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An investigation of border restrictions policies on tourism spread of COVID-19 using scoring tools

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ABSTRACT

Background: There isn't a one-size-fits-all law to effectively handle future pandemics. It is imperative that policies are grounded in robust scientific evidence to minimize preventable fatalities. The more deaths occur, the weaker the economy becomes. This paper aims to reveal the COVID-19 relationship between policy changes and their policy outcomes.

Methods: This paper delves into the methodologies for scrutinizing and managing potential future pandemics. For the effective management of future pandemics, it is crucial to scrutinize the outcomes of the policies implemented during the COVID-19 crisis from an impact assessment perspective. The population mortality rate is used in this analysis study: dividing the number of COVID-19 deaths by the population in millions. The population mortality rate is effective in measuring the policy outcome. Two scoring tools are used, such as scorecovid for discovering a snapshot of the best COVID-19 policy in the world and hiscovid for a time series analyzing COVID-19 policies. A literature review is conducted on identified causes associated with policymakers' mistakes.

Results: This paper discusses the causes of COVID-19 spread in three countries: United-Arab-Emirates, New-Zealand and Japan.

Conclusions: As a result, this paper will discover that recent policy updates to COVID-19 (lifting border restrictions and shortening the quarantine period on tourism) are responsible for the resurgence of COVID-19.

1. Introduction

As the number of deaths increases, the economy weakens. This paper proposes a evidence-based metrics using the population mortality rate. For effective management of future pandemics, it's crucial to thoroughly analyze the outcomes of policies implemented during the COVID-19 pandemic. This research aims to shed light on the relationship between modifications in COVID-19 policies and the resulting effects. The paper explores the reasons for the spread of COVID-19, drawing on cases from the UAE, New Zealand, and Japan. The study employs a single metric, the cumulative population mortality rate, which is calculated by dividing the number of COVID-19 deaths by the population in millions over time (Takefuji, 2021b). The effectiveness of COVID-19 policies can be assessed by the number of daily cumulative deaths due to COVID-19. The lower the death count, the more effective the policy.

This paper presents a comprehensive literature review on the outcomes of COVID-19 policies, utilizing peer-reviewed publications from the National Library of Medicine, the world's largest and most trusted database. Existing studies struggle to pinpoint the cause of pandemic resurgence. Metrics like testing rates and mobility patterns offer insights but can't directly compare policy effectiveness. A new metric, cumulative population mortality rate, tracks total deaths over time, allowing for clearer evaluation of individual policies and their impact on COVID-19 mortality.

This paper provides a snapshot of the cumulative population mortality rate across multiple countries. A time-series policy outcome analysis was specifically conducted for three countries: the UAE, New Zealand, and Japan. These countries were selected based on their superior performance in the snapshot outcome. The time-series analysis tool was used to retrospectively identify instances where these countries may have made incorrect assumptions or policy errors. This analysis was conducted from a retrospective cohort perspective.

The visualization method proposed in this paper, equipped with specific tools, enables both policymakers and the general public to discern policy modifications or updates from significant changes in mortality rates, thereby aiding in death reduction and pandemic mitigation. This paper makes a significant contribution to future pandemic preparedness by presenting a comparative study and visualization of

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policy outcomes in response to the pandemic. Both the snapshot policy outcome tool and the time-series policy outcome tool are deemed essential for effective pandemic management and informed policy decision-making.

This study on COVID-19 policy metrics found that existing research struggles to identify the cause of pandemic resurgence. A new metric, the cumulative population mortality rate, was proposed to assess policy effectiveness, focusing on total COVID-19 deaths over time for a clearer evaluation of policies. Two new tools, scorecovid and hiscovid, were introduced. Scorecovid assigns a score based on a country's total deaths to identify successful policies, while hiscovid, a time-series tool, identifies policy missteps. Both tools use the cumulative deaths metric, with higher numbers indicating less effective policy. The study revealed that mandatory test-isolation strategies, like those in the UAE and New Zealand, effectively suppressed the pandemic, while Japan's voluntary approach was less successful. Hiscovid indicated that recent policy changes, such as lifting travel restrictions, might be causing a resurgence in cases. The study suggests that the cumulative mortality rate metric and the hiscovid tool can be valuable for policymakers managing the COVID-19 pandemic, particularly with border regulations and quarantine periods.

