Misinformation about Travel Vaccines and the Perceived Credibility Assessment by University Students

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MISINFORMATION ABOUT TRAVEL VACCINES IN ONLINE MEDIA

Abstract

Vaccine information is often misrepresented in online media, and scientists begin to express worry that vaccine uptake and hesitancy will be affected by this. Specifically, young adults are at risk of being overexposed to misinformation on social media because of their frequent internet use. The present study examines three determinants, authority, medium, and advertisements, of perceived credibility in the context of travel vaccines. An experimental online study with a set of three separate between-subjects designs was administered to a predominantly female university student convenience sample ($N = 225$). It contained three experiments with two conditions each, to which participants were randomly assigned. Participants were shown mock tweets, Facebook posts, and online news articles. Independent samples t-tests were conducted. Results showed authority to be a positive determinant of perceived credibility ($p = .001$; $d = -.51$) in a health information context, which is consistent with previous research. Daily Twitter use was not a moderating variable ($p = .825$), most likely because social media use does not indicate immediate trust toward it. This is discussed based on previous findings that a critical stance toward the internet and social media credibility does not decrease motivation for using it (Johnson & Kaye, 2015). Advertisements were found to be a negative determinant ($p = .007$), most likely because it decreases the perception of professionalism. Advertisements lead readers to think of the source as less objective and as dependent on outside monetary support (Diviani, van den Putte, Meppelink, & van Weert, 2016). There was no difference between the Facebook and online newspaper condition. Several reasons for this are discussed. For one, neither Facebook nor online newspapers are specialized in health information. Further, it is suggested that the length of the post could have had a positive effect on perceived credibility for the Facebook condition, but not for the online newspaper condition. Overall findings indicate that misinformation posted on non-health-specialized media is not perceived as credible by university students. It is suggested that university students are critical toward vaccine misinformation online. Future research is recommended to focus on diminishing factors for perceived credibility, and conduct studies that take into account both source and user-characteristics to gain a complete picture.

Keywords: *Social media credibility, Online media credibility, Young adults, Perceived credibility*

With the rise in information accessibility, misinformation has become an increasing problem, especially in the domain of health information. As most openly accessible information on the Internet is not peer-reviewed, anyone can express their viewpoints (Morahan-Martin & Anderson, 2000), for example, via social media. There is a marked lack of barriers that prevent misinformation online. Health-information seems to be especially at risk of being misrepresented. Waszak, Kasprzycka-Waszak, and Kubanek (2018) found that tweets regarding vaccines are often misinforming their audience, in comparison to other topics. Scientists express worry that vaccine uptake and hesitancy will be affected through misinformation. Specifically, young adults are at risk of being confronted with high amounts of misinformation, as they use the internet frequently. 65% of youths and young adults between the ages of 16 to 29 years use the internet to read online newspapers, and around 50% use it to find health information (Statistical Office of the European Communities, 2017). This paper addresses the characteristics of online media that influence perceived credibility for university students in the context of travel vaccines.

The Internet and Misinformation

In recent years, the term fake news has gained a certain degree of popularity, particularly in the political sphere. Some define it as “fabricated information that mimics news media content in form but not in general procedure” (Lazer et al., 2018, pp. 1094). According to Rochlin (2017), fake news recently has shifted toward meaning news, which is seen to attack someone's pre-existing beliefs. Current US-President Donald Trump does not call the news fake because he thinks they lack epistemic value, but because they do not conform to his opinions. One can find false or misleading information throughout history. In the 19th century, penny-press papers were prone to sensationalism (Creech & Roessner, 2019). Still, there is a belief that especially nowadays, we are encountering a “fake news epidemic” (Creech & Roessner, 2019), but in this paper, the term misinformation (meaning false or misleading information ((Lazer et al., 2018)) is preferred.

As already stated, the internet made large amounts of information available while not introducing barriers to misinformation. According to Johnson and Kaye (2014), social media are heavily used sources for news despite not being particularly credible. Additionally, social media has become a source for information about risks and crisis (Jin, Liu, & Austin, 2014), and

notably, health information (Thackeray, Crookston, & West, 2013). Social media can be defined as a "group of interactive, collaborative, conversation, and community-based systems" (Lin, Spence, & Lachlan, 2016, pp. 264). Perceived credibility has been linked to both the selection of information and the processing of information which people choose to consume (Xu, 2013). Thus, there is a concern that especially misleading medical information might prove harmful and lead to adverse behavioral changes, for example denying vaccination.

Despite this, Johnson and Kaye (2015) found that low perceptions of credibility do not necessarily affect motivation for using the medium. In a study with American participants, they discovered that Twitter, Facebook, and Fox News were rated as moderately credible, while newspapers were top-rated sources for political information. They found that the credibility of social media did not significantly influence the motivation for using it. Based on this finding, it is likely that university students will still use social media and will be at risk of being exposed to harmful presentations of views on social media. Therefore, there is an urgent need to look into how students assess credibility on social media and how they react to misinformation about vaccines.

