Using Twitter Messaging to Reach and Engage Public Health Audiences about Topics Related to Obesity: A Case Study

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Abstract

The purpose of this case-study is to evaluate the effectiveness of messaging, using Twitter, to reach and engage audiences on topics related to obesity. Messages (tweets) from the Twitter account, @CDCObesity, were collected during the period of May 6 – May 15, 2012. We used federally recommended metric categories (breadth, depth and direct engagement) to organize data in the assessment of user engagement. Breadth was measured by community size (number of followers), and community growth (increase in followers). Depth was measured by a click-through rate (percentage of followers who click on a hyper link). Direct engagement was measured by the number of mentions (including @CDCObesity in tweet body), retweet rate (retweets to tweets sent) and a conversation ratio (total number of mentions divided by total number of tweets sent). In total, 189 tweets were analyzed. @CDCObesity sent 96 tweets (50.8%). For breadth, the community size increased from 869 to 1101 (27% community growth). For depth, the click-through rate was 1%. For direct engagement, @CDCObesity was mentioned in 93 tweets (93/189 = 49.2%); retweet rate was 46.9% (45 retweets of @CDCObesity tweets/96 @CDCObesity tweets sent); conversation ratio was 0.97:1. Based on an increase in followers, the number of @CDCObesity mentions, and robust retweet and click-through rates and conversation ratio, @CDCObesity appeared to effectively reach and engage Twitter users. Our findings suggest Twitter is an effective platform to reach and engage audiences in a public health setting. Public health organizations may use these findings to evaluate their efforts using social media.

Key Words: social media, public health, obesity, organizations

Introduction

Today, 90% of young adults (ages 18 – 29) and more than 65% of adults (ages 30-49) in the United States routinely use social media – a nearly tenfold jump in the past decade (Perrin, 2015; Zickuhr, 2012; Madden, 2011; Madden, 2013; Chou, 2009). Since its founding in 2006, Twitter, an online social networking and microblogging site, has significantly expanded the

number of adult users and their frequency of daily use (Brenner, 2012). Advances in social media offer new methods and, perhaps, improved opportunities for communication for public health outreach. However, the absence of widely accepted standardized performance measures limits the ability to evaluate the potential effectiveness of such advances across digital platforms. *Social Media Metrics for Federal Agencies* is one tool recommended by the Federal Government to systematically measure the effectiveness of social media outreach programs (DigitalGov, 2013).

Studies of social media as a channel for health promotion have been limited; however, evidence is growing as interest in and experience with new media increase. Much of current research focuses on social media as an effective online communication platform to improve knowledge and understanding of specific health topics. For example, some programs have successfully used social media to help individuals quit smoking, control diabetes, and improve their diets (Chou, 2009; Scanfeld, 2010; Harris, 2013; Guide to Community Preventive Services, 2010). Studies have also found that internet-based programs can successfully encourage health improvement and behavior changes (Webb, 2010) to treat and prevent overweight and obesity by enhancing social support networks as a viable component of weight management programs (Li, 2012; Cavallo, 2012; Finlay, 2005). Social media has also been used to promote virtual participation, intra-conference networking, sharing of key messages from lectures and discussions in public health-related academic and professional conferences (Bert F, 2015; Vega, 2013). With the widespread use of social media, there is a need for standardized methodology that will accurately measure and evaluate its public health impact to incorporate outcomes into the design of health promotion programs.

The aim of this case-study was to assess the effectiveness of online messaging to reach and engage audiences on topics related to obesity by applying standardized, federally recommended evaluation metrics to a digital platform. We used *Social Media Metrics for Federal Agencies* to assess the ability of Twitter-based social media data to reach and engage audiences during the three-day obesity health conference, *Weight of the Nation*, and accompanying Home Box Office (HBO) documentary premiere, May 6 to May 15, 2012. To our knowledge, this article is one of the first case-studies to apply *Social Media Metrics for Federal Agencies.*

Study Sample Background

Twitter is a real-time internet-based communication and microblogging platform that allows users to rapidly share ideas, opinions, and news related to their individual interest. Users create accounts which allow them to share and receive text messages consisting of no more than 140 characters called Tweets. Tweets can be posted to Twitter via text message, mobile websites, Twitter's website, and other web applications. Twitter terms and abbreviations are defined in Table 1, such as tweet, retweet, mention and follower (Centers for Disease Control and Prevention, 2011; Twitter, 2015). The CDC uses Twitter as part of an integrated health communication strategy developed within the Health Communication Science Office (HCSO) to connect audiences with information on a variety of health and safety topics.

