# Sustainable policy: Don't get infected and don't infect others

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ABSTRACT

COVID-19 is an environmental policy problem. The goal of this paper is to show sustainable policies against the COVID-19 pandemic. Medical professionals tend to stick only to pharmacological approaches such as vaccination and boosting, but that is not sustainable. The scorecovid and hiscovid tools revealed that the sustainable and the best policy against COVID-19 is based on the mandatory test-and-isolation by law. Because COVID-19 variants have the ability to spike mutations and immune escape, pharmacological approaches such as vaccination alone cannot mitigate or end COVID-19. The scorecovid tool is a Python Package Index (PyPI) application for scoring individual policies against COVID-19. In scorecovid, scoring policies is calculated by dividing the number of deaths due to COVID-19 by the population in millions. The hiscovid tool was developed to identify mistakes by policymakers in order to monitor their policies in time-series scores. The lower the score, the better the policy.

## Introduction

According to Centers for Disease Control and Prevention (CDC), on December 12, 2019, a cluster of patients in Wuhan, Hubei Providence, China begins to experience shortness of breath and fever (CDC 2022). The International Committee on Taxonomy of Viruses (ICTV) announced "severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2)" as the name of the new virus on 11 February 2020 (WHO 2022). This name was chosen because the virus is genetically related to the coronavirus responsible for the SARS outbreak of 2003. The World Health Organization (WHO) on March 11, 2020, has declared the novel coronavirus (COVID-19) outbreak a global pandemic. Mar 19, 2020 (WHO 2020).

From January 2020 until the start of vaccination in January 2021, COVID-19 was prevalent worldwide, but many countries did not have effective policies in place against the COVID-19 pandemic except several countries such as New Zealand, Taiwan, and Japan.

The goal of COVID-19 policies is to reduce the number of unnecessary deaths caused by COVID-19. The number of daily deaths is one good indicator for evaluating the outcome of COVID-19 policy using time series data. There are many COVID-19 policies in the world, and the most effective or best policy needs to be chosen scientifically.

In other words, COVID-19′s policy scoring plays an important role in finding and implementing the best policies. In the Swedish herd immunity debate, a single metric using the number of deaths due to COVID-19 to evaluate individual policies was proposed and accepted (Takefuji 2021b).

Several papers also verified that the number of deaths due to COVID-19 is one good indicators and outcomes for evaluating individual policies against the COVID-19 pandemic (Takefuji 2021a; Takefuji 2021b;

Takefuji 2021c; Takefuji 2021d; Takefuji 2021e). The calculated scores can reveal the best policy in the world for mitigating the pandemic.

Based on the single metric or indicator, a scorecovid tool was developed (Takefuji 2021a), the world's first open-source application for scoring COVID-19 policies in the world. scorecovid is validated via Code Ocean for software reproducibility and quality: https://doi.org/10.24433/CO.9411531.v1

In scorecovid, scoring is based on dividing the number of deaths due to COVID-19 by the population in millions. The lower the score, the better the policy. Scores monotonically increase and policymakers can only suppress them, but policymakers cannot improve them in the future. In other words, mistakes by policymakers are fata.

However, we discovered a strange behavior of experts on epidemiology who tried to solve the COVID-19 pandemic problem alone by themselves without using non-epidemiology experts such as data science experts.

Experts in general tend to stick to their own specialized knowledge to solve intractable problems. Pharmacological approaches using vaccines against COVID-19 have been published in leading scientific journals such as Science, Nature, NEJM, and Lancet. However, vaccination and boosting are not sustainable while the proposed non-pharmacological approach such as the mandatory test-isolation policy by law is sustainable and quite effective.

Because COVID-19 variants have the ability to spike mutations and immune escape (Harvey et al., 2021; Plante et al., 2021; Zhang et al., 2020a; Kupferschmidt 2021), pharmacological approaches such as vaccination alone cannot mitigate or end COVID-19. The current vaccination policy with boosting alone cannot mitigate the COVID-19 pandemic and it is not sustainable at all (Watson 2022).

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A scientific tool for scoring individual policies is needed for adopting the most effective policy and method for mitigating the COVID-19 pandemic. For this purpose, the scoring tool called "scorecovid" was developed for countries with poor scores to learn good strategies from countries with excellent scores (Takefuji 2021a).

Scorecovid is available in public and can be easily installed by PyPI packing. The smaller the score, the more effective the strategy. scorecovid has been downloaded by 13,965 users worldwide, according to PePy: https://pepy.tech/project. The large number of scorecovid users indicates that the applicability, the usability, and the usefulness are justified.