This paper focuses on outcome analysis rather than intervention analysis. Specifically, it examines the effectiveness of border control measures during the early stages of the COVID-19 pandemic, a period characterized by the absence of vaccinations. The primary objective is to assess how these measures impacted the spread of the virus and mortality rates. While the current literature review provides a foundation, we recognize the importance of a more in-depth analysis of existing studies. This includes examining research on non-pharmaceutical interventions and the introduction of vaccinations. By doing so, we can better contextualize our findings and highlight the innovation and added value of our study. The evidence presented in this paper is crucial for informing future pandemic responses. Understanding the effectiveness of border control measures during a period without vaccinations offers valuable insights that can guide policy decisions in similar scenarios.

2. Literature review

A review of literature was carried out on COVID-19 metrics from diverse measurement perspectives. The findings of the review not only suggest that existing studies on policy metrics were unable to pinpoint the cause of the COVID-19 pandemic resurgence, but also endorse the proposed metric of cumulative population mortality for precise evaluation of individual policies.

Kuster et al. put forth a comprehensive metric to gauge the effectiveness of COVID-19 testing (Kuster and Overgaard, 2021). They demonstrated that testing was instrumental in curbing the COVID-19 pandemic. However, their measurement was confined to testing and did not determine the timing and cause of the COVID-19 pandemic resurgence.

Tonjes et al. explored metrics to enhance decision-makers' comprehension of the pandemic's extent (Tonjes et al., 2021). They postulated that superior metrics lead to improved decision-making processes and outcomes. Nonetheless, they did not contrast individual COVID-19 policies to ascertain the timing and cause of the COVID-19 pandemic resurgence. In essence, their work lacked a comparison of policy performance, which is essential to uncover and identify individual policy issues from policy metric viewpoints.

Li et al. researched metrics for evaluating state performance in fighting the COVID-19 pandemic (Li et al., 2021). They proposed and compared two model-based metrics. However, they did not contrast the actual performance of individual policies to determine the timing and cause of the pandemic resurgence.

Ntoumi et al. scrutinized and analyzed metrics to assess pandemic preparedness, encompassing 12 indicators of preparedness and response, 7 indicators of health-system capacity, and 10 other demographic, social, and political conditions (Ntoumi and Zumla, 2022). However, their methodologies are incapable of identifying individual COVID-19 policies that caused the severity of the COVID-19 pandemic.

Panik et al. studied mobility metrics to assess the impact of COVID-19 on travel behavior (Panik et al., 2022). However, their methodology is unable to identify the timing and cause of COVID-19 resurgence in individual policies.

Haber et al. undertook policy impact evaluations to aid epidemiologists, policy-makers, journal editors, journalists, researchers, and other research consumers in understanding and assessing the strengths and limitations of evidence (Haber et al., 2021). However, they did not actually compare individual policies to determine the timing and cause of the COVID-19 pandemic resurgence.

The Lancet paper's findings suggest that enhancing health promotion for key modifiable risks correlates with a decrease in fatalities in a situation like COVID-19 (COVID-19 National Preparedness Collaborators, 2022). They initiated a general discussion on reducing key risks in preparation for future pandemics, but they did not perform a policy performance evaluation to uncover and identify individual policies.

Kucharski et al. disclosed that traditional academic reward structures and metrics do not mirror vital contributions to contemporary science (Kucharski et al., 2020). Their findings support the proposed paper.

Peterson et al. conducted an analysis of bibliometrics or altmetric attention scores for the top 25 COVID-19 publications and the top 25 non–COVID-19 publications in 2020 (Peterson et al., 2021). If they expanded the survey scale and concentrated on COVID-19 metrics, their methodology might reveal the appropriate metric for evaluating individual policies.

Heroy et al. performed a policy analysis of COVID-19 and discovered that labor structure influences lockdown migration behavior (Heroy et al., 2021). Their findings are beneficial for mitigating the COVID-19 pandemic.

Severson et al. examined population health metrics during the early stages of the COVID-19 pandemic (Severson et al., 2022). They found a correlation between COVID-19 cases and inquiries to the helpline about housing and medical needs.