Table 1 *Dictionary of Twitter-related terms*

Term	Definition
Tweet	(verb) The act of posting a message, often called a Tweet, on Twitter. (noun) A tweet / message containing 140 characters or fewer.
@reply	A Tweet posted in reply to another user's message. Always begins with @handle (username).
Handle	A user's Twitter handle is their account (e.g., the username they have selected and the accompanying URL).
Follow	To subscribe to a user's Tweets or updates. When someone posts a new message, it appears in his/her follower's Twitter feed in real time.
Follower	Another Twitter user who has subscribed to follow your account.
Hashtag (#)	The # symbol is used to mark keywords or topics in a Tweet. It was created by Twitter users to organize and catalog, for example, keywords, topics, or conversations.
Retweet (RT)	(verb) The act of forwarding another user's Tweet to all of your followers. (noun) A Tweet by another user, forwarded by someone you follow. Often used to spread news or share valuable findings on Twitter.
Mention	Any Twitter update that contains @username anywhere in the body of the Tweet.

Note. Definitions compiled from "The Twitter Glossary", 2013. Available from: http://support.twitter.com/articles/166337-the-twitter-glossary#. Retrieved on March 6, 2013 from the Twitter Help Center.

The CDC's Division of Nutrition, Physical Activity, and Obesity (DNPAO) created a Twitter account, @CDCObesity, in April 2012. The first tweet was shared on May 1, 2012 to promote the upcoming 2012 Weight of the Nation (WON) conference and *The Weight of the Nation* HBO Documentary Films and Institute of Medicine four-part series premiere. The 2012 WON conference (May 6, 2012 - May 9, 2012) brought together experts engaged in obesity prevention and control initiatives. HBO's *The Weight of the Nation* films, which premiered on May 14, 2012 – May 15, 2012, focused on issues pertaining to the "nation's obesity crisis" to educate viewers and increase awareness (Carmona, 2007). The documentary series was broadcast on HBO and streamed free of charge on HBO.com, and featured case studies, interviews with experts, and individuals and families struggling with obesity (Weight of the Nation, 2012). Conference participants, as well as HBO's *The Weight of the Nation* viewers, were encouraged to engage in conference sessions and discussions via Twitter throughout the duration of both events. The study's goal was to measure the effectiveness of DNPAO's Twitter-based social media outreach program to reach and engage users during this time.

Study Sample

The study sample is comprised of all messages (tweets) shared via DNPAO's Twitter account, @CDCObesity, during the WON conference and *The Weight of the Nation* documentary premiere, May 6, 2012 – May 15, 2012. These include DNPAO tweets, tweets that use hashtags that DNPAO has established or is following, retweets from a list of pre-approved Federal and partner feeds, and tweets that mention @CDCObesity. Tweets were archived by CDC's Office of Policy, Partnerships and Communications and sorted by searching for the keyword, @CDCObesity, in the body of the message and then imported into an Excel database. Only tweets that contained @CDCObesity in the body of the message were included in this analysis. Messages were sorted by message content, time and date shared, and user demographic information (username, gender, location, Klout Score (Klout, 2015) and Twitter join year). Message content terms were categorized into nutrition, obesity, and physical activity messages through searches based on key words within messages meeting definition criteria.

Measures

Social Media Metrics for Federal Agencies was designed as a tool to organize social media data into standardized categories (DigitalGov, 2013). We applied three of these categories: breadth, depth, and direct engagement, to evaluate DNPAO's effectiveness in reaching and engaging Twitter users (Table 2). These categories are briefly defined in the text. A more in-depth description of the associated metrics is shown in Table2.

Table 2 *Breadth, depth and direct engagement definitions and measurement methodsfor each category*

Category	Definition	Metric	Metric Calculation Method	Interpretation
Breadth (DigitalGov, 2013)	Community or number of participants who have contact with the social media application, and their usage of that content.	Community Size	Total number of followers from the first data point to the last data point.	Indicates degree to which content has been spread across Twitter.
		Community Growth	Increase in the number of followers from the first point in time to the last point in time.	Indicates degree to which individual user interest in content is increasing over time.
		Klout Score (Klout, 2015)	Overall score of the number of people a user influences within their immediate network and across extended networks.	Indicates reach across social platforms and the level of community interest in what is being shared.
Depth (DigitalGov, 2013)	Measurement of the extent (time), and outcomesof a visit with a social media application.	Click Through Rate	Percentage of followers who click on a link.	Indicates ability to direct traffic to a website.
Direct Engagement (DigitalGov, 2013, Neiger, 2012)	Measurement that links social media to action and can range from low to medium to high.	Mention	Frequency count of a Twitter update that includes @username in the body of a message.	Indicates individual user interest and engagement with @username message content.
		Retweet Rate (Allen-Griel, 2010)	Total number of retweets divided by the total number of tweets shared.	Degree to which followers use content. Indicates building of an audience through interesting and informative tweets.
		Conversation Ratio (Allen-Griel, 2010)	Ratio of total number of mentions to the total number of tweets sent.	Indicates participating in a conversation versus only broadcasting messages.