Perceived Credibility

Perceived credibility is described as an individual's perception of accuracy, believability, and fairness (Gaziano & McGrath, 1986). Three determinants of perceived credibility are further inspected in this paper. For one, authority is consistently found to be a significant indicator of perceived credibility (Lin et al., 2016; Sbaffi & Rowley, 2017). Individuals trust and follow advice from a university of government institutions (Briggs, Burford, De Angeli, & Lynch, 2002), but also see medical experts and official authorities as high in authority. According to Sundar (2008), authority is especially efficient in younger adults, still in education. In contrast, tweets from peers were found to be low in credibility (Lin et al., 2016). Additionally, Lin et al. (2016) state that authority had the highest impact in their study compared to a shared identity or the number of retweets a particular post got. A person with authority appears trustworthy, as they seem capable of providing information that is both accurate and valid (Hilligoss & Rieh, 2008).

Secondly, research into news item characteristics has also found that different online media are implicitly viewed as more or less credible in comparison to other online media. Facebook is seen as more credible than Twitter, however, less credible in comparison to an

online newspaper (Johnson & Kaye, 2015). Johnson and Kaye (2015) describe that Facebook as a platform usually connects people who already know each other, and are thought to have stronger social bonds, through which credibility increases. On Twitter, most users do not know each other personally (Johnson & Kaye, 2015), which might negatively affect perceived credibility. The study was conducted with political information in the United States.

Moreover, in the context of online websites, Sbaffi and Rowley (2017) analyzed hat advertisements surrounding a website are a negative indicator of perceived credibility. Sillence, Briggs, Harris, and Fishwick (2007) studied consumer-behavior when looking for health information. Participants mainly depended on heuristic processing when asked to search freely, and very quickly rejected websites with busy pop-up advertisements and an unclean visual design. Also, users with high health literacy levels have found to use the absence of advertising as an evaluation criterion of the quality of a source (Diviani et al., 2016).

Misrepresented Vaccine Information

There is a broad scientific consensus on vaccines being both safe and effective. Still, vaccine hesitancy due to misinformation affects multiple age groups. With age, people do not get immunized regularly anymore. Among 5225 people from Australia, Finland, Germany, Norway, Sweden, the UK, and Canada (between 18-65), only 37% were fully vaccinated against both Hepatitis A and B (Heywood et al., 2016), although it is a vaccine highly recommended before traveling to exotic destinations.

One example of misinformation with severe consequences was the claim that the MMR vaccine causes autism. Even though multiple studies have disproved the link between autism and the vaccine (DeStefano & Thompson, 2004), it continues to be a highly debated topic. Schmidt, Zollo, Scala, Betsch, and Quattrociocchi (2018) attribute misinformation spread via social media to influence risk perceptions and attitudes toward vaccinations. Researchers fear that because vaccine-preventable diseases (VPDs) declined, people are not aware of the disease's adverse effects anymore (Kata, 2010). Without being confronted with the negative sides of experiencing a VPD, the adverse side effects of the vaccine itself seem to be amplified (Kata, 2010). Even exposure ranging from 5-10 minutes to misinformation can increase perceptions of vaccination risks and lead to lowered vaccination intentions (Bean, 2011). Bean (2011) also identified a trend

of anti-vaccine websites using testimonials from alleged physicians and experts to make their content more believable.

Kata (2010) reviewed multiple articles containing misinformation about vaccines and summarized the main themes. Most commonly, the vaccine's safety and effectiveness are called into question. Substances within the vaccine are listed poisonous to humans (e.g., anti-freeze, mercury, and nonbacteria). These websites do not mention that the amount of the substance is not enough to be toxic. Further, illnesses like AIDS, asthma, or fibromyalgia, among others are supposed to be linked to vaccines. According to Kata (2010), vaccine studies are often misrepresented, and false conclusions are made from research. Sources and data are described selectively and used untruthfully.

The Present Study

Perceived credibility indicators and cues have been extensively studied for traditional media. However, not many have addressed whether these indicators also apply to online media. With new technologies and systems in light of the Web 2.0, it is essential to know what influences perceived credibility of information posted on Twitter, Facebook, or online newspapers. Especially young adults between 18-29 frequently use the internet and social media applications (Pew Research Center, 2018) and are, therefore, at increased risk of being confronted with harmful misinformation about vaccines. An increasing number of students decide to travel to exotic destinations, for which Hepatitis A and B vaccines are highly recommended. Should their vaccine uptake be influenced, students are potentially at risk for contracting such diseases.

Studies that have previously addressed the credibility of health information have framed it in relation to information seeking behavior (e.g., Diviani et al., 2016; Lin, Zhang, Song, & Omori, 2016; Syn & Kim, 2013; Thackeray, Crookston, & West, 2013). This presupposes that people actively select a source and make a judgment about the information being presented. According to O'Keefe (2002, as cited in Zhang, 2014), in everyday usage, a user will simply encounter information while browsing and pay attention to information that is topically relevant to them. Due to this, the present study wants to investigate the perceived credibility of information without presupposing an intention to seek information by the user. Furthermore, previous studies about the perceived credibility of health information focused on websites specialized in health information (e.g Sun, Zhang, Gwizdka, & Trace, 2019; Walther, Wang, &

Loh, 2004). Not much is yet known about how health information is assessed on media which are not designated for health information, like Twitter, Facebook, or online newspapers. These media have been used in studies about the perceived credibility of political information (e.g., Johnson & Kaye, 2015), however, they have limited generalizability to other topics. Perceived credibility assessments are context dependent. Determinants of perceived credibility depend on the context in which a source is used (Ruppel & Rains, 2012). Therefore, the present study intends to address the research gap on perceived credibility assessments of health information in non-health specialized media.

