Impact of the World Hand Hygiene and Global Handwashing Days on Public Awareness between 2016 and 2020: Google Trends Analysis

Yoshito Nishimura[1,2], Hideharu Hagiya[2*], Koichi Keitoku[1], Toshihiro Koyama[3], Fumio Otsuka[2]

[1]Department of Medicine, John A. Burns School of Medicine, University of Hawai'i, Honolulu, HI, 96813, USA

[2]Department of General Medicine, Okayama University Graduate School of Medicine, Dentistry and Pharmaceutical Sciences, Okayama, 7008558, Japan

[3]Department of Health Data Science, Graduate School of Medicine, Dentistry, and Pharmaceutical Sciences, Okayama University, Okayama, 7008530, Japan

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***Corresponding author:** Hideharu Hagiya, MD, PhD

Department of General Medicine, Okayama University Graduate School of Medicine, Dentistry and Pharmaceutical Sciences, Okayama, 7008558, Japan

E-mail: hagiya@okayama-u.ac.jp

Abstract

Background: Scientific evidence suggest that hand hygiene as one of the most effective measures to control infection. To promote good hand hygiene practices, the WHO introduced May 5 as World Hand Hygiene Day (WHHD), and international stakeholders established Global Handwashing Day (GHD) on October 15. However, its contributions to raising public awareness of hand hygiene is unclear.

Methods: This study evaluates the impact of the WHHD and GHD on the public awareness of hand hygiene in Japan, the United Kingdom, the United States, and worldwide from 2016 to 2020, using the relative search volume (RSV) of "Hand hygiene" in Google Trends as a surrogate. To identify a statistically significant timepoint of a trend change, we performed Joinpoint regression analysis.

Results: Upticks of the RSVs as well as joinpoints were noted worldwide around the WHHD and GHD from 2016 to 2019, but no joinpoints were identified around the WHHD and GHD in 2020. No such changes were observed in each country during these periods.

Conclusions: While the WHHD was originally established to raise awareness of hand hygiene in healthcare facilities, our result suggests that the WHHD and GHD may not have effectively disseminated the importance of hand hygiene to the general public at a country level. Additional policy measures to advocate hand hygiene to the public are necessary to communicate its benefits.

Introduction

Hand hygiene is a fundamental part of infection prevention and control since its first evidence by Hungarian physician Isaac Semmelweis in the 19th century. Thereafter, studies have shown that hand hygiene is the most effective measure to prevent healthcare-associated infections and reduce the dissemination of resistant pathogens[1-3]. However, hand hygiene compliance is reportedly not satisfactory, with mean compliance rates of even only 59.6% in clinical settings globally according to a recent systematic review.

In 2002, a practical guideline for hand hygiene was first established by the United States (US) Centers for Disease Control and Prevention to promote basic infection prevention skills in healthcare settings[5]. Then, in 2009, the World Health Organization (WHO) recognized hand hygiene as one of the top effective measures to decrease the spread of infection, recommending universal hand hygiene practice with the "Five Moments for Hand Hygiene." [6] To promote good hand hygiene practices of healthcare workers globally, the WHO also defined May 5 as World Hand Hygiene Day (WHHD) amid the global Clean Your Hands campaign [7]. Still, the hand hygiene practice has yet to be well standardized at bedsides. For instance, a multicenter prospective study revealed that the average adherence rates of hand hygiene in Japanese hospitals were 15.4% and 22.6% among physicians and nurses, respectively[8].

Other international organizations or initiatives have made significant efforts to raise awareness of hand hygiene. For example, the Global Handwashing Partnership, a coalition of international stakeholders including the United Nations Children's Fund and the World Bank, established Global Handwashing Day (GHD) on October 15 in 2008, to motivate general public and community to wash their hands and advocate for the importance of hand hygiene in daily practices[9]. Also, the Group of 20 Health Ministers [10-13] noted their commitment to implement and improve their policies to promote basic hygiene and reduce healthcare-associated infections in 2019. Amid the COVID-19 pandemic, the importance of hand hygiene and essential sanitization are highlighted more remarkably than ever before.