Qu et al. introduced a new method to track the COVID-19 fatality rate in real-time, a crucial metric to guide public health policy (Qu et al., 2022). They proposed a simple real-time fatality rate estimator with an adjustment for reporting delays. Their methodology supports the proposed metric of the cumulative daily population mortality.

Hall et al. tracked COVID-19 cases and deaths in the US based on metrics of pandemic progression derived from a queueing framework (Hall et al., 2022). Their methodology also supports the proposed metric of the cumulative daily population mortality.

Fleming et al. reviewed metrics and indicators used to evaluate health system resilience in response to shocks to health systems in high-income countries (Fleming et al., 2022). They studied how the resilience of health systems has been measured across various health system shocks. However, while measuring health system resilience is important, the metrics and indicators should be used to reduce the COVID-19 mortality. In other words, reducing the mortality improves the health system resilience.

Fieldhouse et al. researched one health timeliness metrics to track and evaluate outbreak response reporting (Fieldhouse et al., 2022). They concluded that timeliness metrics can be used to assess improvements in outbreak response over time. Their findings support the proposed time-series COVID-19 policy outcome analysis over time.

Shi et al. introduced the COVID-19 spread mapper, a unified framework that uses a log-linear model to estimate and quantify the uncertainty in smoothed daily effective breeding numbers, case rates, and mortality rates in a given region (Shi et al., 2022). They applied the framework to characterize the impact of COVID-19 at multiple geographic resolutions in the US. The proposed COVID-19 spread mapper is useful, but it does not allow policymakers to identify when

they made errors against COVID-19.

Zhong et al. conducted a bibliometric analysis for the economy in the COVID-19 pandemic (Zhong and Lin, 2022). Their approach is useful, but it does not allow them to identify when policymakers made errors against COVID-19.

Welch et al. examined how South Asia displays differences within and among countries and other global regions, and where immediate action is needed to control the outbreaks (Welch et al., 2021). They concluded that surveillance is needed to inform leaders whether policies help control the pandemic. Their findings support the proposed time-series policy outcome analysis against COVID-19.

Cairney evaluated the UK government's COVID-19 policy using real-time, evidence-informed policy analysis (Cairney, 2021). Cairney concluded that the pandemic highlights the necessity to act despite significant ambiguity, uncertainty, and limited government control, using trial-and-error strategies to adapt to new problem manifestations, resulting in unequal impacts on social groups. However, without resorting to trial-and-error strategies, the proposed single metric method can identify the most effective COVID-19 policy globally from a population mortality perspective.

Atkins et al. assessed the effectiveness of sustainability measurement, questioning whether Environmental Social and Governance (ESG) metrics will endure COVID-19 (Atkins et al., 2022). Their findings showed that COVID-19 influenced ESG reporting practices, enhancing disclosure on the health and economic crisis, and necessitating a holistic redesign of sustainability measures considering the growing relevance of the social dimension during COVID-19. However, they did not present the optimal redesign for ESG.

Swallow et al. explored tracking the national and regional COVID-19 epidemic status in the UK using weighted principal component analysis (Swallow et al., 2022). They concluded that the level of COVID-19 hospitalizations is a reliable indicator of the epidemic status, but they could not identify the exact best indicator. This paper responds that the time-series cumulative population mortality rate is their unresolved best indicator.

Xiao et al. introduced three metrics to correlate COVID-19 wastewater data with clinical testing dynamics (Xiao et al., 2021). However, they suggested the need for more integrative models to enhance the utility and application of wastewater surveillance for managing the ongoing COVID-19 pandemic and future pandemics.

Largent et al. researched the incorporation of health equity into COVID-19 reopening plans with policy experimentation in California (Largent et al., 2021). They evaluated the advantages and challenges of their innovative health equity focus and provided recommendations. They concluded that the identified challenges reflect the complexity in implementing genuine policies to promote health equity.

Krieger et al. examined the relationship between the political ideology of US federal and state elected officials and key COVID pandemic outcomes (Krieger et al., 2022). They concluded that the political ideology of U.S. federal elected officials and the correlation between the distribution of party power in each state and the population's health status should be considered more in public health analyses and monitoring dashboards. In other words, they require ongoing monitoring and rigorous analysis of the links between the actions and votes of elected officials and the health profiles of their constituents and the overall population.

