Tweeting about #Diseases and #Publichealth: Communicating Global Health Issues across Nations

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Tweeting about #Diseases and #Publichealth: Communicating Global Health Issues across Nations

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ABSTRACT

Twitter is playing an increasing role in health communications, but little is known about the Twitter use of national health departments in general and across different nations in particular. This quantitative content analysis of 1,200 tweets from 12 national health departments showed that the topics covered in these tweets are often lacking in broad coverage – cardiovascular disease is barely mentioned, while infectious diseases are often highlighted – and the tweets do not try to initiate engagement through creating a two-way dialogue with followers. However, the tweets appear to use Health Belief Model constructs, such as initiating cues to action, mentioning self-efficacy and highlighting perceived benefits of health preventative, treatment or screening options, and this is associated with increased Twitter engagement. The paper ends with recommendations for both future studies and new challenges for the use of Twitter by national health departments.

Introduction and background

According to the Centers for Disease Control and Prevention, "Public health is the science of protecting and improving the health of families and communities through promotion of healthy lifestyles, research for disease and injury prevention and detection and control of infectious diseases" (CDC, 2017). Generally, public health is focused on protecting the health of whole populations, including both small ones, such as neighborhoods, and large ones, such as entire countries. While every country has a public health government entity, these entities can look very different depending on the structure and needs of the country (Centers for Disease Control & Prevention, 2017). This global nature of health encourages the need to look at how national public health organizations are communicating across different countries. In addition, we live in a society characterized by the broad use of social media worldwide (Pew Research Center, 2016), and these platforms are increasingly used to search health-related information (i.e., Health Information National Trends Survey, 2014). Thus, it becomes important for national health departments to have a clear and visible voice in the realm of mass health communication (Moorhead et al., 2013) to inform citizens in ordinary and crisis situations that could have a global impact.

From this outlook, our study faces the challenge of complementing the American perspective that currently dominates health communication research, in order to understand how health communication processes work in different countries and different cultures (Hannawa et al., 2014). With the development and growing popularity of social media worldwide, there is also a need to determine how public health organizations are using social media to communicate locally but at the same time globally, due to the public and scalable dimensions of these digital platforms. Moreover, health issues can be communicated in different ways, according to cultural, political and organizational factors. Comparing different countries is important in the global society we live in, trying to avoid the risk to use a one-size fits all model for communication purposes.

Social media platforms provide new opportunities for organizations to engage in direct dialogue with both other organizations as well as with their stakeholders, and public relations professionals are often at the forefront of this dynamic (Sommerfeldt, Kent, & Taylor, 2012). Today, there are over 3.2 billion active social media users around the world, with more than 95% of them connecting through mobile devices such as smartphones and tablets (Kemp, 2018). Social media are designed to facilitate two-way communication and direct engagement with digital audiences and stakeholders. However, studies have shown that while many public health organizations and practitioners use Twitter to propagate information and to give visibility to certain health issues or services, they most frequently use them as a mechanism for one-way, megaphone-like information broadcasting and, therefore, do not use these platforms to their full potential (Cioni & Lovari, 2014; Syed-Abdul, Gabarrow, & Lau, 2016).

Over the past decade, Twitter has become an important source for health information. More than three quarters of U.S. adults (78.8%) use the Internet to find health-related information for themselves, and 64.6% use it to find health information for someone else (Health Information National Trends

Survey, 2014). Additionally, 67% of online information seekers felt that health-care social media sites assist them in being more informed patients (Wolters Kluwer, 2012), and nearly 40% of social media users believe that information they find on social media plays a role in how they deal with their health (Versel, 2015). Specifically focusing on Twitter, Donnelle and Booth (2012) found that Twitter creates a collaborative model of sharing health information and provides an emerging avenue for consumers to both provide and obtain health information. These findings point to the need for credible sources of health information, such as public health institutions, to serve as an information source for the public on social media platforms both in ordinary and crisis situations that could have a global impact (Moorhead et al., 2013).

Public health organizations are recognizing the value of Twitter as a way for disseminating health information and encouraging actions to improve health (Syed-Abdul et al., 2016). Studies have shown that Twitter is the most commonly used social media platform by national health departments, but that it is most frequently used as a one-way information channel instead of focusing on their publics' needs and preferences (Harris, Snider, & Mueller, 2013; Novillo-Ortiz & Hernàndez-Pérez, 2017). Therefore, while many national health departments have adopted social media for communication purposes, they have been slow to use these platforms to their full potential (Gough et al., 2017). In order to more fully leverage the benefits of Twitter, national health departments should focus increasingly on expanding their information-sharing and relationship-building strategies (Park, Reber, & Chon, 2016), and also shaping their digital content to include local/regional information in order to stimulate publics' engagement (Thackeray, Neiger, Smith, & van Wagenen, 2012). Finally, culture, race, and ethnicity are widely known to affect the effectiveness of health communication. Cultural group characteristics may be associated with health-related beliefs, attitudes, and decisions, and culture can be an important audience segmentation variable (Kreuter & McClure, 2004).

