

Communicating COVID-19 information on TikTok: a content analysis of TikTok videos from official accounts featured in the COVID-19 information hub

Yachao Li ^{1*}, Mengfei Guan², Paige Hammond¹ and Lane E. Berrey²

¹Department of Communication Studies and Department of Public Health, The College of New Jersey, 2000 Pennington Rd, Ewing, NJ 08618, USA and ²Department of Communication, University of Arkansas, 417 Kimpel Hall, Fayetteville, AR 72701, USA

*Correspondence to: Y. Li. E-mail: liya@tcnj.edu

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Abstract

Amid the COVID-19 pandemic, TikTok, an emerging social media platform, has created an information hub to provide users with engaging and authoritative COVID-19 information. This study investigates the video format, type and content of the COVID-19 TikTok videos, and how those video attributes are related to quantitative indicators of user engagement, including numbers of views, likes, comments and shares. A content analysis examined 331 videos from official accounts featured in the COVID-19 information hub. As of 5 May 2020, the videos received 907 930 000 views, 29 640 000 likes, 168 880 comments and 781 862 shares. About one in three videos had subtitles, which were positively related to the number of shares. Almost every video included a hashtag, and a higher number of hashtags was related to more likes. Video types included acting, animated infographic, documentary, news, oral speech, pictorial slideshow and TikTok dance. Dance videos had the most shares. Video themes included anti-stigma/anti-rumor, disease knowledge, encouragement, personal precautions, recognition, societal crisis management and work report. Videos conveying alarm/concern emotions, COVID-19 susceptibility and severity, precaution response efficacy had higher user engagement. Public health agencies should be aware of the opportunity of TikTok in health communication and create

audience-centered risk communication to engage and inform community members.

Introduction

The coronavirus disease 2019 (COVID-19) pandemic continues to affect more than 210 countries and territories [1]. Given the surging number of global cases and deaths, communicating time-sensitive information to the public is critical. COVID-19 is also a novel infectious disease. Community members largely need knowledge of COVID-19 symptoms and modes of transmission, as well as precautions to prevent the disease. Thus, effective public health communication is important to combat the COVID-19 pandemic [2].

Given its popularity and ease in adoption among community members, social media has been widely used by public health agencies to communicate health information [3–5]. An emerging social media is TikTok, a short-form mobile video platform that allows users to create videos often lasting 15–60 s and share them with the wider TikTok community. Since its launch in 2017, TikTok has rapidly gained popularity across the world. Available in 150 countries, TikTok has 800 million monthly active users worldwide and has been downloaded over 2 billion times. It was also the most downloaded mobile application in 2018 and 2019, surpassing Facebook, YouTube and Instagram [6, 7].

In the first quarter of 2020, TikTok was downloaded 315 million times globally, which is a 58% increase from the previous quarter and the highest amount of downloads an application has ever received in a quarter [8]. The surge in TikTok downloads likely results from the COVID-19 pandemic. Under lockdown, people are spending increasingly more time on mobile devices and seeking out new entertainment activities and means to stay connected, which drives TikTok downloads [8]. The rapid expansion of TikTok has provided a unique opportunity for public health agencies to inform and educate people about COVID-19 knowledge.

TikTok also conquers teens and young adults worldwide. About 27% of TikTok users are aged between 13 and 17 and 42% are aged between 18 and 24. Combined, 69% of TikTok users are under 25 years old, and 85% are under 35 years old [9]. This user age distribution is particularly interesting in COVID-19 health communication. While previous evidence suggested that COVID-19 may be less severe among young people [10], more recent studies indicated that COVID-19 could result in prolonged illness even among young adults without underlying chronic medical conditions [11] and one in three young people may experience severe COVID-19 symptoms [12]. Moreover, young individuals are not less susceptible to SARS-CoV-2 infection than older people and they can still transmit the virus to others [13]. To fight the pandemic, every community member, including young people, should be aware of the seriousness of COVID-19 and take proper precautions. Given its popularity among young users, TikTok can be a feasible tool to deliver COVID-19 information to young people.

Although COVID-19 information is not the primary reason that users come to TikTok, having the information readily available helps users stay informed and take proper precautions [14]. Indeed, users are using TikTok to seek and share information about COVID-19 [15]. Thus, TikTok has worked with public health experts and created an information hub to provide users with engaging and authoritative COVID-19 information [14]. This study aims to explore this emerging way to

communicate COVID-19 information to community members. Specifically, we examine the format, type and content of COVID-19 videos and explore how those video attributes are related to quantitative indicators of user engagement, including numbers of video views, likes, comments and shares.

