. We also showed that if a country has a high-performing and resistant health system, the government is not required to take strict measures to cope with pandemic situations. In addition, when Finland and Denmark were compared, we found daily values and descriptive statistics of stringency index, new cases, and deaths (per million). We, therefore, supported existing studies that present Finland as an exemplary country in maintaining its success in the fight against COVID-19 and keeping its spread under control (Moisio 2020; Tiirinki et al. 2020). Although Denmark was also successful (Olagnier and Mogensen 2020), it was not as good as Finland. This finding can be due to the difference in some of these countries’ selected health system indicators. Although standardized values of medical doctors were very similar in these countries, standardized values of hospital beds and nursing personnel were lower in Denmark compared to Finland. Since insufficient capacities were a significant challenge for health systems in fighting pandemic situations (Bayraktar et al. 2021; Remuzzi and Remuzzi 2020), this can be an essential factor in the higher and faster spread of COVID-19 in Denmark compared to Finland. Since the UK and Italy had insufficient health capacities in dealing with the COVID-19 pandemic, governments were obliged to take strict measures (Bayraktar et al. 2021; Hunter 2020; Zala et al. 2020).

In RQ2, we aimed to link COVID-19 indicators with the health system performances of selected countries. We checked standardized numbers of hospital patients, ICU patients, and total deaths when total case numbers reached or exceeded five, ten, thirty, and fifty thousand in these countries. We also analyzed the number of days that passed until the total number of cases reached these values. Obtained values of these indicators were in line with the health system performances of the study countries. We found out that Finland achieved at most 10,000s total cases (per million) during the study period in significantly more extended periods as having a high-performing health system. Although the total cases per million reached 5000s, Finland had higher values in terms of hospital patients and ICU patients than Denmark. The Finnish health system covered it since these
values were lower when the total number of cases reached 10,000s. From another perspective, although the number of hospital patients and ICU patients was higher in Finland when total cases achieved 5000s, the Finnish health system kept the total number of deaths significantly lower than in other study countries. Once again, although the total number of deaths was a bit higher in Finland than in Denmark, when the total number of cases achieved to 10,000s, further investigations on this result showed that this was also a success indicator for the Finnish health system. Since a bit higher death numbers were reached in Finland, the second peak was already skipped, while the second peak was not reached in Denmark yet. Similarly, Denmark obtained better values on these indicators compared to UK and Italy.

In addressing RQ3, we mainly found out that case numbers were unrelated to Finland’s government policies. Thus, the health system was the main power of the Finnish government in fighting against COVID-19, and no strict measures were required. However, the medium-term measures, taken two weeks and one month earlier, were related to death numbers. While both short and medium-term measures had significant effects on COVID-19 case numbers, medium-term measures significantly affected the numbers of deaths in Denmark, presenting the requirement of taking some measures to respond to COVID-19 in this country (Olagnier and Mogensen 2020). In general, both short and medium-term measures seemed to be related to the number of cases and deaths in Italy and the UK. Once again, this highlighted the requirement of taking strict measures in Italy and the UK to fight against COVID-19 since their health system had at least some deficiencies (Bayraktar et al. 2021). When these short and medium-term correlation analysis results were collectively analyzed for all study countries, we depicted one important common finding: Medium-term measures significantly related to numbers of deaths as supported in the literature (Bryant and Elofsson 2020). We, therefore, concluded that governmental response policies affected the number of COVID-19 deaths in the medium term, which may be due to the reduced burden on health systems.

References


**Supplementary Material:** The online version of this article offers supplementary material (https://doi.org/10.1515/jhsem-2021-0073).