However, there remains a paucity of studies that compare the use of social media by health departments and authorities in different countries. Indeed, beside Novillo-Ortiz and Hernàndez-Pérez (2017) who investigated the use of social media by national health authorities in eighteen different countries in Latin America and the Caribbean, scholars have not yet carried out empirical studies in this area outside a single continent (Carrillo-Larco, 2012). At this point, therefore, little is known about how national health departments are using Twitter in different nations and on different continents, and no previous studies exist that compare countries on the use of Twitter for public health communication. Investigating how Twitter is used by different national health departments is a strategic issue with theoretical and practical implications. Opening an official account on Twitter does not mean this account will be effective in spreading public health information and engage with citizens around health issues. For that reason, it is important to identify and compare the content of public health communication on social media, considering content's spread, affordances of the platforms, and digital public's engagement practices. This paper, therefore, aims to help determine how different national health departments are using Twitter to communicate about public

health issues and further the research on whether utilizing certain health communication variables in the content of the tweets has any association with social media engagement levels.

Our study addresses this challenge with a particular focus on comparing different countries from different parts of the world. It represents one of the first studies that addresses this topic from a quantitative perspective. In this context, the study's first two research questions are:

RQ1: What do Twitter messages by national health departments look like in different nations?

RQ2: Are there differences in the Twitter engagement among national health department tweets of different nations?

Health belief model in the use of Twitter

The Health Belief Model (HBM) is one of the primary models used to help explain why individuals may or may not engage in a wide variety of health-related actions (Glanz, Rimer, & Lewis, 2002). The HBM consists of six main constructs: perceived susceptibility, perceived severity, perceived benefits, perceived barriers, perceived self-efficacy, and cues to action. Perceived susceptibility refers to a person's perceived chances of getting a condition, and perceived severity refers to a person's perceived severity and consequences of a given condition (Glanz et al., 2002). Perceived benefits are defined as a person's opinion on the effectiveness of the various methods available for reducing the threat, and perceived barriers are defined as a person's perception of whether the associated costs, financial or psychological, outweigh the benefits (Glanz et al., 2002). Self-efficacy refers to a person's confidence in their capabilities to carry out a particular action, such as exercise or control of their eating habits (Bandura, 2004). Cues to action are encouragements that may motivate a person to change or adopt a behavior (Graham, 2002).

The HBM is often used to design, explain, and evaluate digital health communication, including via social media (Ahadzadeh, Sharif, Ong, & Khong, 2015). Past studies have focused on body image issues (Simpson & Mazzeo, 2017), hookah use (Guidry, Haddad, Jin, & Zhang, 2017), vaccines (Guidry, Carlyle, Messner, & Jin, 2015) and breast cancer awareness (Diddi & Lundy, 2017). Considering the relevance of the Health Belief Model in public health communication as well as its prevalence in social media content analyses, this study's third and fourth research questions are:

RQ3: To what extent are HBM constructs used in national health department tweets across different nations?

RQ4: To what extent does the presence of HBM constructs in tweets by national health departments impact Twitter engagement?

Visual communication and the use of Twitter

Understanding health information can be difficult, even for well-educated members of the public. Using visuals can be helpful when trying to relay complex information (Lipkus, 2007). Displaying data in concrete terms through tools such

as imagery can attract and hold people's attention better than text-only communication and can also trigger emotions that draw viewers' attention and encourage engagement (McCaffery et al., 2012). Specifically looking at comprehension levels, studies have found that reader comprehension increased significantly with the addition of images in materials (Houts, Doak, Doak, & Loscalzo, 2006). While this effect is found to be strongest with low-literacy individuals, others benefited as well (Houts et al., 2006).

An increasing number of newer social media platforms are visual-focused and require a visual (image, infographics, video, etc.) to post a message. While Twitter does not have this requirement, posting visuals is an option, and previous studies have shown that publics increasingly respond to tweets that include visuals (Guidry, Waters, & Saxton, 2014). Visuals, therefore, are both of significance in health communication as well as in social media communication, and since Twitter does not require visuals, it is of interest to see whether and how these tweets by national health departments are using visuals. The fifth and final research question is:

RQ5: To what extent are visuals used in national health department tweets across different nations, and did the presence of visuals impact Twitter engagement?