Materials and methods

Data collection

The TikTok COVID-19 information hub featured videos from official accounts of eight public health and United Nation agencies (see Table I). For each account, we reviewed all of its videos posted since November 2019 and identified COVID-19 videos. A COVID-19 video was a video that included at least one of the following hashtags, namely 'COVID-19', 'coronavirus', 'GoAwayCorona' and 'GoAwayCoronaChallenge.' For videos without any hashtags, the video content and captions were reviewed. Those explicitly mentioning 'COVID-19' or 'coronavirus' in the audio and/or texts were counted as COVID-19 videos. In total, 331 COVID-19 videos were identified and downloaded on 5 May 2020.

Coding scheme

We developed a codebook based on existing content analysis studies of TikTok [16, 17], prior research on video-based health communication [18, 19], health behavior theories, such as the health belief model and appraisal theory, and expert consensus. Expert consensus involved open coding [20], discussions and revisions of the codebook within the research team and review by our interdisciplinary team of collaborators with substantial social media content analysis expertise. The codebook focused on user engagement, video format, video type and video content. First, we recorded the number of views, likes, comments and shares of each video to quantify its user engagement. Second, we collected information on video format (see Table II), including video length, subtitle, text, spoken language, caption and music. Except for video length, each variable was coded as present (1) or absent (0). If a

Table I. Official accounts and descriptive statistics of quantitative indicators of user engagement

Official account	First COVID-19 video posted on	Number of followers	Number of COVID-19 videos	COVID-19 video			
				Views <i>M</i> (SD)	Likes <i>M</i> (SD)	Comments <i>M</i> (SD)	Shares <i>M</i> (SD)
American Red Cross	4 March	500 000	21	1 827 660 (7 808 701)	37 504 (117 840)	62 (64)	158 (434)
British Red Cross	26 February	400 000	26	5 885 790 (11 643 319)	212 496 (412 264)	937 (1789)	1241 (2360)
Food and Agriculture Origination of the UN	3 March	200 000	23	2 051 360 (7 064 669)	20 243 (18 905)	399 (1319)	1237 (4689)
International Federation of Red Cross and Red Crescent Societies	22 January	3 400 000	70	2 442 640 (5 790 322)	80 539 (173 494)	457 (773)	819 (1756)
International Organization for Migration	2 March	1 500 000	35	1 206 570 (3 526 015)	31 247 (74 734)	186 (456)	261 (628)
The UN Refugee Agency	10 March	1 100 000	44	579 920 (446 658)	18 509 (20 172)	168 (312)	221 (357)
World Economic Forum	10 February	1 500 000	94	2 541 300 (6 835 275)	105 599 (289 823)	564 (1113)	2061 (5304)
World Health Organization	28 February	2 500 000	18	10 651 070 (11 162 150)	299 250 (280 698)	1953 (1455)	24 888 (63 786)
All accounts	22 January	11 100 000	331	2 742 980 (7 097 645)	89 536 (231 549)	510 (1070)	2362 (15 808)

Data were as of 5 May 2020. UN, United Nations.

Table II. Variables indexing video format of TikTok COVID-19 videos ($N = 331$)

Variables	Operational definitions	<i>n</i> (%)
Video length	The length of the video.	—
Subtitle	The video includes a piece of text that translates or transcribes the dialogue or narrative.	38 (11.48)
Text	A piece of text is added to the video that repeats, enhances, replaces or spotlights the auditory messages.	260 (78.55)
Spoken language	A language is spoken in the video.	112 (33.84)
Caption	There is a piece of text displayed at the left bottom side of the video that summarizes the video content or provides context of the video.	316 (95.47)
Music	Background music is used in the video.	297 (89.73)

Except for video length, each variable was coded as present (1) or absent (0). The number of hashtags was recorded if captions were present. For each variable, intercoder reliability was excellent (Krippendorff's Alpha = 1.00).

video included captions, the number of hashtags in the captions was recorded.

