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New potentials in the communication of science with non-scientific publics The case of the anti-vaccination movement

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"We have more than 7,000 links to abstracts and full text from mainstream, scientific literature at the <u>www.VaccineResearchLibrary.com</u>. If their own literature isn't a 'reliable source', then what is?"

(SOURCE: Vaccine Research Library, 16 December 2015, http://vaccineresearchlibrary.com/scream-146-call-for-autobots-to-suppress-vaccine-information/)



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Aims & objectives

- To establish whether those located outside of the formal science communication system, now more universally accessible, are using open access publications and open research data.
- To gain insight into the what the potentials of openness are both for society and for the future of science communication. Persistent states of controversy over established scientific truths can damage the scientific communication environment; producing empirical evidence that advances our understanding of the science communication environment is therefore essential to the protection of that environment (Kahan, Scheufele, & Jamieson, 2017).



Conceptual framework





Research questions

- What are the potentials of a more open science in the communication of science?
 - Are non-scientists accessing the products of open science?
 - Are non-scientists engaging with the products of open science?
 - Who are the non-scientists mediating connections to the products of open science?
 - How can science communication respond to the new potentials of open science?



STUDY DESIGN

Overview



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Method: Use of open research data

- Sample
 - Top-down purposive: 186 DOIs
 - Bottom-up snowball: I 67 references to products of science on anti-vaccination websites
- Determined access to open research datasets
 - in social media using DOIs [Altmetric]
 - websites [coding all references manually by product type]



Method: Use of open research data

RESEARCH DATA RESEARCH DATA BIBLIOMETRIC REPOSITORIES JOURNALS DATABASES LITERATURE REVIEW LITERATURE REVIEW RESEARCHER KNOWLEDGE Web of 33 autiem-specific research data repositories 116 data journels 3 open research obta repositories Scienco [A-jowahit-& Mine; 2017] [Candesa, Castoli, Marghi & Tani, 2015] Dryad. sayword search OPEN to ismuel. Pizshaie **Detaset** Oataverse. Scientific F1000 "outpro" or "AGD" II Topic feed keyword searcher: FARPincpled Papers is GipaScience Open Health PlastME Revived search autory"; "secondor keyword searches. Outs Research Data 5 Science within and veccharion heiderkology't '483' Articles 855 kiyword alandrasi Neward Aught: Anti-wanti kawata OPEN + DOM "autors" "weenables" "weiserweiser/", "WSD "within and voccination" attain and vandration - Bthere THE Mari open access Telephone P. DOM: 00% :00% (DOI) DOM: :00h 100ts tala retio officies" 'MORE' 88 tos 320 0 e 2 Article 001 Articles QCIs: reauto portact 0 42 109 by possisivity shapingto COs revenued duplicate DOIx removed renties of the witted DCIs maults acreared for relevance shiplicale DOBs wirecould two its streament for other when Articia Articlas DOts. 29 18+6 DOIs EO(s) 42 · 11 Ogtawr Dataset **Dataset** DOla DOIs. DOb: 117 3.5 24 DOIs DOIs DOB 24 42 120

DOI HARVESTING FOR AUTISM-VACCINATION ISSUE-RELATED OPEN RESEARCH DATASETS

Method: Use of OA journal articles

• Sample:

- Top-down purposive: 56 DOIs
- Bottom-up snowball: 75 DOIs (open access only)
- Determined access to OA journal articles [Altmetric]
- Identified anti-vaccination accounts on social media and websites [web crawler + manual verification]
- Measured for top 10 articles by Altmetric Attention Score:
 - Access/connections [no. of mentions]
 - Activity [frequency of mentions by account]
 - Level of engagement with article content [6-point scale]



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Method: Use of OA journal articles

Article ref.	DOI	Title	Altmetric Attention Score
1.1	10.1371/journal.pbio.1002198	Imperfect Vaccination Can Enhance the Transmission of Highly Virulent Pathogens	511
1.2	10.15585/mmwr.ss6503a1	Prevalence and Characteristics of Autism Spectrum Disorder Among Children Aged 8 Years — Autism and Developmental Disabilities Monitoring Network, 11 Sites, US, 2012	311
1.3	10.1371/journal.pone.0003140	Lack of association between measles virus vaccine and autism with enteropathy: a case- control study	306
1.4	10.1186/2047-217x-3-18	GWATCH: a web platform for automated gene association discovery analysis	113
1.5	10.1371/journal.pbio.1001368	The Evolutionary Consequences of Blood-Stage Vaccination on the Rodent Malaria Plasmodium chabaudi	96
2.1	10.1001/jama.2015.3077	Autism occurrence by MMR vaccine status among US children with older siblings with and without autism	3674
2.2	10.1016/j.vaccine.2014.04.085	Vaccines are not associated with autism: An evidence-based meta-analysis of case-control and cohort studies	2989
2.3	10.1080/15287394.2011.573736	A Positive Association found between Autism Prevalence and Childhood Vaccination uptake across the U.S. Population	1336
2.4	10.1186/2047-9158-3-16	Measles-mumps-rubella vaccination timing and autism among young African American boys: a reanalysis of CDC data	1048
2.5	10.1186/2047-9158-2-25	A two-phase study evaluating the relationship between Thimerosal-containing vaccine administration and the risk for an autism spectrum disorder diagnosis in the United States	1018