Despite the international efforts, it is unclear whether the WHHD and the GHD have effectively improved public awareness toward hand hygiene. Nowadays, internet searches are the primary source of health-related information. Thus, the extent of online health information-seeking behavior can be a surrogate of public attention[14]. Therefore, this study aims to evaluate if these promotional campaigns successfully contributed to improve public awareness for hand hygiene.

Methods

Data source

Google Trend (GT) is a data source generated from the total Google search data available to the public[15]. GT has been used in social and behavioral health research to observe the extent of public attention[16-26]. With GT, the relative popularity of specific search terms in a particular category (for instance, "health"), place, and time range, can be quantified, suggesting how popular the terms are at a certain time point. The relative popularity is defined as a relative search volume (RSV) with a scale of 0–100 (0 being the lowest popularity)[16, 20-22].

Search Input

Fig. 1 summarizes our search strategy using GT. We followed protocols used by previous studies[18, 20, 22]. We chose [Hand hygiene] and its Japanese counterpart [Shushi-eisei] as search inputs. The Japanese term is a noun recognized and used by the general public daily. The location of the search included "Japan", "United Kingdom", "United States", and "Worldwide". We used [Hand hygiene] for the searches designating UK, US, and Worldwide as a location, and [Shushi-eisei] for the search in Japan. Given a term "hand washing" might be a popular term for the public, we also performed the search using [Hand washing] in UK, US, and worldwide (**Supplementary Fig. 1**). Since the term [Shushi-eisei] is also considered a counterpart of [Hand washing], no additional search using other Japanese terms were

conducted. The RSVs of other relative search terms including [Hand rubbing] or [Hand sanitizing] were too low to perform a joinpoint analysis.

Search Variables

To specifically obtain the popularity of the search inputs, all searches were done with a "Search Term" option in a Health category (with a "Topic" option, search volumes of subtopics or relevant themes are included). We chose each full year from 2016 to 2020 as search scales to visualize weekly trends of the RSVs (each year contains 52 or 53 weeks; the WHHD occurred in the 18th week of 2016 to 2019, and the 19th week of 2020; the GHD occurred in the 41st week of 2016 and 2017, and the 42nd week of 2018 to 2020).

Statistical analyses

We utilized a joinpoint regression model with the Joinpoint Regression Program (version 4.9.0.0, March 2021, Statistical Research and Applications Branch, National Cancer Institute, USA)[27] to analyze a time trend in the RSV data. The software identified time points named joinpoints, where a temporal trend significantly changes. We set the analysis criteria to find up to three joinpoints. The weekly percent changes (WPCs) between trend-change points were determined with 95% confidence intervals (CI). The threshold for statistical significance was defined as a p-value < 0.05, which suggested the level at which the slope differed from

77 zero.

78

79 **Ethical approval**

80 We used the publicly available data published by GT (Google LLC, Mountain View CA,
81 USA). The study was approved by the institutional review board of Okayama University
82 Hospital with a waiver for informed consent since the study intended to retrospectively
83 analyze open data (No. 1910-009). All research methods were performed in accordance with
84 relevant guidelines and regulations.

85

86 **Data Availability Statement**

87 The datasets generated and analyzed during the current study are available from the
88 corresponding author on reasonable request.

89

90 **Results**

91 **Fig. 2–5** and **Table 1** describe graphical trends and trend changes of the weekly RSVs for a
92 search term, “Hand hygiene” in the UK, US, and worldwide, or its Japanese counterpart
93 “Shushi-eisei” in Japan, in each full year from 2016 to 2020. **Supplementary Fig. 2–4** show
94 the trends in the RSVs of “Hand washing” from 2016 to 2020.

95

Worldwide trends

Regarding the results for a search term, “Hand hygiene”, worldwide, there was the first joinpoint at the 18th week in 2016, 2018, and 2019 (week of the WHHD) (**Fig. 2**), where significant trend changes were noted in the search results (**Table 1**). In 2017, the first joinpoint was at the 21st week (three weeks after the WHHD), although there was a small uptick of the RSV at the 18th week. In 2020, the first joinpoint was identified at an earlier timepoint at the ninth week but not at the WHHD. In each year, there were relatively small joinpoints around the date of the GHD as well. Concerning the RSV of “Hand washing”, joinpoints around the time of the GHD were observed from 2017 to 2019. In 2020, a significant uptick of the RSV was noted at the 10th week; however, no joinpoints were found around the WHHD (**Supplementary Fig. 2**).