Next, we identified the video types and examined video content by coding the major themes, primary

characters, emotions and COVID-19 risk information presented in the videos. The categories of video type (see [Table III](#)) and theme (see [Table IV](#)) were developed based on an open coding process, in

Table III. Video types of TikTok COVID-19 videos ($N = 331$)

Categories	Operational definitions	Intercoder reliability	Examples	n (%)
Acting	A video in which information is presented via individual or group acting, and role plays.	0.95	https://vm.tiktok.com/cxdE6x/ https://vm.tiktok.com/c9N8pR/	113 (34.14)
Animated infographic	A video that uses a combination of images, illustrations, charts, graphs, text, cartoon and other elements that are animated to visualize information.	1.00	https://vm.tiktok.com/cxNFsg/ https://vm.tiktok.com/cxy7bK/	21 (6.34)
Documentary	A video that provides a factual record or report of events or people.	0.91	https://vm.tiktok.com/vxFAJN/ https://vm.tiktok.com/cxaLyv/	82 (24.77)
News	A video that presents information about recent or important events or newly released statistics.	0.98	https://vm.tiktok.com/cHygND/ https://vm.tiktok.com/cH6coF/	14 (4.23)
Oral speech	A video in which speakers orally, and often formally, presents information to audience.	1.00	https://vm.tiktok.com/cxg9PK/ https://vm.tiktok.com/cxeNFo/	66 (19.94)
Pictorial slideshow	A video that presents a series of still images in a prearranged sequence.	1.00	https://vm.tiktok.com/vx1hqh/ https://vm.tiktok.com/c93wRw/	14 (4.23)
TikTok dance	A video that features the viral dance challenges that circulate on TikTok.	1.00	https://vm.tiktok.com/vxjC3u/ https://vm.tiktok.com/cxeT51/	21 (6.34)

The categories of video type were mutually exclusive. A video was coded into one and only one video type category. Intercoder reliability scores were Krippendorff's Alphas.

which research team members independently generated a list of video types and themes, compared the degree of overlap between the lists and developed the final coding categories through discussions and expert review. We coded the type of a TikTok video into one of the following categories, including acting, animated infographics, documentary, news, oral speech, pictorial slideshow and TikTok dance.

In terms of video content, each video was categorized as one of the following themes, including anti-stigma/anti-rumor, disease knowledge, encouragement, personal precautions, recognition, societal crisis management and work report. If a video included human subjects, we examined the characteristics of the primary characters, which are individuals who played the leading role in the video. The primary characters' general occupation was coded into five categories: the general public, health professionals, public figures, essential workers/volunteers and others. COVID-19-related emotions were also coded. We explored whether alarm/concern, hope and humor were present (1) or absent (0) in the videos. In addition, we recorded whether the videos conveyed susceptibility and severity of COVID-19,

effectiveness of precautionary measures (i.e. response efficacy) and the impacts of COVID-19 on the economy and people's normal life (see Table V).

Video coding

Two coders received four 2-h training sessions. The coders coded five videos for each training session and discrepancies were discussed and resolved. Training videos were included in the final data analysis. To establish intercoder reliability, about 30% of videos (100/331, 30.21%) were randomly selected and independently coded by each coder. The intercoder reliability was high, with Krippendorff's Alpha values ranging from 0.91 to 1.00 (see Tables II–V for intercoder reliability scores for each variable). The remaining videos were then evenly and randomly divided and independently coded by the two coders.

Results

Descriptive analyses

As of 5 May 2020, the 331 COVID-19 videos received a total of 907 930 000 views, 29 640 000

Table IV. Video themes of TikTok COVID-19 videos ($N = 331$)

