



Short communication

Relationship of people's sources of health information and political ideology with acceptance of conspiratorial beliefs about vaccines

Jieyu D. Featherstone*, Robert A. Bell, Jeanette B. Ruiz

Department of Communication, University of California, Davis, One Shields Avenue, Davis, CA 95616, United States



ARTICLE INFO

Article history:

Received 12 October 2018
Received in revised form 15 April 2019
Accepted 22 April 2019
Available online 25 April 2019

Keywords:

Social media
Conspiracy beliefs
Vaccines
Political ideology

ABSTRACT

Background: Conspiracies about vaccination are prevalent. We assessed how the health information sources people rely upon and their political ideologies are associated with acceptance of vaccine conspiracies.

Methods: Online survey ($N = 599$) on Amazon's Mechanical Turk crowdsource platform. Hypotheses were tested via structural equation modeling.

Results: Acceptance of vaccine conspiracy beliefs was associated positively with greater reliance on social media for health information (coef. = 0.42, $p < .001$), inversely related to use of medical websites (coef. = -0.21, $p < .001$), and not significantly related to use of providers for health information (coef. = -0.13, $p = .061$). In addition, liberal political orientation was negatively associated with acceptance of vaccine conspiracies (coef. = -0.29, $p < .001$).

Conclusions: An understanding of vaccine conspiracy acceptance requires a consideration of people's health information sources. The greater susceptibility of political conservatives to conspiracy beliefs extends to the topic of vaccination.

© 2019 Elsevier Ltd. All rights reserved.

1. Introduction

The development of vaccinations has significantly decreased the incidence, prevalence, morbidity, and mortality of many communicable diseases [1–3]. However, many people are uninformed about the effectiveness of vaccines and instead attribute the disappearance of some infectious diseases to improved health care, hygiene, and sanitation [1]. Some doubt the ability of vaccines to prevent the targeted diseases [2] and an alarming number of individuals are misinformed about the safety of vaccines, believing that contaminants cause serious adverse side-effects [1,2]. A recent report found that 43% of parents with young children believe that MMR vaccine side-effects pose a medium or high risk [3].

Of particular concern are those people who are not only misinformed about the effectiveness and safety of vaccines, but who also subscribe to vaccine-related conspiracy beliefs [4,5]. In a recent survey, 56% of Americans agreed or felt neutral about the statement, “doctors and government vaccinate children even though they know vaccines cause autism and other disorders” [6]. In another recent survey, 27% of Americans endorsed a variety of con-

spiracy theories, including conspiracy theories about vaccination [4]. Acceptance of such conspiracies adversely affects parental vaccination decisions and lower vaccination intentions [5,6]. By definition, people who subscribe to vaccination conspiracies distrust science, government, and the pharmaceutical industry, resulting for some to eschew vaccination [2].

Ignorance and conspiracy beliefs have sometimes been conflated in the literature. “Conspiracy” refers to the belief that people are plotting in secret to do harmful things. In the case of vaccinations, this would amount to intentionally providing dangerous and/or ineffective vaccines to the public [5]. Conspiracies reflect more than just ignorance. For example, a person might think that vaccines cause multiple sclerosis (poor knowledge) without necessarily believing that drug companies know this to be true and are concealing the evidence (conspiracy). Not surprisingly, vaccine conspiracy beliefs have been found to reduce people's vaccination intentions [5] and increase vaccine hesitancy among parents [7].

The unique contribution of the present study is its focus on how the offline and online sources people rely upon for health information relate to the cultivation of conspiracy beliefs about vaccination. People have a wide array of information sources they can turn to when they wish to learn about health and medicine. Researchers distinguish between new (online) media and traditional (offline) information sources, and for good reasons [13,14].

* Corresponding author.

E-mail addresses: jding@ucdavis.edu (J.D. Featherstone), rabell@ucdavis.edu (R.A. Bell), jbruiz@ucdavis.edu (J.B. Ruiz).

New media are accessible anytime, everywhere; allow users to co-generate (dis)information without regulation or quality checks; and foster sharing of these creations on a mass scale.