Method

A quantitative content analysis was carried out of 1,200 randomly selected tweets by 12 national health departments: those of the United States (@HHSgov), Canada (@HealthCanada), Brazil (@minsaude), Chile (@gobiernodechile), Italy (@ministerosalute), Germany (@BMG_Bund), Nigeria (@healthNG), South Africa (@healthZA), India (@MoHFW_INDIA), Singapore (@sporeMOH), Australia (@healthgovau), and New Zealand (@minhealthNZ). The sample was derived by selecting the national health departments from two of the economically most productive countries on each of the six continents. These leading countries were determined through a combination of Gross Domestic Product and per capita income (Central Intelligence Agency, 2017a, 2017b). Eleven of the countries were among the top five for their continents based on GDP; Singapore was among the top three countries for per capita income in Asia. China, the country with the largest GDP worldwide, was excluded from the sample as Twitter is not available for usage there.

On December 18, 2016, random sampling was used to collect the 1,200 distinct tweets from the 12 national health departments using the Twitter application program interface, TAGS (Twitter Archiving Google Spreadsheet). This Google spreadsheet allows for the automated collection of data on Twitter through the specification of usernames of interest.

Coding protocols for the content analysis were developed, tested, and implemented for the coding process. Tweets were coded for Twitter-specific variables like hashtags, direct replies, website connection, and visual presence and characteristics; Twitter engagement, here defined as retweet and like frequencies; health issue topics (cardiovascular disease, cancer, diabetes, infectious disease, HIV/AIDS, mental health, natural disasters, injuries, sexual health, and other[1]); and Health Belief Model variables (perceived severity of the mentioned health issue, perceived susceptibility to the mentioned health issue, perceived benefits of recommended actions, perceived barriers to recommended actions, self-efficacy and cues to action related to recommended actions).

Coding protocols for the content analysis were developed, tested, and implemented for the coding process. Tweets were coded for Twitter-specific variables like hashtags and direct replies; Twitter engagement variables in the form of retweets and likes, website connection, and visual characteristics; health issue topics; and Health Belief Model variables. Tweets in languages other than English (Spanish, Portuguese, Italian, and German) were coded by a research team member with the language skills needed. After pretesting and subsequent changes to the coding protocol, the intercoder reliability tests were conducted by five coders on 20% of the sample. One coder (JG) coded all content, while the other four coders (MM, SM, VM, and AL) coded all the content divided between them, in part based on their respective language skills in languages other than English. Overall intercoder reliability was then calculated with the main coder as a constant to the coding of the other four (see Table 1). Calculations with the ReCal statistical program showed that Scott's Pi (Scott, 1955) was on average .82. The individual coefficients for all coding categories were all considered to be reliable, with the lowest coefficient at .70 (see Table 1).

Table 1. Intercoder reliability.

Category	Variable	JG, JA Scott's Pi	JG, MM Scott's Pi	JG, SM Scott's Pi	JG, AL Scott's Pi	Average Scott's Pi
General	Health topic	0.92	0.94	0.92	0.88	
	Link included	1	1	1	1	
	Link type	0.88	0.83	0.79	0.81	
Health Belief Model	Severity	0.86	0.74	0.71	0.7	
	Susceptibility	0.94	0.7	0.73	0.71	
	Benefits	0.92	0.81	0.76	0.74	
	Barriers	0.7	0.83	0.71	0.72	
	Cues to action	0.73	0.89	0.77	0.79	
	Self-efficacy	0.74	0.71	0.7	0.7	
Risk perception	Fear	0.7	0.73	0.78	0.72	
	Danger	0.72	0.77	0.71	0.76	
	Identifiable victim	0.81	1	0.79	0.8	
	Irreversible consequences	0.77	0.79	0.77	0.81	
	Credibility/trustworthiness	0.72	0.7	0.72	0.77	
Visuals	Visual included	1	1	1	1	
	Visual type	0.9	1	0.95	0.97	
Average		0.83	0.84	0.8	0.81	0.82

Results

RQ1: What do Twitter messages by national health departments look like in different nations?