Hypotheses

Previous research into news item characteristics that influence perceived credibility has focused on the general population. The present study seeks to expand knowledge about the perception of misinformation by asking the following research question: "What characteristics of a source influence the perceived credibility for young adults when confronted with misinformation about travel vaccines?" To answer the research question, three hypotheses have been formulated.

Authority is often thought to be a highly influential and consistent predictor of perceived credibility (Sbaffi & Rowley, 2017). Therefore, a tweet from a highly authoritative person will likely be more credible compared to a non-authoritative person.

H1: Misinformation on Twitter about travel vaccines posted by a medical expert will be perceived as more credible compared to a non-medical expert.

Previous research into news item characteristics has found that different online media are implicitly more or less credible in comparison to other online media. Facebook is seen as more credible than Twitter, however less credible in comparison to an online newspaper (Johnson & Kaye, 2015). Thus, the second hypothesis states that misinformation presented in a Facebook environment will seem less credible than in an online newspaper environment.

H2: Misinformation about travel vaccination posted via Facebook will be perceived as less credible than via an online newspaper.

In Sbaffi and Rowley's (2017) review of articles investigating influences on perceived credibility, advertisements surrounding websites were found to be a negative indicator. In their

review, websites were studied, however, the same will most likely hold for online newspapers, so that: an online newspaper surrounded by advertisements will be less credible than an online newspaper without advertisements.

H3: Information about travel vaccination presented in online news without advertisements will be more credible than with advertisements surrounding the online news.

Method

Participants and Design

Through convenience sampling and the snowballing method, 300 participants were recruited. Researchers contacted fellow students and friends via Email, WhatsApp, and Facebook who were asked to distribute the anonymous reusable link of the online study further. Additionally, the study was distributed via the website SONA, used by the University of Twente to allow students to participate in research studies in exchange for credit points. All participation was voluntary. Data collection was done in collaboration with another researcher who studied perceived credibility assessments in the context of climate change.

For data analysis, 225 responses were taken into account. Only data of participants who understood the manipulation were used, which was determined by manipulation check questions. The sample consisted of 35.1% male and 64.9% female participants. Ages ranged between 18-29 years, with a mean of 22.26 years (SD = 2.45). Dutch participants made up 5.8% of the sample, 78.2% were German, and 16% of participants belonged to a different nationality. All participants used social media, and 97.8% use at least one social media platform daily. Participant numbers per condition and chronological order can be found in Figure 1.

An experimental online study was administered. The study consisted of a set of three experiments, each with a between-subjects design. The presentation order of experiments was fixed. For each experiment separately, a participant was randomly assigned to one of two conditions (see Table 1). All three experiments tested the effects of an independent variable on the dependent variable perceived credibility. Experiment one to three tested the IVs authority, news medium, and surrounding advertisements, respectively. Additionally, the daily usage of social media by a participant was taken as a moderating variable on the effects of the independent variables on perceived credibility.

Table 1

Chronological Order and Randomized Assignment of Participants to Conditions in Experiment 1, 2, and 3 and Number of Participants per Condition

	Experiment 1: Authority		Experiment 2: Medium		Experiment 3: Surrounding Advertisement
Randomization	High authority condition (*n* = 81)	*Randomization*	Online newspaper condition (*n* = 77)	*Randomization*	No advertisement condition (*n* = 82)
	Low authority condition (*n* = 83)		Facebook condition (*n* = 86)		Advertisement condition (*n* = 88)

Manipulations

In total, six mock news stimuli were created for this study (see Appendix B). For each of the three experiments, two stimuli were made to test the effects of the respective IVs. Misinformation was provided concerning the topic of travel vaccines. All stimuli were images, with a size of 700x394 and a resolution of 72x72. Participants were able to enlarge the images if needed.

Experiment 1 - High authority vs. low authority

In experiment 1, a mock Twitter page was shown. To manipulate authority, the Twitter user's name, verified status, and profile description were adapted, per condition. The Tweet itself contained misinformation relevant to students about the yellow fever vaccine, which is advised for traveling to countries like Brazil. Encephalitis and meningitis were cited as a potential side effect, misrepresented by not mentioning the slim probability of these to occur.

In the high authority condition, authority was manipulated by adding a doctorate title to the Twitter user's name, adding a verification button and by showing a profile description which detailed the user's status as a medical doctor specialized in vaccines and global health. Combined

with this profile description, it was possible to specify that the user was an expert with high authority on the topic of vaccines.