Note. Definitions and metrics compiled to streamline from multiple resources as mentioned in the text. Adapted from DigitalGov, 2013; Neiger, 2012; and Allen-Griel, 2010.

Breadth

Breadth refers to a group of user characteristics (Table 2). Breadth comprised three metrics, community size, community growth, and, in our analysis, traits unique to individual users such as gender, age and location.

Depth

Depth refers to individual user activity and the time duration of a visit to a social media application (Table 2). We used click-throughs, the action of clicking on a hypertext link when included in a tweet, to measure this metric (DigitalGov, 2013).

Direct Engagement

Direct engagement is related to user action directly associated with social media and can vary according to volume of interaction (Table 2). We measured direct engagement by the most tweeted message content terms, the number of mentions, and in our analysis, a retweet rate and conversation ratio. A retweet rate indicates what message content was most frequently shared by users across networks. The retweet rate was compared to all messages created by users that included topics related to the categories of Nutrition-Obesity-Physical Activity. The conversation ratio is a surrogate for measuring exchange, interaction, and participation among users and determines whether there is a dialogue or a monologue occurring between these users.

Statistical Analysis

Messages were prepared for analysis by removing all non-standard characters or special characters that would hinder the use of content-mining tools, such as Excel and R, a statistical computing and graphics open-source program. Excel was used to organize the WON database, to analyze the social data, and calculate the retweet rate and conversation ratio. R (version 2.15.1) was used for sorting, data mining, and to test for statistical significance (P-value). Data sorting and mining techniques included descriptive statistics (frequency counts, pivot tables), categorization, and message content term clustering as described previously (Yoon, 2013).

Breadth

Breadth analyses measured @CDCObesity's community size and community growth. Community size was measured by the total number of @CDCObesity followers over the case-study period. Community growth was measured by change in the number of @CDCObesity followers between the beginning and the end of the case-study (DigitalGov, 2013). We used Twitter Analytics tools for user demographic analysis, such as foller.me and Klout.com. Foller.me compiles user profile information and tweets to analyze message content and describe topic usage to indicate what areas are most popular. A Klout score measures an individual user's influential standing within a social media community (Klout, 2015). Klout.com's algorithm system automatically generates an individual user score from 1 to 100 as a measure of user influence. According to the creators of this algorithm, the total population of social media users has an average Klout score of 40 (Klout, 2015).

Depth

To calculate depth, all tweets that contained a hypertext link were analyzed to approximate a click-through rate (CTR) as measured by the percentage of Twitter users who clicked on links within a tweet. Click-through data to the CDC – Weight of the Nation website was tracked and collected using Adobe Marketing Cloud Software. R was used to sort messages that contained a hypertext link and to then calculate the click-through rate.

Direct Engagement

To calculate direct engagement, we measured the most tweeted message content terms, the number of mentions, a retweet rate, and a conversation ratio. The most tweeted message content terms were assessed by a frequency count of the number of times a message was shared that included a key message content term, such as "exercise" for physical activity. The number of mentions was assessed by the number of times @CDCObesity was mentioned in a shared message. A retweet rate is calculated by dividing the number of retweets of @CDCObesity messages by the number of @CDCObesity messages sent (Allen-Greil, 2010). A conversation ratio was calculated by comparing the total number of mentions to tweets sent during the case-study (Allen-Griel, 2010). Message content terms were organized by single message content terms (e.g. Physical Activity) and by mixed message content terms for when a combination of terms were being analyzed, (e.g. Physical Activity and Obesity). To calculate a retweet rate or conversation ratio for single message content terms or mixed message content terms, the denominator equaled the total number of tweets that included key words for each message content terms definition criteria.

