K-Pop Fandoms drive COVID-19 Public Health Messaging on Social Media

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This paper examines an unexpected but significant source of positive public health messaging during the COVID-19 pandemic—K-pop fandoms. Leveraging more than 7 million tweets related to mask wearing and K-pop between March 2020 and March 2021 culled from the large public COVID-19 Twitter dataset, we analyzed the online spread and distribution of the hashtag #WearAMask amid heated anti-mask sentiments and public health misinformation. Analyses reveal the South Korean boyband BTS as the most significant driver of health discourse. Tweets from health agencies and prominent figures that mentioned K-pop generate 111 times more of online response compared to tweets that did not. These tweets also elicited a strong responses from South America, Southeast Asia, and rural States–areas often neglected in Twitter-based messaging by mainstream social media campaigns. Our results suggest that public health institutions may leverage pre-existing audience markets to synergistically diffuse and target under-served communities both domestically and globally, especially during health crises such as COVID-19.

Introduction

On August 21, 2020, the president of the WHO Dr. Tedros Adhanon tweeted an unprecendented message when it concerned public health communication. "Thank you," he wrote, "#BTS for the uplifting #BTS_Dynamite and for reminding the #BTSARMY and the rest of us to #WearA-Mask and take care of our health and well-being during this #COVID19 pandemic." The world's most popular boyband had just released their newest single "Dynamite", and in their announcement, directly supported mask-wearing as a public health practice. Our data shows that within a week, Dr. Tedros' tweet grew to become the most shared tweet related to public health practices. The tweet has since received 91.2k likes and 36.9k reweets [1].

In times of public health crises, such as the COVID-19 pandemic, effective messaging of public health practices is essential to combating diseases. Typically, institutional leaders are responsible for ensuring best practices are being communicated. However, the spread of these practices has faced major challenges from misinformation (*1*). In the case of mask wearing, anti-maskers emerged in the early stages of the COVID-19 pandemic has reportedly prevented effective adoption of mask wearing in the US (*2*). Evidence shows that countries that adopted the practice earlier generated much better prevention outcomes (*3, 4*).

Alarmingly, misinformation in many ways disproportionally impacting the Global South. Even before COVID-19, reports had documented how misinformation causes more harm in aggregation, such as misinformation on WhatsApp leading to mob killings in India (*5*). Another case-in-point, Brazil's public health had been severely impacted by its president supporting claims of hydrochloroquine as a miracle cure if vaporized. At this time, Brazil is amongst the highest countries in false claims (third to the USA and India), and growing more precarious as their strands of misinformation were decoupled from other countries (*6*). From the individual level, misinformation can be stymied by increased deliberation (*7*), reliance on reason

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[1]https://twitter.com/drtedros/status/1296926289648025601

over emotion (*8*), and simply thinking about accuracy before resharing (*9*). But mechanistically and practically, external factors such as the timing of the information and trustworthiness of the source can impact ones belief in misinformation (*10*). Information from third-parties have been found to generate more trust in how Americans received COVID-19-related information. Latkin and associates' study (*11*) showed that COVID-related data from a university (John Hopkins) received slightly more trust than from state health departments and the CDC, possibly due to the CDC being discredited and politicized by the then President Trump. In other words, the importance of third-parties with no political impetus or alignment but with highly mobilized networks and large online traction like K-pop fandom could be the key for effective and trustworthy dissemination of health information.

In parallel, K-pop fandom has been increasingly exerting their powerful influence on social causes internationally. Through their strategic support for artists and enthusiastic online presence, K-pop fans have attracted significant attention from the press recently for their political activism and coordinated collective action, such as their attempt to tank former President Trump's 2020 rally in Oklahoma (*12*), and their 2020 successful raising of over one million USD to support Black Lives Matter through the virtual #MatchAMillion campaign (*13*).

This report studies the effectiveness of mobilizing K-pop fanbase to promote positive health practices on a global scale. Utilizing the largest public Twitter database on COVID-19, we found that the most important player in public health messaging, as related to the most popular health-related hashtag #WearAMask, was the Korean boyband BTS. We show how Twitter-based messaging tends to target populations that are previously harder to reach–such as Indonesia, the Phillippines, Brazil, Mexico, and Peru, as well as more conservative States within the US whose policies had previously neglected mask-wearing. We show that the synergy of public health officials and international idols can be an effective way to not just disseminate critical health messages on a large scale, but also to the most vulnerable populations.