Categories	Operational definitions	Intercoder reliability	Examples	n (%)
Anti-stigma/anti-rumor	A video that opposes COVID-19 related discriminations, hate crimes, racism, stigmas, rumors and misinformation.	0.98	https://vm.tiktok.com/cxeFCb/ https://vm.tiktok.com/cxhMtJ/	40 (12.08)
Disease knowledge	A video that presents the symptoms, transmission methods, statistics, severity, susceptibility and any other information about COVID-19.	0.97	https://vm.tiktok.com/cH5KYR https://vm.tiktok.com/cHygND/	43 (12.99)
Encouragement	A video that motivates and inspires viewers, eases their negative feelings, provides tips for bettering mental health or provides people with support, confidence or hope.	0.91	https://vm.tiktok.com/vxL9ac/ https://vm.tiktok.com/c9wsqx/	51 (15.41)
Personal precaution	A video that focuses on the precaution measures taken by individuals to prevent COVID-19.	0.94	https://vm.tiktok.com/vxRH6s/ https://vm.tiktok.com/cHhm83/	112 (33.84)
Recognition	A video that acknowledges and thanks the contributions of health professionals and essential workers during the COVID-19 crisis.	0.92	https://vm.tiktok.com/vxjC3u/ https://vm.tiktok.com/cx4j9s/	27 (8.16)
Societal crisis management	A video that shows how the society prevents and manages the COVID-19 crisis through regulations, research and technologies.	0.94	https://vm.tiktok.com/cxqaQc/ https://vm.tiktok.com/cxquN/	31 (9.37)
Work report	A video presents an agency's goals and duties, achievements, on-going efforts and plans to help manage the COVID-19 crisis.	0.96	https://vm.tiktok.com/v9cgQR/ https://vm.tiktok.com/cxeNFo/	27 (8.16)

The categories of video theme were mutually exclusive. A video was coded into one and only one video theme category. Intercoder reliability scores were Krippendorff's Alphas.

likes, 168 880 comments and 781 862 shares (see Table I).

The videos ranged from 9 to 115 s in length ($M = 32.87$, $SD = 17.63$, median = 29). Five videos were longer than 60 s. About 11.48% of videos included subtitles, 78.55% contained textual information in the video, 33.84% had a spoken language, 95.47% used captions and 89.73% had background music (see Table II). The language used in subtitles (37/38 videos), texts (255/260) and oral messages (98/112) were predominantly English. The majority (96.17%, 315) of videos had at least one hashtag ($M = 5.01$, $SD = 2.36$, median = 5, range: 0–11). Seven types of COVID-19 TikTok videos were identified (see Table III). About one in three videos were acting videos, one in five were documentaries and oral speeches. Other video types included animated infographics, TikTok dance, news and pictorial slideshow.

We identified seven categories of video themes (see Table IV). Videos focusing on personal precautions were the most prevalent, followed by encouragement, disease knowledge, anti-stigma/anti-rumor, social crisis management, recognition and work report videos. About 88.22% (292) of the videos had human characters, most of whom were the general public (138, 41.69%) or essential workers/volunteers (104, 31.4%). Nearly 10.88% (36) of the videos primarily focused on health professionals, and 4.23% (14) featured public figures, such as politicians, celebrities, social media influencers and business leaders.

We also examined the emotions and cognitive variables conveyed in the video content (see Table V). One in three videos expressed hope (32.63%). About the same number of videos expressed alarm/concern (12.99%) and humor (12.39%). While over one-third of videos conveyed the response efficacy of COVID-19 precautions

Table V. Emotions and cognitive variables conveyed in TikTok COVID-19 videos ($N = 331$)

Categories	Operational definitions	Intercoder reliability	Examples	n (%)
Alarm/concern	A video expresses COVID-19 fear, anxiety, worry or sadness for self or others.	0.92	https://vm.tiktok.com/cHmeJQ/ https://vm.tiktok.com/cxC3bt/	43 (12.99)
Hope	A video shows that something positive about COVID-19 is happening or will happen, such as decreased health threats, increased health care conditions and effectiveness of treatment.	0.93	https://vm.tiktok.com/cYFtqp/ https://vm.tiktok.com/cHRsB2/	108 (32.63)
Humor	A video presents an unexpected, funny or playful situation about COVID-19 that intended to make people laugh.	0.94	https://vm.tiktok.com/c9DCRq/ https://vm.tiktok.com/cxrYjg/	41 (12.39)
Susceptibility	A video mentions how likely a person may be infected, harmed, or influenced by COVID-19.	0.91	https://vm.tiktok.com/cHhp5y/ https://vm.tiktok.com/cx4BYp/	18 (5.44)
Severity	A video mentions how dangerous COVID-19 is or describes the negative health consequences of COVID-19.	0.92	https://vm.tiktok.com/vx1VTu/ https://vm.tiktok.com/cxpqrV/	30 (9.06)
Response efficacy	A video demonstrates that precaution measures are effective in preventing and tackling COVID-19.	0.93	https://vm.tiktok.com/vxk1Ms/ https://vm.tiktok.com/cxqaQc/	118 (35.65)
Economy/Normal life impacts	A video presents that COVID-19 impacts the economy and/or people's normal life.	0.91	https://vm.tiktok.com/cxfAj9/ https://vm.tiktok.com/cxaLyv/	27 (8.16)

Variables in the table were not mutually exclusive. A video could be coded into more than one variable. Intercoder reliability scores were Krippendorff's Alphas.

