DIGITAL LISTENING FOR VACCINES CONFIDENCE

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DISCLOSURES

• Booz Allen provides digital listening & insights services to commercial and government clients, including Merck on the topic of the HPV vaccine.
• The project and publication presented here was funded by Sanofi Pasteur, and conducted by Epidemico, ProMED-Mail, and Sanofi Pasteur.
• Epidemico has since been acquired by Booz Allen Hamilton.
Our digital listening methodology includes both automated and human elements.

**SOFTWARE AUTOMATION**

**HUMAN INTERPRETATION**

**ACQUIRE**

**FILTER**

**CURATE**

**DESCRIBE**

**Improve data tools for efficiency**

Natural language processing (NLP) and machine learning tools can assist in reducing human burden.
Tool developed to understand vaccine sentiment in digital media, in real time

Publicly Available Online Tool Facilitates Real-Time Monitoring Of Vaccine Conversations And Sentiments

Chi Y. Bahk1, Melissa Cumming2, Louisa Paushter3, Lawrence C. Madoff4, Angus Thomson5, John S. Brownstein6

ABSTRACT
Real-time monitoring of mainstream and social media can inform public health practitioners and policy makers about vaccine sentiment and hesitancy. We describe a publicly available platform for monitoring vaccination-related content, called the Vaccine Sentimeter. With automated data collection from 100,000 mainstream media sources and Twitter, natural language processing for automated filtering, and manual curation to ensure accuracy, the Vaccine Sentimeter offers a global real-time view of vaccination conversations online. To assess the system’s utility, we followed two events: polio vaccination in Pakistan after a news story about a Central Intelligence Agency vaccination ruse and subsequent attacks on health care workers, and a controversial episode in a television program about adverse events following human papillomavirus vaccination. For both events, increased online activity was detected and characterized. For the first event, Twitter response to the attacks on health care workers decreased drastically after the first attack, in contrast to mainstream media coverage. For the second event, the mainstream and social media response was largely positive about the HPV vaccine, but antivaccine conversations persisted longer than the pro-vaccine reaction. Using the Vaccine Sentimeter could enable public health professionals to detect increased online activity or sudden shifts in sentiment that could affect vaccination uptake.
Interactive dashboard for real-time monitoring of vaccination conversations
Wide range of topics and vaccines being discussed online

<table>
<thead>
<tr>
<th>Date</th>
<th>Summary</th>
<th>Vaccine</th>
<th>Category</th>
<th>Sentiment</th>
<th>Location</th>
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</thead>
<tbody>
<tr>
<td>2014-11-10</td>
<td>Mass sterilization: Kenyan Doctors Find Anti-fertility Agent in UN ...</td>
<td>Tetanus/NOS</td>
<td>Beliefs - Conspiracy theory, Beliefs - Religious, Fertility, Programmatic Error/Issue/Conflict</td>
<td>Negative</td>
<td>Kenya</td>
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<td>Zoster Vaccination in Patients with Rheumatoid Arthritis: Time to Change the ... - HCPLive</td>
<td>Shingles</td>
<td>Research, Recommendation by HCW</td>
<td>Positive</td>
<td>United States</td>
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<td>2014-11-14</td>
<td>Yellow Fever Vaccine - Only One Dose Required for Immunity - AllAfrica.com</td>
<td>Yellow Fever</td>
<td>Recommendation - Policy, Vaccine Effectiveness</td>
<td>Positive</td>
<td>Cameroon</td>
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<td>2014-11-24</td>
<td>WSU students asked to have mumps vaccination - KXLY Spokane</td>
<td>MMR</td>
<td>Recommendation by HCW</td>
<td>Positive</td>
<td>Washington State, United States</td>
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</tbody>
</table>
Example: identify proactive stakeholder engagement on Meningococcal vaccines
Example: identify proactive stakeholder engagement on Meningococcal vaccines
Example: high volume of social media discussions surrounding the HPV vaccine
Case Study: Impact of Katie Couric segment on digital media coverage

December 4, 2013 episode of Katie, the US television personality Katie Couric's show on the ABC network, titled “HPV vaccine controversy”

Vaccine Sentimeter data from November 2013 to Jan 2014

160 relevant mainstream media reports and 1,534 tweets

Bahk et al. Health Affairs. Feb 2016
Notable content mentioning HPV vaccine, including Couric event

**EXHIBIT 2**

*Mainstream Articles And Tweets About Human Papillomavirus (HPV) Vaccine Per Week, August 2013–July 2014*

- **2013**
  - Aug
  - Sep
  - Oct
  - Nov
  - Dec

- **2014**
  - Jan
  - Feb
  - Mar
  - Apr
  - May
  - Jun
  - Jul

**Sep 1**
CDC reports that doctors should encourage HPV vaccination more

**Oct 24**
Research finds that one dose may be enough for HPV immunity
CDC reports that HPV vaccine is cost-effective

**Dec 4**
Airing of “The HPV Controversy” on TV show Kotie

**Dec 10**
Couric releases acknowledgment that some criticism of the segment “was valid”

**Feb**
Research finds that HPV vaccine does not increase sexual activity

**Jul 25**
CDC reports: “Safe and effective vaccine that prevents cancer continues to be underutilized”
Predominant media coverage following the segment was in support of the vaccine.
In social media, negative sentiment towards the vaccine was triggered and sustained.

**EXHIBIT 4**

**Volume And Sentiment Of Tweets Referencing Broadcast Of “HPV Vaccine Controversy” Segment, Per Day, December 2013-January 2014**

“"The HPV Controversy" airs on the TV show *Katie*

*Katie Couric releases acknowledgment that some criticism of segment “was valid”*

<table>
<thead>
<tr>
<th>Date</th>
<th>Positive sentiment</th>
<th>Negative sentiment</th>
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<tbody>
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<td>1/19/14</td>
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<td>1/26/14</td>
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</table>

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

_Bahk et al. Health Affairs. Feb 2016_
Did this event create change in the overall landscape of HPV vaccine conversation?

Dec 4, 2013  Airing of “The HPV Controversy” on TV show Katie
Dec 10, 2013  Couric releasing acknowledgement of the show’s bias

Bahrk et al. Health Affairs. Feb 2016
Value of digital listening for vaccine confidence

- In a timely manner,
  - Anticipate, understand, and respond to the public’s questions and concerns
  - Inform strategic communication tailored by vaccine and geography
  - Encourage engagement between public health organizations and journalists, bloggers, or other influencers
  - Measure efficacy of campaigns
- Unique stream of data compared to surveys and traditional channels
## Digital listening for vaccine confidence

### Successes
- Additional data sources
- Looking beyond sentiment into drivers of sentiment
- Understanding influencers and networks
- Informing action based on insights

### Challenges
- Sustained operation for continuous monitoring
- Balance between automation vs manual efforts
- Connecting digital media to offline behavior
QUESTIONS?

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