



Data science, social media, and HPV vaccines: the state-of-the-art and future challenges

Adam G. Dunn

Centre for Health Informatics

Australian Institute of Health Innovation

Macquarie University

@adamgdunn

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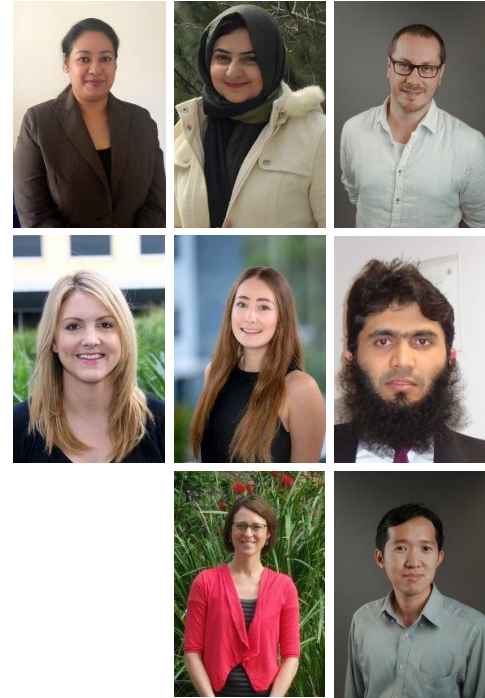
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Team: Samia Amin, Rabia Bashir; **Adam G. Dunn;**
Amalie Dyda; Paige Newman; Zubair Shah;
Maryke Steffens; Didi Surian
(team includes computer science, data science and
machine learning, software engineering, epidemiology
and public health, journalism, and clinical medicine)

Team alumni: Xujuan Zhou, Diana Arachi, Smriti Raichand

Collaborators: **Julie Leask, Kenneth D. Mandl, Aditi Dey,**
Enrico Coiera, Gilla Shapiro, Margaret Kelaher,
and many more...



Analyses of HPV vaccine information on social media:

YouTube: Ache 2008

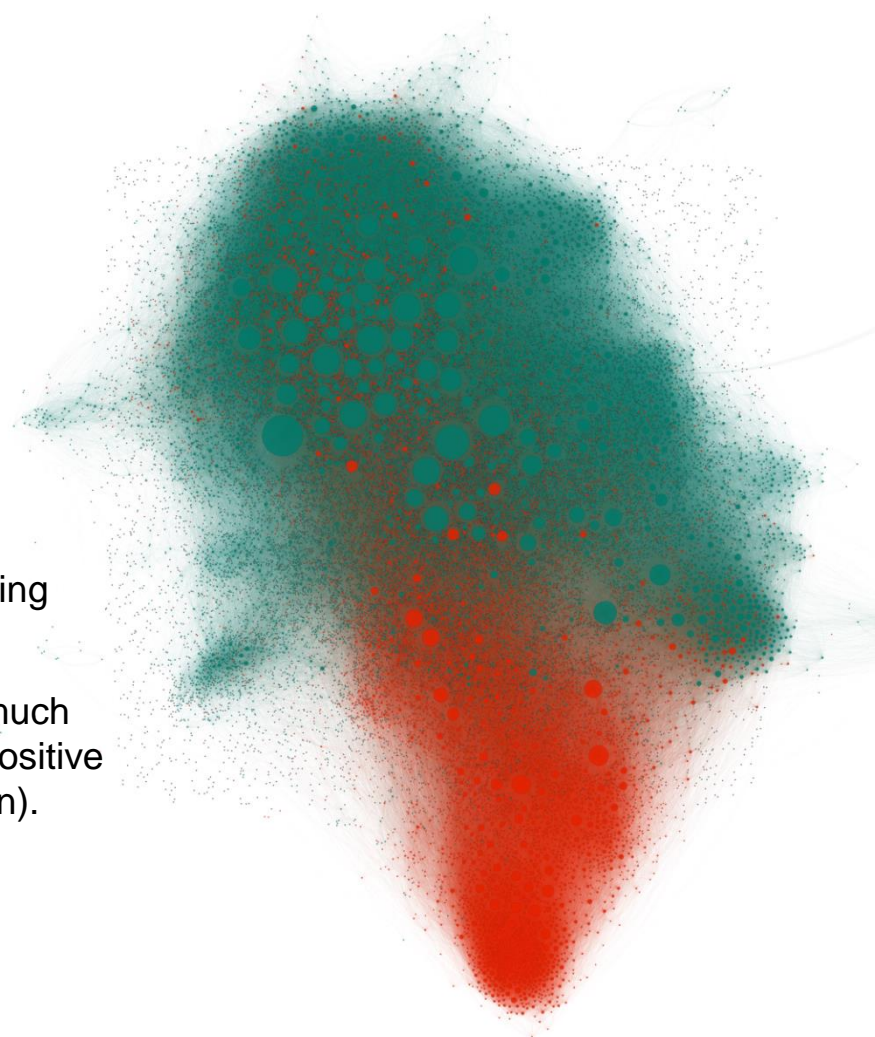
MySpace: Keelan 2010

Analysis of vaccine information on Twitter

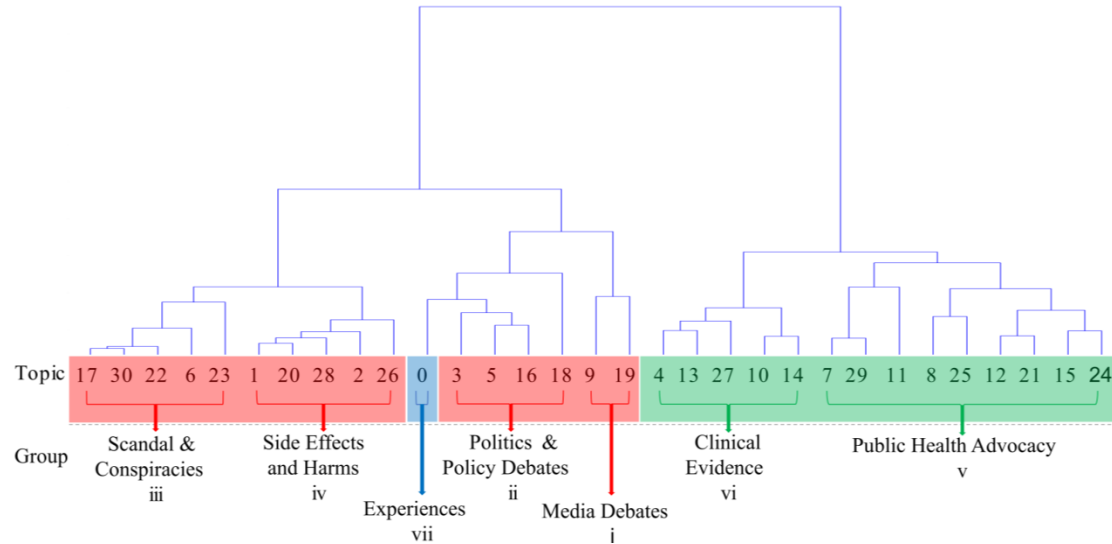
Signorini 2010

Salathe 2011

- We started collecting HPV vaccine tweets in 2013 (764,869 tweets as of 29 Jan 2018).
- Discovered we could predict negative tweets without reading them; just need to know who the users follow.
- Users mostly exposed to negative tweets (orange) were much more likely to go on to post a negative tweet rather than positive tweet about HPV vaccines compared to other users (green).



I wanted to know if Twitter could be a good enough signal of a population's **information diet** that we could *actually use* it to understand whether information was demonstrably associated with attitudes, behaviours, and HPV vaccine coverage.



“Computer scientists often brilliantly solve the wrong problems.”

Problem 1: flawed studies published with potentially dangerous conclusions.

- Call out bad epidemiology from data science;
- Contribute to pre-publication and post-publication peer review;
- Know and understand the limits and biases in social media data; and
- Real collaboration to teach computer scientists epidemiological methods.

Problem 2: robust studies that can't be used to guide policy or practice.

- Ask data scientists the *“why are we doing this?”* question more often; and
- Help translate research findings into real-time news/misinformation reporting and surveillance of attitudes and behaviours.

A poor literature review can be a good indicator of less robust research in this area.



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I wanted to be able to connect the work back to how people and communities *actually engage* with **evidence and misinformation**, because these are where we can provide evidence for how to manipulate the information diets of at-risk populations.



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PLOS ONE

Personality, Gender, and Age in the Language of Social Media: The Open-Vocabulary Approach

M. Andrew Schwartz^{1,2}, Johannes C. Eichstaedt¹, Margaret L. Kern¹, Lukasz Duzvarynski¹, Stephanie M. Ramones¹, Megha Agrawal^{1,3}, Ashal Shah¹, Michal Kosinski¹, David Stillwell¹, Martin P. Sellman¹, Lyle H. Ungar¹

Abstract

We analyzed 700 million words, phrases, and text instances collected from the Facebook messages of 75,000 volunteers who also provided personality tests, and found striking correlations in language with personality, gender, and age in our open-vocabulary technique. The data itself shows a comprehensive registration of language that distinguishes people. Reading correlations are not captured with the traditional closed-vocabulary word-category analyses. Our analyses show new insight on psychosocial processes underlying social media use, including being in high school and the social requirements to do so with other research, being a parent, being a graduate student, and the desire to do the world. Surprisingly, we suggest that Facebook (as well as other social media) is not just a place to share thoughts but also a place to share one's self. We suggest that the use of different words often serves to use one's "social self" or "persona" to do this. We represent the largest study, by an order of magnitude, of language and personality.