Approximately 4 in 5 Internet users go online for health information [8] and social media have become an important source of online vaccine information [2]. However, online information sources vary dramatically in quality. Online vaccine information often provides incomplete and inaccurate information [9], with a large percentage of online sites touting anti-vaccine rhetoric and spreading vaccine conspiracy theories [2,10]. Conspiracy theories abound on the internet [2,9,10], and especially on social media [2,10]. The interactive nature of social media allows for conspiracies' to be both learned and spread. This is in sharp contrast to the excellent sources of vaccine information that can be found online at authoritative sites sponsored by medical authorities, health associations, and government agencies [11]. When offline, people can also turn to their healthcare providers, who remain the most trusted sources of health information for most people [12].

We hypothesized that individuals who rely on unauthoritative online health information sources, specifically information shared on social media, would be more inclined to hold conspiracy beliefs about vaccination. In contrast, we expected reliance on medical authorities (online and off) to be associated with lower levels of conspiratorial thinking about vaccines.

This survey also sought to assess the role that political ideology might play in people's adoption of conspiracy beliefs about vaccination. Previous research on the psychology of conspiracy suggests an association between political ideology and belief in conspiracies, with self-described conservatives being more likely to accept conspiracy theories than their liberal counterparts [15]. Only one investigation that we know of purports to investigate conspiratorial beliefs about vaccines but, in fact, that investigation only assessed lack of knowledge on the topic, not perceptions of deception by health and government leaders [16]. Another study found that conservatives are less likely than liberals to trust vaccine science but did not explicitly link trust with conspiracy beliefs [15]. In line with previous research, we predicted that conservatives would be more likely than liberals to accept vaccine conspiracies.

2. Methods

2.1. Sample

This study was approved by the IRB at the authors' institution. Respondents were recruited through Amazon's Mechanical Turk (MTurk). Mturk nonprobability convenience samples are more appropriate for examining relationships among variables, the objective of the present study, than estimating population parameters. To be eligible for the study, participants had to be at least 18 years of age. The online survey was delivered to consenting and eligible respondents using Qualtrics Labs, Inc. software.

2.2. Measures

Conspiracy beliefs were measured with the 7-item vaccine conspiracy beliefs scale (e.g., *Pharmaceutical companies cover up the dangers of vaccines*) [7]. Political ideology was assessed by having respondents rate themselves on a single-item 7-point scale ranging from "extremely conservative" (1) to "extremely liberal" (7). Our novel measures of health information source reliance were developed by integrating typologies used in past research on information seeking, as well as various typologies of social webs. Health information sources were categorized into online and offline where

online sources include health forums, online news, social media, blogs and so on; offline sources include traditional news media and interpersonal channels (doctors, friends, family). For each category, participants were asked, "How often do you go to [source] when you need to find health information?" with the ordered response options of *never*, *rarely*, *sometimes* and *often* provided. The questionnaire concluded with a set of standard demographic questions.

2.3. Data analysis

Descriptive statistics were used to characterize the sample and study variables. The items written to assess use of various sources of health information were not previously used, and were thus subjected to exploratory factor analysis (EFA). Thereafter, the fit of the measurement model was examined with confirmatory factor analysis (CFA) and hypotheses were tested with structural equation modeling (SEM) [17]. This sequential analytical approach allowed us to validate the restrictions imposed by confirmatory factor analysis that are not a part of the EFA, such as fixed cross-loadings. SEM also provides estimates that are adjusted for measurement error. Analyses were conducted using the maximum likelihood method of estimation as implemented in Stata, version 15. The model was judged to have a good fit if its root mean square of error of approximation (RMSEA) was ≤ 0.06 and comparative fit index (CFI) was ≥ 0.95 [18]. Criterion for an acceptable fit was $RMSEA \leq 0.08$, $CFI \geq 0.90$ [18]. In addition, a standardized root mean square residual (SRMR) value of ≤ 0.08 was considered desirable, although a cutoff value near 0.09 for SRMR, in combination with a CFI value of 0.95, evidenced acceptable fit [18]. Modification indices were examined when an unsatisfactory fit was obtained to identify parameters that would improve fit.