Results

Demographics (Breadth)

The community size of @CDCObesity increased over the ten days from 869 followers on May 6, 2012 to 1,101 followers on May 15, 2012 for community growth of 27%. The @CDCObesity community included Twitter users following @CDCObesity during the study time period. Of these followers, 72 users engaged in conversation with @CDCObesity through a tweet, retweet, hashtag or mention; 33% were located in the Southern region of the United States; 51.4% represented public health organizations engaged in issues related to obesity (the majority of whom are unaffiliated with the CDC (97%)); 45.8% joined Twitter between the years of 2009-2010; and 40.3% had a Klout score between the ranges of 41-60. At the time of the study period, @CDCObesity's Klout score was 56.

Activity (Depth)

Among DNPAO's community of followers, 1,042 tweets were archived during the WON conference and documentary premiere. One hundred eighty nine tweets included "@CDCObesity" in the body of the message and were therefore included in this analysis. Of these, 96 (50.8%) were generated by @CDCObesity, and 93 tweets (49.2%) were generated by @CDCObesity's community of Twitter users (Table 3). A total of 49 messages shared by @CDCObesity contained a hypertext link, which led to an average of 11.42 individual user click-throughs per message shared. The click through rate for each message shared by @CDCObesity was 1 out of 82 Twitter users (1%).

Engagement (Direct Engagement)

Seventy-two unique Twitter users shared and or mentioned @CDCObesity in their tweets. The single message content terms most frequently shared were "Obesity" (27.5%) followed by "General WON Documentary" (21.7%) and "General WON Conference Logistics" (19.0%). The single message content terms least frequently shared were "Nutrition" (3.2%) followed by "Physical Activity" (3.7%) and "General WON Conference" (7.9%). The mixed message content term most frequently shared was "Nutrition-Obesity-Physical Activity" (6.9%). The mixed message content terms least frequently shared were "Nutrition-Obesity" (0%) followed by "Obesity-Physical Activity" (0.5%).

The retweet rate for all general @CDCObesity messages was 46.9% (Table 3). The single message content term with the highest retweet rate was "Obesity" (62.5%) and the lowest was "Nutrition" (0%). The mixed message content term with the highest retweet rate was "Nutrition-Obesity–Physical Activity" (116.7%) and the lowest was "Obesity – Physical Activity" (0%). The conversation ratio for all general @CDCObesity messages was 0.97:1. There were several single message content terms with a more than one to one conversation ratio. Of those, the highest were "Nutrition" (2:1), "General WON Conference" (2:1) and "Other" (3:1). The single message content terms with a ratio further from one were "General WON Documentary" (0.4:1) and "Conference Logistics" (0.71:1). Of mixed message content terms, all had a conversation ratio of at least 1:1, except "Nutrition – Obesity" (0:0). Overall, "Nutrition – Obesity" was the only message content term without a conversation ratio.

Discussion

Our findings support the use of Twitter in public health as a tool to reach and engage audiences. Followers of @CDCObesity effectively engaged users in conversations as reported through engagement metrics of mentions, retweet rate of 46.9% and a nearly 1:1 conversation ratio (Table 3). The results of our analysis suggest that users were interested in the content and were also engaged in discussions within the digital platform. Direct engagement outcomes were highest for mixed-message content terms (e.g. Nutrition – Obesity - Physical Activity). For example, Twitter users retweeted more and created more dialogue when a message discussed not only school nutrition standards, but also physical activity requirements for children. In addition, we found an increase of 27% in the number of followers of our Twitter account over the duration of the observed time period and a 1% click-through rate, as compared to an average CTR of 1.46% on Twitter (Bennet, 2014), suggesting a user interest in the shared message topics. *Social Media Metrics for Federal Agencies* is a tool to analyze social media data using a standardized method. Its key criteria to evaluate social media efforts may be used for further analysis in an effort to create common terminology recognize trends and set benchmarks across Federal Agencies in social media.

A proposed advantage of *Social Media Metrics for Federal Agencies* is the use of standardized terminology to simplify evaluation of health messages and engagement of users of social media across studies. We did, however, find it necessary to integrate additional metrics suggested in previous literature such as the retweet rate and the conversation ratio. As a consequence, we found no studies whose results can be directly compared to our study. It is important, however, that prior to creating social media accounts for their agencies, public health professionals have appropriate evaluation metrics to interpret the success of social media outreach programs in the achievement of their goals. Our hope is that the methods used in our case study may provide assistance for future application of these metrics to analyze, measure and report on social media programs.