Tarantola et al. researched how to enhance COVID-19 metrics to improve the quality of COVID-19 surveillance (Tarantola and Dasgupta, 2021). They supplemented existing valuable guidance documents by providing examples of correct and incorrect interpretations of epidemiological data and methods to enhance reporting accuracy through improved COVID-19 data and better data validity and interpretation.

Salomon et al. assessed the Centers for Disease Control and Prevention's COVID-19 community-level performance as a leading indicator of COVID-19 mortality (Salomon and Bilinski, 2022). They concluded that designing indicators for public health decision making involves a balance between identifying early signals for action and avoiding excessive restrictions when risks are modest. An explicit framework for evaluating monitoring metrics can enhance transparency and decision support.

Ludvigsson et al. presented the results of a herd immunity approach in Sweden (Ludvigsson et al., 2021). Takefuji engaged in a debate on the outcome of the herd immunity in Sweden (Takefuji et al., 2021a). The herd immunity approach was deemed unsuccessful due to the high number of deaths among the elderly in Sweden, and it was suggested that Sweden should employ digital fence technology (Takefuji et al., 2021a). Ludvigsson et al. concurred with the challenged debate (Takefuji et al., 2021a) in their response, stating that infection testing is crucial and that health policies need constant updates. The outcome of individual policies can be computed and scored by dividing the number of COVID-19 deaths by the population in millions.

Following this debate, a scorecovid tool was developed (Takefuji, 2021b), the best COVID-19 policy was unveiled, and the single metric calculation was validated by five refereed journals (Takefuji, 2021b, 2021c, 2021d, 2022a; Takefuji et al., 2021a; Takefuji, 2021c). The best policy revealed is based on the test-isolation strategy. The test-isolation strategy involves testing and identifying infected individuals at an early stage and isolating them from uninfected individuals during the quarantine period. The digital fence manages infected individuals and their location via smartphones during the quarantine period. The duration of the quarantine period plays a crucial role in mitigating the COVID-19 pandemic. A shorter quarantine period leads to a more widespread COVID-19, while a longer quarantine period suppresses the infections.

A review of COVID-19 policy metrics found existing studies struggle to pinpoint the cause of pandemic resurgence. While various metrics like testing rates and mobility patterns offer insights, they lack the ability to directly compare policy effectiveness. The review proposes a new metric: cumulative population mortality rate. This metric tracks total deaths over time, allowing for a clearer evaluation of individual policies and their impact on COVID-19 mortality.

This research introduces two COVID-19 policy analysis tools: scorecovid and hiscovid. Scorecovid, a snapshot tool, assigns a score based on a country's total deaths to identify the most effective policies globally. Conversely, hiscovid, a time-series tool, helps pinpoint policy missteps. Both tools use a single metric: cumulative COVID-19 deaths, with higher numbers indicating less effective policy. Scorecovid aims to guide struggling countries by showcasing best practices from high-scoring nations like UAE and New Zealand, who implemented mandatory test-isolation strategies. However, Japan, with a lower score, utilizes a voluntary approach, highlighting a potential difference in effectiveness. Hiscovid builds on this by revealing policy errors over time. The analysis suggests recent policy changes, like lifting travel restrictions, might be causing a resurgence in cases. Hiscovid further indicates that mandatory test-isolation, as seen in UAE and New Zealand, effectively suppressed the pandemic, whereas Japan's voluntary approach proved less successful. This paper examines the UAE, New Zealand and Japan, three of the world's best three countries for COVID-19 policies for pandemic mitigation. The hiscovid tool can reveal when and how many times policymakers made mistakes and what policy updates resurged COVID-19 in the three countries.

3. Methods

Regardless of individual policies, two scoring tools such as scorecovid and hiscovid are both based on the single metric. This paper focuses on the analysis of policy outcomes, rather than the policies themselves. The evaluation of these outcomes is conducted using a single metric - the cumulative population mortality rate. This rate is calculated by dividing the number of COVID-19 related deaths by the population in millions. In other words, the number of COVID-19 deaths over time is used for policy assessment. The lower the score, the better the policy. The scorecovid tool provides a comprehensive snapshot to

assist policymakers in identifying the most effective strategies worldwide. This allows countries with lower scores to learn and adopt successful strategies from those with excellent scores. The hiscovid is a time-series tool to help policymakers understand when they made incorrect assumptions or mistakes over time so they can prevent the same mistakes in the future.