Trends in each country

In Japan, the RSVs of “Shushi-eisei”, a Japanese counterpart of “Hand hygiene” and “Hand washing”, remained nearly zero during the first half of the year during the study period (**Fig. 3**). Increases of RSVs were observed at several points during the WHHD and GHD; however, neither coherent rises nor joinpoints were observed. In the US, the RSV of “Hand hygiene” was seemingly maintained at a relatively high level during the same period (**Fig. 4**). Increases in the RSVs were observed, for example, during the WHHD in 2016 and 2017; however, no

115 statistically significant increases in RSVs were noted. There were three joinpoints at the 47th
116 and 50th week of 2018, and the ninth week of 2019; however, no joinpoints were observed
117 around the WHHD or GHD. Regarding the RSV of "Hand washing", a similar significant
118 uptick at the 10th week in 2020 was observed as worldwide, although no joinpoints around
119 the WHHD or GHD were found (**Supplementary Fig. 3**). In the UK, the extent of RSVs of
120 "Hand hygiene" was similar to those of the US during this period (**Fig. 5**). Non-statistically
121 significant increases of RSVs were noted around the WHHD in 2016, 2017, and 2018.
122 Around the GHD, short-term elevations of RSVs were observed each year; however, no
123 joinpoints were identified during the period. Similarly, no joinpoints were identified with a
124 search term of "Hand washing" from 2016 to 2020 (**Supplementary Fig. 4**).
125
126 **Discussion**
127 This study evaluated how the global campaigns for promoting hand hygiene, such as the
128 WHHD and GHD, affected public awareness using the RSVs of GT data as a surrogate. The
129 present results showed that there were significant trend changes in the search volume of hand
130 hygiene alongside the WHHD and GHD worldwide. However, the promotion campaigns did
131 not significantly impact the general public's interest at a country level in Japan, the UK, and
132 the US (**Fig. 2-5**). These findings suggest that these global campaigns may not have
133 effectively contributed to improving the public awareness of hand hygiene in the countries of

interest. Given the results of the present study, international organizations may need to focus not only on raising awareness of hand hygiene in healthcare facilities, but also on public and communities.

Due to the COVID-19 pandemic, the importance of hand hygiene has been highlighted more than ever before. To fight against the pandemic from the perspective of infection prevention and control, the WHO and United Nations Children's Fund launched Hand Hygiene for All Initiative[28]. However, compliance with hand hygiene in hospitals and the general public may not have significantly changed before and after the pandemic. Although a study including surveillance data of nine US hospitals showed that hand hygiene performance significantly increased in the US at the beginning of the pandemic around March 2020, hand hygiene compliance rapidly declined in the next two months[29]. Another study from France noted that healthcare workers' hand hygiene compliance rate decreased over time, with its peak at the first wave of the COVID-19 pandemic[30]. Also, a Japanese internet-based survey that examined the frequency of hand hygiene in the general public showed that only 21.1% of the participants implemented hand hygiene at appropriate moments amid the COVID-19 pandemic[31]. The results suggest that the Japanese public might have lower hand hygiene awareness at the baseline, which might be related to the lower RSVs of hand hygiene than

other countries. Thus, while COVID-19 may have served to raise awareness of hand hygiene[32, 33], it might have provided only a short-term improvement in its compliance.

Similarly, as we showed with our analysis, the impact of WHHD and GHD or related campaigns to raise public awareness may not be a long-lasting solution. Additional interventions may be considered to motivate hand hygiene behaviors. These might include increasing visibility and accessibility of hand sanitizing materials in the public settings[34], and risk communication of non-adherence to hand hygiene, such as dissemination of resistant pathogens or spread of viral infections, to the general public using online tools or smartphone applications. Also, given the popularity of social media, health awareness campaigns using these channels may reach a broad audience[35] and convey the critical importance of hand hygiene to the general public. The Centers for Disease Control and Prevention defines 10 crucial moments of hand hygiene to the general public, including before and after eating food, treating a cut or wound, or after blowing nose, coughing or sneezing[36]. As such, policymakers would need to ensure a sufficient budget to promote these basic health promotional activities.

