Network Modeling Analysis in Health Informatics and Bioinformatics (2023) 12:4
https://doi.org/10.1007/s13721-022-00400-3

ORIGINAL ARTICLE

Policy analysis and data mining tools for controlling COVID-19 policies

Yoshiyasu Takefuji[1]

Received: 15 September 2022 / Revised: 20 November 2022 / Accepted: 21 November 2022

Abstract
Much research has been done on the efficacy of vaccines against the COVID-19 pandemic, but the claims have not yet been realized in the real world. This paper proposes three COVID-19 policy outcome analysis tools such as jpscore for scoring and revealing the best prefecture policy in Japan, scorecovid for scoring and revealing the best country policy in the world, and finally hiscovid for visualizing and identifying when policymakers made mistakes in time-series scores. Poorly scored countries or prefectures can learn good strategies from the best country or prefecture with excellent scores. Three tools are based on a single metric dividing the number of COVID-19 deaths by the population in millions. Three tools suggest us that the sustainable mandatory test-isolation strategy should be adopted in the world for mitigating the pandemic. This paper also addresses what is lacking in Japan for scientific evidence-based research for mitigating the pandemic. Visualization tools and sorted and time-series scores of policy outcomes help policymakers make the right decisions.

Keywords Scoring COVID-19 policies · Evidence-based data · COVID-19 policy · PyPI tool

1 Introduction

Data mining on continuous open data or time series datasets plays an important role in discovering scientific facts. Based on the scientific facts uncovered in this study, policymakers need to make the right decision on how to deal with the COVID-19 pandemic, whether to update, strengthen, or mitigate policies. Ristea et al. studied a database that tracked the impact of the COVID-19 pandemic on local communities (Ristea et al. 2022).

Policymakers sometimes speak as if science has superhero powers; when it comes to COVID-19, they often speak as if they expect vaccines to return life to the way it used to be but it does not (Shah 2021). Pickersgill et al. addressed the similar research gap (Pickersgill and Smith 2021).

Policymakers ignore the past lesson on polio and HIV (Spinney 2022). Long COVID is the latest reminder that epidemics have long tails—biologically, as well as psychologically, economically and socially. Since the persistent effects of COVID-19 were recognized 6 months into the pandemic, up to 200 symptoms have been reported in 10 organ systems, including the skin, brain, heart, and gut (Spinney 2022).

Although many papers have emphasized the efficacy of the vaccine against the COVID-19 pandemic, their claim has not yet been realized in real society (Abbasi 2022; Yakusheva et al. 2022; Miller 2021; Sante 2021; Litvak et al. 2021; Ntoumi et al. 2022). This is because vaccine efficacy in the laboratory is different from vaccine effectiveness in the real world. The COVID-19 environment changes with human behavior and new COVID-19 variants.

The purpose of this paper is to propose policy outcome analysis tools that score individual policies against COVID-19 and sort the list of scores to help policymakers navigate the pandemic problem. In other words, regardless of the vaccine effectiveness adopted by many countries, the proposed tools will be able to discover the best COVID-19 policy country in the world or prefecture in Japan based on the policy outcomes. Policy outcomes and results can be calculated by the number of COVID-19 deaths. This is because the number of cases is always proportional to the number of COVID-19 deaths. The more COVID-19 deaths the more cases. In other words, the better the policy, the fewer deaths there should be.

The contribution of this paper is to proposed policy outcome analysis tools for policymakers to reveal the best policy among countries in the world or prefectures in Japan

✉ Yoshiyasu Takefuji
takefuji@keio.jp

[1] Faculty of Data Science, Musashino University, 3-3-3 Ariake Koto-Ku, Tokyo 135-8181, Japan

Published online: 05 December 2022

and they can learn good strategies from excellent scored countries or prefectures. A time-series policy outcome analysis tool allows policymakers to identify and quantify when they made mistakes. Past mistakes cannot be corrected, but mistakes in the future can be mitigated with the proposed time-series policy outcome analysis tool. To our knowledge, there is no such tool.