The low authority condition received the same mock Twitter page. To manipulate authority, the name of the user did not contain a doctorate tile, and the account was not verified. The profile description contained information associated with an average person's profile that enjoys traveling. Followers and likes were also adjusted, as a verified account usually has a higher number of followers and likes in contrast to an account that is not verified.

To check the manipulation, participants were asked whether the tweet was by an expert and whether it was by someone specialized on vaccines on a 3-Point Likert Scale (1 = Yes to 3 = No). In the high authority condition, 20.4% of participants thought the tweet was by an expert. 51.3% were unsure, and 28.3% answered with a "No." The manipulation only worked moderately. Participants were also included if they answered with "Maybe." In the low authority condition, manipulation worked well. 73% of participants did not think the Tweet was by an expert, and only 0.9% answered with a "Yes." 66.7% did not believe the Tweet was by someone specialized in vaccines, and 31.5% were unsure.

Experiment 2 - Online Newspaper vs. Facebook

In experiment 2, a mock Facebook page and mock online newspaper were created. Both conditions received a three-paragraph long post. Misinformation in this post explained that travel vaccines were simply a way for companies to make money. It was described that students who wish to travel to an exotic destination are recommended to get a multitude of unnecessary shots. Additionally, it was mentioned that a student was paralyzed as a consequence of a vaccine shot and could therefore not go on vacation.

The online newspaper condition received a mock online newspaper page. The article had a headline, so to make it appear more realistically like a newspaper. An author was not mentioned as in online newspapers; it is common to find the author at the bottom of the page, and participants were told that they were only viewing an excerpt of the article. In contrast, the Facebook condition contained the mock Facebook page. The number of likes was blurred, but an author was added named "Vaccine Organization."

As for manipulation check question, participants were asked on a 5-Point Likert Scale whether the text was written on Facebook or in a newspaper respective of the condition. In the

Facebook condition, manipulation was successful with 85.7% thinking the text was written on Facebook and 10.2% being unsure. In the newspaper condition, manipulation was also successful, with 68.3% answering that the text was written in a newspaper and 12.9% being unsure.

Experiment 3 - Advertisement vs. no advertisement

In the third experiment, an online newspaper was shown either with or without advertisements. The article had misinformation with both positive and negative messages about travel vaccines. A testimonial of a fictitious 21-year-old was detailed, who became sick after receiving a Hepatitis A vaccine shot. This vaccine is commonly recommended for travelers whose destination lies outside of Europe. In one paragraph misinformation was given that Hepatitis had been eliminated in the 1980s, and the only known cases originated from the vaccine itself. In the next paragraph, it was correctly described that vaccines face tough safety standards and that most risks are unnecessarily amplified.

In the no advertisements condition, this misinformation was shown without advertisements. In the advertisements condition, a cookies message was added and two advertisements for a clothes sale and a popular mobile application game.

To check the manipulation, participants were asked whether there was advertisement on a 3-Point Likert Scale. In the no advertisement condition, manipulation was moderately unsuccessful. Only 28.6% thought there were no advertisements, while 52.7% answered with "Maybe." All participants in this condition were taken into account for analysis. In the advertisement condition, manipulation was successful. 87.6% correctly identified that ads were present, and 9.3% were unsure.

Materials

Informed consent

Informed consent was administered to respondents, containing information about the researchers, the purpose of the study, as well as information about the length of the study. Participants were assured that any information would remain confidential and that risks to stored data were minimized by encryption and safe storage. Contact information for both researchers and the supervisor were provided.

Debriefing

Participants were given a debriefing. It contained information about the purpose of the study, and more details about the research itself, among others what the independent variables were. These were not mentioned before the experiment so that participants responses were not influenced. It was stressed that artificial news items were used and that all items contained misinformation. Additionally, it was stated that all accounts/persons portrayed in these items were fictional and were not associated with the statements portrayed by us. Participants were provided again with contact information from the researchers and their supervisor. They could withdraw their participation at this point.

Instruments

For the experiment, an online questionnaire was used. It consisted of 51 items (see Appendix A). Participants could fill out the survey in English via a laptop, tablet, or smartphone.

To measure the dependent variable perceived credibility, participants indicated on a 7-point Likert scale (1 = Strongly Disagree to 2 = Strongly Agree) to what extent they agreed with three statements. Scores between 1 and 3 were interpreted as low, 4 as average, and between 5 to 7 as high. The first statement was "The news item is believable," the second one was "The news item is fair (free from bias), and the third one was "The content of the tweet is accurate (correct)." For two adjectives, fair and accurate, synonyms were given in parentheses as a pilot test indicated confusion about the meaning of these words. These items were adapted from Gaziano & McGrath (1986), as believability, fairness, and accuracy have been found to be consistent indicators of perceived credibility (Johnson & Kaye, 2015). In experiment 1, the three items were found to have a Cronbach's Alpha value of .83, in experiment 2, a value of .90, and in experiment 3, a value of .87 was found. Reliability was good in all three experiments.

Further, manipulation check questions were included. The questionnaire also contained items concerning demographics. Participants indicated their age, gender, and nationality as well as whether they were a university student or not. Lastly, respondents were asked which platforms they use and also which of these platforms they use daily. They could choose from 8 options (see Appendix A). One of the options included "None."