Both tools are based on Python Package Index (PyPI) so that they can run on Windows, MacOS and Linux operating systems as long as the Python is installed by pip command on the system. Scorecovid has been downloaded 25,287 times worldwide which indicates one of the most popular COVID-19 tools of its kind. The hiscovid tool has been downloaded 8333 times. The large number of downloads of both tools indicates that the usefulness, the usability, and the applicability were justified.

Both tools utilize identical datasets pertaining to COVID-19 fatalities and national populations. The dataset enumerating the number of COVID-19 deaths by country can be accessed at this online location:
https://raw.githubusercontent.com/owid/covid-19-data/master/public/data/jhu/total_deaths.csv.

The dataset detailing the population of each country is available at the following online location:
https://www.worldometers.info/world-population/population-by-country/

In order to install scorecovid after installing Python on the system, run the following command. ($) character indicates the prompt from the system terminal.

$pip install scorecovid.

To run the scorecovid tool, run the following command.

$ scorecovid.

The hiscovid is a PyPI package tool so that the following command can install it.

$ pip install hiscovid.

Run the hiscovid tool for Japan, United Arab Emirates and New Zealand.

$ hiscovid Japan 'United Arab Emirates' 'New Zealand'

Run the hiscovid tool for the US and the UK.

$ hiscovid 'United States' 'United Kingdom'

Firstly, the scorecovid and hiscovid tools have been validated via Code Ocean to ensure reproducibility (Takefuji, 2022b, 2022c). Detailed calculations and methodologies are thoroughly explained. These tools utilize publicly available datasets from the internet and are based on two specific metrics: the normalized score from the scorecovid tool and the normalized time-series score from the hiscovid tool. Both tools automatically download datasets and calculate individual scores.

To elaborate, the scorecovid tool computes the normalized score by dividing the cumulative daily COVID-19 death toll by the population size in millions. This approach allows for a fair comparison across countries, regardless of their population sizes. The hiscovid tool, on the other hand, calculates the normalized time-series score by dividing the cumulative daily COVID-19 deaths by the population size in millions over a specified period. This enables a temporal analysis of the impact of COVID-19 on different countries.

Regarding the dependence on a single indicator, we recognize that the COVID-19 pandemic has a multifaceted impact on public health. While this study focuses on the cumulative population mortality rate as a primary measure, we agree that incorporating additional indicators such as the number of tests performed, the number of cases, hospitalizations, and the economic impact of the pandemic would provide a more comprehensive analysis. Future research could expand on these aspects to offer a more balanced perspective on the effectiveness of policies.

4. Results

Fig. 1 shows the result of scorecovid as of March 7, 2023. Shaded numbers indicate scores of the UAE, New Zealand, and Japan respectively. Scores for the UAE, New Zealand and Japan were 237, 528 and 577 respectively while scores for the US and the UK are 3395 and 3239 respectively. The UAE's score is 13 times better than that of the United States and the United Kingdom. Fig. 2 shows the result of hiscovid with the UAE, New Zealand and Japan as of March 7, 2023. Fig. 3 shows the hiscovid result with the US and the UK as of March 7, 2023.

country	deaths	population	score
United Arab Emirates	2349	9.89	237.5
New Zealand	2548	4.82	528.6
Japan	72997	126.48	577.1
South Korea	34093	51.27	665
Australia	19574	25.5	767.6
Iceland	263	0.34	773.5
Canada	51720	37.74	1370.4
Israel	12329	8.66	1423.7
Germany	168935	83.78	2016.4
Sweden	23777	10.1	2354.2
France	165204	65.27	2531.1
United Kingdom	219948	67.89	3239.8
Brazil	699276	212.56	3289.8
United States	1123836	331	3395.3
Hungary	48762	9.66	5047.8

Fig. 1. COVID-19 scores of 15 countries as of March 7, 2023.

