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Journal Pre-proofs

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Google searches for the keywords of "wash hands" predict the speed of national spread of COVID-19 outbreak among 21 countries.

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Highlights

- The increased Google searches for “wash hands”, rather than “face mask”, reducing the speed of COVID-19 outbreak during the following three weeks among 21 countries.
- Google search for “wash hands” indicated not only the promotion of hand hygiene awareness but might also reflect the extent that people proactively engaged in hand washing.
- Google searches for “wash hands” provide real-time indicators for transmission-reduction policies and population health literacy in the early stage of the COVID-19 outbreak.

Abstract

This study hypothesized that national population health literacy might reflect on their keywords searching. We applied Google searches for “wash hands” and “face mask” during January 19 to February 18 as a surrogate of national population health literacy among 21 countries, and examine whether google searches for “wash hands” and “face masks” would protect from increased numbers of confirmed cases of among 21 countries We found the increased google searches for “wash hands” from January 19 to February 18, 2020, correlated with a lower spreading speed of COVID-19 from February 19 to March 10, 2020 among 21 countries (Pearson's correlation coefficient of -0.70, $P < 0.001$). The result highlights the importance of public awareness of hand washing in preventing COVID-19 disease spreading.

Background

On 20 January, Chinese health authorities announced the human-to-human transmission of the coronavirus disease 2019 (COVID-19). The number of cases of COVID-19 outside China started to rapidly increase on February 20, with Italy, South Korea and Iran reporting new infections, and the rapid spread in European countries in March (1). As COVID-19 spreads around the world, the general population seek information on methods of protecting themselves. This concern and health literacy could be reflected in Google searches. Google searches for flu symptoms have been found as good indicators of influenza outbreaks, and have been applied to estimate national and regional influenza incidence (2). Google search trends were also used to predict the national COVID-19 outbreak in China (3), Iran (4) and Taiwan (5). In addition to infectious diseases, Google searches have been used to reflect population mental status and behaviors such as major depression (6) and suicide (7). This study hypothesized that the search behaviors on health literacy might reflect the spreading speed among different countries. More specifically, we aimed to examine whether google searches for “wash hands” and “face masks” would protect from increased numbers of confirmed cases of COVID-19 among 21 countries.

Methods

We applied Google searches for “wash hands” and “face mask” during January 19 to February 18 as a surrogate of national population health literacy and health policy among 21 countries with differing rates of increase in COVID-19 after February 19, 2020 (no countries other than China had accumulated more than 100 cases of COVID-19 prior to February 19, 2020). We used Google Trends (8) to target two keywords “wash hands” and “face mask” among the 21 countries with differing rates of COVID-19 spread during February 19 to March 10. We confirmed the translation of these two keywords by using both the translation from Chinese and English, with back-translation on Google Translate (https://translate.google.com/), and to examine whether these keyword searches had the most increase in the latest 30 days on Google Trends (Supplement Table S1).

A “Google trend” number represents the search interest relative to the highest point for the selected region and time. A value of 100 is the peak popularity of the term, whilst a value of 50 means that the term is half as popular. Considering both the intensity and duration of the increased population interest, we defined the indicator as the number of days during January 19 to February 18 with a “Google Trend” value of at least 25 from baseline (Figure 1), which we have defined as search interest from December 19, 2019 to January 18, 2020 (A period prior to any widespread knowledge of the disease worldwide). We examined the temporal correlation between the indicator and the

increased case numbers of COVID-19 among 21 countries from February 19 to March 10, 2020.

Results

The number of days with an increased value of at least 25 from baseline search for "wash hands" from January 19 to February 18, 2020, was temporally negatively associated to the logarithmic increased cases from February 19 to March 10, 2020 with the Pearson's correlation coefficient (r) of -0.70, $P < 0.001$ (Figure 2). In addition, the number of days of a value of at least 15 to 50 value in increased search for "wash hands" were all significantly negatively correlated to the increased case numbers of COVID-19 ($r= -0.46$, $P=0.038$ to -0.70, $P<0.001$). The findings show that increased google searches for "wash hands" (defined either as increased at least 25 from baseline search value or at least 15 to 50 baseline search value, Supplement Table S2) from January 19 to February 18, 2020, correlated with a lower spreading speed of COVID-19 from February 19 to March 10, 2020. Whereas, increased search interest in "face mask" had no significant correlation with changes in COVID-19 cases ($r = -0.22$ to -0.43, $P > 0.05$, Table S2).