In order to identify when policymakers made mistakes, a new policy analysis tool, hiscovid was developed to monitor and visualize policy outcomes (Takefuji 2022). In hiscovid, scoring time-series scores can identify when policymakers made mistakes. Scoring is based on dividing the number of COVID-19 deaths by the population in millions. The lower the score, the better the policy. In other words, a flat graph indicates that the policy suppresses the COVID-19 pandemic. Graphs with steep slope change points indicate when policymakers made mistakes. By visualizing policy outcomes in hiscovid, policymakers can learn lessons in real time.

This paper using scientific tools such as scorecovid and hiscovid will reveal that the discovered mandatory test-isolation policy by law is not only sustainable but also one of the best policies against COVID-19 in the world. hiscovid is a new tool for policymakers to monitor policy effectiveness. By visualizing policy effects with hiscovid, policy makers can perform PDCA (Plan, Do, Check, and Act) cycles in real time.

Repeatability is one of the essences of science. A key feature of this paper is that it provides repeatability to the journal's readers by distributing the hiscovid source code and explaining how to use the Python commands. hiscovid reads and processes open COVID-19 death count data, so readers can see the latest COVID-19 data in real time. Readers can see the latest COVID-19 status on their machines in real time. This demonstrates the high validity of this paper not only as an academic paper, but also as a highly practical technical document. hiscovid simply deals with the number of daily COVID-19 deaths. Looking at the worldwide transmission of COVID-19 to date, it can be said that no expert is equipped with universal knowledge for policymaking against COVID-19. Under these circumstances, it would be better to design policies and monitor their effectiveness through risk communication among many experts based on more easily understandable indicators, rather than having a few experts in epidemiology and pathology drive policy-making decisions.

Fischhoff posed questions about COVID-19 decision-making, and this paper answers those questions through expert risk communication (Fischhoff 2020).

### Methods and results

This paper shows the-step-by-step approach such as "tool installation" and "how to run tools" for practitioners. The scorecovid tool calculates scores by dividing the number of deaths by COVID-19 by the population in millions to produce a sorted list of scores by country.

The hiscovid tool is used for visualizing the policy outcomes by dividing the number of COVID deaths by the population in millions in time series. The lower the score, the better the policy. The hiscovid allows policymakers to identify when they made mistakes in time-series scores.

To use scorecovid, you need to have a Python environment. The Python can be installed by miniconda from the following site:

https://docs.conda.io/en/latest/miniconda.html

Depending on your platform or OS, you should choose one of Windows, MacOSX, and Linux. Our recommendation is to install Python3.8 or Python3.7. After downloading the file, you should install it. On Windows, double-click the file. On MacOSX, Linux, or WSL on Windows, run the following command in the terminal.

For MacOSX, "$" sign is the prompt from your terminal.
$ bash Miniconda3-py38_4.10.3-MacOSX-x86_64.sh
For Linux or WSL on Windows,
$ bash Miniconda3-py38_4.10.3-Linux-x86_64.sh
After installing the Python programming environment, close your terminal and reopen it.

Then, install scorecovid by the following command:
$ pip install scorecovid
You may need pandas library if you don't have it. Install pandas library by the following command:
$ pip install pandas
In order to run scorecovid, run the following command:
$ scorecovid

Fig. 1 shows the result of running scorecovid. Scorecovid program scrapes the latest data of deaths and the static population information from sites on the Internet. In other words, the data is always updated daily on the number of the total deaths. The scores are sorted in ascending order as shown in Fig. 1.

The top three scoring countries, including Japan, Taiwan, and New Zealand, were found to have less than 500 points.

The UK, the US, Brazil and Hungary have more than 2700 points respectively.

In order to monitor the outcomes of policies of Japan, Taiwan and New Zealand, the hiscovid tool was used. In order to install hiscovid, run the following pip command.

$ pip install hiscovid
Run the following command:
$ hiscovid Japan Taiwan 'New Zealand'

Fig. 2 shows that New Zealand made a single mistake in March 2022 and Taiwan made two mistakes in May 2021 and May 2022. The significant difference between Japan and two countries such as Taiwan and New Zealand lies in that the flat graph is observed in Taiwan and New Zealand. There is no flat graph in Japan.

Flat graph and non-flat graph results (policy outcomes) are distinguished by the mandatory test-isolation by law adopted in Taiwan (Wang et al., 2020; Wu 2020; Zhang 2020b) and New Zealand, and later adopted in the UAE (Takefuji 2021c) and voluntary test-isolation adopted in Japan, respectively. 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. Fig. 2 shows that the voluntary test-isolation policy is leaky with the non-flat graph in Japan.

### Discussion and conclusion

New Zealand had the best score in the world for mitigating the COVID-19 pandemic until March 2022 as shown in Fig. 1. Unfortunately, New Zealand has lifted border restrictions and shortened the quarantine period (Washington Post 2022). In other words, controlling the quarantine period with the mandatory test-isolation plays a key role in mitigating the pandemic.