(35.65%), 5.44% and 9.06% of videos mentioned the susceptibility and severity of COVID-19, respectively. About 8.16% of videos also mentioned the impact of COVID-19 on the economy and people's normal life.

Substantial analyses

Correlation and ANOVA analyses explored how quantitative indicators of user engagement (numbers of views, likes, comments and shares) were related to different attributes of video format and content. Due to space limits, only significant results were reported.

First, we examined whether user engagement differed as a function of the accounts. A series of one-way ANOVA showed that the number of views, $F(7, 323) = 5.29, P < 0.001$; likes, $F(7, 323) =$

$4.98, P < 0.001$, comments, $F(7, 323) = 8.02, P < 0.001$ and shares, $F(7, 323) = 6.24, P < 0.001$; differed between accounts. *Post hoc* analysis using the Bonferroni correction indicated that videos posted by the World Health Organization (WHO) received significantly more views, likes, comments and shares than any other accounts. Thus, a dummy variable (0 = accounts other than WHO, 1 = WHO) was computed and controlled for in all subsequent data analyses.

The earlier a TikTok video was posted, the higher user engagement it may accumulate; thus, we correlated the number of days a video was posted ($M = 38.20, SD = 19.74, \text{range: } 1\text{--}106$) with the quantitative indicators of user engagement. Results showed that the number of posted days was positively correlated with the number of views, $r(331) = 0.41, P <$

0.001; likes, $r(331) = 0.43$, $P < 0.001$; comments, $r(331) = 0.46$, $P < 0.001$; and shares, $r(331) = 0.15$, $P = 0.005$. Thus, the number of posted days was controlled for in all subsequent data analyses.

A partial correlation analysis examined the associations between quantitative indicators of user engagement, video length and the number of hashtags. Controlling for accounts and the number of posted days, the number of hashtags was positively correlated with the number of likes, $r(327) = 0.13$, $P = 0.018$. Other user engagement measures were not significantly correlated.

A series of one-way ANOVA explored whether user engagement differed between videos with and without subtitles, texts, spoken language, captions and music. Results showed that controlling for accounts and the number of posted days, videos with subtitles ($M = 4\,830\,000$, $SD = 10\,250\,000$) received more shares than those without subtitles ($M = 2\,040\,000$, $SD = 16\,380\,000$), $F(1, 327) = 6.98$, $P = 0.009$. There were fewer comments for videos with spoken language ($M = 448$, $SD = 890$) than those without spoken language ($M = 542$, $SD = 1152$), $F(1, 327) = 4.05$, $P = 0.045$. Videos with spoken language ($M = 1808$, $SD = 6298$) also had fewer shares than those without spoken language ($M = 2646$, $SD = 18\,917$), $F(1, 327) = 4.32$, $P = 0.039$.

A series of one-way ANOVA also explored whether quantitative indicators of user engagement differed between different categories of video type and video theme. We found that the number of shares was significantly different across the seven types of TikTok videos, $F(6, 322) = 4.13$, $P = 0.001$. *Post hoc* analysis using the Bonferroni correction indicated that TikTok dance videos ($M = 15\,687$, $SD = 59\,999$) were shared significantly more than news ($M = 5467$, $SD = 10\,374$), pictorial slideshow ($M = 3155$, $SD = 8194$), documentary ($M = 1486$, $SD = 4355$), oral speech ($M = 1132$, $SD = 4572$), animated infographic ($M = 1116$, $SD = 1896$) and acting videos ($M = 989$, $SD = 2917$). No differences in video views, likes and comments were found across video types. There were also no significance differences in user engagement between different message theme categories.

Compared to videos without human characters ($M = 1536$, $SD = 4721$), videos with human characters ($M = 8544$, $SD = 44\,217$) were more likely to be shared, $F(1, 327) = 7.62$, $P = 0.006$. The number of views, likes, comments and shares did not differ as a function of primary characters' occupations. In terms of emotions, videos expressing alarm/concern ($M = 1002$, $SD = 1501$) received more comments than those without alarming emotions ($M = 437$, $SD = 973$), $F(1, 327) = 4.24$, $P = 0.040$. In contrast, hopeful videos ($M = 1476$, $SD = 4657$) had fewer views than those did not express hope ($M = 3356$, $SD = 7954$), $F(1, 327) = 4.83$, $P = 0.029$.