Procedure

Data was collected between the 14th of April and the 27th of May 2019, after having received ethical approval from the Ethics Committee at the University of Twente. First, a pilot test was done on two participants. They sat down together with the researchers and went through the questionnaire while voicing their initial thoughts and comments. Based on this, some wording was adjusted. Also, the size and resolution of the images were increased for better legibility. They were also asked whether the news items seemed authentic. Both participants did not think the items were mock representations of Twitter, Facebook, or an online newspaper. Thus, the items were seen as valid for use in the experiment.

Recruitment was done online, either via the snowballing method or via the website SONA. It was stated that the study was looking for 18-29-year-old people with good proficiency in English. Participants received an anonymous link to the survey. At the beginning of the study, participants received an initial informed consent and were informed that the study would take around 10 to 15 minutes. Then, demographic questions were asked. Afterward, participants were randomly assigned to the high or low authority condition. There it was explained that, below, a screenshot was provided. Participants were asked to read the post and answer the questions given below. If unsure, they were told to choose "Neither disagree nor agree." Additionally, it was pointed out that the study was interested in their gut feeling, so they should not spend too much time on each question. They were informed that it was possible to zoom into the screenshot. After the perceived credibility assessment, some manipulation check questions were asked. As the data collection was done in collaboration with another researcher, participants also received items concerning climate change. The same procedure applied to these items.

This procedure was repeated two more times. Participants were randomly assigned either to the Facebook or the online newspaper condition. Then they were again randomly assigned either to the advertisements or no advertisements condition. Following each travel vaccine item, participants also viewed a climate change item from the collaborating researcher. After viewing the last news item, it was asked which online media the participant used. Then, they were told that they had almost reached the end of the survey. A debriefing was given, in which the manipulation was described. Participants were once again asked whether they allowed the researchers to use their data. Lastly, participants received a thank you message and a notification that their response had been recorded.

Data Analysis

The software IBM SPSS Statistics 24 was used for statistical analysis. To calculate perceived credibility scores, the results of the three items concerned with believability, fairness, and accurateness were summed and averaged. To measure the internal consistency of the scales, Cronbach's Alpha was calculated for each experiment. For an initial overview, descriptive statistics were calculated. To test the hypotheses, independent samples t-tests were conducted for the dependent variable perceived credibility. In experiment 1, the IV was authority, in experiment 2, it was medium, and in experiment 3, the IV was advertisements. The null hypothesis was rejected if $\alpha < 0.05$. Additional analysis was conducted to explore the data further, in the form of independent samples t-tests, and a two-way ANOVA.

Results

Experiment 1

Authority

In Hypothesis 1, it was stated that misinformation posted on Twitter by a medical professional would be more credible compared to a post by a non-medical expert. To test this hypothesis, a one-sided independent samples t-test was conducted. Overall, the tweets were perceived as neither very high nor low in credibility. The high and low authority condition respectively had means of 3.85 and 3.20. In line with this studies hypothesis, the high authority group differed significantly from the low authority group, $t(162) = -3.29$, $p = .001$; $d = -0.51$. This suggests that information posted by a medical professional has higher perceived credibility than by a non-medical professional.

Additional Analysis

To further explore how participants identified the Twitter user as a medical professional, it was tested whether the conditions differed in how much attention they paid to the profile description. Participants in both conditions were unsure, on average, to how much attention they paid to the profile description of the tweet ($M_{LowAuthority} = 2.16$, $SD = .95$; $M_{HighAuthority} = 2.12$, $SD = .97$). A two-tailed independent samples t-test also revealed no significant differences between the groups,

with $t(162) = .221$, $p = .825$, which suggests that neither condition actively read the profile description.

Additionally, a two-way ANOVA was run on the sample to test for moderation of daily Twitter use on the relationship between authority and perceived credibility. No interaction effects were found between daily Twitter use and perceived credibility, $F(1, 160) = .75$, $p = .388$. This implies that daily Twitter usage does not have a moderating effect on the relationship between authority and perceived credibility.

Experiment 2

Medium

In Hypothesis 2, it was stated that misinformation posted on Facebook would be less credible than when it is posted via an online newspaper. The screenshots were seen as neither high or low in credibility, with $M = 3.39$ in the Facebook condition and $M = 3.78$ in the online newspaper condition. To test this hypothesis, a one-sided independent samples t-test was conducted. Both conditions were compared on their perceived credibility score. In contrast to the hypothesis, the Facebook condition did not differ significantly from the online newspaper condition, $t(161) = -1.41$, $p = .081$. It appears that the medium does not have a significant effect on perceived credibility.

Additional Analysis

The data was further explored to find explanations for this result**.** With $M = 2.27$ ($SD = 1.35$), most participants were unsure whether they paid attention to the author of the Facebook post. In the online newspaper condition, it was not asked whether attention was paid to the author as the online newspaper excerpt did not have an author.