For the entire sample, 31.8% (n = 382) of the tweets consisted of a retweet (a tweet forwarded from another Twitter user), and only 2.1% (n = 25) of the tweets consisted of a direct reply (a tweet starting with another user's handle, commonly used to directly address another Twitter user). In addition, a little over half (55.4%, n = 665) of the tweets in the sample included a hyperlink, and the majority of those pointed either to the organization's own website (37.3%, n = 248) or to another, related, government website (38.8%, n = 258). An additional 10.8% (n = 72) pointed to a social media website besides Twitter. In addition, about half, 49.7% (n = 596), of the tweets mentioned a specific health issue. The majority, 43.1% (n = 257), fit into the "other" category (containing issues such as breastfeeding and dementia); followed by infectious diseases (26.7%, n = 159), HIV/AIDS (7.9%, n = 47), and cancer (7.4%, n = 44). Cardiovascular disease was only mentioned in .8% (n = 5) of the tweets, the lowest count in the sample.

When considering the linking practices of the countries individually, six of the twelve countries – Australia, India, Nigeria, Italy, Germany, and South Africa – used a great breadth of websites. In contrast, Canada almost exclusively linked to its own website, and the U.S. account only linked to government websites and their other official social media platforms; never sharing news websites or major medical organization hyperlinks. A complete breakdown of hyperlink sources can be found in Table 2. Table 3 outlines the health topics as addressed by country. Each of the 12 countries mentioned infectious diseases in their tweets, but Nigeria, Brazil, and India each dedicated 20% or more of their tweets to this issue. Only three countries (Brazil, India, and Nigeria) mentioned cardiovascular disease, and each only mentioned it in one or two tweets. Half of the countries – Canada, Chile, Germany, New Zealand, Singapore, and the USA – did not address a specific health issue or topic in more than 50% of their tweets, instead often posting more general messages about agency activities like meetings, services, and travels.

RQ2: Are there differences in the Twitter engagement among national health department tweets of different nations?

For the complete sample, the mean number of retweets was 29.85 (SD = 213.099) and the mean number of likes was 20.12 (SD = 109.349). However, neither of these engagement variables were normally distributed, and the median will be a better measure of central tendency (Mdn = 6.00 for retweets and Mdn = 2.00 for likes). When breaking the results down per country, Italy's health department Twitter account produced the highest mean of retweets (M = 107.98, SD = 637.743), but a low median (Mdn = 6.00), while Chile's health department Twitter account produced the highest median number of retweets (Mdn = 29.50) with a much lower mean than Italy (M = 43.10, SD = 59.145) (See Table 4 for complete results). India reached the second highest median number of retweets, and the highest median number of likes.

RQ3: To what extent are HBM constructs used in national health department tweets across different nations?

Of the total sample of 1,200 tweets, 8.8% (n = 106) mentioned the perceived severity of a health issue, 7.2% (n = 86) mentioned perceived susceptibility to a disease or health issue, 17.7% (n = 212) mentioned perceived benefits of health preventative, treatment, or screening actions, 2.3% (n = 27) mentioned perceived barriers to health preventative, treatment, or screening actions, 21.7% (n = 260) mentioned self-efficacy, and 28.7% (n = 344) mentioned cues to action. However, while Canada, Chile, Nigeria, and Singapore used these constructs in fewer than 10% of their tweets, Australia used some form of cues to action in 72% of their tweets, and self-efficacy in 55%. Similarly, the U.S. used cues to action in 71% of their tweets, and self-efficacy in 56%. New Zealand used perceived benefits in 44% and cues to action in 45% of their tweets. In general, perceived benefits, cues to action, and self-efficacy were most frequently utilized (see Table 5).

RQ4: To what extent does the presence of HBM constructs in tweets by national health departments impact Twitter engagement?

In order to answer this question, this study compared engagement as operationalized by levels of retweets and likes with the presence/absence of HBM constructs within each organization's tweets. Since neither of the Twitter engagement variables were normally distributed, we again used the nonparametric Mann Whitney U test to compare the medians for retweets and likes by country. All HBM constructs were at least associated with

Table 2. Type of link by country.

Country	Other social media	Blog	Other gov site	Own site	Major news site	Major medical org	Other
Australia	5.3% (n = 5)		45.3% (n = 43)	42.1% (n = 40)	3.2% (n = 3)	3.2% (n = 3)	4.2% (n = 4)
Brazil	20.0% (n = 12)		70.0% (n = 42)		8.3% (n = 5)		
Canada				97.9% (n = 94)			2.1% (n = 2)
Chile	1.9% (n = 1)		98.1% (n = 52)				
Germany	26.7% (n = 12)		46.7% (n = 21)		13.3% (n = 6)	11.1% (n = 5)	2.2% (n = 1)
India	6.3% (n = 1)		25.0% (n = 4)	6.3% (n = 1)	56.3% (n = 9)	6.3% (n = 1)	
Italy	4.8% (n = 3)		22.2% (n = 14)	46.0% (n = 29)	9.5% (n = 6)	9.5% (n = 6)	17.5% (n = 11)
New Zealand	8.8% (n = 7)		27.5% (n = 22)	50.0% (n = 40)		8.8% (n = 7)	
Nigeria	48.0% (n = 12)	8.0% (n = 2)	8.0% (n = 2)	8.0% (n = 2)	16.0% (n = 4)	4.0	
Singapore	13.6% (n = 6)			86.4% (n = 38)			
South Africa	37.5% (n = 9)		16.7% (n = 4)	4.2% (n = 1)	8.3% (n = 2)	33.3% (n = 8)	
USA	6.3% (n = 4)	4.7% (n = 3)	84.4% (n = 54)	4.7% (n = 3)			

Table 3. Health issues by country.