There are two types of approaches against the COVID-19 pandemic such as pharmacological approach with vaccination and non-pharmacological approach such as test-isolation strategy. These two approaches must be integrated to control COVID-19 with the best possible strategy.

The most important contribution in this paper lies in that the proposed single metric method can discover the best policy in prefectures in Japan regardless of the existing approaches. The outcomes of policies can be visualized by the proposed tools.

The previously proposed scorecovid tool, a Python program can score individual policies by country and reveal the best country policy in the world (Takefuji 2021a). The score is actually calculated by dividing the number of COVID-19 deaths by the population in millions. The scorecovid tool generating sorted scores will reveal that which countries have been handling the pandemic well or not (Takefuji 2021b).

In this paper, a newly developed jpscore is introduced for scoring COVID-19 prefecture policies in Japan. The jpscore is a Python package tool so that jpscore runs on Windows, MacOS, and Linux operating systems, respectively, as long as Python is installed on the system. The goal of the jpscore tool is for prefectures with poor scores to learn good strategies from prefectures with excellent scores.

The jpscore tool will reveal which prefectures have been handling well against the pandemic. The result of sorted scores from scorecovid and jpscore will be discussed.

Two web sites over the Internet show raw data and computed data using a variety of graphs. The significant difference between the proposed method with jpscore and scorecovid and two web sites lies in sorted outcomes of individual policies in countries and prefectures. Policymakers must learn the good strategies from excellent countries or prefectures. It is extremely hard for policymakers with two web sites to discover the best policy in the world and to learn it from countries or prefectures with excellent scores. In other words, providing a variety of data and calculated data on COVID-19 is not convenient for policymakers to make their right decisions.

How can we discover which country or prefecture has the best score, the second-best score with using two sites? In other words, information on sorted scores plays a key role in revealing the best policy regardless of pharmacological and non-pharmacological approaches. Such a single metric sorted score method has never been proposed in previous studies.

In the proposed scoring tools such as scorecovid and jpscore, it is intended to show **sorted scores** as policy outcomes. Experts must understand foundations of science. By comparing sorted scores, we will be able to discover new findings such as Niigata has the best score not only in Japan but also that in the world.

The single metric for scoring policy outcomes (the number of deaths per million population) in prefectures or countries used in this study has been validated for COVID-19 policy evaluation (Takefuji 2021a, b, c; Alsolami et al. 2022). In the herd immunity debate in Sweden, the author proposed the single metric for investigating the policy effectiveness. The herd immunity failed in Sweden due to the large number of elderly COVID-19 deaths (Takefuji 2021c). In their response (Takefuji 2021c), researchers in Sweden agreed with the proposed issue by the author that infection testing plays a key role and that health policies need to be continuously updated (Takefuji 2021c). The less the number of COVID-19 deaths, the better the policy.

The usscore tool was previously proposed for scoring individual state policy in the US (Alsolami et al. 2022). The usscore discovered that Vermont has the best score of 1099, while Arizona has the worst score of 4350 as of September 1, 2022.

The hiscovid tool is newly proposed for evaluating time-transition scores to identify when policymakers made mistakes in their policies. This paper will discover when Japan made multiple mistakes, while Taiwan made only two mistakes and New Zealand made a single mistake from the beginning of the COVID-19 pandemic.

Remember that mistakes in policies caused unnecessary COVID-19 deaths. The single metric score always monotonically increases in all tools such as scorecovid, usscore, jpscore, and hiscovid. In other words, policymakers must learn past lessons when they made mistakes not to repeat the same mistakes. The proposed scoring tools are extremely useful for policymakers to make right decisions against the COVID-19 pandemic.

To enforce the foundations of science on the single metric for scoring policies, intensive literature survey was conducted. Gibney wrote an article on whose coronavirus strategy worked best (Gibney 2020 May). Gibney used the number of infections and that of deaths due to COVID-19. In other words, the number of deaths indicates the final

outcome for evaluating coronavirus strategies in the world. Gibney supports the proposed single metric.

