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## Letter to the Editor

### Association between Numbers of “Imported Cases” and “Reported Cases in a Source Country” of COVID-19: January to April 2020 in Japan



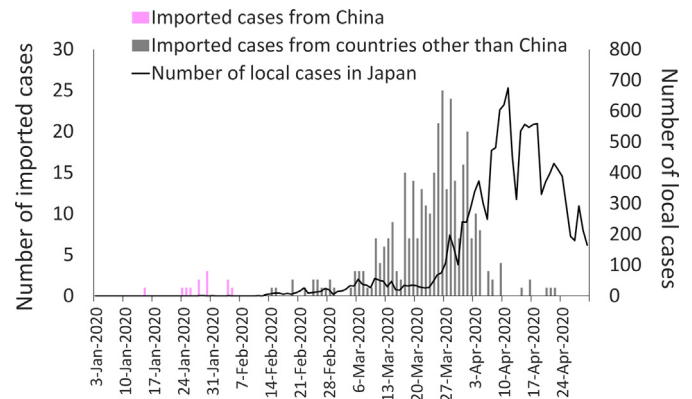
Dear Editor,

A letter in the journal recently discussed increase in the importation risk of the coronavirus disease 2019 (COVID-19) cases in China<sup>1</sup>. Another report in the journal described difference in vulnerability and coping capacity against COVID-19 outbreak among countries<sup>2</sup>. Since the disease affected many countries worldwide, it is important to assess the importation risk of COVID-19 cases from different countries to better control the epidemic. Yet, it remains elusive how we can assess and predict such a risk.

Since the detection of the first COVID-19 patient—a traveler from China—on January 15 in Japan, the number of COVID-19 cases slowly increased in the country until the middle of March<sup>3</sup>. Thereafter, Japan had a large number of imported cases. An imported case was defined as a case who had a travel history outside of Japan within 14 days. There were 348 imported cases from over 30 countries among a total of 14,116 cases by April 30, 2020 (Fig. 1). As “a travel history from affected areas outside of Japan” is one of the criteria for COVID-19 laboratory testing in Japan, the sensitivity of detecting imported cases was considered high. Moreover, there were 146 COVID-19 cases detected at airport quarantine stations; however, we excluded them from an analysis in this study as their source countries were not publicly available. The 348 imported cases analyzed in this study were detected not at airport quarantine stations but in communities.

The USA, France, the UK, Spain, Egypt, Philippines, and China were considered sources of  $\geq 10$  imported cases. To see if we could assess the importation risk of COVID-19 cases, we compared the date of illness onset of the imported cases and the 1) daily number of newly reported cases in a source country, 2) cumulative number of cases in a source country, and 3) ratio of “total number of cases in the past 7 days (when X is a date of interest, we referred data between X-6 and X)” to “total number of cases in a week before that (data between X-13 and X-7).” We call the third indicator “epidemic growth rate.”

The number of imported COVID-19 cases increased along with the number of newly reported cases in a source country. For the US, France, the UK, and Spain, most imported cases were detected when a source country's daily number of newly reported cases surpassed “1 per 100,000-capita” (Fig. 2A). However, the daily number of newly reported cases did not reach that threshold for Philippines, Egypt, or China as of April 2020. Likewise, whereas a source country's “cumulative” number of cases reached “1 per 100,000-capita” before the increase of imported cases from the US, France, the UK, and Spain, the threshold cannot be used to predict upcoming increases in imported cases from Philippines, Egypt, and