Country	Cardiovascular disease	Cancer	Diabetes	Infectious disease	HIV/AIDS	Mental health	Natural disasters	Injuries	Sexual health	Other	None
Australia		13.0% (n = 13)	1.0% (n = 1)	12.0% (n = 12)		16.0% (n = 16)				36.0% (n = 36)	22.0% (n = 22)
Brazil	2.0% (n = 2)	5.0% (n = 5)	4.0% (n = 4)	20.0% (n = 20)		2.0% (n = 2)		1.0% (n = 1)		23.0% (n = 23)	35.0% (n = 35)
Canada		3.0% (n = 3)		8.0% (n = 8)	8.0% (n = 8)					2.0% (n = 2)	87% (n = 87)
Chile		2.0% (n = 2)		1.0% (n = 1)	2.0% (n = 2)		10.0% (n = 10)	1.0% (n = 1)		19.0% (n = 19)	65.0% (n = 65)
Germany	2.0% (n = 2)	2.0% (n = 2)	1.0% (n = 1)	16.0% (n = 16.0)		2.0% (n = 2)			1.0% (n = 1)	8.0% (n = 8)	70.0% (n = 70)
India		3.0% (n = 3)	2.0% (n = 2)	20.0% (n = 20)	3.0% (n = 3)	2.0% (n = 2)		1.0% (n = 1)	1.0% (n = 1)	40.0% (n = 40)	26.0% (n = 26)
Italy		2.0% (n = 2)	1.0% (n = 1)	7.0% (n = 7)	3.0% (n = 3)		1.0% (n = 1)	2.0% (n = 2)	3.0% (n = 3)	38.0% (n = 38)	43.0% (n = 43)
New Zealand		1%0 (n = 1)		16.00% (n = 16)		3.0% (n = 3)		4.0% (n = 4)		17.0% (n = 17)	56.0% (n = 56)
Nigeria	1.0% (n = 1)			46.0% (n = 46)						44.0% (n = 44)	
Singapore		2.0% (n = 2)	3.0% (n = 3)	2.0% (n = 2)		3.0% (n = 3)		1.0% (n = 1)		22.0% (n = 22)	67.0% (n = 67)
South Africa		4.0% (n = 4)	2.0% (n = 2)	5.0% (n = 5)	26.0% (n = 26)	1.0% (n = 1)			7.0% (n = 7)	26.0% (n = 26)	29.0% (n = 9)
USA		7.0% (n = 7)	2.0% (n = 2)	6.0% (n = 6)	5.0% (n = 5)	1.0% (n = 1)		2.0% (n = 2)		17.0% (n = 17)	60.0% (n = 60)

Table 4. Engagement by country.

Country	Variable	Retweets frequency	Likes frequency
Australia	Median	4.00	2.00
	Range	1476	314
Brazil	Median	3.00	6.00
	Range	316	817
Canada	Median	12.00	2.00
	Range	354	65
Chile	Median	29.50	21.00
	Range	483	879
Germany	Median	4.00	2.00
	Range	89	47
India	Median	22.50	33.00
	Range	2812	2721
Italy	Median	6.00	2.00
	Range	6009	5360
New Zealand	Median	3.00	1.00
	Range	92	103
Nigeria	Median	2.00	.00
	Range	86	18
Singapore	Median	0.00	0.00
	Range	42	3
South Africa	Median	3.50	1.00
	Range	32	18
USA	Median	17.50	17.50
	Range	640	1461

a statistically significant increase in median engagement in at least one instance, and only one construct, self-efficacy, was associated with statistically significantly lower median like frequency (in the Chilean health department tweets). In Brazil's case, four of the six constructs (benefits, severity, self-efficacy, and cues to action) were associated with either a higher median retweet or like frequency. Cues to action was associated with seven separate instances of higher median engagement, while perceived severity was associated with six separate instances. Finally, there were no significant differences associated with the presence of any of the HBM constructs for both Italy and the U.S. (see Table 6).

