

Adopting YouTube to Promote Health: Analysis of State Health Departments

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E-pub: 01/14/2019

<https://doi.org/10.7812/TPP/18-094>

ABSTRACT

Introduction: We describe videos posted to the YouTube video-sharing Web site by US state health departments (SHDs) and associated institutional factors.

Methods: YouTube channels from SHDs were identified, their data retrieved, and their videos saved to a playlist on January 10, 2016. Ten randomly sampled videos from each channel were manually coded for topics. The 2012 Association of State and Territorial Health Officials profile survey was used to obtain information on staff, expenditure, and top 5 priorities for each SHD. Descriptive statistics and univariable regression were conducted.

Results: Forty-three SHDs had YouTube channels. Together, all SHDs posted 3957 videos, accumulated 12,151,720 views, and gained 6302 subscribers. In total, 415 videos were manually coded. Information about the agency (17.6%), communicable diseases (12.5%), and mother/infant health (8.9%) comprised the largest share of topics. No statistically significant association was observed between the log-transformed number of videos posted on an SHD's YouTube channel and any of the explanatory variables of SHD staffing and expenditure in 2011. The number of full-time employees ($r = 0.34$, $p = 0.03$), number of epidemiologists and biostatisticians ($r = 0.41$, $p = 0.01$), and 2011 total year expenditure ($r = 0.38$, $p = 0.02$) were positively correlated with the log-transformed number of views per YouTube video posted by SHDs. No meaningful patterns of statistical association were observed between the percentage of expenditure on a specific program area and the topics of videos.

Conclusion: Most SHDs are using YouTube, which provides a unique opportunity for SHDs to disseminate health messages.

INTRODUCTION

Social media is an important tool for health communications.¹ The Centers for Disease Control and Prevention recognize the importance of social media and provide professional guidelines on its use.² Video-sharing social media have gained popularity during the last decade, with 72% of online adults using some form of video-sharing sites and 63% using YouTube specifically.³ Health-related videos with varying topics, such as weight loss,⁴ lead poisoning,⁵ diabetic retinopathy,⁶ tinnitus,⁷ Zika virus,⁸ and Lyme disease,⁹ are commonly found on YouTube, as discussed in a recent systematic review.¹⁰

State health departments (SHDs) in the US use media for health promotion. Even in 2011, as many as 60% of SHDs had at least 1 social media application; 86.7% were on Twitter, 56% were on Facebook, and 43% were on YouTube.¹¹ The SHDs with higher per capita health

department expenditures, more staff, and younger staff were among the first to adopt the use of Facebook and Twitter.¹² Prior studies found that SHD Twitter contents were focused primarily on personal health, whereas SHD Facebook posts were disconnected from health conditions that affected their populations.^{13,14} Nevertheless, to our knowledge no data are available on SHD use of YouTube videos and their correlates. A cross-sectional study of SHD YouTube videos could serve as a baseline for future studies to understand the evolving SHD use of YouTube videos as means of health communication.

The objective of this study was to identify the public health information, education, and disease topics of the videos that SHDs posted on their YouTube channels as of January 2016.

In addition, analyses were conducted to identify factors that might be associated with the quantities and the topics of YouTube videos uploaded by SHDs and the

number of views per video. The following hypotheses were tested:

1. SHDs with more staff and higher expenditure posted more videos on YouTube
2. SHDs with more staff and higher expenditure had more views per video on YouTube
3. SHDs with higher expenditure for a category were more likely to have a video on that topic posted
4. SHDs that identified a category as a top priority were more likely to have a video on that topic posted.

METHODS

This cross-sectional study covered SHDs of 50 US states and the District of Columbia. The 2012 Association of State and Territorial Health Officials (ASTHO) profile survey was used to obtain information on staff, expenditure, and top 5 priorities for each SHD.¹⁵ Nevada and South Carolina did not participate in the survey, and they were excluded in the regression models described below.