- Sample: I I 3 article DOIs [Attention score > 0]
- Tweeter coupling matrix from Altmetric / CWTS to create edges [mentions > 2 articles]
- NodeXL Pro
- Measured for anti-vaccination accounts:
 - Centrality [degree, eigenvector, betweenness]
 - Activity [number of mentions > 2]



FINDINGS

Findings: Use of open research data

Number of datasets downloaded from the Dataverse (March 2016 to January 2017)



Number of times vaccine-related datasets downloaded from Dryad, as at 14 February 2017 (n=29)





Findings: Use of open research data

- The findings show that a politically active non-scientific community the global anti-vaccination community is not accessing open research data on the purported link between vaccination and autism.
- At most, there is evidence of the use of non-textual scientific information in the form of numerical tables and graphs, neither of which are indicative of the use of raw scientific data by the anti-vaccination community.



Findings: Use of OA journal articles

Breakdown of attention by attentive publics for 10 open access journal articles (%)





Findings: Connections to OA journal articles

Number and proportion of anti-vaccination tweets

Sample	1.1	1.2	1.3	1.4	1.5	2.1	2.2	2.3	2.4	2.5
Total no. of tweets	382	131	69	93	25	3551	3509	2589	2268	2282
No. of anti-vaccination tweets	52	I	I	0	4	45	21	812	672	545
% of anti-vaccination tweets	13.6%	0.8%	1.5%	0%	16.0%	1.3%	0.6%	31.4%	29.6%	23.9%



Findings: Activity of anti-vaccination accounts

Twitter: Frequency of mentions per articles 2.3, 2.4 and 2.5





Findings: Activity of anti-vaccination accounts

Facebook: Frequency of mentions for article 2.3





Twitter: Levels of engagement for articles 2.3, 2.4 and 2.5





Twitter: Frequency of reposts by anti-vaccination account for article 2.5 (n=197)

09 June 2016	C
19 June 2016	
29 June 2016	01
09 July 2016	0
19 Iuly 2016	-0
2005 (inf 60	×
	D-
10 August 2010	00
10 August 2016	XO -
20 August 2016	-0
U/ September 2016	
1/ September 2016	D-0
27 September 2016	
07 October 2016	00
17 October 2016	- O -
27 October 2016	•
06 November 2016	0
16 November 2016	-0+
26 November 2016	oc
06 December 2016	0-0
16 December 2016	0
26 December 2016	DC
05 January 2017	
15 January 2017	
25 January 2017	
04 February 2017	••••
14 February 2017	
24 February 2017	
06 March 2017	
16 March 2017	
	00
26 March 2017	01
05 April 2017	
15 April 2017	
25 April 2017	
05 May 2017	D-1
15 May 2017	
25 May 2017	
04 June 2017	00
14 June 2017	DC
24 June 2017	
04 July 2017	
14 July 2017	
24 July 2017	200
03 August 2017	oc
13 August 2017	
23 August 2017	oc
02 September 2017	×
12 September 2017	
22 September 2017	20-1
02 October 2017	C
12 October 2017	
22 October 2017	0-



Facebook: Level of engagement for article 2.3





Web: Level of engagement





Web: Level of engagement vs level of activity of Twitter



Tweets p.a. UWeb Engagement



Findings: Use of open access journal articles

- Anti-vaccination movement is using open access journal articles in its online communications
- Highly active selected articles
- Low levels of engagement in social media
- When read collectively, findings show how the social media as self-referential networks operating outside of the norms of science, are used by a group of nonscientists to amplify its minority position without the need to engage closely with the contested scientific knowledge at its disposal.



Connections between Article 2.3 and Twitter accounts that mention the article (n=1569)



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Created with NodeXL Pro (http://nodexl.codeplex.com) from the Social Media Research Foundation (http://www.smrfoundation.org)

Connections between Article 2.2 and Twitter accounts that mention the article (n=2777)



Created with NodeXL Pro (http://nodexl.codeplex.com) from the Social Media Research Foundation (http://www.smrfoundation.org)

Sociogram for connections between two opposing Twitter accounts and their followers



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Tweeter coupling network for 113 OA journal articles (n=12 207)



Created with NodeXL Pro (http://nodexl.codeplex.com) from the Social Media Research Foundation (http://www.smrfoundation.org)



Centrality degree distribution for a tweeter coupling network





Difference types of intermediation



- Anti-vaccination accounts have the highest degree and eigenvector centrality
- Betweenness centrality = both pro-science and anti-vaccination accounts



Findings: Network analysis

- The findings of this chapter indicate the presence of intermediaries in the flow of scientific information in the Twitter communication network.
- There are different types of intermediaries with different functions in relation to the distribution of information in the network. While there are sub-clusters within the anti-vaccination community, they remain highly connected to one another and disconnected from the pro-science cluster in relative terms.



Discussion points

- Openness and access within and between
- Expertise as a barrier to use
- The production of uncertainty
- The amplification of uncertainty
- Trust and intermediation in social media
 networks
- Implications for science communication





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Thank you