The Lancet article conducted the intensive study on pandemic preparedness and COVID-19: an exploratory analysis of infection and fatality rates, and contextual factors associated with preparedness in 177 countries (COVID-19 National Preparedness Collaborators 2022). They analyzed infection and fatality rates. Their study also supports the proposed single metric as the final outcome evaluation.

The UK government reported the article entitled "Coronavirus: lessons learned to date" (COVID-19 National Preparedness Collaborators 2022). In their report, the strong message was issued on the single metric: one of the key ways to measure a country's success in fighting COVID-19 is to measure deaths from COVID-19. The UK official document supports the proposed single metric.

Chang et al. studied on the determinants of COVID-19 morbidity and mortality across countries (Chang et al. 2022). Their study also supported the proposed single metric as the final outcome for evaluating policies. In existing studies, researchers did not attempt to compare countries' scores on a single indicator to derive the best policy.

Fawaz Alsolami et al. investigated to determine which treatments for COVID-19 disease are the most effective and preferable (Alsolami et al. 2022).

Fawaz Jaber Alsolami et al. analyzed two perspectives: the early approach and the late approach of COVID-19, and the consequent effects on different aspects of the society (Takefuji 2022).

Although openness and continuous open data with daily updated datasets play a key role in analyzing the data and discovering new facts. Open means that the dataset is available to outside experts or scientists and the general public, not just to a limited set of experts and advisors chosen by government or local government. Being open is important so that outside experts can analyze from the dataset and complement the internal experts' inadequate analysis and mistakes. To solve intractable problems, openness can maximize the use of all available resources, including external and internal experts and the general public.

Without data analysis, policymakers cannot decide whether the current policy should be updated, strengthened, or mitigated. Policymakers need to review all available decision-making data from internal and external experts to make the right decisions based on priorities.

COVID-19 datasets in csv format of the world are available in public and can be downloadable over the Internet. In other words, daily updated data csv file needs to be scraped over the Internet and the data will be used for scoring individual policies.

The US is one of the best countries on open datasets where datasets of individual states are updated daily and publicly available. In other words, the United States consists of 50 states and Washington, DC. Detailed daily datasets on COVID-19 for each state are available in public. In Japan, it is hard to find the latest dataset of prefectures on COVID-19.

Although many countries have emphasized openness and open data, they did not disclose detailed daily datasets for each state or prefecture in public. Many datasets in the world are limited to a set of internal experts and scientists without being open.

Unfortunately, as far as we know, the latest daily dataset on COVID-19 by prefecture is not available on the Japanese government website when the paper was submitted. However, NHK, stands for Nippon Hoso Kyokai (Japan Broadcasting Corporation) which has been providing the useful COVID-19 dataset in csv format in public on each prefecture. NHK is owned by government of Japan, statutory corporation chartered under the Broadcasting Act of 1950. NHK's dataset was used in the proposed jpscore tool. However, NHK no longer updates that dataset, so it now uses the government's late-start dataset.

In summary, the goal of the proposed scoring tools such as scorecovid, usscore, jpscore, and hiscovid with a single policy outcome indicator can be used for policymakers to learn good strategies against COVID-19 from countries with excellent scores for mitigating and ending the pandemic. Data science plays a key role in revealing the best COVID-19 policy with sorted scores. This paper will reveal that Niigata with the best score is the best state in the world while Japan is the best country in the world. However, there is still room for improvement in Japan with regard to COVID-19 policies.

This paper will present policy analysis and data mining tools such as scorecovid, jpscore and hiscovid to mitigate the COVID-19 pandemic. The best and sustainable policy is based on the mandatory test-isolation strategy. The test-isolation strategy is to test and identify infected individuals at an early stage and to isolate them from uninfected people during the quarantine period. In other words, the more testing, the stronger the COVID-19 mitigation. The longer the quarantine period, the fewer the COVID-19 spreads. The shorter the quarantine period, the more COVID-19 spreads.

This paper presents how to use the proposed visualization tools for controlling the mandatory test-isolation and the quarantine period for mitigating the pandemic.

