# Vaccine Sentimeter: Online Tool Facilitates Real-Time Monitoring of Vaccine conversations and Sentiments

Chi Bahk, Melissa Cumming, Louisa Paushter, Larry Madoff, Angus Thomson, John Brownstein
Epidemico Inc, ProMED-Mail, Sanofi Pasteur, Boston Children's Hospital

Vaccine refusals can have devastating effects leading to disease outbreaks that result in long-term health problems or death. Although studies have shed some light on why patients say no to vaccines, many gaps remain in the research. One such gap is how, if at all, mainstream media and social networks shape awareness, attitudes and confidence in vaccines.

Vaccine Sentimeter is a web-based tool developed to fill this gap. It collects and visualizes informal sources including blogs and online groups that are often disregarded by the public health community as having no credence, yet may still have significance sway and patient communities.
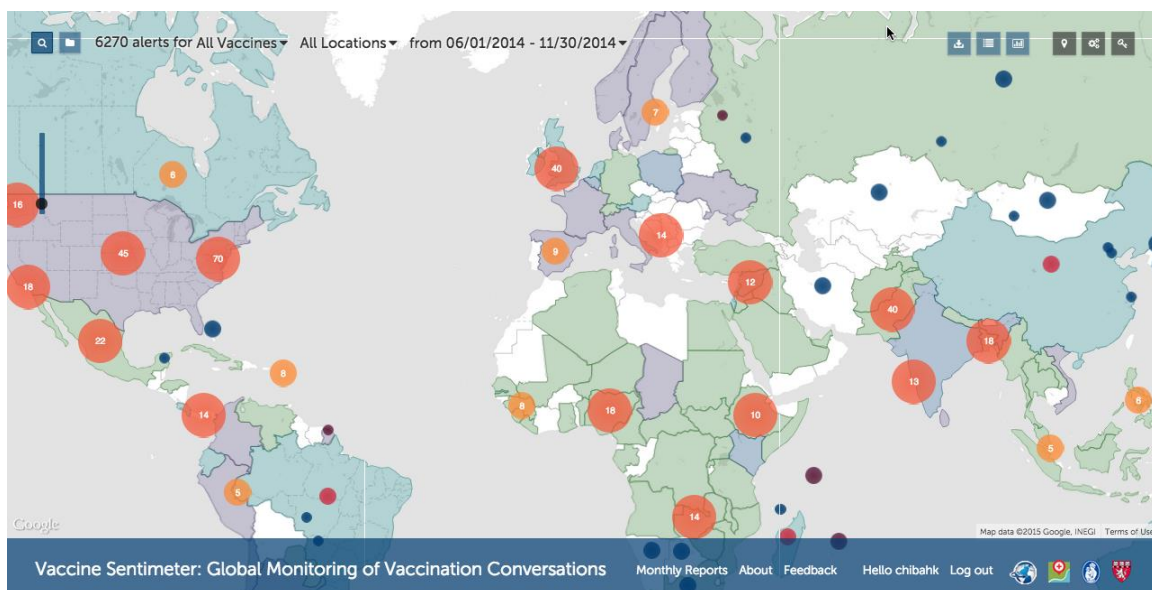


Using data from Vaccine Sentimeter, we followed two events that stimulated a high volume of both mainstream media reports and social media responses: 1) December 2013 airing of US television personality Katie Couric's segment on the "HPV vaccine controversy" and 2) the fake vaccination campaign orchestrated by the United States Central Intelligence Agency (US CIA) in Pakistan.

In studying the two events, we were able to detect spike in volume due to these specific events. The predominant sentiment in mainstream news media was positive while in social media was negative, indicating that social media may be the more opportunistic target of intervention than official press releases or news coverage. In terms of long term effect, for the CIA case, despite continued follow-up of positive sentiment media

coverage towards vaccination, Pakistan saw a record-high number of vaccine refusals, attack on vaccination workers, and a re-emergence of polio.

In the US, HPV vaccine-related conversations increased drastically after the airing of the Katie Couric episode, with overwhelmingly positive sentiment supporting the vaccine in spite of the coverage. However, especially in Twitter, this high spike in positive sentiment diminished rapidly followed by much longer lasting support from the anti-vaccine community with negative sentiment towards the vaccine, pointing to the "stickiness" of negative vaccine sentiment compared to positive sentiment.

**EXHIBIT 4**

**Volume And Sentiment Of Tweets Referencing Broadcast Of "HPV Vaccine Controversy" Segment, Per Day, December 2013–January 2014**
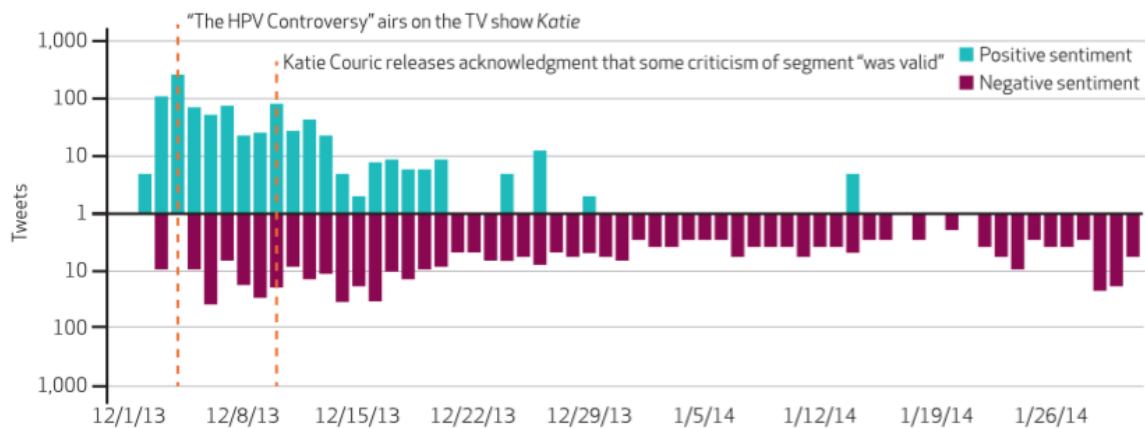


SOURCE Vaccine Sentimeter (Note 4 in text). NOTE The y axis uses a log scale.

This study, published in Health Affairs in February, 2016, illustrated the potential of using a tool like Vaccine Sentimeter to keep abreast of, and in turn, proactively respond to, misinformation and negative vaccine sentiment in the online space.

Reference: Chi Y. Bahk, Melissa Cumming, Louisa Paushter, Lawrence C. Madoff, Angus Thomson and John S. Brownstein. Publicly Available Online Tool Facilitates Real-Time Monitoring Of Vaccine Conversations And Sentiments Health Affairs, 35, no.2 (2016):341-347.