Health Intervention Opportunities Using Social Media Analytics and Behavioral Science Theory

A position paper for Specialist Meeting on Human Dynamics in the Mobile Age, August 1-2 2016

Author: Lourdes S. Martinez, School for Communication, San Diego State University

There is growing interest in unlocking ways to use social media and big data to target behaviors that improve the health of the public while reducing the burden of disease. One way in which social media can be used to enhance health outcomes is by acting as a platform for launching health interventions that target behaviors with health implications. As with interventions launched through other channels, social media-based interventions designed to target behaviors require a clear understanding of behavior and how it can be influenced. The area of behavioral science theory offers tools to guide public health interventions, but its use in tandem with social media analytics needs further exploration. Behavioral science theory represents an area of research that draws perspectives and tools from disciplines as diverse as communication, health, sociology, psychology, marketing, and economics. A rising volume of empirical evidence suggests that behavioral interventions developed and implemented using behavioral science theory tend to be more successful in meeting their objectives. While many of the frameworks that fall under behavioral science theory have been used to guide the design and implementation of public health interventions, one that is particularly useful in also identifying opportunity for intervention is the reasoned-action approach. This paper proposes to merge the strengths of the reasoned-action approach with social media analytics to explore the potential of this combination for uncovering new ways of identifying intervention opportunities on social media in the context of vaccine noncompliance.

The reasoned-action approach posits that behavioral intention represents the most robust predictor of future behavior. According to this theory, having a sense of how an individual intends to behave is a fairly accurate predictor of how that individual will behave. Three factors are responsible for shaping behavioral intention. The first is attitude toward the behavior, or how an individual weighs the nature and likelihood of the outcomes resulting from engaging in a behavior (e.g. "*getting my child vaccinated is good/bad and will/won't protect my child against diseases*"). Perceived norm, or how an individual perceives others to view the behavior represents a second key determinant. Perceptions of whether others engage in the behavior and approve of the behavior comprise the concept of perceived norm (e.g. "*Other parents think I should/shouldn't get my child vaccinated*" and "*Parents like me do/don't get their children vaccinated*"). Lastly, a personal belief in possessing the requisite skill and opportunity to successfully engage in the behavior can influence whether an individual decides to engage in that particular behavior. This concept it known as perceived behavioral control (e.g., "*I am able/unable to get my child vaccinated*"). Thus considering attitude, perceived norm, and perceived behavioral control allows us to approximate intention, which in turn provides an idea of how likely an individual will be to engage in a particular behavior. For example, some parents may possess negative vaccine attitudes and believe that vaccines do not confer sufficient benefit and protection to outweigh perceived risks. If vaccination intention is primarily driven by attitude (vs. perceived norm or perceived behavioral control), the theory predicts that parents who remain unconvinced about the risk/benefit ratio of vaccinations will be less likely to follow recommendations for vaccinating their children.

As the relative weight of attitude, perceived norm, and perceived behavioral control in shaping intention is likely to vary across behaviors, recommendations for applying the reasoned-action approach suggest designing interventions to target the strongest determinant of intention for a certain behavior. Approaches for establishing which determinant acts as the dominant factor directing intention have typically relied on conventional research methods, and the utility of using social media analytics for this purpose is unknown. One possibility is to develop an algorithm that identifies pro- vs. anti-vaccine social media messages that sorts them according to whether they contain attitude (e.g. "*vaccines are dangerous*"), perceived norm (e.g., "*no one I know is vaccinated their children*"), or perceived behavioral control (e.g. "*vaccines are easy to get*") elements. Using geo-spatial plotting of these social media messages, we can then overlay these social media messages with existing data on current vaccine compliance and rates and disease outbreaks in various geographical areas. We can then examine the nature and density of different social media messages and whether they correspond with geographical areas experiencing increased or decreased rates of compliance and disease.

If vaccination intentions are largely steered by attitude, identifying the underlying beliefs of vaccine attitudes can help guide the design of more effective interventions aimed at increasing compliance. Traditionally, the standard practice of eliciting underlying beliefs of attitude (or perceived norm and perceived behavioral control) has relied on surveys, interviews, and focus groups. However, little is known if social media analytics can contribute to this type of formative research. One possibility is to develop algorithms designed to identify pro- vs. anti- vaccination social media messages and look for patterns in message strategies and argumentation. For example, we know from previous research that anti-vaccine messages are more likely to employ expository information in the form of testimonials, while pro-vaccine messages are more likely to include statistical information. An algorithm trained to detect a variety of social media message features including the presence of expository and/or statistical information could then be used identify pro- vs. anti- vaccination social media messages. Once identified, these social media messages could be examined for belief patterns consistent with vaccine compliance. Insight into these beliefs could then inform the content of behavioral interventions. Similarly, researchers and health professionals may also consider examining social media messages for uncovering belief patterns that coincide with vaccine noncompliance and debunk or undermine these beliefs as part of a comprehensive intervention strategy. In this way, an approach leveraging the power of social media analytics can position researchers and health professionals to more effectively persuade parents to comply with vaccine recommendations while offering points of resistance that may be targeted with counterarguments as part of behavioral interventions.

The reasoned-action approach is also useful for guiding decisions about whether to intervene or not. This approach recommends using an intention-behavior matrix to determine whether intervention is worthwhile and may be potentially enhanced by social media analytics. The matrix crosses levels of behavioral performance (e.g., vaccine compliance) across varying degrees of intention and assists in establishing whether attitudinal/normative perceptions and/or environmental barriers are preventing individuals from adopting vaccine recommendations. Using an algorithm trained to detect social media messages with these components, we can use geo-spatial mapping and overlay messages with data on geographical locations where vaccines are readily available. This could help identify previously unseen communities in need of intervention and specify whether environmental barriers present a problem to vaccine compliance for these communities.

Combining the reasoned-action approach and social media analytics may offer researchers and health professionals new ways of identifying opportunities and communities for intervention. However, more research is needed to test whether these methods substantially add to existing approaches. This position paper addresses some possible opportunities for combining the reasoned-action approach and social media analytics to address this gap.

References

1. Amicizia, D., Domnich, A., Gasparini, R., Bragazzi, N. L., Lai, P. L., & Panatto, D. (2013). An overview of current and potential use of information and communication technologies for immunization promotion among adolescents. *Human Vaccines & Immunotherapeutics*, *9*(12), 2634-2642.
2. Fishbein, M., & Cappella, J. N. (2006). The role of theory in developing effective health communications. *Journal of Communication*, *56*(s1), S1-S17.
3. Fishbein, M., & Ajzen, I. (2010). Prediction and change of behavior: The reasoned action approach.
4. Glanz, K., & Bishop, D. B. (2010). The role of behavioral science theory in development and implementation of public health interventions. *Annual Review of Public Health*, *31*, 399-418.
5. Larson, H. J., Jarrett, C., Eckersberger, E., Smith, D. M., & Paterson, P. (2014). Understanding vaccine hesitancy around vaccines and vaccination from a global perspective: a systematic review of published literature, 2007–2012. *Vaccine*, *32*(19), 2150-2159.