RQ5: To what extent are visuals used in national health department tweets across different nation, and did the presence of visuals impact Twitter engagement?

For the entire sample, 44.0% (n = 528) of the tweets contained a visual. Of those, 37.7% (n = 199) consisted of primarily image (a photo with little or no text), 22.0% (n = 116) consisted of a mix of image and text, and 16.1% (n = 85) consisted of an infographic. Considering each country individually, 41% of Australia's tweets included a visual, 62% for Brazil, 7% for Canada, 89% for Chile, 40% for Germany, 61% for India, 50% for Italy, 24% for New Zealand, 19% for Nigeria, 3% for Singapore, 58% for South Africa, and 75% for the USA. In other words, two countries utilized visuals in fewer than 10% of their tweets: Canada and Singapore; four countries included visuals in more than 60% of their posts: Brazil, Chile, the USA, and India. Moreover, Germany, India, Italy, South Africa, and the U.S. all seemed to use a broad visual strategy, utilizing all major visual types in their subsample of 100 tweets: primarily photo, primarily text, a mix of photo and text, infographic, and video. City-state Singapore is the only nation that exclusively used one visual type: primarily photo (for a complete breakdown, see Table 7). Finally, Mann Whitney U tests showed that tweets including a visual were retweeted more frequently (Mdn = 9.00) than tweets lacking a visual (Mdn = 3.00); similarly,

Table 5. Health belief model constructs by country.

Country	Severity	Susceptibility	Benefits	Barriers	Cues to action	Self-efficacy
Australia	3.0% (n = 3)	8.0% (n = 8)	27.0% (n = 27)	1.0% (n = 1)	72.0% (n = 72)	55.0% (n = 55)
Brazil	13.0% (n = 13)	17.0% (n = 17)	15.0% (n = 15)	2.0% (n = 2)	19.0% (n = 19)	16.0% (n = 16)
Canada	0.0% (n = 0)	0.0% (n = 0)	0.0% (n = 0)	0.0% (n = 0)	2.0% (n = 2)	0.0% (n = 0)
Chile	2.0% (n = 2)	2.0% (n = 2)	6.0% (n = 6)	0.0% (n = 0)	9.0% (n = 9)	5.0% (n = 5)
Germany	5.0% (n = 5)	7.0% (n = 7)	10.0% (n = 10)	0.0% (n = 0)	9.0% (n = 9)	7.0% (n = 7)
India	18.0% (n = 18)	14.0% (n = 14)	34.0% (n = 34)	3.0% (n = 3)	36.0% (n = 36)	27.0% (n = 27)
Italy	10.0% (n = 10)	3.0% (n = 3)	10.0% (n = 10)	3.0% (n = 3)	33.0% (n = 33)	10.0% (n = 10)
New Zealand	8.0% (n = 8)	4.0% (n = 4)	44.0% (n = 44)	8.0% (n = 8)	45.0% (n = 45)	48.0% (n = 48)
Nigeria	7.0% (n = 7)	6.0% (n = 6)	0.0% (n = 0)	0.0% (n = 0)	9.0% (n = 9)	7.0% (n = 7)
Singapore	4.0% (n = 4)	2.0% (n = 2)	3.0% (n = 3)	1.0% (n = 1)	3.0% (n = 3)	3.0% (n = 3)
South Africa	28.0% (n = 28)	14.0% (n = 14)	33.0% (n = 33)	5.0% (n = 5)	36.0% (n = 36)	26.0% (n = 26)
USA	8.0% (n = 8)	9.0% (n = 9)	30.0% (n = 30)	4.0% (n = 4)	71.0% (n = 71)	56.0% (n = 56)

Table 6. Health belief model variables and median engagement.