YouTube Data

On January 10, 2016, we searched for the YouTube channels of SHDs. To determine which SHDs had a YouTube channel, we visited each SHD's Web site and looked for a link to YouTube. If the SHD did not provide a link on its Web site, we searched for the YouTube channel on YouTube and Google. The number of

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Keywords: health communication, social media, state health department, technology adoption, YouTube

uploaded videos, number of subscribers, total views, and the date an SHD joined YouTube were manually recorded for each SHD that had a YouTube channel via YouTube.com by the first author (CHD). All videos uploaded by the SHDs were saved to a playlist for manual coding.

Random numbers were generated using a spreadsheet (Microsoft Excel, Microsoft Corp, Redmond, WA) to draw a simple random sample of 10 videos from each SHD for manual coding. A manual code book of video topics (see Sidebar: Manual Code Book, available online at: www.thepermanentejournal.org/files/2018/18-094-Sidebar.pdf) was created; it was based on the expenditure categories of the ASTHO that were relevant to health communication, as well as additional categories added after watching a convenience sample of the videos. Relevant expenditure categories included Chronic Disease, Infectious Disease, Injury Prevention, WIC (Women, Infants and Children), Environmental Health, and All Hazards Preparedness and Response. The code book contained 18 topics and a “not relevant” category. Topic categories were not mutually exclusive; coders were instructed to code all relevant topics for a video. Two trained, independent coders (coauthors EBB and SEA) each independently coded half of the selected videos. Interrater reliability was determined by the first author (CHD) double-coding 10% of the videos (Cohen $\kappa = 0.82$ and 0.75).

Statistical Analysis

Descriptive statistics were performed for the variables recorded from YouTube: Number of subscribers, number of uploaded videos, number of views, and date joined. A scatterplot matrix was created to determine the correlation between explanatory variables (see next paragraph).

Univariable regression models were used to assess the relationship between staff and spending of the SHDs and their total number of uploaded videos (linear and negative binomial models) and their views per video (linear models). Log transformation was used in the count outcome for linear regression. Also, log transformation was used in explanatory variables owing to the right or left skew

of the variables. Pearson r correlation with 95% confidence intervals and p values were calculated for the SHD explanatory variables: Number of full-time employees, number of epidemiologists or

biostatisticians on staff, number of public information specialist staff, number of preparedness and response staff, number of health educators, and 2011 total year expenditure.

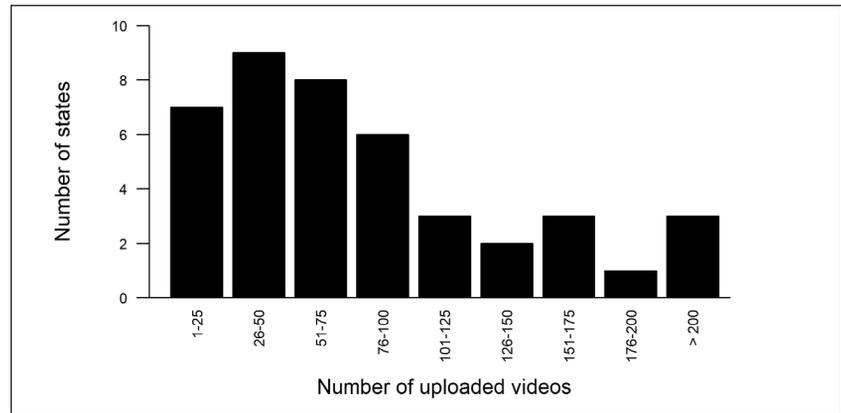


Figure 1. Distribution of state health departments by the number of uploaded videos.

