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Short Communication

Applications of Google Search Trends for risk communication in infectious disease management: A case study of the COVID-19 outbreak in Taiwan

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ABSTRACT

Objective: An emerging outbreak of a novel coronavirus, COVID-19, has now been detected in at least 211 countries worldwide. Given this pandemic situation, robust risk communication is urgently needed, particularly in affected countries. Therefore, this study explored the potential use of Google Trends (GT) to monitor public restlessness toward COVID-19 infection in Taiwan.

Methods: We retrieved GT data for the specific locations and subregions in Taiwan nationwide using defined search terms related to the coronavirus, handwashing, and face masks.

Results: Searches related to COVID-19 and face masks in Taiwan rapidly increased following the announcements of Taiwan's first imported case and reached a peak as locally acquired cases were reported. However, searches for handwashing gradually increased during the period of face-mask shortage. Moreover, high to moderate correlations between Google relative search volumes (RSVs) and COVID-19 cases were found in Taipei (lag-3), New Taipei (lag-2), Taoyuan (lag-2), Tainan (lag-1), Taichung (lag0), and Kaohsiung (lag0).

Conclusion: In response to the ongoing outbreak, our results demonstrated that GT could potentially define the proper timing and location for practicing appropriate risk communication strategies for affected populations.

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Introduction

As of April 6, 2020, the World Health Organization (WHO) reported there were 1,210,956 laboratory-confirmed cases of COVID-19 (World Health Organization, 2020). The infection was declared a public health emergency of international concern (PHEIC) on January 30, 2020 (World Health Organization, 2020c) and the disease has spread to at least 211 different countries (World Health Organization, 2020). Given this pandemic situation, robust risk communication is urgently needed particularly in affected countries. Therefore, this study explored the potential use

of Google Trends (GT) for monitoring public restlessness toward COVID-19 infections in Taiwan.

Methods

Terms from GT related to coronavirus, handwashing, and face masks were collected from December 5, 2019 to February 8, 2020. These search terms represented searches for information on COVID-19 and the practice of personal hygiene in order to prevent disease transmission. Data on relative search volumes (RSVs) were filtered by geographic region in Taiwan. GT data were then compared with daily data on COVID-19 cases that were obtained from the Taiwan Centers for Disease Control's website. Moving averages with an interval of three days of GT queries and number of COVID-19 cases were plotted to observe trends along the period of observation. This moving average method was used to facilitate comparison of trends among datasets. Time-lag correlations were utilized to assess whether increases in GT data were correlated

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with the subsequent increase in COVID-19 cases, as previously applied in another study (Shin et al., 2016).

Results and discussion

COVID-19-related searches in Taiwan remained low in the period after the first case was detected on December 12, 2019 in Wuhan, China (CNN, 2020) and continuously increased after the announcements of Taiwan's first imported case on January 21, 2020 (Taiwan CDC, 2020). This same trend occurred worldwide and in China (Strzelecki, 2020). COVID-19-related searches in Taiwan continued to expand and reached a peak on January 30, 2020 as locally acquired cases were reported, and the WHO declared the disease as PHEIC. It took two weeks for COVID-19-related searches to reach a peak, and they continuously declined afterwards due to massive availability of information provided by online news reporting, video/radio news reporting, and health expert reporting (Keller et al., 2009) in the first week of February 2020, which was identified as the peak of the outbreak in the observation period.

In addition, face masks-related searches in Mandarin also increased as COVID-19-related searches increased. Public restlessness seemed to be driving immense purchases of face masks that led to shortages of face mask in Taiwan. This forced the Taiwanese government to loosen restrictions on surgical mask imports (Pan and Chiang, 2020). Due to massive panic buying of masks, the Taiwanese government announced on February 3 that face masks would be distributed through National Health

Insurance (NHI)-contracted pharmacies and drugstores beginning on February 6, 2020. This policy might have also corresponded with a decline in masks-related searches after point D in Figure 1 (Taiwan CDC, 2020).

Otherwise, searches for handwashing-related information were relatively stable at 20 points and quickly increased in the fourth week of January 2020. These searches gradually increased as COVID-19 and face masks-related searches were declining. This condition indicated that people were still gathering information about necessary handwashing practices for personal hygiene and protection while lacking face masks.

According to Figure 1, the dynamics of GT data in Taiwan were related to vulnerability due to confirmation of local transmission of COVID-19 and public restlessness given the announcement of the international warning by the WHO. Therefore, GT data can be used to frame the proper timing for communications of risks to the public. Additionally, Figure 2 shows huge numbers of COVID-19 searches in six cities including Taipei (100 points), New Taipei (73 points), Taoyuan (85 points), Taichung (80 points), Tainan (82 points), and Kaohsiung (87 points). "coronavirus 中文" was the term with the highest Spearman's rank correlation coefficient. This keyword represented a strong tendency of Taiwanese people to search for information in Mandarin for disease- and symptom-related information. Accordingly, GT data could also depict the information requested by users based on keyword utilization.