3. Results

3.1. Sample characteristics

Complete data were obtained from 599 respondents. The majority of respondents were male, white, married, middle-aged, and college-educated. Most reported a household family income under \$60,000 (Table 1).

Table 1
Sample Characteristics (N = 599).

| Characteristic | n | % |
|---------------------------|------|---------|
| Male | 322 | 53.8 |
| White Race | 429 | 71.6 |
| Age, M (SD) | 36.9 | (11.61) |
| Marital Status | | |
| Married/living as married | 305 | 50.9 |
| Never married | 230 | 38.4 |
| Widow/widower | 10 | 1.7 |
| Separated or divorced | 54 | 9.0 |
| Education | | |
| HS or less | 73 | 12.2 |
| Some college | 143 | 23.9 |
| Associate's degree | 71 | 11.6 |
| Bachelor's degree | 232 | 38.7 |
| Graduate degree | 80 | 13.4 |
| Income | | |
| Under \$20,000 | 60 | 10.0 |
| \$20,000–39,999 | 139 | 23.2 |
| \$40,000–59,999 | 160 | 26.7 |
| \$60,000–79,999 | 99 | 16.5 |
| \$80,000–99,999 | 60 | 10.0 |
| \geq \$100,000 | 70 | 11.7 |
| Declined to answer | 11 | 1.8 |

3.2. Item assessment

The EFA, carried out using the eigenvalue ≥ 1.0 criterion, resulted in a four-factor solution. Two items did not load highly on any factor and were thus discarded. The discarded items asked about the use of television news stories and reliance on online health forums for health information seeking. In retrospect, measuring reliance on television news for health information would be problematic, as exposure to health stories in broadcast media is largely incidental. The failure of the health forums item to covary with other health sources may reflect the diversity of such sites. For example, only some of these sites are sponsored and audited by medical authorities or include recommendations from authoritative sources. The EFA was repeated without the two discarded items and the same four factors emerged; these were labeled *Social Media, News, Providers, and Medical Websites*.

A confirmatory factor analysis (CFA) was carried out to assess the goodness of fit for a five-factor model that included the four health information factors and the vaccine conspiracy beliefs items. The five latent variables were allowed to covary in the model. This initial model provided a reasonable fit to the data, although the CFI value was suboptimal ($\chi^2 (143) = 686.34, p < .001; CFI = 0.93, RMSEA = 0.08, SRMR = 0.056$). The modification indices revealed significant covariation between the first and fifth item on the conspiracy beliefs measure. These items had identical wording, with the exception that one referenced vaccine *safety* and the other vaccine *effectiveness*. When their error terms were allowed to covary, a very good fit was achieved ($\chi^2 (141) = 408.49, p < .001; CFI = 0.96, RMSEA = 0.056, SRMR = 0.055$). Table 2 reports the coefficients, standard errors, and standardized coefficients for this model, along with item means and standard deviations. The plot symbols used for the structural model are also tabled.

3.3. Descriptive statistics for study variables

Means, standard deviations, and reliability values for the primary study variables are reported in Table 3. The composite vari-

ables reported in the table were based on the averaging of items. Reliabilities were acceptable, especially considering the small number of items that comprised the health information source variables. For example, the reliability of 0.56 for the Providers measure reflects its composition of two items.

3.4. Structural model

The structural model is reported in Fig. 1. Coefficients have been standardized and significance levels are reported only for the structural paths for clarity of presentation. Goodness-of-fit measures, provided in the figure textbox, indicates a very good fit for the model. As expected, stronger vaccine conspiracy beliefs were associated with greater reliance on social media (coef. = 0.42, $p < .001$) and less reliance on medical websites (coef. = -0.21, $p < .001$). Conspiracy belief acceptance was not significantly related to reliance on providers (coef. = -0.13, $p < .061$) or news sources for health information (coef. = 0.07, $p < .50$).

Regarding political ideology, individuals who rated themselves as more liberal were less inclined to subscribe to conspiracy beliefs (coef. = -0.29, $p < .001$). To better understand this finding, we examined the relationship of political ideology to preferred health information sources. Conservatives were more likely to report using social media use ($r = 0.15, p < .01$) but less reliant on medical websites ($r = -0.09, p < .05$).