Compared to those without mentioning the susceptibility of COVID-19 ($M = 82\,963$, $SD = 209\,290$), those mentioning susceptibility ($M = 203\,837$, $SD = 471\,419$) received more likes, $F(1, 327) = 3.89$, $P = 0.049$. Videos mentioning the severity of COVID-19 ($M = 970$, $SD = 1447$) had more comments than those without severity information ($M = 464$, $SD = 1017$), $F(1, 327) = 4.95$, $P = 0.027$. Moreover, videos mentioning response efficacy of COVID-19 precautions ($M = 4\,920\,000$, $SD = 9\,830\,000$) received more views than those without response efficacy information ($M = 1\,540\,000$, $SD = 4\,590\,000$), $F(1, 327) = 5.75$, $P = 0.017$. There were more likes for videos with ($M = 156\,363$, $SD = 327\,017$) than without response efficacy information ($M = 52\,515$, $SD = 143\,443$), $F(1, 327) = 4.30$, $P = 0.039$. Videos mentioning response efficacy ($M = 780$, $SD = 1363$) also had more comments than those without response efficacy messages ($M = 350$, $SD = 827$), $F(1, 327) = 10.90$, $P = 0.001$.

As an alternative approach, regression analyses examined how video format variables (see [Table II](#)) and how emotions and cognitive variables (see [Table V](#)) all together predicted quantitative indicators of user engagement. Results were consistent with the ANOVA results.

Discussion

This study explored the format, type and content of TikTok COVID-19 videos, as well as examined how those video attributes were related to

quantitative indicators of user engagement, namely numbers of views, likes, comments and shares. TikTok is an emerging social media platform that has the potential to engage and inform community members about public health information [16]. Yet, public health agencies are at the early stage of creating and delivering health communication on TikTok. In the context of COVID-19, this descriptive study provides insights into the structural features and content of existing COVID-19 videos. We also identified several video attributes that appear to invite more user engagement. The results can inform future development and dissemination of public health messages on TikTok.

Video format and user engagement

Almost every TikTok video had a hashtag, and a higher number of hashtags was related to more video likes. Social media research has shown that hashtag use assists users to seek, follow and share information [21, 22]. Health campaign-specific hashtags also help increase the credibility and dissemination of campaign messages [23, 24]. Similar to our results, a study of health advocacy tweets found that a higher number of hashtags predicted more retweets [25]. Thus, hashtags on TikTok seem to share similar functions of those on other social media platforms and should be utilized strategically to attract viewers and promote user engagement. Due to the exploratory nature of this study, we did not examine the content of the hashtags. Future research should examine whether user engagement differs as a function of different types of hashtags, such as between #GoAwayCorona and #coronaviurs.

About 1 in 10 videos included subtitles. *Post hoc* analyses showed that subtitles were predominately used in news and oral speech videos. In addition, videos with subtitles received more shares than those without subtitles. This may be because subtitle enables viewers to have a better understanding of video content [26], which may promote content sharing. In contrast, TikTok videos with spoken language attracted fewer comments and shares than those without spoken language. A recent study on

government-generated health communication via TikTok showed that users preferred easily understood messages and entertaining videos than scientific jargon and overly formal presentations [16]. Delivering information via spoken language may be perceived as more formal than non-verbal performances like dances and thus, invite less user engagement. Future studies should further examine how the interactions of different video format features affect user engagement.

Video type and user engagement

Seven different types of COVID-19 videos emerged from the data, including acting, animated infographic, documentary, news, oral speech, pictorial slideshow and TikTok dance. The first five types were also identified in general public health communication on TikTok, with documentary and animated infographics being most frequently viewed [16]. We found that while the number of views, likes and comments did not differ as a function of video types, TikTok dance videos had more shares than any other types of videos. Audience-centered interactions are crucial for public health communication via social media [27]. Compared to other video types, TikTok dance videos are often featured with rhythmic and earworm music and easy-to-mimic lip-sync and body movement, all of which may encourage audience-centered interactions and increase shares. We encourage future studies to explicitly focus on public health communication via TikTok dances.