5. Discussion

Fig. 1 shows the effectiveness of the test-isolation strategy for mitigating the pandemic. Countries with the test-isolation strategy can suppress the number of COVID-19 deaths. There are two types of the test-isolation strategy: mandatory policy regulated by law and voluntary policy.

The result of the hiscovid tool for the UAE, New Zealand and Japan is shown in Fig. 2. In hiscovid's graph, the steeper the slope of the line, the stronger the resurgence of COVID-19 is observed. The UAE has mandatory regulations of the test-isolation policy and New Zealand had mandatory regulations of the test-isolation policy from the beginning of the pandemic until February 2022 while Japan has the voluntary test-isolation policy. The two graphs for the UAE and New Zealand with the mandatory test-isolation policy show that the lines are flat except where mistakes are made by policymakers. In the graph of Japan, there is no flat line due to the voluntary test-isolation policy.

The graph for New Zealand shows that during the entire pandemic period, only one mistake was made in February 2022. New Zealand reopened to the world with removing border regulations on tourism (Jeong, 2022). According to New Zealand government, vaccine passes is no longer required and face covering requirements on arrival and physical distancing from the air border order were removed. Due to removing the border regulations on tourism, a sharp resurgence of COVID-19 in New Zealand has been observed.

The UAE had the voluntary test-isolation policy from the beginning of the pandemic to January 2022. The UAE reduced the quarantine period from 14 days to 10 days in January 2021 as the resurgence is shown in the graph (UAE, 2021)(UAE, 2021). The UAE has changed their policy to the mandatory green pass policy from January 2022 to today (UAE, 2022). The green pass is the mandatory test-isolation policy with test, 14 days quarantine period and vaccination. The flat graph indicates that the UAE has successfully suppressed the COVID-19 pandemic from January 2022 to today.

Japan made several mistakes where the latest mistake was conducted

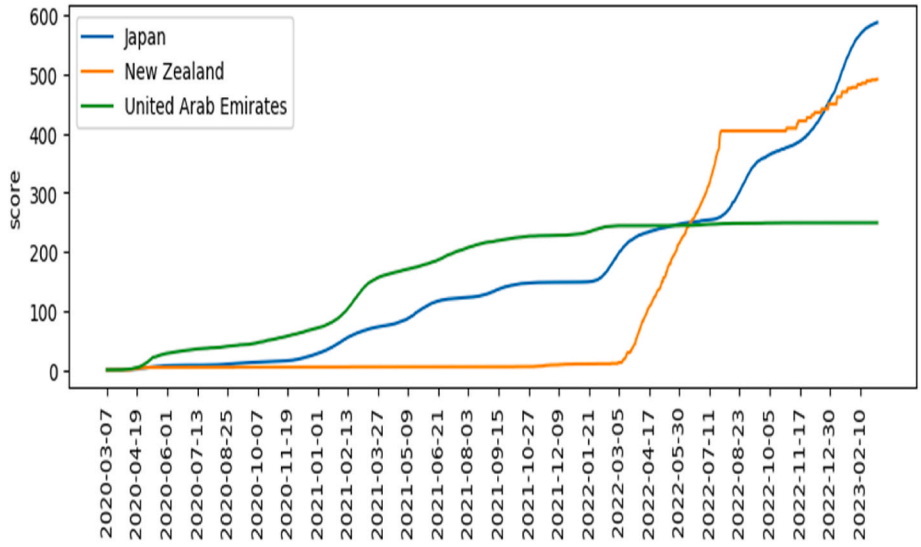

Fig. 2. Time-series scores of the UAE, New Zealand and Japan as of March 7, 2023.