4. Discussion

This investigation demonstrates that the sources of health information people rely upon predict their likelihood of accepting conspiracy beliefs about vaccines. Social media appear to play an especially nefarious role. Previous studies have shown that social media propagate vaccine conspiracy theories [2,10] and can exert a large effect on people's world views [19]. The present study brings these two findings together by implicating social media use in the development of vaccine conspiracy beliefs. The unique features of social media make it an especially potent platform for the promulgation of vaccine conspiracy beliefs. Social media allows

Table 2
Confirmatory Factor Analysis.

| Plot | Measure/Item | Unst. Coef. | SE | Stand. Coeff. | M | SD |
|--|---|------------------|-------|---------------|------|------|
| <i>Social Media</i> | | | | | | |
| A | General social networking sites | 1.0 ^a | | 0.68 | 2.07 | 0.99 |
| B | Bloggng sites | 0.88 | 0.061 | 0.67 | 1.98 | 0.88 |
| C | Microblogging sites | 1.07 | 0.064 | 0.80 | 1.65 | 0.90 |
| D | Video sharing sites | 0.86 | 0.064 | 0.61 | 2.21 | 0.95 |
| E | Photo sharing sites | 1.10 | 0.064 | 0.83 | 1.62 | 0.89 |
| <i>News</i> | | | | | | |
| F | Online news organizations' websites | 1.0 ^a | | 0.61 | 2.35 | 0.89 |
| G | Newspaper health news stories | 1.16 | 0.101 | 0.69 | 1.87 | 0.92 |
| H | Health magazines (printed) | 1.12 | 0.105 | 0.66 | 1.84 | 0.92 |
| <i>Providers</i> | | | | | | |
| I | Doctor | 1.0 ^a | | 0.57 | 3.31 | 0.95 |
| J | Pharmacist | 1.18 | 0.252 | 0.68 | 2.39 | 0.93 |
| <i>Medical sources of health information</i> | | | | | | |
| K | Medical association websites | 1.0 ^a | | 0.77 | 2.84 | 0.85 |
| L | Government health websites | 0.97 | 0.110 | 0.72 | 2.77 | 0.89 |
| <i>Conspiracy beliefs</i> | | | | | | |
| M | Vaccine safety data is often fabricated (made up) | 1.0 ^a | | 0.85 | 2.36 | 1.15 |
| N | Immunizing children is harmful, and this fact is covered up | 1.15 | 0.037 | 0.91 | 2.18 | 1.23 |
| O | Pharmaceutical companies cover up the dangers of vaccines | 1.19 | 0.039 | 0.90 | 2.54 | 1.30 |
| P | People are deceived about the effectiveness of vaccines | 1.16 | 0.038 | 0.90 | 2.45 | 1.26 |
| Q | Data about vaccine effectiveness is often fabricated (made up) | 1.04 | 0.023 | 0.84 | 2.33 | 1.21 |
| R | People are deceived about vaccine safety | 1.21 | 0.039 | 0.91 | 2.48 | 1.29 |
| S | The government is trying to cover up the link between vaccines and autism | 1.17 | 0.039 | 0.89 | 2.24 | 1.28 |

^a Constrained parameter, not tested for statistical significance. All other unstandardized estimates are statistically significant at $p < .001$.

Table 3
Descriptive Statistics for Study Variables.

| Variable | M | SD | Range ^a | Items | Alpha ^b |
|-------------------------------|------|------|--------------------|-------|--------------------|
| Conspiracy beliefs | 2.37 | 1.13 | 1–5 | 7 | 0.97 |
| Health information source use | | | | | |
| Social media | 1.91 | 0.72 | 1–4 | 5 | 0.84 |
| News | 2.02 | 0.71 | 1–4 | 3 | 0.68 |
| Providers | 2.75 | 0.78 | 1–4 | 2 | 0.56 |
| Medical websites | 2.82 | 0.76 | 1–4 | 2 | 0.71 |
| Conservative-Liberal | 4.52 | 1.82 | 1–7 | 1 | – |

^a Theoretical range for variable.

