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Applications of Google Search Trends for Risk Communication in Infectious Disease Management: a Case Study of COVID-19 Outbreak in Taiwan

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Highlights

- Searches related to COVID-19 and face masks in Taiwan increased rapidly, following the announcements of Taiwan' first imported case and reached its peak as local cases were reported.
- Searches for handwashing were gradually increased in period of face masks shortage in Taiwan.
- Google Trends provides information on the most common knowledge needed by users and location of searches.
- In response to the ongoing outbreak, our results demonstrated that Google Trends could potentially define the proper timing and location for practicing appropriate risk communication strategies to the affected population.

Abstract

Objective: An emerging outbreak of COVID-19 has been detected in at least 26 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 epidemic infection in Taiwan.

Methods: We retrieved GT data for the specific locations of Taiwan nationwide and subregions using

defined search terms related to coronavirus, handwashing, and face masks.

Results: Searches related to COVID-19 and face masks in Taiwan increased rapidly, following the announcements of Taiwan' first imported case and reached its peak as local cases were reported. However, searches for handwashing were gradually increased in period of face masks shortage. Moreover, high to moderate correlations between Google relative search volume (RSV) 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 to the affected population.

Introduction

As of February 20th, 2020, the World Health Organization (WHO) reported there were 75,748 laboratory-confirmed cases of COVID-19 (World Health Organization, 2020a). The infection has become a public health emergency of international concern (PHEIC) since January 30th, 2020 (World Health Organization, 2020c) and has been spread in 27 different countries (World Health Organization, 2020a). 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 epidemic infection in Taiwan.

Methods

Coronavirus, handwashing, and face masks related terms from GT were collected from December 5th, 2019 to February 8th, 2020. These search terms represented the information search for COVID-19 and practice of personal hygiene in order to prevent disease transmission. Relative search volume (RSV) data were filtered by geographic regions in Taiwan. GT data then were compared with daily data on COVID-19 cases that were obtained from the Taiwan Centers for Disease Control' website. Moving average with interval of three days of GT queries and number of COVID-19 cases were put into chart to observe the trends along the period of observation. This moving average method used to facilitate the trends comparison among datasets. Time-lag correlation was utilized to assess whether

the raised of GT data were correlated with the following increased of COVID-19 cases, as previously applied in other study (Shin et al., 2016).

Results and discussion

COVID-19 related searches in Taiwan remained low in period of the first case was detected on December 12th, 2019 (CNN, 2020) and continuously increased with the announcements of Taiwan' first imported case on January 21st, 2020 (Taiwan CDC, 2020). The same trend as occurred in worldwide and China (Strzelecki, 2020). However, COVID-19 related searches in Taiwan continued to extend and reached its peak on January 30th, 2020 as local cases were reported and the declaration of WHO for PHEIC was issued globally. It took two weeks for COVID-19 related searches to reach its peak and continuously declined afterward since the massive availability of information provided in 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 peak of outbreak in observation period.

In addition, face masks related searches in Mandarin also increased as raised of COVID-19 related searches. Public restlessness seems to drive immense purchases of face masks that lead to face masks shortage in Taiwan that forced Taiwan government to loosen restrictions on surgical mask imports (Tzu-yu and Yi-ching, 2020). And due to massive panic buying of masks, Taiwan government has announced in February 3rd that face masks will be distributed through National Health Insurance (NHI) contracted pharmacies and drugstores started from February 6th 2020. This policy might also correspond with declined of masks-related searches after D point (Taiwan CDC, 2020)

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

According to Fig.1, the dynamics of GT data in Taiwan were related with the vulnerability due to the confirmation of local COVID-19 and public restlessness given the announcement of international warning from the WHO. Therefore, GT data could be used to frame the proper timing for risk communications to the public. Additionally, Fig.2 showed 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 language for disease and symptom-related information. Accordingly, GT data could also depict the information needed by users based on keyword utilization.