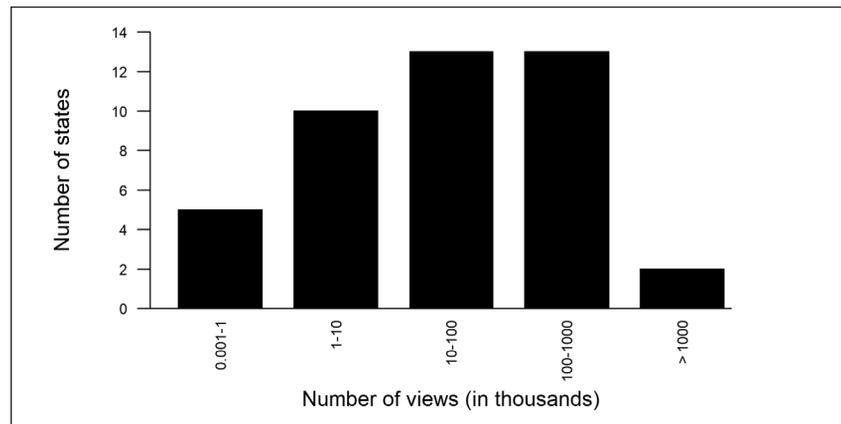


Figure 2. Distribution of state health departments by the total number of views (in thousands).

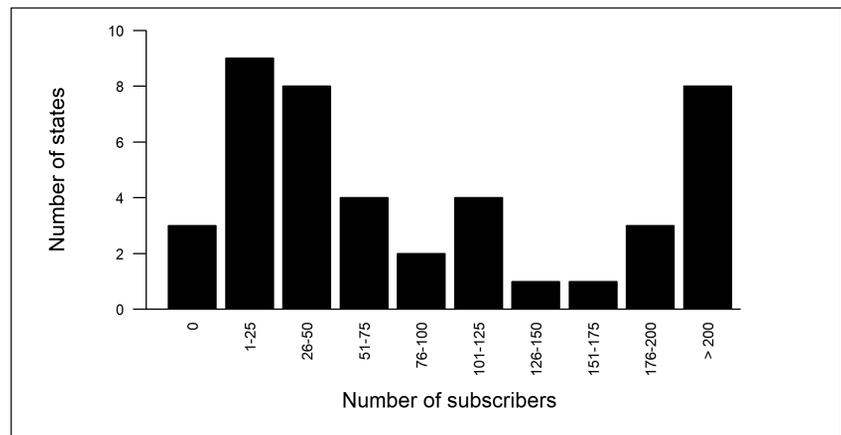


Figure 3. Distribution of state health departments by the number of subscribers on YouTube, as of January 10, 2016.

To address the stratified sampling of videos of each SHD, univariable weighted logistic regression was used to assess the relationship between the percentage of expenditure that SHDs spent per expenditure category and the likelihood of the SHDs posting YouTube videos on that topic. Percentage expenditure variables analyzed by category and the 2011 total expenditure variable were continuous, and the topic of the video was binary. Univariable weighted logistic regression was also used to assess the likelihood of SHDs posting a video on a topic stated as 1 of their top 5 priorities. If a category was mentioned as 1 of the top 5 priorities, it would be considered in the analysis. Odds ratios (ORs) and p values were computed.

Data were analyzed using R Version 3.2.4 software (R Foundation for Statistical Computing, Vienna, Austria). The level of statistical significance was determined a priori with $\alpha = 0.05$. This study was exempt from full institutional review board review under B4 exemption, according to the institutional review board of the corresponding author's (ICHF) institution (H16309).

RESULTS

As of January 10, 2016, a total of 43 of 51 SHDs had YouTube channels; the exceptions were the following: District of Columbia, Maine, Maryland, Massachusetts, Mississippi, New Jersey, Pennsylvania, and Wyoming. Together, all 43 SHDs had posted 3957 videos, accumulated 12,151,720 views, and gained 6302 subscribers (Figures 1-3). Missouri was the first state to join (in February 2007), and Colorado was the most recent state to join (in September 2015). Arizona had the largest number of posted videos (510), subscribers (834), and views (5,175,153), whereas Colorado had the smallest number of uploaded videos (2), subscribers (0), and views (1), as shown in Table 1.