Participants were also asked on a 5-Point Likert Scale (1 = “Definitely yes” to 5 = “Definitely not”) whether they found information in online newspapers/Facebook generally trustworthy. Participants in the Facebook condition were neutral toward trustworthiness of information on Facebook generally ($M = 3.93$, $SD = .93$). Participants in the online newspaper condition were also neutral to the trustworthiness of information in online newspapers ($M = 3.22$, $SD = .98$). A two-tailed independent samples t-test revealed that participants in the Facebook

condition trusted the information on Facebook significantly less than participants in the other condition trusted online newspapers, $t(161) = 4.73$, $p < .000$.

Lastly, it was tested how carefully participants read through the text. Participants in both conditions read carefully through the text ($M_{Facebook} = 2.16$, $SD = 1.1$; $M_{onlinenews} = 2.10$, $SD = .93$). An independent samples t-test showed no significant difference between the conditions, with $t(161) = .37$, $p = .712$.

Experiment 3

Hypothesis Testing

In Hypothesis 3, it was stated that information presented in an online newspaper without surrounding advertisements would be more credible than information with surrounding advertisements. The information was seen as credible with $M = 3.93$ in the advertisements condition and $M = 4.40$ in the no advertisements condition.

To test the hypothesis, a one-sided independent samples t-test was conducted. The advertisements and no advertisements conditions were compared to each other on their perceived credibility scores. In line with the hypothesis, the conditions differed significantly from each other, $t(168) = -2.48$, $p = .007$. This indicates that the presence of advertisements has a negative effect on perceived credibility.

Additional Analysis

To explore why advertisements negatively impact perceived credibility, the additional analysis addresses professional look, if participants read the text completely and whether advertisements were found to be intrusive and distracting. Participants were asked on a 3-Point Likert Scale (1 = Yes to 3 = No) if they thought the newspaper looked professional. In the advertisements, people did not think the newspaper appeared to be professional ($M = 2.48$, $SD = .76$). In the no advertisements condition, participants thought the newspaper looked professional ($M = 1.62$, $SD = .71$). A two-tailed independent samples t-test showed that in the no advertisements condition, the newspaper was perceived as significantly more professional than in the advertisements condition, with $t(168) = 7.56$, $p < .000$.

However, participants in both conditions read the text until the end. There was no significant difference found by an independent samples t-test, $t(168) = 1.47$, $p = .142$

Lastly, descriptive statistics were calculated for the intrusiveness and degree to which advertisements distracted from the text in the advertisements condition. Participants found ads both intrusive ($M = 1.98$) and distracting from the text ($M = 1.88$).

Discussion

The purpose of this study was to examine the determinants of perceived credibility online when assessed by young adults. It was studied in the context of travel vaccines published in three types of online media: Twitter, Facebook, and a mock online newspaper. Credibility research has existed since the 1950s, however many findings were based on traditional media, such as print newspapers, television, or radio. More research was needed to evaluate determinants in an online media environment, especially in the context of health information. Previous research about the credibility of health information focused on health websites, not on media which do not have the purpose of informing about health like Facebook, Twitter, or online newspapers. To extend knowledge in this area, an online experimental questionnaire with between-subjects design was administered to participants in order to test the effect of authority, medium, and advertisement on the perceived credibility of travel vaccine information online.

Main Findings

The first hypothesis stated that misinformation about travel vaccines posted on Twitter would be more credible posted by a medical expert compared to a non-medical expert. Authority was found to have a significant positive effect on perceived credibility. The high authority condition was shown to score significantly higher on perceived credibility compared to the low authority condition at a medium effect size. This finding converges with previous research findings. Lin et al. (2016) found that authority robustly increased credibility in both health and risk research. Zhang (2014) also reported authority, in the form of profession and expertise, to be among the top three factors that influence source credibility. Moreover, other studies have shown that tweets by official authorities, medical experts, and official accounts are perceived as more credible than non-official accounts (Hilligoss & Rieh, 2008; Westerman, Spence, & Van Der Heide, 2014).

Further analysis was conducted to check whether daily Twitter usage would be a moderating variable. However, that was not found to be the case. To the author's knowledge,

there has been no previous research that focused on daily social media use as a moderator for the relationship between authority and perceived credibility. Stavrositu and Sundar (2008) did pose the hypothesis that internet use for information will be positively related to Internet credibility, for which support was found. Stavrositu and Sundar (2008) explained that persons who frequently use the Internet are aware of the amount of misinformation available and tend to engage in content verification. They suggest that experienced information seekers learned how to find credible information effectively. This might explain why no moderating effect was found. Daily Twitter use does not suggest that someone perceives Twitter as credible. Johnson and Kaye (2015) posed a similar question to Stavrositu and Sundar (2008) and investigated why people would use social media despite not trusting the information on it. For traditional media, it has been confirmed that low perceived credibility leads to decreased motivation to use. The same seems to not hold for social media. In the context of political information, Johnson and Kaye (2015) found that satisfaction of social utility needs outweighed credibility (Johnson & Kaye, 2015). This would be in line with this study's finding that daily Twitter use does not moderate the relationship between authority and perceived credibility. Even though a student uses Twitter daily, it does not guarantee that she or he also finds the platform or its users credible.