Many of our followers were partners and researchers engaged in policy related obesity prevention and control initiatives. As expected, social media users are generally more receptive to messages from sources they deem credible and trustworthy (Cowdery, 2013). Ultimately, some Federal Agencies may intend to use social media platforms to establish or leverage relationships to address public health issues among their followers. Use of standardized evaluation metrics as proposed in *Social Media Metrics for Federal Agencies,* may benefit the field. For example, evaluators will have standardized measures of social media criteria to compare across studies as well as common terminology and methods for data organization.

The retweet rate and conversation ratio were two metrics used to specifically measure user engagement. User engagement has been consistently described as a key component to maximize social media's potential impact on public health (Allen-Griel, 2010; Neiger, 2012). The retweet rate and conversation ratio for @CDCObesity were notably higher for messages that included mixed message content terms (Table 3). For example, the retweet rate for the single message content term "Obesity" was 62.5%, while the mixed content term "Nutrition-Obesity-Physical Activity" was 116.7%. This indicates that users are more engaged in content that spans more than one topic. One should consider the baseline number of messages shared per content term when analyzing these metrics. For example, messages related to "Physical Activity" had a lower retweet rate and conversation ratio; however, this term had the lowest number of shared messages (Table 3). Comparatively, although "Nutrition" had a very low number of messages shared; its 2:1 conversation ratio indicates that there was strong interest in dialogue among followers surrounding this topic. "Nutrition" generated the highest conversation ratio, second to the category of "Other" and equal to "General WON conference". In general, for every message that was shared by @CDCObesity, a dialogue was initiated with followers surrounding that message content as indicated by nearly half of all messages shared were retweeted as well as a close 1:1 conversation ratio existed for a majority of content terms.

The limitations of our case-study include our small sample size, which limited the ability to look across all available metrics in the framework, such as loyalty, customer service campaign, and strategic outcomes. Still, our sample size allowed for a focused application of metrics for evaluation through the *Social Media Metrics for Federal Agencies* recommendations. Additionally, to our knowledge, this article is one of the first case-studies to apply these social media metrics to a digital platform. Due to this literature gap, researchers may benefit from use of this case-study or *Social Media Metrics for Federal Agencies* independently, for the common terminology, data organization methods, and baseline social media metric findings to compare across studies.

Increased access to the Internet and mobile communication combined with strategic uses of social media can bring timely, accessible, and credible health information to more people than before and, in turn, may positively impact public health outcomes. However, there is a need for standardized methodology that will accurately measure and evaluate social media's public health impact to incorporate outcomes into the design of health promotion programs. The aim of this case-study was to assess the effectiveness of online messaging to reach and engage audiences on topics related to obesity during the 2012 WON conference and *The Weight of the Nation* documentary premiere by applying standardized, federally recommended evaluation metrics to a digital platform. Our findings suggest that Twitter was an effective platform to reach and engage audiences in conversations about topics related to obesity by analyzing and reporting upon specific metrics as recommended in *Social Media Metrics for Federal Agencies*. Researchers and public health professionals concerned in measuring the value and impact of social media in addressing their agency mission and program goals may consider using *Social Media Metrics for Federal Agencies* along with the additional metrics outlined in this case-study (DigitalGov, 2013). As more researchers use a consistent framework, organizations will be able to set social media benchmarks based on evidence-based practice.

Acknowledgements

The authors wish to thank all contributors in their guidance and support in writing this manuscript.

Funding

There are no relevant financial interests to report.

References

About Twitter. (2014). Retrieved on 6 March 2013 from: https://about.twitter.com/.

Allen-Greil D. (2010). *Twitter for Museums: Measuring, Analyzing, Reporting*. United States: MuseumsEtc.

Bert, F, Zeegers Paget D, Scaioli G. (2015). A social way to experience a scientific event: Twitter use the 7th European Public Health Conference. *Scandinavian Journal of Public Health,* 44(2):130-133.

Bennett S. (2012). Twitter CTR Gets Exponentially Worse as Followers Grow, Reveals Study. Retrieved on 8 August 2014 from: http://www.mediabistro.com/alltwitter/twitter-ctr_b30416.

Brenner ASJ. (2012). Twitter Use 2012. Pew Research Center's Internet & American Life Project 2012. Retrieved from: http://www.pewinternet.org/2012/05/31/twitter-use-2012/.

U.S. Public Health Service, Surgeon General. (2003). *The Obesity Crisis in America*. [Press Release]. Retrieved from: http://www.surgeongeneral.gov/news/testimony/obesity07162003.html.

Cavallo DN, Tate DF, Ries AV, Brown JD, Devellis RF, Ammerman AS. (2012). A social media-based physical activity intervention: a randomized controlled trial. *American journal of preventive medicine,* 43(5):527-532.