This paper is composed of "Methods" and "Results" Section on tools such as jpscore, scorecovid and hiscovid, "Discussion" Section, "Conclusion", and Appendix on how to install and run the proposed tools.

2 Methods

PyPI packaging allows scorecovid for generating a list of sorted scores by country, usscore, jpscore for generating a list of sorted scores by prefecture in Japan and hiscovid for time-series policy outcome analysis by country to run on Windows, MacOS, and Linux operating systems, respectively, as long as Python is installed on the system. "Appendix-1" details how to install and run the proposed tools.

There are two types of single metric policy scoring tools: a snapshot scoring tool and a time-series scoring tool. While snapshot analysis is a single event, time series analysis is a method of analyzing a sequence of snapshots over time. The time series analysis can look at the time transitions and changes while the snapshot analysis cannot.

In the framework, scoring is based on the single metric or population mortality rate: the number of daily cumulative COVID-19 deaths divided by the population in millions. In all tools, dataset is automatically scraped over the Internet.

The dataset on the number of daily cumulative COVID-19 deaths by prefecture in Japan is used at: https://covid19.mhlw.go.jp/public/opendata/deaths_cumulative_daily.csv.

The dataset on that in countries on daily cumulative COVID-19 deaths is used at the following site:

https://covid.ourworldindata.org/data/owid-covid-data.csv.

To clarify the details of jpscore's scientific calculations, the open-source code of jpscore.py is attached to "Appendix-2". This source code of jpscore-0.0.8.tar.gz file can be downloaded from the following site:

https://files.pythonhosted.org/packages/59/d2/6f5c1f254151c4b1483a27b506d0d5b8078a5cb85f6b9fe496c1ee93c321/jpscore-0.0.8.tar.gz.

Because jpscore is a snapshot policy outcome analysis tool, it uses the most recent data as a single event, while hiscovid, a time-series policy outcome analysis tool, uses the entire data to observe the passage of time and calculate time-series trends. In other words, jpscore is a subset of hiscovid. However, while hiscovid cannot calculate scores by prefecture in Japan, it can calculate time-series scores by country.

Table 1 Sorted scores of four prefectures in Japan

Prefecture	Deaths	Population	Score
Niigata	126	2.223	56.7
Tottori	59	0.556	106.1
Fukui	87	0.768	113.3
Hokkaido	2440	5.25	464.8
Hyogo	2661	5.466	486.8
Osaka	6072	8.809	689.3

3 Results

3.1 Result of jpscore

The result of four sorted scores is shown in Table 1. Niigata Prefecture has the best score of 56.7 while Osaka Prefecture has the worst score of 689.3. Niigata's score is 12 times better than Osaka's score. In other words, Osaka caused the unnecessary COVID-19 deaths due to the poor policy.

3.2 Result of scorecovid

Table 2 shows that Japan has the best score of 318 and Hungary has the worst score of 4895 in 15 countries.

3.3 Result of hiscovid

Figure 1 shows that New Zealand had the best score until February 2022. New Zealand made a single mistake and Taiwan made two mistakes. Japan made several mistakes during the pandemic.

4 Discussion

Table 1 with jpscore shows that Niigata prefecture has the best score in the world, while Table 2 with scorecovid indicates that Japan is handling the pandemic well until July 2022.

Table 2 Sorted scores of 15 countries in the world

Country	Deaths	Population	Score
Japan	40,241	126.48	318.2
New Zealand	1910	4.82	396.3
Taiwan	9950	23.82	417.7
South Korea	26,940	51.27	525.5
Australia	13,999	25.5	549
Iceland	213	0.34	626.5
Canada	44,317	37.74	1174.3
Israel	11,620	8.66	1341.8
Germany	147,642	83.78	1762.3
Sweden	19,904	10.1	1970.7
France	154,203	65.27	2362.5
United Kingdom	205,288	67.89	3023.8
United States	1,047,006	331	3163.2
Brazil	683,965	212.56	3217.8
Hungary	47,291	9.66	4895.5