Second, it was hypothesized that misinformation about travel vaccines on Facebook would be less credible than in an online newspaper. No significant difference was found between the conditions in perceived credibility, although further analysis did show a difference in general trust that people assign to each medium. The online newspaper was trusted more. The findings stand in contrast to Zhang (2014), who found that social media platforms are perceived as less credible because it is possible for anyone to share information there without previously being reviewed. Information on social media is seen as a collaborative effort and therefore perceived as not credible in contrast to other media (Zhang, 2014).

Also, Zhang (2014) suggests that the credibility of online health information not only depends on the author of the information but also on the authority of the website itself. One reason for the present non-significant finding might be that neither Facebook nor the online newspaper has authority concerning health information, as Facebook is primarily used by university students to facilitate social relationships (Pempek, Yermolayeva, & Calvert, 2009), and non-specialized online newspapers generally cover political information. The non-significant finding could also be explained by the length of the post. Longer texts on Facebook have been

shown to have a positive effect on the perceived usefulness of the information (Koroleva & Kane, 2017). The length of the three-paragraph text in the second experiment could have had a positive effect on perceived credibility for Facebook but not for the online newspaper. As a consequence, no difference in means of perceived credibility could be found.

Thirdly, it was hypothesized that an online newspaper excerpt with advertisement would be less credible than one without advertisement. The results did show a significant difference between conditions at a small to medium effect size. Advertisements had a negative impact on perceived credibility. Other studies have also shown advertisements to have a detrimental effect on perceived credibility (Sun et al., 2019). Sun et al. reviewed thirty-seven different articles and found that the third most frequently reported indicator for perceived content quality was advertisements, with website owners/sponsors and consensus among multiple sources in second place. According to their review, sites were seen as less objective with advertisements, and this remained true for advertisements in various forms like banners or pop-ups. Additional analysis of this study also revealed that the same newspaper with advertisements was seen as significantly less professional, which is in line with other research indicating that advertisements contribute to less credibility and professionalism. Diviani et al. (2016) reported that users expect professional sources to not depend on the monetary support of advertisements. Thus, it can be said that the presence of advertisements decreases perceived credibility, as readers perceive said source to be less objective and less professional, as it depends on outside monetary support.

Overall findings of the present study suggest that university students do not perceive misinformation about travel vaccines on Twitter, Facebook, or online newspapers as credible. A high educational background has been suggested to lead to more careful credibility assessment (Shariff, Zhang, & Sanderson, 2017). University students have also been shown to feel confident in finding credible information online and are aware of basic criteria to evaluate a source's credibility, like author credentials or scholarly scope (Biddix, Chung, & Park, 2011). In the present study, the sample consisted entirely of university students. This potentially is the reason why perceived credibility scores were low in almost all conditions. Students in higher education are aware that Facebook, Twitter, and online newspapers are less credible compared to academic resources.

A different explanation for the overall low perceived credibility scores relates to the context specificity of health information. Neither Twitter, Facebook, nor online newspapers are

specialized in vaccines. Although an effect of authority was found, the misinformation provided via the Tweet was still not seen as credible. Although the tweet itself was posted by a medical expert, Twitter itself is not a channel specialized on health information.

Further, participants could have had positive attitudes toward vaccines and were therefore not convinced of the negative messages about travel vaccines. However, the questionnaire did not measure such attitudes. In future research, this should be taken into account, as Kessler and Zillich (2018) stated that initial attitudes toward a topic have an even more substantial impact on perceived credibility than source characteristics like the ones discussed. Only the third experiment contained both positive and negative statements about travel vaccines, and only one of the conditions received a neutral rather than a low perceived credibility score.

Strengths and Limitations

One of this study's strengths is the relevance of travel vaccines for university students. With the growing number of exchanges, also to more exotic destinations like Brazil, getting vaccinated against Hepatitis A and B, or yellow fever is a topic of concern. The relevance of a topic has been shown by O'Keefe (as cited in Zhang, 2014) also to affect attention when people simply browse through the internet. Students potentially showed interest in the topic, and more carefully participated in the study due to the relevance of the topic. Additionally, the sample size of 225 participants allows for relatively small margins of error and better generalizability in the context of health information.

Secondly, data was collected in collaboration with another researcher also studying perceived credibility online. Her manipulations contained information about climate change, which means that participants alternatingly received manipulations with travel vaccine or climate change information. Participants had to read the texts actively and likely did not develop a tendency to answer all questions the same way just because the topic remained the same (i.e., negative messages about travel vaccines).

When interpreting the results, it is essential to keep a few limitations in mind. First of all, the manipulations were mock representations. These allowed controlling for confounding variables. For example, it was possible to control for social endorsement in the Facebook condition, which can affect credibility (Borah & Xiao, 2018), by blurring out the number of likes and comments. Still, actual screenshots would have provided more external validity, as these

represent more accurately what information people encounter in online media. Further studies should test the hypotheses again with actual Tweets, Facebook posts, and online newspaper excerpts to check whether results remain the same.