Results

A year in review
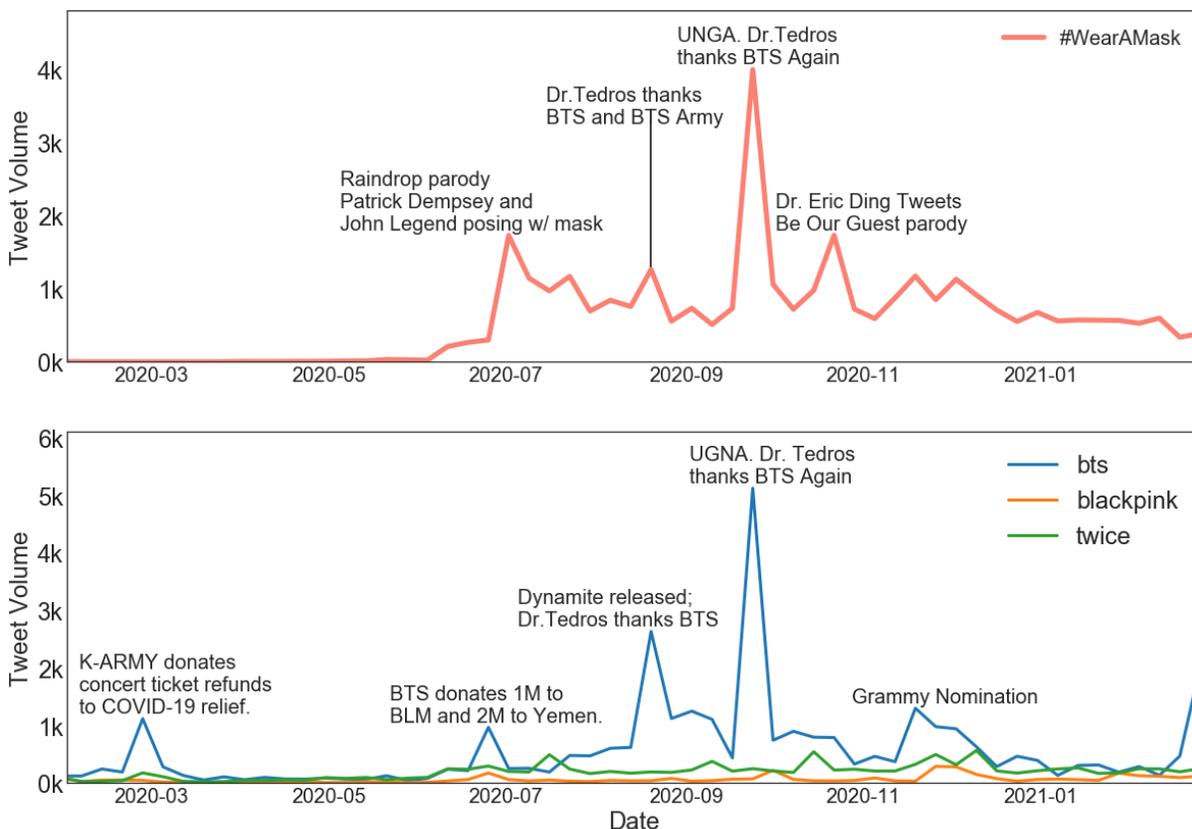
Figure 1: The time series of key terms between March 2020 and March 2021. Figure 1a) shows the evolution of the hashtag #wearamask, annotated with the key events during the evolution. Figure 1b) shows the time series of top K-Pop groups, annotated with the key events for BTS.

Fig. 1a) shows the time-series of #WearAMask and the top events associated with it. Four events and their time periods stand out. First, near early July, US comedian Randy Rainbow released a parody of the song Raindrom, that both promoted mask wearing. Importantly, this is the key event, in conjunction with other celebrities such as Grey's Anatomy Star Patrick Dempsey and Grammy Award winning singer John Legend that propelled the term into more widespread use. These first two events suggest the importance of celebrities on driving public

dissemination.