Discussion

Google searches for "face mask" reached an all-time high since February 2020. Another keyword "wash hands", which is more important and relevant to COVID-19 spread,

also increased but not in the magnitude of increase of the search for “face mask”. Google search for “wash hands” indicated not only the promotion of hand hygiene awareness but might also reflect the extent that people proactively engaged in hand washing. The related queries for “wash hands” on Google Trends among the 21 countries included hand sanitizer brands, hand washing steps, and information regarding COVID-19. The increased internet search queries indicated the more people proactively engaged in hand hygiene, which may have had an effect on reducing the speed of COVID-19 outbreak during the following three weeks. Since approximately 19% of the world population washes hands with soap after contact with excreta (9), and environmental contamination by patients with COVID-19 through respiratory droplets and fecal shedding (10) suggests the need for strict adherence to hand hygiene.

The significant increase in searches for “face mask” revealed general population’s anxieties towards COVID-19 and the possible short supply of face masks during periods of a COVID-19 pandemic, despite the evidence that face masks worn by healthy individuals are still controversial in infection prevention (11). Although current available research supports the possibility that severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) could be spreads via bioaerosols generated directly by patients’ exhalation, face masks seem to be ineffective in preventing the dissemination of SARS–CoV-2 from the coughs of patients with COVID-19 to the environment (13).

These findings were consistent with our results that hand hygiene is a more effective strategy than wearing a face mask. In addition, the Google searches for "face mask" and "wash hands" would correspond to different implications. The increased search for "face mask" might indicate the increased numbers of people wearing face masks, but also might result from the short supply of face masks in the corresponding country, which would indicate few people were wearing face masks. However, the increased google searches for "wash hands" would simply indicate people engaged more in hand hygiene. In summary, our findings support the experts' suggestion that even if wearing a face mask is indicated, it is still important to wash hands with soap and water for at least 20 seconds prior to putting on the face mask (14), and repeating hand hygiene after touching the outer surface of masks (13).

We expect that the increase of google searches for "wash hands" provide real-time indicators for transmission-reduction policies and population health literacy in the early stage of the COVID-19 outbreak. Moving forward it is noteworthy to examine whether the promotion of population's awareness of hand washing will still provide the greatest benefit to mitigate the pandemic.

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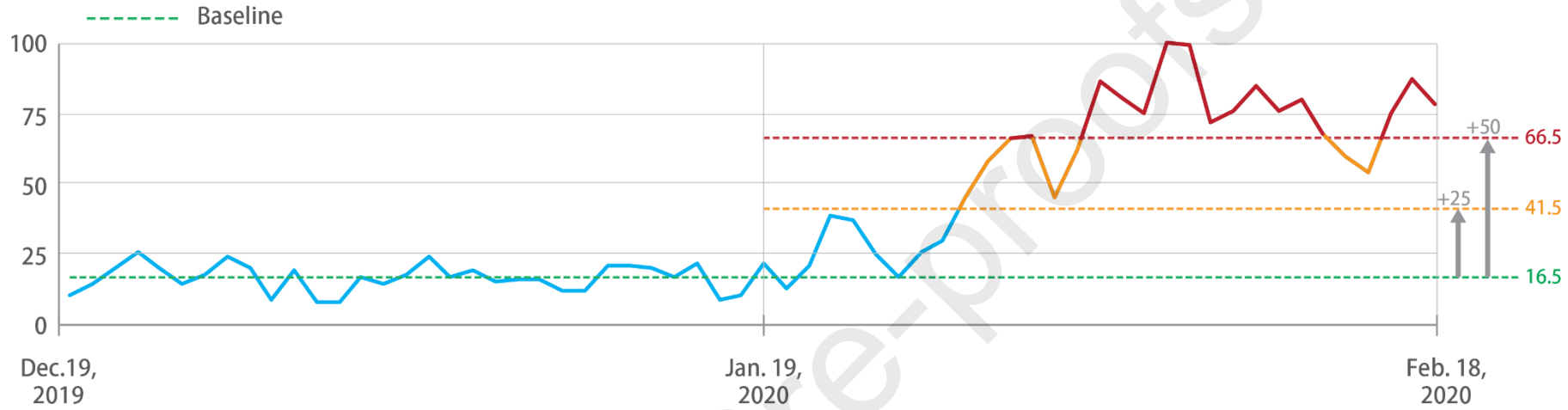


Figure 1. We defined the baseline as the average of Google Trend" value (16.5) from December 19, 2019 to January 18, 2020, based on this period prior to any widespread knowledge of the disease worldwide. We defined the indicator as the number of days during January 19 to February 18 with a "Google Trend" value of at least 25 (16.5+25=41.5) from baseline. The number of days was 22 with an increased value of at least 25. Similarly, the number of days was 15 with an increased value of at least 50 in Taiwan