The study's strength includes that this is the first study to show the public awareness of hand hygiene in multiple countries, including Japan, the UK, the US, and worldwide using the GT

database. Using the open data, we could quantify the current trends of general awareness in hand hygiene. However, several limitations need to be addressed. First, due to the nature of GT, the present results only included results from those who had internet access and sought health-related information via Google search. Given high internet penetration rates and the market share of Google search being approximately 75 %, 86%, and 83% in Japan, the UK, and the US, respectively[37], GT is considered a good surrogate of public awareness. Second, GT lacks full transparency and reproducibility, as suggested previously[38], because non-public mathematical assumptions define RSVs. We documented our search strategy in detail to address the limitation. Despite these limitations, our approach is interestingly novel to grasp the comprehensive picture of the public awareness of hand hygiene.

In conclusion, our study suggested that the WHHD and GHD may not have effectively disseminated the importance of hand hygiene to the general public at a country level. In contrast, they had a transient impact on increasing public awareness worldwide. Universal hand hygiene is the most critical part to prevent diverse microorganisms from spreading in communities. Furthermore, amid the COVID-19 pandemic, the importance of hand hygiene has been more crucial than ever before. Therefore, additional policy measures to advocate hand hygiene to the public are necessary to spread these good habits.

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None.

Author Contributions

YN wrote the manuscript and analyzed the data. HH proposed the study concept, designed the study, and analyzed the data. KK wrote the manuscript. TK analyzed the data and revised the manuscript critically. FO supervised the research.

Conflicts of interest

The authors declare no conflicts of interest in association with the present study.

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Figure legends

Figure 1. Google Trends search strategy

Figure 2. Trends in relative search volume of "Hand hygiene" worldwide, 2016–2020

Weekly relative search volumes (RSVs) for a search term "Hand hygiene" were described. The World Hand Hygiene Day (WHHD) occurred in the 18th week of 2016 to 2019, and the 19th week of 2020; the Global Handwashing Day (GHD) happened in the 41st week of 2016 and 2017, and the 42nd week of 2018 to 2020. Periods around the WHHD (the 15th to the 20th week) and the GHD (the 40th to the 45th week) were highlighted with an orange or blue bar. The number of slopes is determined by the number of joinpoints identified by the analysis. Joinpoints are the time points when statistically significant changes in the linear slopes are noted.

Figure 3. Trends in the relative search volume of "Hand hygiene" in Japan, 2016–2020

Weekly RSVs for the search term "Shushi-eisei," a Japanese counterpart of "Hand hygiene," were described. No joinpoints were identified around the time of the WHHD or the GHD during the study period with the search terms.

Figure 4. Trends in the relative search volume of "Hand hygiene" in the United States, 2016–2020

Weekly RSVs for the search term "Hand hygiene" were described. No joinpoints were

342 identified around the time of the WHHD or the GHD for the search terms during the study
343 period.
344
345 **Figure 5. Trends in the relative search volume of "Hand hygiene" in the United**
346 **Kingdom, 2016–2020**
347 Weekly RSVs for the search term "Hand hygiene" were described. No joinpoints were
348 identified around the time of the WHHD or the GHD for the search terms during the study
349 period.
350
351 **Supplementary Figure 1. Google Trends search strategy for a search term "Hand**
352 **washing"**
353
354 **Supplementary Figure 2. Trends in relative search volume of "Hand washing"**
355 **worldwide, 2016–2020**
356 Weekly RSVs for a search term "Hand washing" were described. In 2017 to 2019, joinpoints
357 were identified around the time of the GHD. In 2020, a significant uptick in the RSV was
358 noted at the 10^{th} week. No joinpoints were found around the time of the WHHD throughout
359 the period.
360

Supplementary Figure 3. Trends in the relative search volume of "Hand washing" in the United States, 2016–2020

Weekly RSVs for the search term "Hand washing" were described. No joinpoints were identified around the time of the WHHD or the GHD for the search terms during the study period.

Supplementary Figure 4. Trends in the relative search volume of "Hand washing" in the United Kingdom, 2016–2020

Weekly RSVs for the search term "Hand washing" were described. No joinpoints were identified around the time of the WHHD or the GHD for the search terms during the study period.