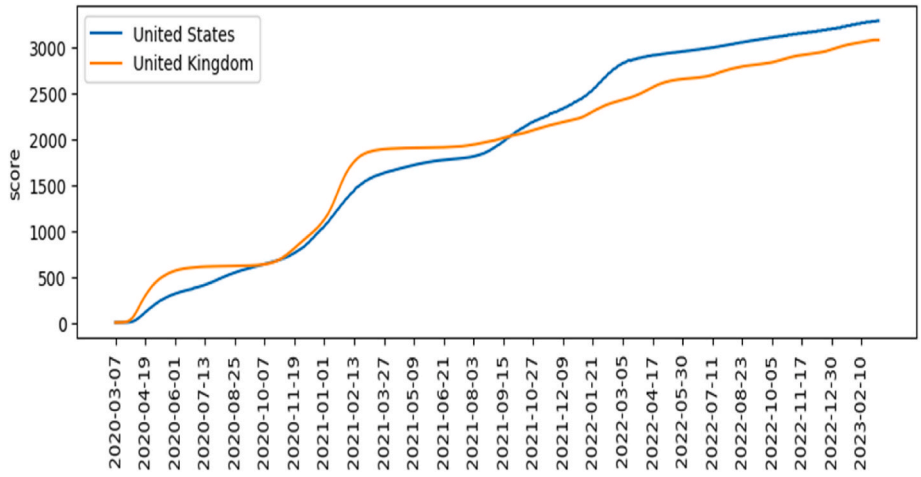

Fig. 3. Time-series scores of hiscovid for the US and the UK as of March 7, 2023.

in February–March 2022. Japanese government removed the COVID-19 regulation for promoting domestic tourism. In July 2022, new regulations in Japan allow tourists to enter the country without restrictions. The sharp COVID-19 resurgence is currently observed in Japan. The Japan's graph without a flat line shows that the test-isolation strategy has been leaky.

In contrast to the measures taken by the US and UK, Japan implemented border control policies under a state of emergency; however, these measures lacked legal enforcement, significantly undermining their effectiveness. In sharp contrast, New Zealand and the UAE adopted stringent, legally binding policies that mandated quarantine and established strict entry requirements for travelers. This disparity in the rigor of enforcement and compliance illustrates the varying levels of effectiveness in border control strategies during the early stages of the pandemic. A comparison of these approaches highlights the critical role that legal frameworks play in shaping public health responses to international travel crises. For instance, while Japanese officials advised travelers at the airport to "avoid public transportation to your home," there were no mechanisms in place to verify adherence, leaving transportation choices largely unmonitored.

In three countries with excellent scores of scorecovid in the world, the strong COVID-19 resurgence is currently observed due to deregulating restrictions on tourism. Policymakers should use the hiscovid tool to manage border regulations for mitigating and ending the COVID-19 pandemic. In the graph of hiscovid, the steeper the slope of the line, the stronger the resurgence of COVID-19 is observed.

Fig. 3 illustrates data for the US and the UK. These countries did not implement mandatory border controls at the onset of the pandemic. Consequently, the graph does not show any flat lines in Fig. 3, which would indicate a failure in border control measure. To clarify, this study is an outcome analysis, not an intervention analysis. Our primary focus is on evaluating the effectiveness of border control measures during the early stages of the COVID-19 pandemic, prior to vaccination. Significant differences between the UAE and New Zealand group and the US and UK group are observed in Figs. 2 and 3.

On January 31, 2020, the administration imposed a travel ban specifically targeting non-US travelers from China, yet it did not implement any symptom screening or quarantine measures for those entering the country (Hanage et al., 2020). By that time, the virus had already been detected in several other nations, including Italy, Iran, Spain, Germany, Finland, and the United Kingdom. It wasn't until March 11, 2020—six weeks later—that selective travel restrictions on Europe were enacted, by which time Italy had reported 830 fatalities (compared to 259 deaths reported by China on January 31, 2020). Importantly, these restrictions did not extend to returning US citizens or permanent residents, despite their potential exposure to SARS-CoV-2 (Hanage et al., 2020).

As COVID-19 cases began to rise, UK public health authorities closely monitored travel and issued guidance at ports of entry. On January 25, 2020, Public Health England activated the Airport Public Health Monitoring Operations Centre for direct flights from China to Heathrow, a protocol that remained in effect until March 23, when a national lockdown was enacted prohibiting non-essential travel abroad (Cai et al., 2022). Participants remarked that adherence to official UK guidance felt voluntary and voiced concerns regarding the insufficient scientific knowledge available, which contributed to confusion in interpreting the advice offered. Ultimately, both the US and the UK struggled to effectively enforce border control measures during the early stages of the pandemic. (Cai et al., 2022).