Video content and user engagement

We also identified seven major themes of COVID-19 videos, including anti-stigma/anti-rumor, disease knowledge, encouragement, personal precautions, recognition, societal crisis management and work report. A content analysis of government social media during the COVID-19 crisis revealed similar message content, including the latest updates about COVID-19, appreciation to front-line emergency services, guidance for stakeholders and information about the government's handling of the crisis [28]. Moreover, compared to appreciation posts, latest pandemic updates and government crisis response

lead to increased user engagement [28], as different message themes may meet community members' demands in different ways [29, 30]. However, our study found no differences in video views, likes, comments and shares across the seven message themes. Studies with larger samples should continue to explore different message themes of COVID-19 across various social media platforms.

TikTok videos expressing alarm/concern received more comments than those without expressing the emotions. Videos mentioning susceptibility and severity of COVID-19 received more likes and comments, respectively. The results suggest that risk information may increase user engagement. Indeed, research on health information engagement demonstrated that risk information content increased likes, comments and shares of health communication posts [31]. Moreover, during infectious disease outbreaks, social media use predicts individuals' prevention behaviors through risk perceptions and negative emotions [32]. Our results suggest that risk information and negative emotions in social media messages may be the underlying mechanisms accounting for the relationships between social media use and individuals' risk perceptions and negative feelings. Finally, response efficacy of COVID-19 precautions attracted greater views, likes and comments. During the COVID-19 pandemic, community members are experiencing heightened uncertainty and fear. Videos mentioning the effectiveness of precaution measures help people reduce uncertainty and boost their confidence [2] and thus, have higher user engagement. In short, risk information and response efficacy are crucial for user engagement.

Practical implications

Our findings provide practical implications for public health agencies to use TikTok to communicate COVID-19 and health information in general. First, including more hashtags invited more likes for videos. Campaign-specific hashtags have also facilitated the dissemination of health communication messages. Thus, public health agencies can create various hashtags to summarize the video content

and promote user engagement. Second, due to its audience-center features, TikTok dance videos are more engaging and easier to 'duet' than other types of videos. When possible, public health professionals are encouraged to communicate health information via TikTok dances. The viral handwashing dance suggests that TikTok dances are a feasible tool to demonstrate and ultimately promote health behaviors, such as washing hands, wearing face covers and social distancing. Third, TikTok videos mentioning risk information of COVID-19 and response efficacy of precautionary measures have higher user engagement. Thus, health message designers should consider incorporating those elements in their message design.

Limitations and future research

There are several limitations. First, we collected COVID-19 videos from official accounts featured in the information hub. While this approach helps ensure the credibility of the videos, the majority of TikTok videos are created by ordinary community members. The content, format and popularity of user-generated COVID-19 videos remain unstudied. Future research should examine COVID-19 information and misinformation created by average users. Moreover, this study is cross-sectional and explanatory in nature. While numbers of views, likes, comments and shares are common quantitative indicators of user engagement in social media studies [16, 17], the comment and share functions of a few TikTok videos were disabled by the accounts and thus, may not reflect the actual user engagement. Moreover, those measures do not indicate the message effect of TikTok videos on viewers' health literacy, attitudes or behavioral change.

User comments were also not analyzed and thus, we do not know the number of comments that indicates approval or disapproval of the messages in the TikTok videos. Future studies are needed to examine users' demographics and their cognitive, emotional and behavioral responses to TikTok health communication videos. In addition, epidemiology and our understanding of COVID-19 have also been changing over time. This study captures videos in the early

stage of the pandemic and thus, reflects video content, format and popularity from that period only. Additional research is needed to examine how COVID-19 videos and user engagement change as community members become more knowledgeable about the COVID-19 pandemic progresses.

Conclusion

TikTok is an emerging tool for public health professionals to communicate health information to the public, especially during the COVID-19 pandemic. A content analysis of 331 COVID-19 videos showed that various types of videos had been used to communicate different messages related to the pandemic. Although user engagement did not differ as a function of video themes, dance videos were more popular in the TikTok community due to their audience-centered characteristic. In addition, users were more likely to engage in videos mentioning risk information of COVID-19 and response efficacy of precautions as the information helps reduce their uncertainty and increase their confidence in this challenging time. Public health agencies should be aware of the opportunity of TikTok in health communication and create audience-centered risk communication to engage and educate community members.

Conflict of interest statement

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