In lag period, high to moderate correlations between Google RSV and COVID-19 cases were found in Taipei (lag-3), New Taipei (lag-2), Taoyuan (lag-2), and Tainan (lag-1). This finding reflected the increased of googling activities in one until three days before the increased of COVID-19 cases. While in Taichung and Kaohsiung, information searches increased in same day as increased of cases. Moreover, a distinct phenomenon found in New Taipei which indicated the increased of Google searches still found in two days after increased of COVID-19 cases.

These findings indicated that GT can be used as a tool to monitor public restlessness toward COVID-19 epidemic infection in Taiwan at a range of 1 to 3 days before the increased of confirmed cases. In addition, the Taiwan Network Information Center (TNIC, 2019) reported that the Internet users in Taiwan have reached 82% or attained 17.38 million people. Interestingly, proportions of Internet and mobile users are higher in Northern (86.1%; 81.5%) and Central (82.2%; 77.1%) compared to the Southern part of Taiwan (75.8; 71). Number of internet users in specified location could determine the volume of internet search. Thus, Northern part of Taiwan which has higher proportion of Internet users are commonly has higher correlation, compared to Central and Southern cities.

Providing proper information during the outbreak through risk communication is urgently needed. Appropriate risk communication could 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 could potentially define the proper timing and location for risk communication.

Conflict of interest

No competing interest declared.

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A. Google RSV related to COVID-19
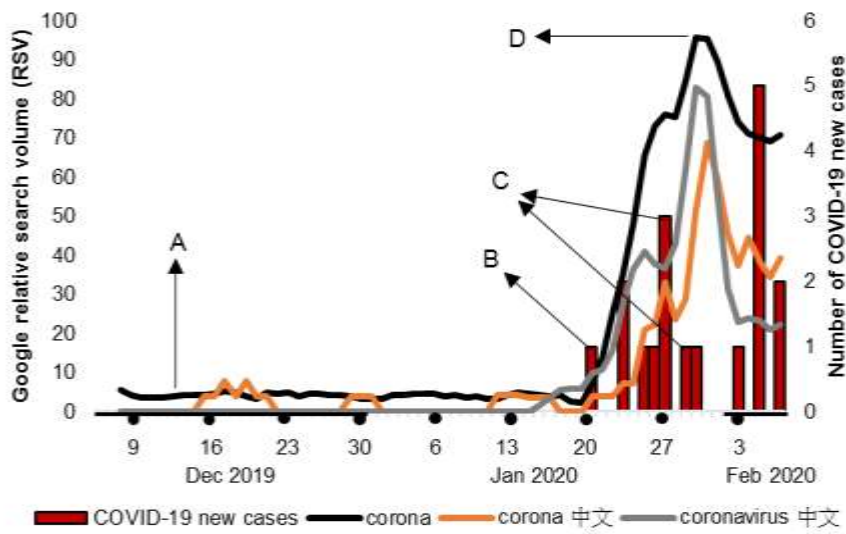
Note:
A: First case is reported in Wuhan [Dec 12th, 2019]

B: First imported case is reported in Taiwan [Jan 21th, 2020]

C: 1st and 2nd local cases are reported in Taiwan [Jan 28th and 30th, 2020]

D: WHO declares the outbreak of COVID-19 as Public Health Emergency of International Concern [Jan 30th, 2020]

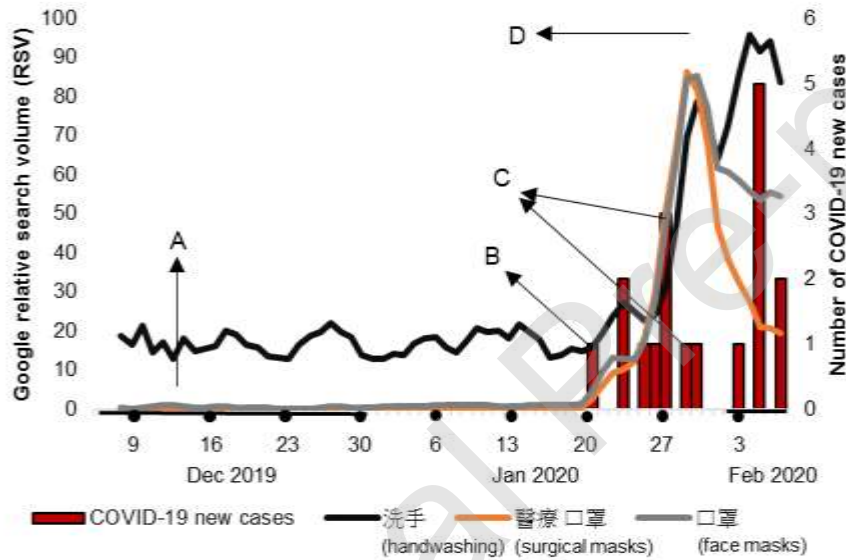B. Google RSV related to handwashing and mask