Committee PAGA. (2008). *Physical Activity Guidelines Advisory Committee Report.* Washington DC: United States Department of Health and Human Services.

Cowdery J. (2011). Promoting health in a virtual world: Impressions of health communication messages delivered in Second Life. *First Monday*, 16(9).

Chou WY HY, Beckjord EB, Moser RP, Hesse BW. (2009). Social Media Use in the United States: implications for health communication. *Journal Of Medical Internet Research,* 11(4):e48.

DigitalGov, Administration TGS. (2013). *Social Media Metrics for Federal Agencies*. Retrieved from: http://www.digitalgov.gov/2013/04/19/social-media-metrics-for-federal-agencies/.

Finlay SJ, Faulkner G. (2005). Physical activity promotion through the mass media: inception, production, transmission and consumption. *Preventive Medicine,* 40(2):121-130.

Frequently Asked Questions: Klout. (2013). Retrieved on 6 March 2013 from: http://klout.com/corp/faq.

Harris JK MN, Snider D, Haire-Joshu D. (2013). Local health department use of twitter to disseminate diabetes information, United States. *Preventing Chronic Disease,* 10:120215.

Li JS BT, Goodman E, Wasserman RC, Kemper AR. (2012). Approaches to the Prevention and Management of Childhood Obesity: The Role of Social Networks and the Use of Social Media and Related Electronic Technologies : A Scientific Statement from the American Heart Association. Dallas, Texas: American Heart Association.

Madden M, Zickuhr, Kathyrn. (2011). 65% of online adults use social networking sites. Washington, DC: Pew Research Center. Retrieved from: http://www.pewinternet.org/2011/08/26/65-of-online-adults-use-social-networking-sites/.

Madden M, Lenhart, Amanda, Cortesi, Sandra, Gasser, Urs, Duggan, Maeve, Smith, Aaron, Beaton, Meredith. (2013). Teens, Social Media, and Privacy. Pew Research Center: The Berkman Center for Internet and Society at Harvard University.

Neiger BL, Thackeray R, Burton SH, Giraud-Carrier CG, Fagen MC. (2012). Evaluating Social Media's Capacity to Develop Engaged Audiences in Health Promotion Settings: Use of Twitter Metrics as a Case Study. *Health Promotion Practice*, 14(2):157-62.

Perrin Andrew. (2015). Social Media Usage: 2005-2015. Pew Research Center. Retrieved from: http://www.pewinternet.org/2015/10/08/social-networking-usage-2005-2015/.

Prevention CDC. Social Media Guidelines and Best Practices. (2011). Retrieved on 6 March 2013 from: http://www.cdc.gov/socialmedia/tools/guidelines/.

Scanfeld D, Scanfeld V, Larson EL. (2010). Dissemination of health information through social networks: twitter and antibiotics. *American Journal of Infection Control,* 38(3):182-188.

Taber's cyclopedic medical dictionary including a digest of medical subjects: Medicine, surgery, nursing, dietetics, physical therapy. *Journal of the American Medical Association.* 1940;115(25):2205-2205.

The Community Guide. (2010). Health Communication and Social Marketing: Health Communication Campaigns That Include Mass Media and Health-Related Product Distribution. Retrieved on 10 October 2013 from: www.thecommunityguide.org/healthcommunication/campaigns.html.

The Twitter Glossary. (2013). Retrieved on 6 March 2013 from: http://support.twitter.com/articles/166337-the-twitter-glossary#.

To Win, We Have to Lose. (2012). The Weight of the Nation. Confronting America's Obesity Epidemic: About the Project. Retrieved on 6 March 2013 from: http://theweightofthenation.hbo.com/about-the-project.

Vega E PR, Torres J. Where are my tweeps?: Twitter Usage at Conference. Blacksburgh, Virgina: Virginia Tech University: 6.

Webb TL, Joseph J, Yardley L, Michie S. Using the internet to promote health behavior change: a systematic review and meta-analysis of the impact of theoretical basis, use of behavior change techniques, and mode of delivery on efficacy. *Journal of Medical Internet Research,* 2010;12(1):e4.

Yoon S EN, Bakken S. (2013). A Practical Approach for Content Mining of Tweets. *American journal of preventive medicine,* 2013;45(1):122-129.

Zickuhr KS, Aaron. (2012). Digital Differences. Retrieved on 13 April 2012 from: http://pewinternet.org/Reports/2012/Digital-differences/Main-Report/Internet-adoption-over-time.aspx#footnote3.