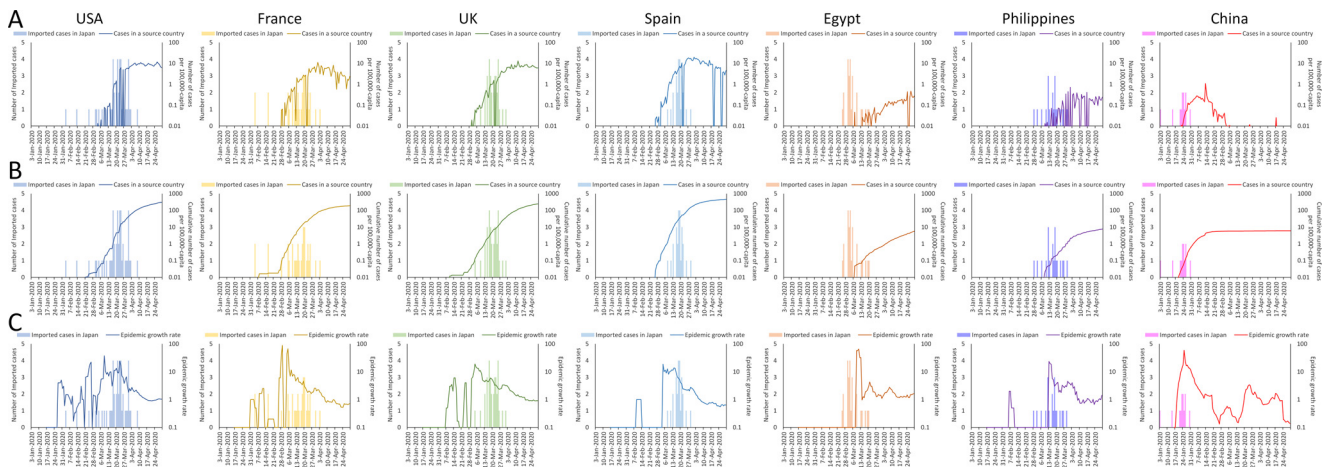


**Fig. 1.** The epidemic curve of imported and local COVID-19 cases in Japan from January to April, 2020. Data are from the surveillance data as described in<sup>3</sup>. The dates are for disease diagnosis by laboratory confirmation.

China (Fig. 2B). We also assessed the “epidemic growth rate” as described above. When the value is larger than “1,” we can tell the epidemic is exponentially growing. Except for Egypt, the rate exceeded “1” before the increase of imported cases for all countries analyzed in this report (Fig. 2C). When Egypt reported few cases, exported cases from the country were detected in not only Japan but numerous countries<sup>4,5</sup>.

We investigated if we could assess the importation risk of COVID-19 cases simply using a source country's number of cases. However, a single indicator cannot be used to assess the risk. As the number of cases differed among countries owing to testing strategy and capacity, sometimes the reported number of cases cannot reflect actual prevalence of the disease. The criterion that “epidemic growth rate exceeds 1 in a source country” preceded the increase of imported cases for most countries. However, it should be noted that the rate could easily surpass “1” at the beginning of an outbreak even when the disease prevalence is quite low. Moreover, we must consider many other factors including the volume of inbound travelers, purpose of the travelers, differences in disease prevalence among areas within a country, and political and economic connection between countries.

After the massive introduction of imported COVID-19 cases in March, Japan had a surge of local cases (Fig. 1). Genetic analysis of viral genome revealed that most viruses of local cases in April had not derived from viral strains that had been lingering in Japan since February but were viral strains circulating in European countries at the time<sup>6</sup>. We rarely detected imported cases following the implementation of partial border control in Japan, which substantially reduced the volume of inbound travelers from the



**Fig. 2.** Comparison between the number of imported cases in Japan and three indicators of epidemic situation in a source country. Bars indicate the number of imported cases in Japan, and lines represent A) daily number of newly reported cases, B) cumulative number of cases, and C) epidemic growth rate in a source country. The number of cases in a source country was obtained from the World Health Organization website (<https://covid19.who.int/>) accessed on May 21, 2020. The dates for imported cases in Japan are illness onset, and the dates for cases in a source country are reporting day.

beginning of April. Travel restrictions could contribute significantly to controlling the spread of the disease <sup>7,8</sup>. Many countries are currently discussing how to lift international travel restrictions to resume and restore socioeconomic activities, considering when to open and re-close international borders for which countries and who should be quarantined. Those decisions depend on the situations of both the country in question and its counter countries, as there is no single solution or indicator. Certainly, we must keep vigilant, flexible, and united in a new world with COVID-19.

#### Declaration of Competing Interest

None.

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