In the lag period, high to moderate correlations between Google RSVs and COVID-19 cases were found in Taipei (lag-3), New Taipei

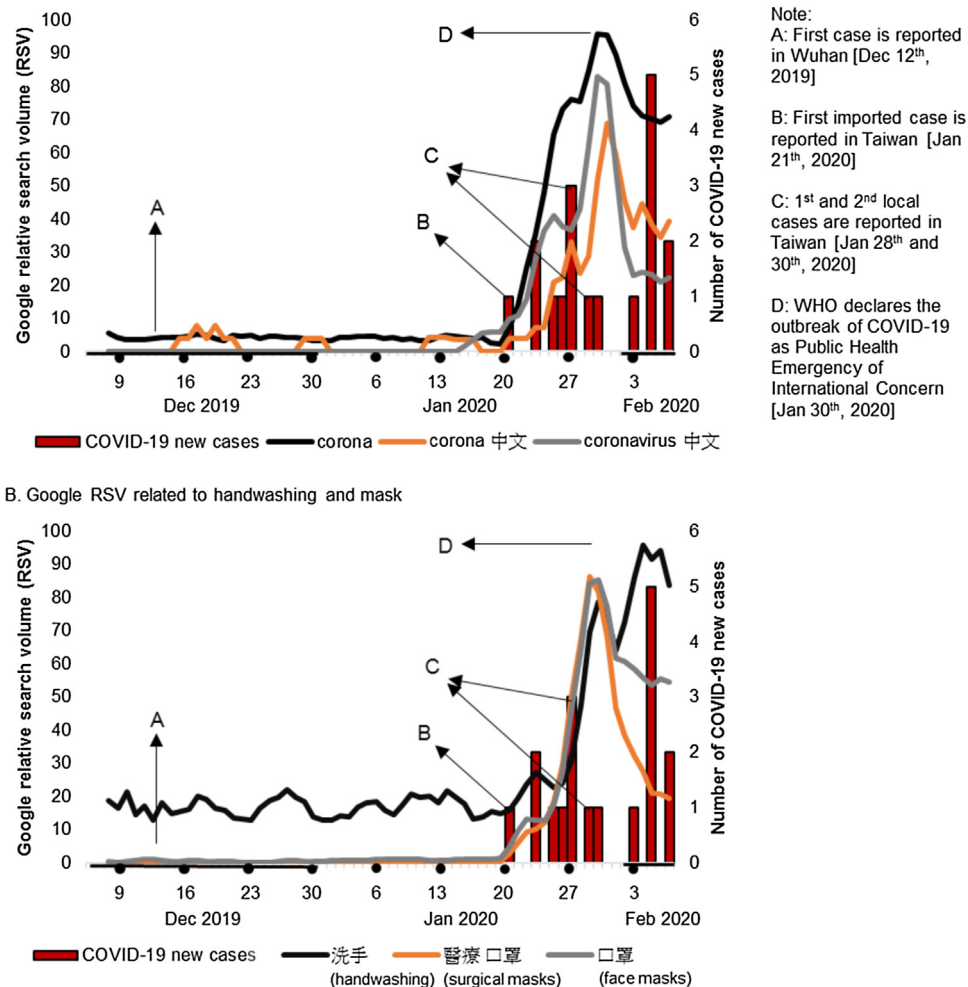


Figure 1. Time series of Google relative search volumes (RSVs) related to COVID-19 and COVID-19 cases in Taiwan.

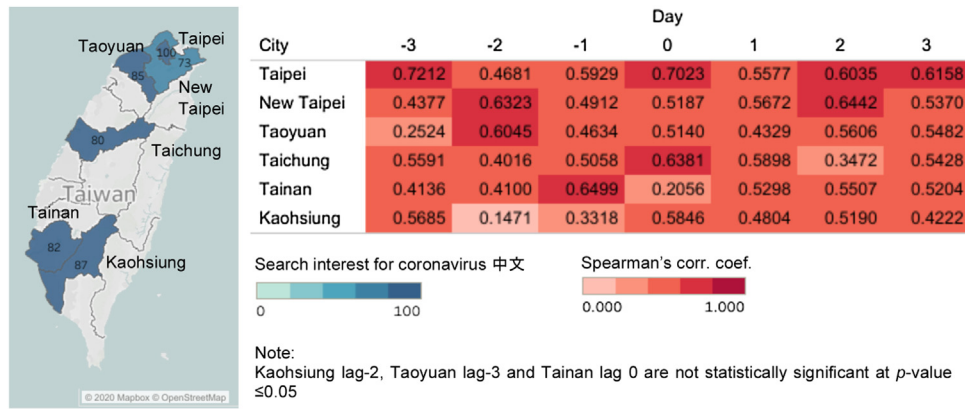


Figure 2. Time-lag correlations between Google relative search volumes (RSVs) related to COVID-19 and COVID-19 cases in Taiwan.

(lag-2), Taoyuan (lag-2), and Tainan (lag-1). These findings reflect increases in “googling” activities in one to three days before the increase in COVID-19 cases occurred. In Taichung and Kaohsiung, information searches increased the same day as the increase in cases occurred. Moreover, a distinct phenomenon was found in New Taipei City which indicated an increase in Google searches was still found two days after the increase in COVID-19 cases.

These findings indicate that GT can be used as a tool to monitor public restlessness toward COVID-19 infections in Taiwan at a range of one to three days before the number of confirmed cases increased. In addition, the Taiwan Network Information Center (TNIC, 2019) reported that Internet users in Taiwan have reached 82%, or 17.38 million people. Interestingly, the proportions of Internet users and mobile users were higher in Northern (86.1% and 81.5%) and Central Taiwan (82.2% and 77.1%) compared to Southern Taiwan (75.8% and 71%, respectively). The number of Internet users in specific location could determine the volume of Internet searches. Thus, the Northern part of Taiwan, which has a higher proportion of Internet users commonly had higher correlations, compared to Central and Southern cities.

Providing proper information during an outbreak through risk communication is urgently needed. Appropriate risk communication can help prevent “infodemics” (World Health Organization, 2020b) or an excessive amount of information circulating in affected populations which might induce public restlessness or panic. In response to the ongoing outbreak, our results demonstrated that GT can potentially define the proper timing and location of risk communications.

Conflict of interest

No competing interest declared.

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Ethical approval

No need for ethical approval as used of anonymous open data.

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