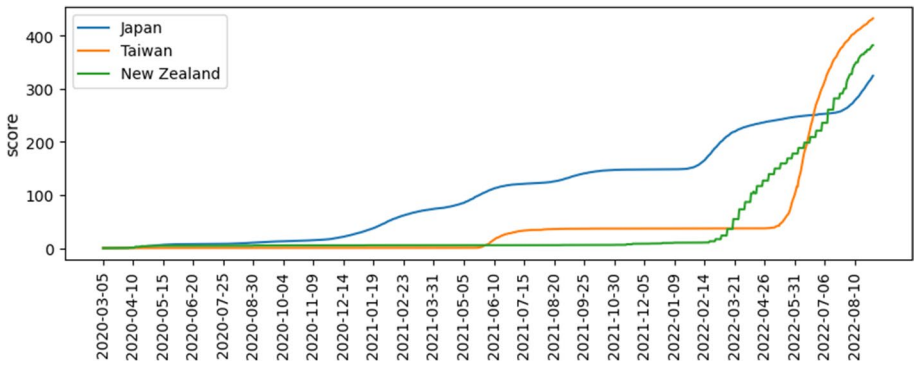

Fig. 1 Time-series scores of three countries such as Japan, Taiwan, and New Zealand as of September 1, 2022

In Fig. 1, the vertical axis represents time series scores and the horizontal axis represents dates. Scores are monotonically increasing as they are scored by daily cumulative mortality. In general, the steeper the slope of the graph, the worse the policy outcome. The flat graph shows that the policy has successfully controlled and suppressed the COVID-19 pandemic.

As shown in Fig. 1, the hiscovid tool discovered that the mandatory test-isolation policy by law is extremely effective against the COVID-19 pandemic. The test-isolation policy is to test and identify infected individuals at an early stage and to isolate them from uninfected people during the quarantine period. The mandatory test-isolation policy has been adopted only in Taiwan, New Zealand and other several countries. Since the score is calculated by dividing the number of deaths due to COVID-19 by the population in millions in time series, score is always monotonically increasing.

In Fig. 1, the result of hiscovid (Japan, Taiwan, New Zealand) shows that until February 2022, New Zealand was the best country in the world handling the COVID-19 pandemic well. However, New Zealand made the single mistake of lifting boarder regulations (Mercer 2022), the score in New Zealand is rapidly increasing.

Taiwan made two mistakes: May 2021 and May 2022. The first failure in Taiwan was attributed to the lack of testing of the aircraft crew and the crew's families in May 2021 (Davidson 2021). The second failure in Taiwan was caused by lifting border regulations since May 2022 (Reuters 2022). Most interestingly, the graph is linear and flat until Taiwan and New Zealand successfully implemented a mandatory test-isolation strategy, but two countries failed to mitigate the COVID-19 pandemic after the removal of border restrictions and shortening the quarantine period. Lifting border regulations can significantly affect the outcomes of the COVID-19 pandemic. The quarantine period plays a key role in mitigating the pandemic. The longer the quarantine period, the fewer the COVID-19 spreads. The shorter the quarantine period, the more the COVID-19 spreads.

In Japan, the slope of the graph can always be seen and the scores are constantly increasing over time. In other words, a linear or flat graph as seen in Taiwan and New Zealand has never been observed for time series scores in Japan. Japan's policy on the test-isolation strategy is voluntary and leaky. This is because Japan does not have the mandatory law on the test-isolation strategy, but the voluntary regulations. The mandatory regulations by law significantly play a key role in mitigating the COVID-19 pandemic. In other words, Japan, there is still room for improvement on the COVID-19 policy with the mandatory test-isolation strategy. The recent resurgence in Japan in Fig. 1 is due to relaxing the border regulations.

The further investigation is needed since there is no official document on detailed policies in Niigata. Niigata's policy against the COVID-19 is one of the best policies in the world. Japanese people wear face masks at all times, with or without warning from the government. In other words, the policy mentioned in this paper may be heavily affected by the general public's behavior in Japan. Thus, policy effects on COVID-19 are a consequence of the policies of policymakers and the actions of the general public. However, we do not know the ratio of two characteristics on the consequence.