Fig.1 Time series of Google RSV related to COVID-19 and COVID-19 cases in Taiwan.

City	Day -3	-2	-1	0	1	2	3
Taipei	0.7212	0.4681	0.5929	0.7023	0.5577	0.6035	0.6158
New Taipei	0.4377	0.6323	0.4912	0.5187	0.5672	0.6442	0.5370
Taoyuan	0.2524	0.6045	0.4634	0.5140	0.4329	0.5606	0.5482
Taichung	0.5591	0.4016	0.5058	0.6381	0.5898	0.3472	0.5428
Tainan	0.4136	0.4100	0.6499	0.2056	0.5298	0.5507	0.5204
Kaohsiung	0.5685	0.1471	0.3318	0.5846	0.4804	0.5190	0.4222

Search interest for coronavirus 中文

0   100

Spearman's corr. coef.

0.000   1.000

Note:
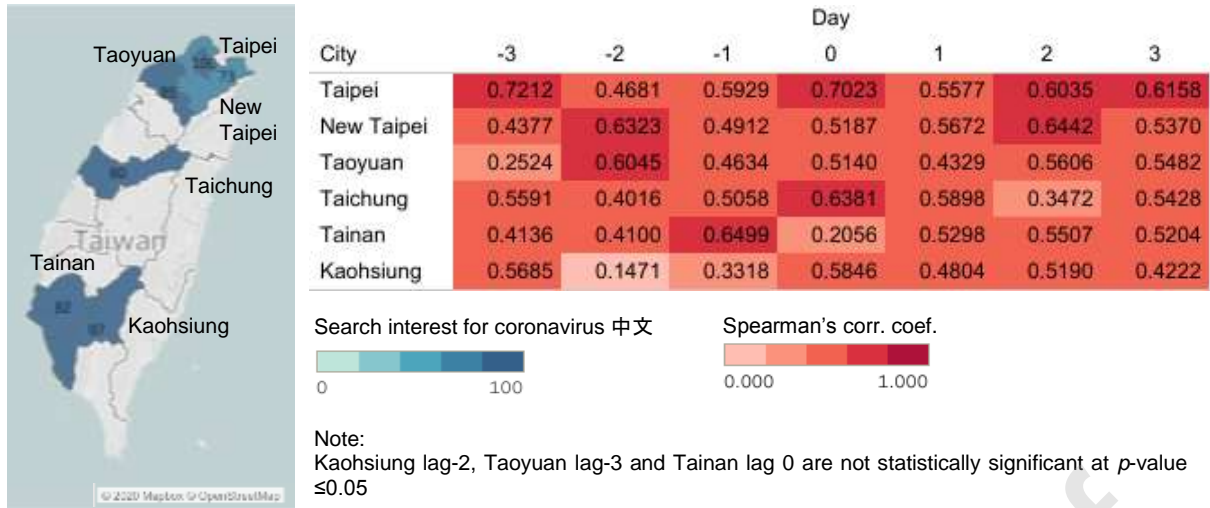Kaohsiung lag-2, Taoyuan lag-3 and Tainan lag 0 are not statistically significant at p-value ≤0.05

Fig.2 Time-lag correlations between Google RSV related to COVID-19 and COVID-19 cases in Taiwan.