The third event is the aforementioned tweeting of Dynamite by Dr. Tedros, during mid-August. It is the fourth most significant event related to mask wearing, and shortly afterward, BTS spoke at the United Nations General Assembly and became the most significant event related to mask wearing. This suggests the combination of health officials can leverage the entertainment industry. Similarly, the fourth most significant event (second by volume) was when Dr. Eric Ding retweeted comedy show *Saturday Night Live*'s parody of a disney song to promote mask wearing. By then, Ding had already attracted a large following regarding COVID-19, due to his accurate commentary and predictions about the pandemic. We investigate the synergy further in the next section.

Fig. 1b) further shows how BTS performs against other popular K-Pop fandoms on Twitter. BTS has 35.1 million users, BlackPink 6.6 million, and Twice 7.8 million. Statistically speak, based on each group's followers, we would expect a distribution of 71%, 13% and 16% when normalized on these three groups. However, we observe BTS occupying 92% of COVID-19 related discourse. Other ways for which BTS and their fans impacted COVID-19 was by donating to COVID-19 relief in early March, and matched donations of fans to the Black Lives Matter protests in May 2020 and the Yemen Crisis in collaboration with UNICEF.

It's important to note that BTS's official account never made an explicit tweet about mask wearing. Rather, these tweets were driven solely by Dr. Tedro's inclusion of a BTS's speeches and the subsequent reaction from their fans. Especially with the inclusion of online donations, the grassroot nature of the movement suggests that beyond messaging users of the fandom were actively taking action.

	Dr. Tedros' Tweets (A)	
	K-Pop (B)	No K-Pop (¬B)
Total RT Volume	234,601	282,650
Unique Tweets	16	2,144
Retweet per post	14,662.5625	131.8330224
Syn(A+B)	**111.2207111**	

Table 1: Synergy Calculation of Tweets that include references to K-Pop, primarily BTS

Quantifying Synergy

In the time-series, a commonality between the topshared social media events is the combination of health institutions and entertainment industry. Whether it is Dr. Tedros thanking BTS or Dr. Eric Ding retweeting Saturday Night Live, the combination of established entertainmenters and public health officials generate synergistic virality. This motivates the quantification of synergy and impact entertainment groups may have. To assess the direct impact BTS had on public health messaging, we consider a group of 70 health agencies and officials based in the United States (included in the Appendix). We use the United States mainly as the country includes the largest amount of Twitter users in the aggregate data set, and would be at the minimum representative of the impact on a single country. **Tab. 1)** then shows the comparison between the retweet volume of tweets that include BTS and those that do not. Here we use the notation $Syn(A + B)$ to denote the synergy of A referencing B in a tweet, formally:

$$Syn(A + B) = \frac{RT(A \cup B)}{RT(A \cup \neg B)} \cdot \frac{T(A \cup \neg B)}{T(A \cup B)}$$

where RT specifies the number of retweets and T the number of unique tweets from A. This captures the ratio between the average retweets per tweet, conditional on including K-Pop or not.

The first column shows that a total of 16 tweets containing BTS is responsible for 234,601 retweets. Note, since our data stream captures only 1% of all tweets, the expected number of retweets will be closer to 23 million. On the other hand, there were 2,144 tweets during this

one-year period that did not feature BTS, which amounted to 282,650 retweets. We then take the ratio of retweets per post, between those that contain K-Pop and those that don't, which yields an increased virality factor of 111.22. While certainly this is contingent on specific events— such as the release of an album— there is sufficient evidence here that demonstrates the use of entertainment platforms can boost public awareness of health practices.