Country	Engagement variable	HBM variable	Mdn present	Mdn absent	U	Z	p-value
Australia	Retweets	Severity	15.00	4.00	245.500	2.029	.039
Brazil	Retweets	Benefits	7.00	3.00	911.500	2.665	.008
	Retweets	Severity	7.00	3.00	809.000	2.514	.012
	Retweets	Self-efficacy	9.50	3.00	990.500	3.017	.003
	Likes	Self-efficacy	12.50	5.50	902.500	2.178	.029
	Retweets	Cues to action	12.00	3.00	1,250.000	4.253	<.001
	Likes	Cues to action	17.00	5.00	1,186.000	3.678	<.001
Canada	Retweets	Cues to action	28.50	11.50	177.000	1.947	.044
Chile	Likes	Self-efficacy	3.00	7.00	112.000	−1.986	.047
Germany	Retweets	Susceptibility	8.00	3.00	513.500	2.554	.011
	Retweets	Severity	10.00	5.00	72,694.500	4.329	<.001
India	Likes	Severity	58.50	31.00	973.500	2.114	.035
	Retweets	Susceptibility	40.00	19.00	827.500	2.241	.025
New Zealand	Retweets	Self-efficacy	3.00	2.00	1,673.500	2.970	.003
	Retweets	Cues to action	3.00	2.00	1,672.500	2.733	.006
Nigeria	Retweets	Severity	13.00	2.00	579.500	3.479	.001
	Retweets	Susceptibility	10.00	2.00	480.000	2.913	.004
	Retweets	Cues to action	8.00	2.00	589.500	2.198	.028
Singapore	Retweets	Cues to action	5.00	0.00	277.500	3.055	.002
South Africa	Retweets	Barriers	9.00	3.00	396.000	2.521	.012
	Retweets	Severity	6.00	3.00	1,389.500	2.945	.003
	Retweets	Cues to action	5.50	3.00	1,496.500	2.488	.013

No significance for any HBM constructs for USA and Italy

Table 7. Visual type by country.

Country	Primarily image	Primarily text	Mixed	Infographic	Video	Other
Australia	14.6% (n = 24)	34.1% (n = 14)	43.9% (n = 18)		7.3% (n = 3)	
Brazil	30.6% (n = 19)		1.6% (n = 1)	35.5% (n = 22)	30.6% (n = 19)	
Canada	28.6% (n = 2)	28.6% (n = 2)	42.9% (n = 3)			
Chile	37.5% (n = 33)		10.2% (n = 9)	31.8% (n = 28)		
Germany	50.0% (n = 20)	5.0% (n = 2)		25.0% (n = 10)	17.5% (n = 7)	2.5% (n = 1)
India	44.3% (n = 27)	6.6% (n = 4)	21.3% (n = 13)	21.3% (n = 13)	3.3% (n = 2)	3.3% (n = 2)
Italy	64.0% (n = 32)	4.0% (n = 2)	16.0% (n = 8)	4.0% (n = 2)	10.0% (n = 5)	2.0% (n = 1)
New Zealand	50.0% (n = 12)	4.2% (n = 1)	37.5% (n = 9)	8.3% (n = 2)		
Nigeria	42.1% (n = 8)		31.6% (n = 6)	10.5% (n = 2)	10.5% (n = 2)	
Singapore	100.0% (n = 3)					
South Africa	44.8% (n = 26)	20.7% (n = 12)	8.6% (n = 5)	6.9% (n = 4)	19.0% (n = 11)	
USA	14.7% (n = 11)	13.3% (n = 10)	58.7% (n = 44)	2.7% (n = 2)	10.7% (n = 8)	

tweets including a visual were also liked more frequently (Mdn = 5.00) than tweets not using a visual (Mdn = 1.00).

Discussion

This content analysis focused on the Twitter use and public engagement of national health departments in twelve countries on six continents. One of the most interesting results was the glaring lack of attention to cardiovascular disease in these tweets across the nations: the issue is barely mentioned, while it is one of the main causes of morbidity and mortality worldwide (WHO, n. d.). Most tweets that address a specific topic focus on infectious diseases, which is not surprising considering the recent Ebola and Zika outbreaks. Each of the 12 countries mentioned infectious diseases in their tweets, but Nigeria, Brazil, and India each dedicate 20% or more of their messages to this issue. The same three countries were the only ones to mention cardiovascular disease, but each only mentioned it in one or two tweets. Surprisingly, the U.S. and Canada did not mention cardiovascular disease at all. Topics like infectious disease are relevant and should be covered, but the lack of focus on cardiovascular disease and its prevention is startling and cause for concern, particularly since it is still the leading cause of death worldwide (Finegold, Asaria, & Francis, 2013).

Half of the countries – Canada, Chile, Germany, New Zealand, Singapore, and the USA – did not address a specific health issue or topic in more than half of their tweets; instead often posting more general messages about agency activities like meetings, services, and travels. These messages elicited little engagement by digital publics, and while they may seem to make sense from a public relations point of view, they are likely not the most productive type of tweet for public health communication professionals or for the agencies themselves since they mostly do not satisfy local public's needs (Thackeray et al., 2012).

On social media, connecting with hyperlinks to additional sources often is cause for concern when the associated websites are lacking in trustworthiness. In this case, most hyperlinks point to either a health department's own site, other related government sites, or associated other official social media platforms.