Four hundred fifteen videos were manually coded; some states had fewer than 10 posted videos, and therefore, the number was fewer than 430 videos. Video length ranged from 6 seconds to 59 minutes. Fifteen coded videos (15/415; 3.6%) were in Spanish. Information about the public health agency (73/415; 17.6%), Infectious Disease (52/415; 12.5%), and Mother/

Infant Health (37/415; 8.9%) comprised the largest share of topics. Forty-one coded videos (41/415; 9.9%) were not intended for public communication about health

(coded "not relevant") and were meant for SHD staff training purposes (Table 2).

Two of the 415 coded videos had received more than 100,000 views: Both

Table 1. Data of YouTube channels of state health departments that had a YouTube channel, as of January 10, 2016

State ^a	Videos, no.	Subscribers, no.	Views, no.	Date joined
Alabama	70	107	103,571	March 22, 2010
Alaska	109	103	340,249	November 16, 2007
Arizona	510	834	5,175,153	April 21, 2008
Arkansas	61	70	12,290	May 7, 2010
California	147	722	477,692	August 22, 2008
Colorado	2	0	11	September 8, 2015
Connecticut	52	37	22,403	February 25, 2011
Delaware	101	42	8941	June 29, 2012
Florida	227	388	141,294	July 27, 2009
Georgia	78	76	31,487	June 29, 2011
Hawaii	27	16	1516	April 18, 2013
Idaho	32	11	2760	May 29, 2012
Illinois	35	23	3803	May 24, 2007
Indiana	19	16	3487	May 22, 2012
Iowa	76	30	3880	July 18, 2013
Kansas	88	49	17,091	September 2, 2009
Kentucky	158	55	11,883	July 7, 2010
Louisiana	116	161	39,318	September 7, 2010
Michigan	70	192	46,541	February 6, 2015
Minnesota	82	146	99,470	March 2, 2012
Missouri	129	123	71,579	February 21, 2007
Montana	173	50	42,356	June 8, 2012
Nebraska	224	247	196,986	September 2, 2009
Nevada	29	8	879	January 6, 2015
New Hampshire	2	7	141	August 9, 2013
New Mexico	78	65	27,806	January 27, 2009
New York	55	658	2,736,116	July 1, 2008
North Carolina	173	801	465,118	April 29, 2009
North Dakota	13	1	286	July 29, 2015
Ohio	13	16	7023	September 13, 2013
Oklahoma	70	33	5423	August 29, 2013
Oregon	49	244	401,871	April 30, 2009
Rhode Island	73	43	173,551	October 26, 2009
South Carolina	195	195	62,840	July 1, 2007
South Dakota	45	5	5683	January 15, 2014
Tennessee	44	30	11,149	April 25, 2011
Texas	266	NA	566,889	August 18, 2009
Utah	30	244	204,066	June 1, 2011
Vermont	100	86	218,358	August 5, 2010
Virginia	54	197	303,444	January 6, 2011
Washington	21	114	103,563	August 5, 2010
West Virginia	40	6	747	May 29, 2014
Wisconsin	21	51	3006	September 16, 2013

^a The following state health departments did not have a YouTube account as of January 10, 2016: District of Columbia, Maine, Maryland, Massachusetts, Mississippi, New Jersey, Pennsylvania, and Wyoming. NA = not applicable.

Table 2. Analysis of topic of 415 YouTube videos (randomly selected for manual coding) from 43 state health departments^a

Video topic	Videos, no. (%)
Adult health	36 (8.7)
Alcohol	7 (1.7)
Child health	30 (7.2)
Chronic disease	29 (7.0)
Emergency preparedness and response	21 (5.1)
Environmental health	26 (6.3)
Family planning	2 (0.5)
Health insurance	16 (3.9)
Infectious disease	52 (12.5)
Injury prevention	20 (4.8)
Miscellaneous	33 (8.0)
Mother/infant health	37 (8.9)
Not relevant	41 (9.9)
Nutrition	22 (5.3)
Occupational health	1 (0.2)
Public health agency information	73 (17.6)
Tobacco	30 (7.2)
Vaccines	32 (7.7)
Women, infants and children (WIC)	20 (4.8)