The Japanese government's official residence provides daily data on the third vaccination rate by prefecture; the data as of October 21, 2022 shows that Niigata Prefecture's vaccination rate is 73.9%, which is in the top group, but not particularly high. However, in terms of immunization coverage by ordinance-designated cities, Niigata City ranks first in the nation at 70.7%. According to the population in the table, about one-third of the population of Niigata Prefecture is concentrated in Niigata City, suggesting that COVID-19 infection may have been suppressed by the was no unique policy in Niigata for non-pharmacological approaches such

as test-isolation strategies, then the author may be right that the effect may have been due to herd instinct, such as the Japanese always wearing face masks.

The tools can discover the best country in the world or prefecture in Japan. As a result, policymakers can understand that countries with poor scores can learn good strategies from countries and prefectures with good scores. The time-series policy outcome analysis tool allows policymakers to identify when they made mistakes for future policy updates. In the future, the focus should be on the worse off countries to mitigate the pandemic.

Watson clearly mentioned that vaccination with boosting is not sustainable (Watson 2022). This is because we do not know how many boostings are needed.

5 Conclusion

This paper showed the results on data mining with datasets in public. The daily cumulative mortality scoring plays a key role in discovering five facts. The sorted scores and visualization of results are essential for policymakers to observe policy effectiveness, update policies, and make the right decisions to mitigate the pandemic. The jpscore tool is intended for policymakers to learn good strategies from prefectures with excellent scores. However, we need to investigate why Niigata has the best score in the world from a herd behavior perspective instead of individual policies. New findings are summarized as follows.

(1) Niigata has the best score in the world.
(2) New Zealand had the best score until February 2022.
(3) New Zealand made a single mistake against COVID-19 and Taiwan made two mistakes.
(4) hiscovid discovered that lifting border regulations and shortening the quarantine period significantly affect the outcomes of the COVID-19 pandemic.
(5) hiscovid also discovered that the mandatory test-isolation strategy by law is sustainable and extremely effective for mitigating the pandemic.

Appendix-1: How to install and run jpscore, scorecovid, and hiscovid

How to install and run jpscore

For Windows, double-click the exe file: Miniconda3-py38_4.11.0-Windows-x86_64.exe.

https://repo.anaconda.com/miniconda/Miniconda3-py38_4.11.0-Windows-x86_64.exe.

For MacOS, run the following command:

https://repo.anaconda.com/miniconda/Miniconda3-py38_4.11.0-MacOSX-x86_64.sh.

($) sign is a prompt given from system in the terminal.

$ zsh Miniconda3-py38_4.11.0-MacOSX-x86_64.sh.

or.

$ bash Miniconda3-py38_4.11.0-MacOSX-x86_64.sh.

For WSL on Windows or Linux operating systems, run the following command:

https://repo.anaconda.com/miniconda/Miniconda3-py38_4.11.0-Linux-x86_64.sh.

$ bash Miniconda3-py38_4.11.0-Linux-x86_64.sh.

Before installing jpscore, the following libraries such as pandas and openpyxl are needed:

$ pip install pandas.

$ pip install openpyxl.

Then, install jpscore by the following command:

For WSL on Windows, MacOS, and Linux operating systems,

$ pip install jpscore.

Finally, run jpscore:

$ jpscore.

How to install and run scorecovid

This paper will investigate scores of fifteen countries using scorecovid to compare with scores of prefectures in Japan.

Scorecovid is a powerful tool to be able to reveal the effectiveness of policies. To run scorecovid, install scorecovid by the following command in the terminal on Windows, MacOS, or Linux operating systems. Scorecovid displays the sorted scores of countries.

The file countries can be modified for more or less countries.

For WSL on Windows, MacOS, and Linux operating systems:

$ pip install scorecovid.

Then, run the following command:

$ scorecovid.

How to install and run hiscovid

The hiscovid tool is to identify when policymakers made mistakes against the COVID-19 pandemic. Scoring policies in hiscovid is based on time-series scores so that the outcomes can show clearly when they made mistakes. To run hiscovid, run the following command for installation.