Taiwan made the first mistake in May 2021 because of missing test of crew and their families (Guardian 2021). The second failure in Taiwan is due to cutting the quarantine period to 3 days (Reuters 2022). As shown in Fig. 2, Japan's score is increasing because of the voluntary test-isolation policy and accepting travelers from foreign countries. In other words, except for May 2021 and after May 2022, the mandatory test isolation policy has been a great success for COVID-19 in Taiwan.

Because of spike mutations and immune escape, vaccination alone cannot mitigate the COVID-19 pandemic. We should adopt the best policy of the mandatory test-isolation strategy for mitigating the pandemic. By visualizing policy outcomes with the hiscovid tool, policymakers can learn lessons from ongoing policies and modify and update policies.

In the mandatory test-isolation strategy, controlling the quarantine period plays a key role in mitigating the COVID-19 pandemic. The longer the quarantine period, the better the policy. The shorter the quarantine period, the greater the spread of COVID-19.

| country | deaths | population | score |
|---|---|---|---|
| Japan | 42658 | 126.48 | 337.3 |
| New Zealand | 1950 | 4.82 | 404.6 |
| Taiwan | 10284 | 23.82 | 431.7 |
| South Korea | 27498 | 51.27 | 536.3 |
| Australia | 14432 | 25.5 | 566 |
| Iceland | 213 | 0.34 | 626.5 |
| Canada | 44607 | 37.74 | 1182 |
| Israel | 11656 | 8.66 | 1346 |
| Germany | 148299 | 83.78 | 1770.1 |
| Sweden | 20006 | 10.1 | 1980.8 |
| France | 154537 | 65.27 | 2367.7 |
| United Kingdom | 205718 | 67.89 | 3030.2 |
| United States | 1050323 | 331 | 3173.2 |
| Brazil | 684813 | 212.56 | 3221.7 |
| Hungary | 47367 | 9.66 | 4903.4 |

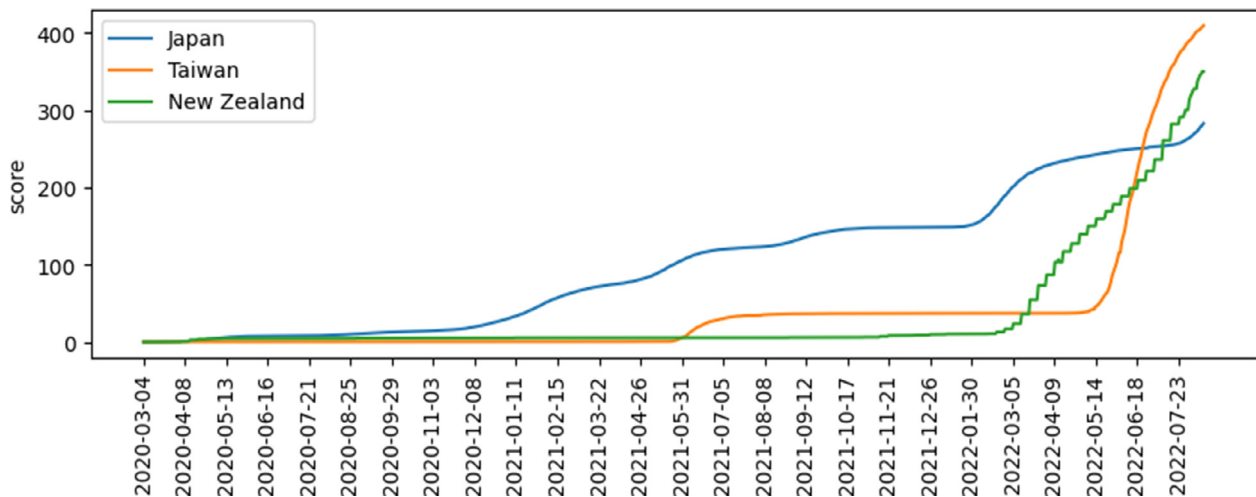**Fig. 1.** scoring individual policies against COVID-19 as of September 11, 2022.



**Fig. 2.** hiscovid result of Japan, Taiwan and New Zealand as of September 11, 2022.

Therefore, policymakers need to monitor and visualize policy outcomes in real time with the proposed tools such as scorecovid and hiscovid. Both tools are essential for policymakers to make scientific and right decision-making against COVID-19.

In addition, hiscovid has demonstrated that it can visualize the adverse effects of policy changes in Taiwan and New Zealand in real terms, and it can be expected to make decisions on the continuation or revision of policies immediately.

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