As far as engagement with the tweets in this sample, while Italy has the highest engagement level in mean level of retweets and likes, engagement metrics on social media in this study were not normally distributed (they rarely are), and both Chile and India elicited the highest engagement as far as median frequency for retweets and likes. More importantly, engagement was low compared to other Twitter health topic studies (Guidry, Jin, Orr, Messner, & Meganck, 2017), which points to the need for a greater commitment on fostering public engagement and a specific focus on strategic message design for these health departments. Public health Twitter use seems to be mostly one-way in order to disseminate information (McNab, 2009), rather than allowing and activating dialogue and participation around health issues with digital publics and local communities (Harris et al., 2013). There is an increase in focus on using health behavior and other theories in health communications practice, and this study shows when HBM constructs are present, message engagement is significantly higher. While we cannot confirm the intention of the use of these constructs, this dynamic is notable and should be further investigated through future qualitative interviews.

Health Belief Model (HBM) constructs were used frequently and, in most cases, increased public engagement in a statistically significant manner. In general, perceived benefits, cues to action, and self-efficacy were most frequently utilized by the health departments in this study. Their focus, therefore, seems to be less on perceived threat of health issues (in the form of perceived severity and susceptibility as well as perceived barriers to solutions), and more on the potential for management of threats in the form of perceived benefits, cues to action, and self-efficacy. However, both threat and management of threat seem to increase tweet engagement rates. Cues to action was associated with seven separate instances of higher median engagement, while perceived severity was associated with six separate instances of higher median engagement. On the other end of the spectrum, city-state Singapore, which only incidentally used theory constructs in their tweets, and no variety in their visuals, also did not elicit engagement on Twitter, while countries with a deeper and more balanced approach elicited more engagement.

Finally, use of visuals on Twitter varies wildly among the national health departments in this sample, ranging from 3% (Singapore) to 89% (Brazil). Over the complete sample, tweets including a visual elicited significantly higher levels of both retweets and likes. This confirms what we know from other studies: the use of visuals on Twitter tends to be associated with higher engagement (Guidry et al., 2017).

Conclusion

This study recommends several best practices for public health communication professionals on Twitter that could be applied, despite the cultural and legal factors impacting public health digital communication strategies across the world. First of all, while different countries and cultures may have different perceptions of which health issues are perceived as a more imminent threat, it is important to increase focus on chronic diseases, such as cardiovascular disease, because of the associated morbidity and mortality in the majority of the countries included (WHO, n.d.).

Second, health communication professionals should use and adopt theoretical constructs when defining social media strategies and creating tweets in order to make these messages more effective towards digital publics. They should also utilize visuals such as images, videos, or infographics in their public health tweets in order to increase message engagement among citizens with low literacy (Houts et al., 2006). Lastly, health communication professionals should reply to online stakeholders when they are contacted or mentioned in conversations in order to gain a visible, active, and trustful role in the social web, thus averting situations in which rumors or misleading information are diffused by non-official sources (Vraga & Bode, 2018).

This study's limitations also point to options for future directions: The study only focused on Twitter while newer, more visual platforms have long overtaken Twitter in terms of popularity and active users. Future studies should consider a similar study on other social media platforms such as Instagram, especially once these platforms are increasingly adopted by public health agencies and departments. In addition, this study only focused on twelve nations; thus, the study could be extended to other nations to identify possible commonalities or differences in digital health communication strategies in the different parts of the globe. Moreover, we focused on retweets and likes for public engagement, which is what Twitter provides on its platform. However, retweets and likes are a limited form of engagement (Neiger, Thackeray, Burton, Giraud-Carrier, & Fagen, 2013), and other research methods like surveys, digital ethnography, and interviews may provide a broader insight into which posts are most effective in reaching health departments' publics. These methods could help enrich theoretical implications related to publics' engagement specifically related to health communication.

Additionally, while this study focused on differences in Twitter use and engagement by health departments of different nations, more attention needs to be paid to the culture and language differences involved and how those affect both messaging strategies and engagement rates since different countries and cultures will likely have different perceptions of health issues. For further comparative studies, it would be important also to consider the different health systems of the countries analyzed, since this factor could influence publics' perception of health-related messages published on institutional social media channels. Finally, the integration of theoretical frameworks

from other disciplines in the study messages seems to hold potential and deserves further consideration.

In closing, social media in general and Twitter, in particular, have become essential tools for public health communications that allow them to reach large audiences immediately. Therefore, it is essential that more research is conducted on how these digital platforms alter the way organizations communicate about important topics such as disease prevention, epidemics, and natural disasters. The integration of theoretical frameworks from other disciplines is an important step in the expansion of this research area.

Note

1. Based on the WHO's list of top causes of death (World Health Organization, 2017).

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