$ pip install hiscovid.

And run the following command for scores of three countries such as Japan, Taiwan and New Zealand.

$ hiscovid Japan Taiwan 'New Zealand'.

Appendix-2: jpscore.py source code

```
import requests,re
import pandas as pd
import subprocess as sp
import numpy as np

def main():
 sp.call("wget -nc https://github.com/ytakefuji/covid_score_japan/raw/main/jppopu.xlsx
--no-check-certificate",shell=True)
 df = pd.read_excel('jppopu.xlsx',engine='openpyxl')
 df.to_csv('pop.csv')
 print('pop.csv was created')

 print('downloading https://covid19.mhlw.go.jp/public/opendata/deaths_cumulative_daily.csv file')
 sp.call("wget -nc
https://covid19.mhlw.go.jp/public/opendata/deaths_cumulative_daily.csv",shell=True)
 p=pd.read_csv('deaths_cumulative_daily.csv')
 dateL=len(p['Date'])
 date=p['Date'][dateL-1]

 pp=pd.read_csv('pop.csv')
 print('calculating scores of prefectures\n')
 print('score is created in result.csv')
 print('date is ',date)
 prefectures=p.columns.values
 d=np.delete(prefectures,[0,1])
# print(len(d),d)

 for i in d:
  globals()[str(i)]=int(p[i][dateL-1])

 dd=pd.DataFrame(
  {
   "prefecture": d,
   "deaths": range(len(d)),
   "population": range(len(d)),
   "score": range(len(d)),
  })

 for i in d:
  dd.loc[dd.prefecture==str(i),'deaths']=int(p[i][dateL-1])

dd.loc[dd.prefecture==str(i),'population']=round(df.loc[df.Prefecture==str(i),'Population
2019'].astype(int)/1000,3)
dd.loc[dd.prefecture==str(i),'score']=round(dd.loc[dd.prefecture==str(i),'deaths']/dd.loc[
dd.prefecture==i,'population'],1)
  if i=='Okinawa':
   dd.loc[dd.prefecture=='Okinawa','population']=round(pp['Population 2019'][len(d)-
1].astype(int)/1000,3)

dd.loc[dd.prefecture=='Okinawa','score']=round(dd.loc[dd.prefecture=='Okinawa','death
s']/dd.loc[dd.prefecture==i,'population'],1)
 dd=dd.sort_values(by=['score'])
 dd.to_csv('result.csv',index=False)
 dd=pd.read_csv('result.csv',index_col=0)
 print(dd)
 dd.to_csv('result.csv',encoding='utf_8_sig',index=True)
 sp.call("rm d*.csv p*.csv *.xlsx",shell=True)


if __name__ == "__main__":
 main()
```

Data availability Not applicable.

Declarations

Conflict of interest This research has no fund. The author has no conflict of interest.

References

Abbasi J (2022) Studies suggest COVID-19 vaccine boosters save lives. JAMA 327(2):115. https://doi.org/10.1001/jama.2021.23455

Alsolami FJ et al (2021) Impact assessment of COVID-19 pandemic through machine learning models. CMC-Comput Mater Contin 68(3):2895–2912. https://doi.org/10.32604/cmc.2021.017469

Alsolami F et al (2022) A unified decision-making technique for analysing treatments in pandemic context. CMC-Comput Mater Contin 73(2):2591–2618. https://doi.org/10.32604/cmc.2022.025703

Chang D, Chang X, He Y et al (2022) The determinants of COVID-19 morbidity and mortality across countries. Sci Rep 12:5888. https://doi.org/10.1038/s41598-022-09783-9

COVID-19 National Preparedness Collaborators (2022) Pandemic preparedness and COVID-19: an exploratory analysis of infection and fatality rates, and contextual factors associated with preparedness in 177 countries, from Jan 1, 2020, to Sept 30, 2021. Lancet (london, England) 399(10334):1489–1512. https://doi.org/10.1016/S0140-6736(22)00172-6