Asymmetric Diffusion
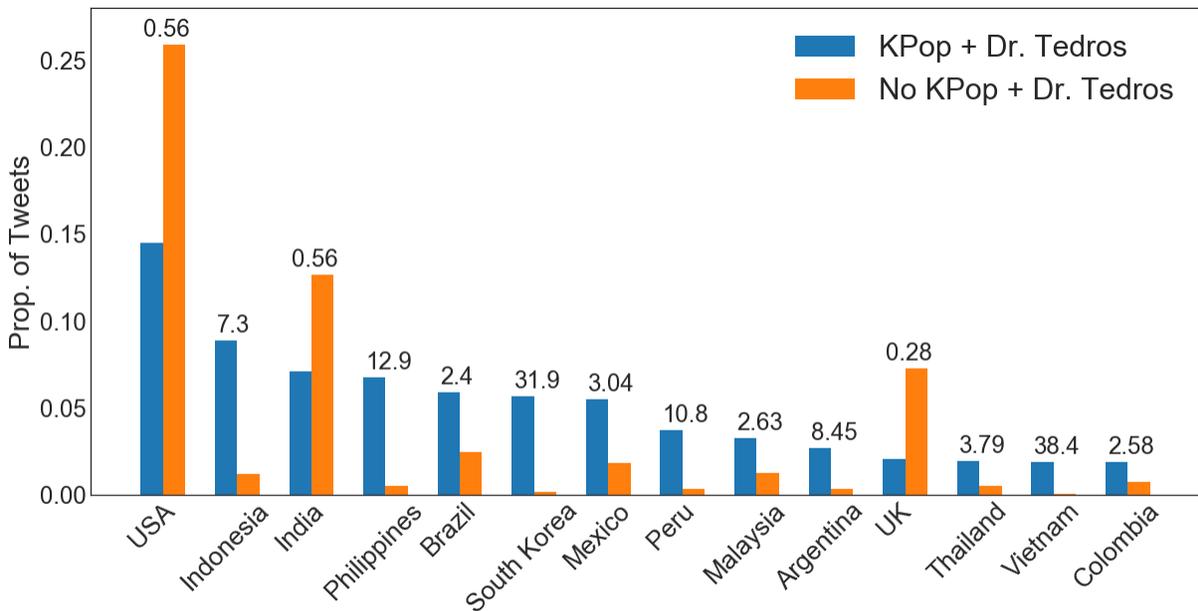
Figure 2: Figure 2 shows the normalized population size of 14 countries (the union of the top 10 for both categories).

We have shown BTS has increased the virality dramatically; next, we investigate if there is any localization of BTS tweets. Fig. 2 shows the normalized population of 14 countries that received Dr. Tedros' tweets. The 14 countries are the union of the top 10 countries that include K-Pop and don't incldue K-Pop.

While the USA is the top country for both categories, the proportion for the USA is much lower for tweets containing BTS (0.25 without K-Pop and 0.145 with K-Pop). Let the ratio

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here be defined as the percentage with K-Pop over the percentage without K-Pop. We see similar changes in ratio for the UK and India. On the other hand, we see dramatic increases in Southeast Asian countries like Indonesia, the Phillipines, Thailand, and Vietnam, and Central and Southern American countries such as Brazil, Mexico, Peru, Argentina, and Colombia.

a) Top States by Diffusion Advantage			b) Top States by ΔADV	
State	ADV_P	ADV_T	State	$ADV_T - ADV_P$
DC	9.436	-0.074	SD	0.519
NY	1.058	0.323	ND	0.410
HI	0.732	0.664	MS	0.392
CA	0.634	0.242	MO	0.388
ME	0.306	0.219	UT	0.374
OR	0.290	-0.091	LA	0.369
IL	0.267	0.234	WI	0.361
TX	0.209	0.086	NE	0.329

Table 2: Percentage advantage of K-Pop-containing tweets. Table 2a) shows the top 8 states by the population advantage and the associated Twitter dataset advantage. Table 2b) shows the top 8 States by advantage conferred controlling for the underlying platforom (Twitter).