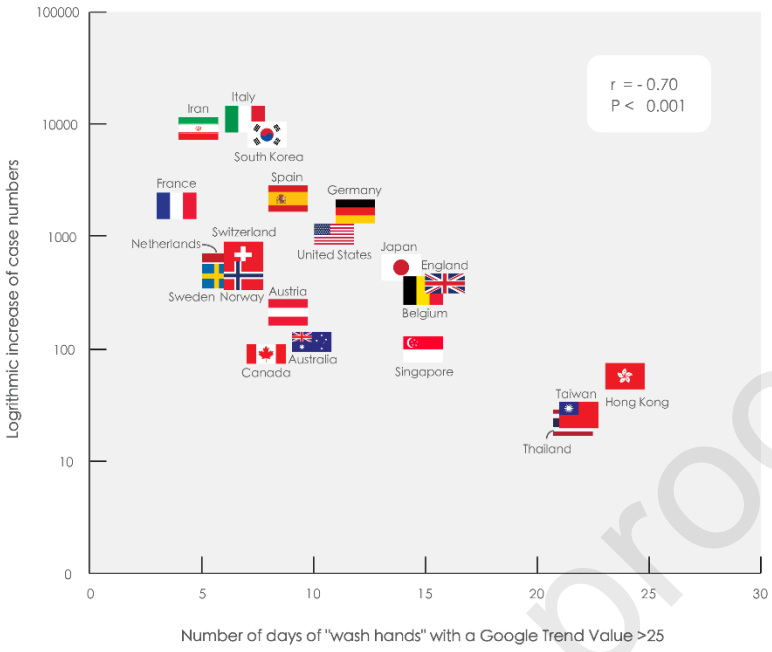


Figure 2. The number of days with a "Google Trend" value of > 25 for "wash hands" during January 19 to February 18 had a temporally negatively association to the logarithmic increased COVID-19 cases among 21 countries during February 18 to March 10.