Davidson H (2021) How did Covid slip through Taiwan's 'gold standard' defences? https://www.theguardian.com/world/2021/may/17/how-did-covid-slip-through-taiwans-gold-standard-defences

Gibney E (2020) Whose coronavirus strategy worked best? Scientists hunt most effective policies. Nature 581(7806):15–16. https://doi.org/10.1038/d41586-020-01248-1

https://pypi.org/project/jpscore/

https://ourworldindata.org/covid-deaths

https://web.sapmed.ac.jp/canmol/coronavirus/japan_death.html

Litvak E, Keshavjee S, Gewertz BL, Fineberg HV (2021) How Hospitals Can Save Lives and Themselves. Annal Surg 274(1):37–39. https://doi.org/10.1097/SLA.0000000000004871

Mercer P (2022) New Zealand Plans to Ease Its Tough COVID-19 Border Controls https://www.voanews.com/a/new-zealand-plans-to-ease-its-tough-covid-19-border-controls/6424766.html

Miller MR (2021) Language choice about COVID-19 vaccines can save lives. J Commun Healthc 14(2):99–101. https://doi.org/10.1080/17538068.2021.1892285

Ntoumi F, Nachega JB, Aklillu E, Chakaya J, Felker I, Amanullah F, Yeboah-Manu D, Castro KG, Zumla A (2022) World Tuberculosis Day 2022: aligning COVID-19 and tuberculosis innovations to save lives and to end tuberculosis. Lancet Infect Dis. https://doi.org/10.1016/S1473-3099(22)00142-6

Pickersgill M, Smith M (2021) Expertise from the humanities and social sciences is essential for governmental responses to COVID-19. J Glob Health 11:03081. https://doi.org/10.7189/jogh.11.03081

Reuters (2022) Taiwan cuts COVID quarantine for arrivals even as cases rise. https://www.reuters.com/world/asia-pacific/taiwan-cuts-covid-quarantine-arrivals-even-cases-rise-2022-05-03/

Ristea A, Tucker R, You S et al (2022) A multisource database tracking the impact of the COVID-19 pandemic on the communities of Boston, MA, USA. Sci Data 9:330. https://doi.org/10.1038/s41597-022-01378-3

Organised by: DG Sante (2021) Chair persons: Massimo Fagnini (European Commission), 4.O. Workshop: Using data to save lives in times of COVID-19 and beyond. Euro J Public Health 31(Supplement_3), ckab164.306, doi:https://doi.org/10.1093/eurpub/ckab164.306

Shah H (2021) COVID-19 recovery: science isn't enough to save us. Nature 591:503. https://doi.org/10.1038/d41586-021-00731-7

Spinney L (2022) Pandemics disable people — the history lesson that policymakers ignore. Nature 602:383–385. https://doi.org/10.1038/d41586-022-00414-x

Takefuji Y (2021a) SCORECOVID: A Python Package Index for scoring the individual policies against COVID-19. Healthcare Analytics 1:100005. https://doi.org/10.1016/j.health.2021.100005

Takefuji Y (2021b) Analysis of digital fences against COVID-19. Health Technol 11:1383–1386. https://doi.org/10.1007/s12553-021-00597-9

Takefuji Y (2021c) Correspondence: open schools, covid-19, and child and teacher morbidity in Sweden. N Engl J Med 384:e66. https://doi.org/10.1056/NEJMc2101280NEJM(2021)

Takefuji Y (2022) Discovering COVID-19 state sustainable policies for mitigating and ending the pandemic. Cities (london, England) 130:103865. https://doi.org/10.1016/j.cities.2022.103865

Watson C (2022) Three, four or more: what's the magic number for booster shots? Nature 602(7895):17–18. https://doi.org/10.1038/d41586-022-00200-9

Yakusheva O, van den Broek-Altenburg E, Brekke G, Atherly A (2022) Lives saved and lost in the first six month of the US COVID-19 pandemic: a retrospective cost-benefit analysis. PLoS One 17(1):e0261759. https://doi.org/10.1371/journal.pone.0261759