^a Some state health departments had < 10 YouTube videos. Topics were not mutually exclusive.

were about tobacco cessation and were posted by New York and California.^{16,17} A video posted by California about injury prevention received the most likes (107), and a video about environmental health received the most comments (30).^{18,19}

The number of staff and the number of full-time employees were highly correlated, as were all expense variables (2010 total year expenditure, 2011 total year expenditure, 2010 relevant expenditure, and 2011 relevant expenditure).

No statistically significant association was observed between the log-transformed number of YouTube videos posted on an SHD's YouTube channel and any of the explanatory variables of SHD staffing and expenditure in 2011 (Table 3).

The number of full-time employees ($r = 0.34, p = 0.03$), number of epidemiologists and biostatisticians ($r = 0.41, p = 0.01$), and 2011 total year expenditure ($r = 0.38, p = 0.02$) were positively correlated with the log-transformed number of views per video posted to YouTube by SHDs (Table 4).

However, no meaningful patterns of statistical association were observed between the percentage of expenditure on a specific program area and the topics of videos. Table 5 shows the ORs and p values of the 42 models ran to test the hypothesis

if SHDs with higher expenditure for a category were more likely to have a video on that topic posted. The odds of SHDs posting a video on All Hazards Preparedness and Response was quintuple if they had higher percentage expenditure for Infectious Disease (OR = 4.94, $p = 0.03$) and was 94 times higher for a 10-fold increase in 2011 total expenditure in US dollars (OR = 94.16, $p = 0.02$). However, surprisingly, the odds of SHDs to post a video on All Hazards Preparedness and Response was 96% lower if they had a higher percentage expenditure on the same topic (OR = 0.04, $p = 0.01$). The odds for SHDs to post videos on WIC was 2.61 times if they had higher expenditure on Injury Prevention (OR = 2.61, $p = 0.01$). However, surprisingly, their odds to post videos on WIC was reduced by 97% if they had higher expenditure on WIC (OR = 0.03, $p = 0.02$).

Table 6 presents the ORs of SHDs posting a video on topics related to their top 5 priorities. The SHDs were significantly more likely to post a video on All Hazards Preparedness and Response if they had priorities in Chronic Disease (OR = 132.70, $p < 0.01$) and All Hazards Preparedness and Response (OR = 38.66, $p = 0.01$). The SHDs were significantly

Table 3. Pearson *r* correlations and negative binomial regression of number of videos posted to YouTube by state health departments (SHDs)

Explanatory variable	Pearson <i>r</i> correlation ^a	95% CI ^a	p value (linear regression) ^a	p value (negative binomial regression) ^b
Number of full-time employees	0.27	(-0.04 to 0.53)	0.089	0.082
Number of epidemiologists/biostatisticians	0.21	(-0.12 to 0.50)	0.219	0.124
Number of information specialists	0.25	(-0.12 to 0.55)	0.184	0.239
Number of preparedness and response staff	0.05	(-0.30 to 0.38)	0.793	0.551
Number of health educators	0.13	(-0.22 to 0.46)	0.466	0.250
2011 total year expenditure	0.23	(-0.08 to 0.50)	0.144	0.093

^a Pearson *r* correlation, 95% confidence intervals (CI), and p values are for log-transformed number of videos posted to YouTube by SHDs vs type of staff and expenditure of SHD analyzed by univariate linear regression.

^b p values of number of videos posted to YouTube by SHDs vs type of staff and expenditure of SHD analyzed by negative binomial regression (number of videos).