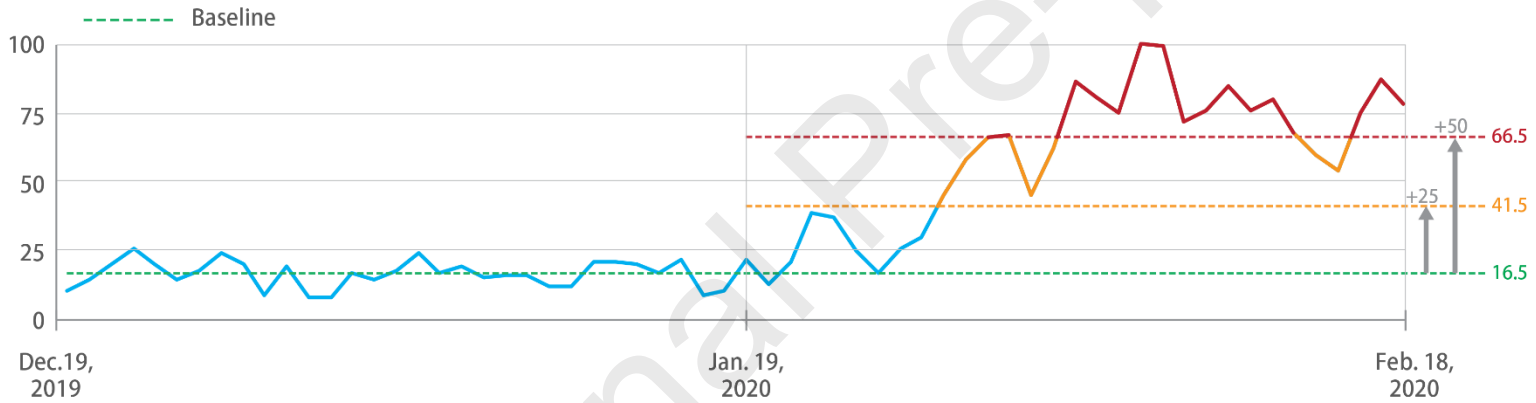
Supplement

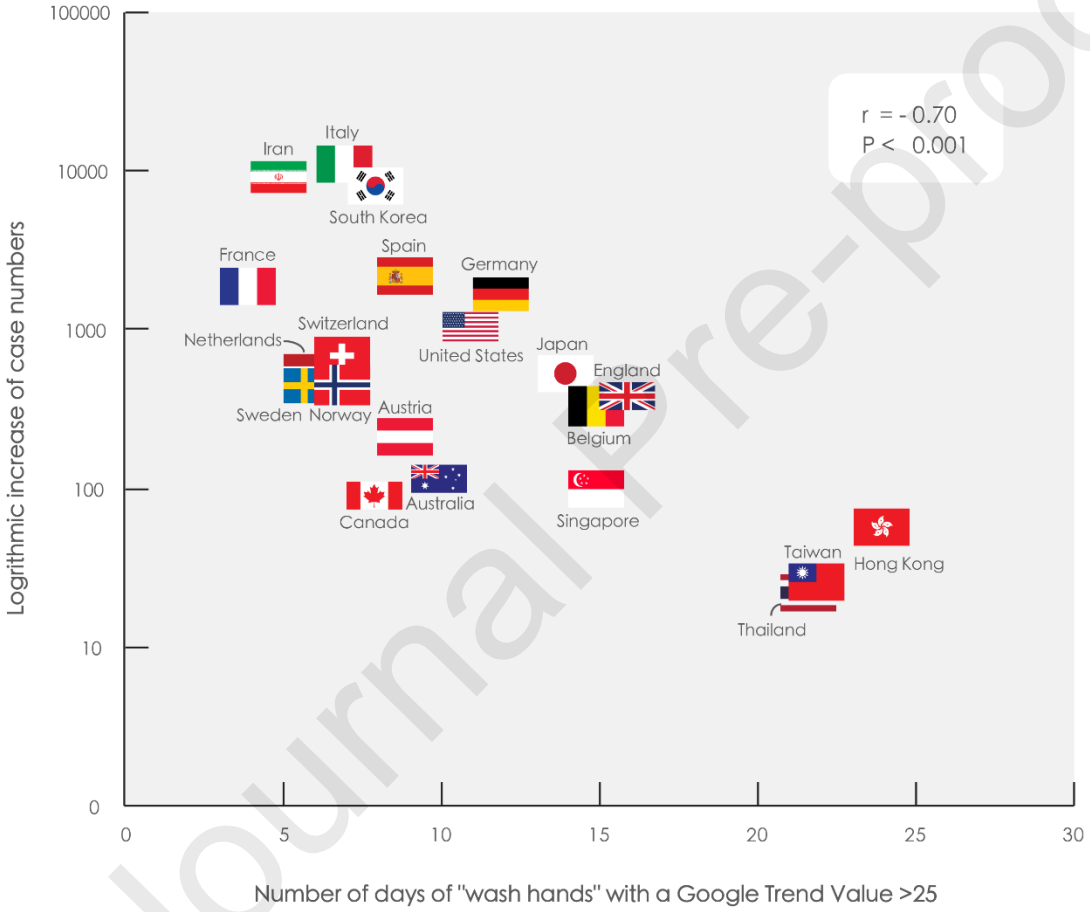
Table S1. The search keywords of “wash hands” and “face mask” among 21 countries.

	wash hands	face mask
Australia	wash hands	mask
Austria	Hände waschen	maske
Belgium	handen wassen	masque
Canada	wash hands	mask
France	laver les mains	masque
Germany	Hände waschen	maske
Hong Kong	洗手	口罩
Iran	دست شستن	ماسک
Italy	lavare le mani	maschera
Japan	手洗い	マスク
Netherland	handen wassen	masker
Norway	håndvask	maske
Singapore	wash hand	mask
South Korea	손씻기	마스크
Spain	lavarse las manos	mascaras
Sweden	tvätta händerna	ansiktsmask
Switzerland	hände waschen	mask
Taiwan	洗手	口罩
Thailand	ล้างมือ	หน้ากาก
United Kingdom	wash hands	mask
United State	wash hands	mask

Table S2. The correlations between the increased case numbers of COVID-19 and the Google searches for “wash hands” and “face mask” with an increased value of at least 15 to 50 from baseline.

Keywords									
Wash hands	Increased search value from baseline	+15	+20	+25	+30	+35	+40	+45	+50
	Pearson's correlation coefficient	-0.45	-0.65	-0.70	-0.62	-0.61	-0.60	-0.61	-0.62
	P value	0.038	0.001	<0.001	0.003	0.003	0.004	0.003	0.003
Face mask	Increased search value from baseline	+15	+20	+25	+30	+35	+40	+45	+50
	Pearson's correlation coefficient	-0.22	-0.22	-0.23	-0.18	-0.32	-0.35	-0.40	-0.43
	P value	0.329	0.339	0.323	0.430	0.159	0.123	0.073	0.051





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