Introduction

The social network has changed the way we interact, revealing the unprecedented access of online language that social media offers [1–4]. Through sites such as Facebook and Twitter, we can explore, for more than 1/3 of the world population [5], variations in social life, mental health, and social norms [2], need to modify the way we think [6]. Also, knowledge of online language activities [7] has brought attention to English language proficiency issues [8,9]. Also,

PLOS ONE

Psychological targeting as an effective approach to digital mass persuasion

S. C. Mead^{1,2}, M. Kosinski^{1,3}, G. Nave^{1,4}, and D. S. Stillwell¹

Abstract

People are exposed to persuasive communication every time they click on a link, visit a website, or use an app. This paper reports on the effectiveness of psychological targeting in real-world persuasion campaigns. We tested whether targeting people based on their personality, gender, and age in social media advertisements led to higher click-through rates compared to non-targeted advertisements. We found that targeted advertisements led to higher click-through rates than non-targeted advertisements, and that this effect was mediated by increased engagement with the advertisement. These findings suggest that psychological targeting is an effective approach to digital mass persuasion.

RESEARCH ARTICLE

Exposure to ideologically diverse news on Facebook

Yotam Sadeh¹, Yonatan Shmida¹, Luba A. Shteynberg¹

Abstract

Exposure to news, opinion, and other information increasingly occurs through social media. How do these news providers influence exposure to perspectives that act across ideological boundaries? We used a naturalistic Facebook (FB) dataset to investigate how exposure to ideologically diverse news on Facebook varies with user characteristics and network structure. We found that exposure to ideologically diverse news on Facebook is higher for users who are more socially connected, have a higher number of friends, and are more active on the platform. These findings suggest that social media can facilitate exposure to diverse perspectives, but that this exposure is influenced by user characteristics and network structure.

PLOS ONE

The Spread of Behavior in an Online Social Network Experiment

David Foray¹

Abstract

Through social networks, an empirical study of how individuals in a social network influence each other's behavior. We conducted an experiment on Facebook to study the spread of behavior in an online social network. We found that behavior spread through social networks, and that this spread was influenced by network structure and user characteristics. These findings suggest that social media can facilitate the spread of behavior, but that this spread is influenced by network structure and user characteristics.

We already have the tools we need to **identify individuals** with opinions and attitudes that put them at risk of unhealthy decisions and behaviours.

With automated personalisation of advertising and chatbots we are now able to deploy **autonomous behavioural interventions**; digital mass persuasion with no consent, and no humans involved in the diagnosis or delivery of the intervention.

If we choose to go down this path as a field of research, it will be vital that we get the ethics and implementation right.

Twitter: [@adamgdunn](https://twitter.com/adamgdunn)
Email: adam.dunn@mq.edu.au

These slides, with links, will be made available online at:
www.adamgdunn.net/speaking/
with thanks to @parryville for video production

1. **AG Dunn**, D Surian, J Leask, A Dey, KD Mandl, E Coiera (2017) Mapping information exposure on social media to explain differences in HPV vaccine coverage in the United States, *Vaccine*, 35(23):3033-3040.
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3. D Surian, DQ Nguyen, G Kennedy, M Johnson, E Coiera, **AG Dunn** (2016) Characterizing Twitter discussions about HPV vaccines using topic modelling and community detection. *Journal of Medical Internet Research*, 18(8):e232.
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5. X Zhou, E Coiera, G Tsafnat, D Arachi, M-S Ong, **AG Dunn** (2015) Using social connection information to improve opinion mining: Identifying negative sentiment about HPV vaccines on Twitter, *Studies in Health Technology and Informatics*, 216:761-765.

Other examples of *data-driven* studies using Twitter data related to HPV vaccines:

1. J Du, J Xu, H-Y Song, **C Tao** (2017) Leveraging machine learning-based approaches to assess human papillomavirus vaccination sentiment trends with Twitter data, *BMC Medical Informatics and Decision Making*, 17(Suppl2):69.
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Names in bold are good contacts for more information.