Table 4. Statistics of log-transformed number of views per video posted to YouTube by State health departments (SHDs) vs type of staff and expenditure of SHD analyzed by univariable linear regression

Explanatory variable	Pearson <i>r</i> correlation	95% confidence interval	p value (linear regression)
Number of full-time employees	0.34	(0.04 to 0.59)	0.030
Number of epidemiologists/biostatisticians	0.41	(0.10 to 0.65)	0.012
Number of information specialists	0.32	(-0.04 to 0.61)	0.077
Number of preparedness and response staff	0.15	(-0.20 to 0.47)	0.391
Number of health educators	-0.20	(-0.51 to 0.16)	0.271
2011 total year expenditure	0.38	(0.08 to 0.61)	0.015

more likely to post a video on Mother/Infant Health if they had priorities in Infectious Disease (OR = 24.08, p = 0.01), All Hazards Preparedness and Response (OR = 51.58, p = 0.01), and Mother/Infant Health (OR = 29.07, p = 0.01).

DISCUSSION

Principal Findings

As of January 10, 2016, a total of 43 SHDs uploaded health-related videos to YouTube. A total of 415 randomly selected videos were manually coded for contents. Information about the public health agency, communicable diseases, and mother/infant health comprised the largest share of topics. One in 10 coded videos were not intended for public communication about health (coded “not relevant”) and were meant for SHD staff training purposes.

Number of full-time employees, number of epidemiologists and biostatisticians, and 2011 total year expenditure were found to be positively correlated with the log-transformed number of views per video posted to YouTube by SHDs. Our findings implied that larger SHDs with

a bigger budget and a larger work force were likely to create and upload YouTube videos that attracted more views per video.

Public Health Implications

Most SHDs made use of YouTube to reach their audience. Although 17.6% of SHD YouTube videos were to promote or to inform the public about the SHDs and their affiliated agencies, the proportion was lower than that on Twitter, where one-third of tweets posted by SHDs were about the organizations and two-thirds were focused on personal health topics.¹³

Clearly, SHDs can create videos appealing to young adults, as 82% of 18- to 29-year-olds used YouTube in 2014. YouTube can also serve as a platform to reach minorities, considering that 76% of blacks and 74% of Hispanics in the US reported using YouTube, compared with 57% of whites.³ Creating and posting videos in multiple languages would help to reach a broader range of individuals (eg, Hispanics). Considering our findings that only 15 of our manually coded sample of 415 YouTube videos were in Spanish, there is

certainly room for further development in video health communication outreach to the Spanish-speaking minorities in the US.

Given that we observed no meaningful patterns of statistical association between the percentage of expenditure on a specific program area and the topics of videos, we postulated that the SHD decision to create and upload YouTube videos of a given topic might not be informed by the share of resources dedicated to the specific program area.

Strengths and Limitations

This study presents a qualitative view of YouTube videos posted by SHDs as of 2016. Changes over time were not studied because this is a cross-sectional study. All states of the US were included in the study as we identified SHD YouTube videos, but Nevada and South Carolina were excluded from the regression models because they did not participate in the 2012 ASTHO profile survey.

The study has some limitations. We coded only 10 randomly chosen videos

Table 5. Odds ratio and p values for video topic by state health department expenditure category using univariable weighted logistic regression analysis

Explanatory variable	Video topic as outcome variable, odds ratio (p value)					
	Chronic disease	Infectious disease	Injury prevention	WIC	Environmental health	All hazards preparedness and response
Percentage of expenditure						
Chronic disease	0.23 (0.17)	NA	2.37 (0.30)	2.13 (0.38)	0.48 (0.30)	NA
Infectious disease	1.40 (0.69)	NA	0.72 (0.66)	NA	1.55 (0.49)	4.94 (0.03)
Injury prevention	1.51 (0.19)	NA	1.57 (0.20)	2.61 (0.01)	0.92 (0.80)	NA
WIC	NA	2.40 (0.26)	0.53 (0.49)	0.03 (0.02)	0.43 (0.32)	0.09 (0.05)
Environmental health	0.71 (0.59)	1.21 (0.71)	2.13 (0.20)	2.51 (0.18)	1.13 (0.75)	1.36 (0.58)
All hazards preparedness and response	0.32 (0.39)	0.48 (0.69)	1.41 (0.78)	NA	0.68 (0.62)	0.04 (0.01)
Expenditure, US dollars						
2011 total expenditure	25.71 (0.10)	37.40 (0.12)	0.42 (0.60)	4.12 (0.31)	0.46 (0.30)	94.16 (0.02)

NA = not applicable; WIC = Special Supplemental Nutrition Program for Women, Infants and Children.