^b Cronbach's alpha.

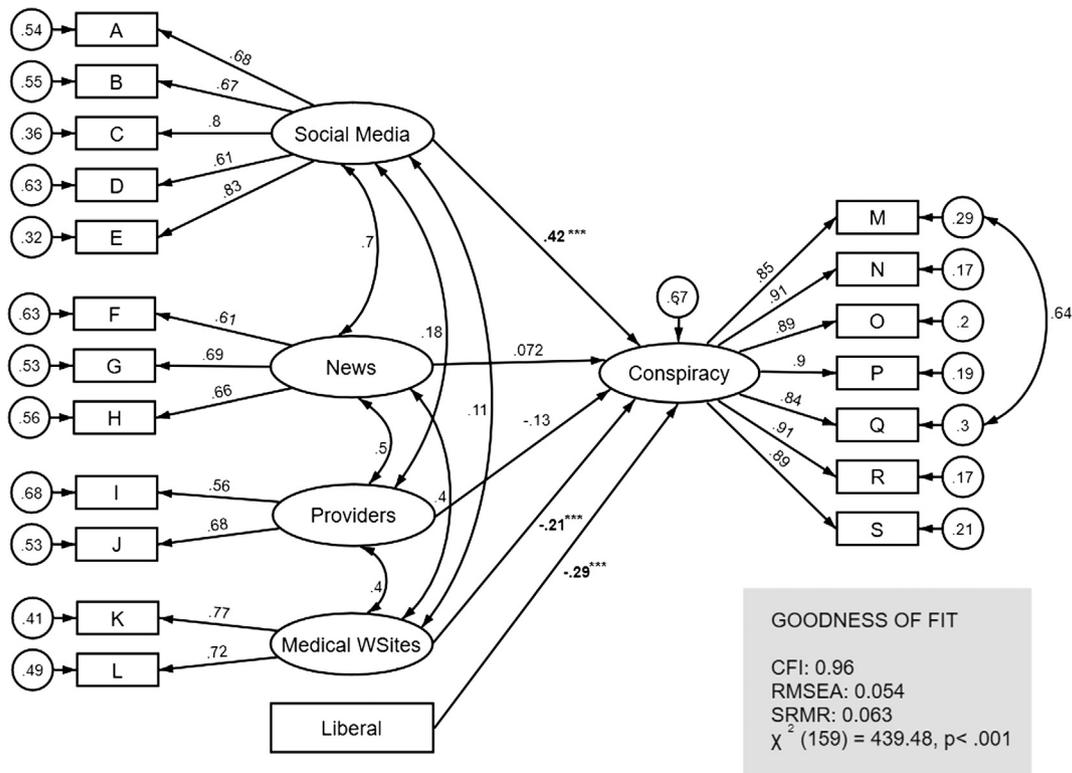


Fig. 1. Structural model.

the true believer of such conspiracies to spread their false beliefs widely and quickly. Social media also allows other true believers to reinforce false claims about vaccination and even respond, sometimes aggressively, when their falsehoods are countered.

This study also suggests that the Internet can play a constructive role in the cultivation of veridical views on vaccination. For example, medical website use was negatively correlated with people's acceptance of conspiracy beliefs. Most people consider medical sources, which are largely free of vaccine conspiracies [9], to be generally credible and trustworthy [20]. Thus, people who rely upon medical websites for health information are unlikely to encounter support for vaccine conspiracies. Furthermore, authoritative news websites are not exclusively about health and do not typically push content based on the audience member's political stance.

This study also provides evidence that the tendency of conservatives to accept conspiracy beliefs extends to the topic of vaccination. This finding can be explained, in part, by conservatives' greater reliance of social media and lesser reliance on authoritative medical websites for health information. The finding might also

reflect conservatives' tendency to be less accepting of scientific consensus and their more negative feelings about scientific experts [16], a possibility we did not examine. This anti-intellectualism may also be one of the motivations for some conservatives to seek out social media to fill gaps in knowledge that cannot be addressed for them by science. Future research should examine the psychological and experiential basis of conservatives' acceptance of conspiracies within the context of vaccination.