Table 2 further shows at the State level within the United States, by measuring the proportion of response relative to a) the population of the United States and b) the population of the dataset itself. This allows us to separate the influence of the platform from the influence of the content, though it should be noted that demographics specific to the platform can also be a source of targeted messaging. Explicitly, using California as an example, we consider the representational advantage at the state-level.

$$ADV_{twt} = \frac{\%Pop(CA, BTS) - \%Pop(CA, T)}{\%Pop(CA, T)} \qquad ADV_{pop} = \frac{\%Pop(CA, BTS) - \%Pop(CA, P)}{\%Pop(CA, P)}$$

This statistic then captures the relative increase in representation for messages including BTS, as compared to the population and the underlying Twitter dataset. Observing Table 2a., When comparing BTS and COVID-19 engagement with the State population, we observe much higher diffusion rates in Washington D.C. (944%), New York (106%), Hawaii (73%), and Cali-

fornia (63%), in aggregate.

These advantages may be a result of Twitter being the underlying platform. When we adjust for the advantage of K-Pop over Twitter (ADV_T), we observe that the advantage of DC disappears. Table 2b) then ranks the top 8 States after controlling for Twitter's underlying advantage. We observe rural states, due to the increased rate of diffusion benefit between 32% to 52% compared to their usual rates of response.

This indicates two things. First, the combination of platform and synergistic diffusion can help target States with metropolitan areas for which a greater density of people exist, and thus a greater risk of infection. This is however primarily an effect of using Twitter. So second, the inclusion of BTS also elicits stronger diffusion into States that usually respond less to Twitter-based messaging, such as South Dakota, North Dakota, Mississippi, Montana, and Utah.

Conclusion

The efficacy of public health messaging is vital to responding agilely to health crises, such as the COVID-19 pandemic. In this report, we investigated the key drivers of the spread and distribution of mask wearing messaging on Twitter, and if there are any asymmetries in the target audience. Our results revealed the rising phenomenon where BTS, a South Korean pop group, became the critical factor for global public health messaging on Twitter. Furthermore, while increased virality is to be expected when influential individuals such as K-pop artists and major Western-based health institutions collaborate, we found the amount of synergy to appear underrated. Importantly, the observed virality in our study does not originate from direct messages from the entertainment groups, but from the community of fans and their grassroots response that suggests potentially significant and tangible results. Although we do not have data on how the K-pop fans in our sample practiced mask-wearing in real life, BTS fandom had previously materialized their online participation from the virtual #MatchAMillion campaign to fund rais-

ing of over one million USD for Black Lives Matter (*13*). This high-profile demonstration could serve as a benchmark for researchers to gauge and study the possible translation between online collective action and offline results.

Perhaps more important than the virality aspect is the noteworthy potential for targeted messaging. We show that messages including K-pop elicited heavy responses from countries in Southeast Asia and South/Central America, as compared to messages that did not. Within the US, we found increased K-pop-related responses in densely metropolitan States that are highly susceptible to disease transmission, and rural states that are often neglected (probably unintentionally) by mainstream social media campaigns and news. In simple terms, the inclusion of K-pop not only increased the depth of diffusion, but also toward more diverse and traditionally under-served areas both globally and domestically.

With prior studies showing the importance of perceived more neutral third parties in establishing source trustworthiness (*11*), the use and perhaps social responsibility of the entertainment industry in spreading public health practices may be critical to responding to future public health crises. Internationally recognized entertainment artists, as evidenced by their role in the COVID-19 pandemic, contain significant broadcasting power due to tightly tuned audiences despite their differences in ethnicity, national identity, political alignment, and beliefs in health practices such as mask-wearing. This area of synergistic communication remains an open field of study, and future research entails studying the community dynamics more granularly.

References and Notes

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Supplementary Materials

Materials and Methods

We culled our data from the largest Public COVID-19 Twitter dataset (*1*). Our data contains the following sub-datasets:

1. Tweets containing the hashtag #WearAMask.

2. Tweets from and retweets of important health institutions or figures. These include Dr. Tedros, the WHO, the CDC, and the Twitter accounts of all state-level office for the study of our US-Centric portion.

3. Tweets containing K-Pop: Given the large amount of fandom activity on Twitter, well-established hashtags have been used to express these fandoms. We first subset a list of these hashtags (such as #BTS and #BTSArmy), then extracted the top co-occuring words related to these groups. We focused on BTS, BlackPink and Twice, the three most prominent K-Pop groups on Twitter.

Given that the entire dataset captures the general COVID-19 related discourse, each of these data subsets intersect with discussion about the pandemic.