With the proposed hiscovid tool, we should manage the COVID-19 pandemic on tourism. This paper showed the usefulness of the indispensable hiscovid tool for managing the COVID-19 pandemic on tourism for controlling border regulations and the quarantine period. The precision of policy outcome analysis is intrinsically linked to the accuracy of the dataset qualities. Consequently, it is imperative that we scrutinize the quality of these datasets.

This cohort study is designed to highlight the importance and effectiveness of border policies during the early stages of the pandemic. The three countries selected—United Arab Emirates, New Zealand, and Japan—were chosen specifically because they demonstrated notable success in managing the pandemic without the aid of vaccinations during the initial chaotic period.

While the sample size is indeed limited, the study provides critical insights into how effective border policies can be in mitigating the spread of the virus. The period analyzed, which includes the initial phase of the pandemic and subsequent non-pharmaceutical intervention measures, is crucial for understanding the impact of these policies.

It is important to note that this study does not aim to generalize the results to all countries. Instead, it offers evidence-based findings that underscore the significance of border control measures in reducing mortality rates. The visualization of mortality trends as shown in Figs. 2 and 3 clearly illustrates the correlation between stringent border policies and lower death rates, providing a compelling argument for the effectiveness of such measures. We believe that these findings contribute valuable knowledge to the ongoing discourse on pandemic management and border policy effectiveness.

We acknowledge the importance of considering various intervention measures that may influence the pandemic's limitations, such as differences in health systems, population density, vaccine availability, and local social customs. However, it is important to clarify that this study is an outcome analysis rather than an intervention analysis. The primary focus is on evaluating the effectiveness of border policies using two specific metrics: the normalized score from the scorecovid tool and the normalized time-series score from the hiscovid tool. These metrics allow for a standardized comparison across different countries, irrespective of their unique characteristics.

While we recognize that other non-pharmaceutical interventions (NPIs) and the introduction of vaccinations are significant factors, the scope of this study is intentionally limited to border policies. This approach provides a clear and focused analysis of how these specific measures impact mortality rates during the early stages of the pandemic.

Current tools like scorecovid and hiscovid aren't designed to establish causal relationships. However, they do identify policy transitions, as described in this manuscript. To our knowledge, no publicly available tools establish causal associations. The causal association tool is valuable and may guide the development of future pandemic policy management tools.

The conclusions drawn from this study are based on evidence-based findings that highlight the correlation between stringent border policies and reduced mortality rates. We believe that this focused analysis contributes valuable insights to the broader discourse on pandemic management and the effectiveness of various intervention measures.

6. Conclusion

This study investigated COVID-19 policy metrics and proposed a new metric—the cumulative population mortality rate—to assess policy effectiveness. This metric focuses on total COVID-19 deaths over time, facilitating a clearer evaluation of individual policies. In addition, the research introduced two COVID-19 policy analysis tools: Scorecovid, which assigns a score based on a country's total deaths to identify the most successful policies globally, and Hiscovid, a time-series tool that helps pinpoint policy missteps over time. Both tools leverage the cumulative deaths metric, where higher numbers indicate less effective policy.

The analysis revealed that mandatory test-isolation strategies, as implemented in countries like the UAE and New Zealand, effectively suppressed the pandemic. By contrast, Japan's voluntary approach resulted in a less successful outcome, and Hiscovid further indicated that recent policy changes—such as lifting travel restrictions—might be contributing to a resurgence in cases.

These findings underscore the importance of legal mechanisms in bolstering public health responses. In light of the effectiveness of mandatory isolation strategies, it is recommended that policymakers develop robust legal frameworks enabling such strategies in preparation for future pandemics. This legal preparedness would allow for the swift implementation of enforced measures to contain disease spread more effectively.

Furthermore, given the demonstrated utility of the cumulative population mortality rate metric and the Hiscovid tool, these resources should be integrated into pandemic preparedness plans. The combination of sound legal structures and effective policy analysis tools offers a powerful strategy for managing border regulations, quarantine periods, and other critical public health measures in future global health emergencies.

Author contribution

YT completed this research and wrote the program and this article.

Ethical approval

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Data availability statement

Not applicable.

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Conflict of interest

The author has no conflict of interest.

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Not applicable.

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