This study is not without limitations. The survey made use of a nonprobability sample. Second, we relied upon self-reports of health information source use rather than objective logs or other record types of actual sources used. Third, the sample was recruited from an online pool of research participants who might be more "internet-savvy" than the general public. Fourth, the data are cross-sectional, making it difficult to determine if exposure to poor health information sources cultivates conspiracy beliefs or if a tendency to believe in conspiracies shapes health information source references. Finally, this study did not measure parental status, which could moderate the effect of health information sources used, as well as political ideology, on conspiratorial beliefs.

Conflict of interest statement

The authors certify that they have no affiliations with or involvement in any organization or entity with any financial or non-financial interest in the subject matter or materials discussed in this manuscript.

References

- [1] Temoka E. Becoming a vaccine champion: evidence-based interventions to address the challenges of vaccination. *S D Med* 2013. Spec no: 68–72.
- [2] Kata A. A postmodern Pandora's box: anti-vaccination misinformation on the Internet. *Vaccine* 2010;28:1709–16.
- [3] Funk C, Kennedy B, Hefferon M. Vast majority of Americans say benefits of childhood vaccines outweigh risks. Pew Research Center; 2017.
- [4] Freeman D, Bentall RP. The concomitants of conspiracy concerns. *Soc Psych Psych Epid* 2017;52:595–604.
- [5] Jolley D, Douglas KM. The effects of anti-vaccine conspiracy theories on vaccination intentions. *PLoS ONE* 2014;9.
- [6] Oliver JE, Wood T. Medical conspiracy theories and health behaviors in the United States. *JAMA Intern Med* 2014;174:817–8.
- [7] Shapiro GK, Tatar O, Dube E, Amsel R, Knauper B, Naz A, et al. The vaccine hesitancy scale: psychometric properties and validation. *Vaccine* 2018;36:660–7.
- [8] Fox S. Online health search 2006: most internet users start at a search engine when looking for health information online. Very few check the source and date of the information they find. Washington, DC: Pew Internet & American Life Project; 2006.
- [9] Madden K, Nan XL, Briones R, Waks L. Sorting through search results: a content analysis of HPV vaccine information online. *Vaccine* 2012;30:3741–6.
- [10] Guidry JPD, Carlyle K, Messner M, Jin Y. On pins and needles: how vaccines are portrayed on Pinterest. *Vaccine* 2015;33:5051–6.
- [11] Xiao N, Sharman R, Rao HR, Upadhyaya S. Factors influencing online health information search: an empirical analysis of a national cancer-related survey. *Decis Support Syst* 2014;57:417–27.
- [12] Diaz JA, Griffith RA, Ng JJ, Reinert SE, Friedmann PD, Moulton AW. Patients' use of the Internet for medical information. *J Gen Intern Med* 2002;17:180–5.
- [13] Cotten SR, Gupta SS. Characteristics of online and offline health information seekers and factors that discriminate between them. *Soc Sci Med* 2004;59:1795–806.
- [14] Dobransky K, Hargittai E. Inquiring minds acquiring wellness: uses of online and offline sources for health information. *Health Commun* 2012;27:331–43.
- [15] Hamilton LC, Hartter J, Saito K. Trust in scientists on climate change and vaccines. *Sage Open* 2015;5.
- [16] Motta M. The dynamics and political implications of anti-intellectualism in the United States. *Am Polit Res* 2018;46:465–98.
- [17] Kline RB. *Methodology in the social sciences. Principles and practice of structural equation modeling*. 2nd ed. New York (NY): Guilford Press; 2005.
- [18] Hu LT, Bentler PM. Cutoff criteria for fit indexes in covariance structure analysis: conventional criteria versus new alternatives. *Struct Equ Model* 1999;6:1–55.
- [19] Bialik K. 14% of Americans have changed their mind about an issue because of something they saw on social media. Pew Research Center; 2018.
- [20] Song H, Omori K, Kim J, Tenzek KE, Hawkins JM, Lin WY, et al. Trusting social media as a source of health information: online surveys comparing the United States, Korea, and Hong Kong. *J Med Internet Res* 2016;18.