Table 6. Odds ratio and p values of state health departments posting a video on topics related to their top 5 priorities

Explanatory variable: Top 5 priorities	Topic of video as outcome variable, odds ratio (p value)					
	Chronic disease	Infectious disease	Injury prevention	Environmental health	All hazards preparedness and response	Mother/infant health
Chronic disease	0.69 (0.78)	NA	0.82 (0.86)	8.48 (0.13)	132.70 (< 0.01)	6.90 (0.15)
Infectious disease	0.76 (0.83)	0.24 (0.35)	0.28 (0.28)	6.16 (0.16)	8.62 (0.12)	24.08 (0.01)
Injury prevention	NA	NA	NA	8.28 (0.13)	0.73 (0.81)	1.41 (0.82)
Environmental health	NA	1.93 (0.69)	0.28 (0.42)	0.42 (0.58)	NA	0.12 (0.20)
All hazards preparedness and response	2.84 (0.50)	NA	0.69 (0.79)	0.51 (0.64)	38.66 (0.01)	51.58 (0.01)
Mother/infant health	1.62 (0.71)	0.26 (0.38)	0.63 (0.69)	9.01 (0.11)	18.54 (0.05)	29.07 (0.01)

NA = not applicable.

from each state. Although the sample was randomly selected, the small sample size might introduce selection bias. Video topics were manually coded. Although 10% of the sampled videos were double-coded, coder subjectivity in determining the main topic was plausible. We did not record the year the videos were first uploaded and did not study whether they were timely regarding the current public health needs in the state served by each of the SHDs. We also did not analyze whether the images or messages in the videos were acculturated to their intended audience. Furthermore, this study is limited to YouTube, and SHDs might have used other video-sharing sites. Future studies could explore these directions of research.

Although we used the most recent ASTHO data available to us when this study was conducted in 2016, the 2011-2012 data may not be representative of the current expenditure profile and top priorities of the SHDs. As mentioned, we coded only 10 randomly chosen videos from each state. With a small sample size, the randomization may have affected the results. However, the videos were randomly selected from all posted videos, and our regression models were weighted. When we compared the video topics with expenditure categories, not all categories were encompassed by the expenditure categories, meaning that SHDs posted videos on topics that did not easily fit into any one expenditure category. It is important to highlight that the budget for and the quantity of advertisements and other promotional efforts undertaken by SHDs might be correlated with the number of views per video and thus were potential confounders.²⁰⁻²² However, we did not have access to such information, and we could not estimate that based on the ASTHO data that we had.

CONCLUSION

Forty-three of 51 SHDs had YouTube channels as of January 2016. Information about the public health agency, communicable diseases, and mother/infant health comprised the largest share of topics.

Larger SHDs with a bigger budget and a larger work force were likely to create and upload YouTube videos that attracted more views per video. YouTube provides SHDs with a unique opportunity to disseminate health messages to the community. Future studies could focus on how SHDs promote their videos and could provide examples of best practices for other states to follow. ❖

Disclosure Statement

The author(s) have no conflicts of interest to disclose.

Acknowledgment

Kathleen Loudon, ELS, of Loudon Health Communications provided editorial assistance.

How to Cite this Article

Duke CH, Yin J, Zhang X, et al. Adopting YouTube to promote health: Analysis of state health departments. *Perm J* 2019;23:18-094. DOI: <https://doi.org/10.7812/TPP/18-094>

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