Results have limited generalizability as participants were predominantly female and German. Moreover, the findings at hand are not generalizable beyond the context of health information. Perceived credibility is a very context specific construct. In this study, information on Twitter was not perceived as credible. Conversely, crisis information on Twitter and other time-sensitive social media are seen as legitimate, as it enables quick information updates (Westerman et al., 2014) which traditional media fail to cope with. In that context, Twitter is able to provide good functionality for useful information. Despite this, multiple studies have shown authority and advertisements to be determinants of perceived credibility in various contexts like crisis communication and health information.

Concerning the manipulations, some limitations need to be considered. In experiment 1, the mock Twitter users differed in their verification status, the number of followers, and likes. In the literature, verification status and the number of followers has been a topic of research. The difference in verification status should not have an effect, as Edgerly and Vraga (2019) identified that the status is paid little attention during credibility assessment. In contrast, a higher number of followers has previously been identified as a determinant for perceived credibility. Lee and Sundar (2013) showed that an expert source with many followers was perceived as more credible than when only one determinant was available (i.e., either the expert source or a high number of followers). Conversely, a professional with fewer followers, was not seen as credible. Manipulation could have potentially been less successful, had the account had a lesser number of followers. Apparently, not only the name indicates authority, but also the number of followers.

Lee and Sundar (2013) suggest that users mainly rely on heuristics when determining the credibility of a source. This is in line with this study's finding that neither high nor low authority conditions actively read through the profile description of the medical expert. This would also explain why over 50% of participants answered "maybe" when asked whether the Tweet was by an expert. The name indicated that it was a doctor, however only the profile description gave more information about the source's status as a vaccine expert.

Additionally, some confounding variables were present in the second experiment. To make the mock Facebook post appear like a real representation, an author was added, but not to

the online newspaper in the other condition. The author of a post on Facebook can influence perceived credibility. In the context of health information, young adults perceive health organizations and government agencies as more credible than peers (Syn & Kim, 2013). In the present manipulation, "Vaccine News Organization" was given as the originator of the post, which could have negatively impacted perceived credibility. The vaccine news organization is neither an official health organization nor a government agency. A vaccine news organization was potentially not perceived as impartial and as having an interest in spreading misinformation to convince the reader of the dangers of vaccines. Because impartiality is often used as an indicator of content quality and credibility by readers (Savolainen, 2011), the author "vaccine news organization" potentially negatively impacted perceived credibility.

Further, headlines were added to the article, to make the excerpt appear more naturalistic. The headline detailed that the article dealt with a vaccination debate and that the question was raised whether vaccinations are helpful before traveling. This should not have influenced the results significantly, as both conditions roughly received the same information. Still, it is important to note that the Facebook and online newspaper condition are not directly comparable. Based on this, the results of the second experiment need to be interpreted with caution, as not only the medium was manipulated, but also authority in the case of Facebook.

Future Research

Perceived credibility can be viewed as a multi-disciplinary effort uniting information technology, communication, and psychology and has been the focus of research for a number of years. However, most studies focus either on source characteristics or user-characteristics. Only a handful of studies exist up to this point that have tried to take both of these characteristics into account, and a unifying framework is needed, especially for online media. Perceived credibility is most likely best understood in terms of the interaction between user and source characteristics. For one, future research should look into the relationship between vaccine attitude and perceived credibility of online media that is not specialized in health information. Secondly, it would be interesting to contrast designated health information websites with social media to further build on an explanation for these results.

Further research should also study more extensively what diminishes perceived credibility. Many studies have focused on why misinformation might seem credible, and factors

like high authority have been found as indicators. Apart from advertisements, not many robust indicators of negative perceived credibility have been found. This information would be valuable when formulating misinformation denials, for example. Building on diminishing factors, information literacy for health information can be improved, as well as strategies to counter misinformation.

Additionally, Sundar (2008) suggested that in some cases, younger persons might assign more credibility to their peers. Research on this has been mixed (Lin & Spence, 2018), and this research also found that students between 18 and 29 years perceived a medical authority to be more credible. However, perceived credibility has to be understood in its particular context. This study dealt with health information, which is most credible when delivered by someone with medical expertise. However, in a different context, the perceived credibility of a peer could be evaluated higher compared to traditional authorities.

Conclusion

This study aimed to answer the research question of what source characteristics influence perceived credibility for young adults in the context of travel vaccines. The present findings showed that authority influences it positively, and advertisements negatively. These findings extend the current body of research in the field of perceived credibility, by showing that the positive determinant authority, and negative determinant advertisements, also apply for health information which is posted on non-health specialized media.

Overall, the information about travel vaccines was not perceived as credible by university students. Although authority was shown to be a positive determinant of perceived credibility, the effect was not large enough to make the information on Twitter appear fully credible. A positive conclusion can be taken from this. As detailed previously, there is a rising concern that young adults spend much time online and on social media and are therefore confronted with large amounts of misinformation about vaccines. Worry is expressed that vaccine hesitancy and reduced vaccine uptake will ultimately be the result of belief in misinformation. However, the present study found that university students did not find negative misinformation about travel vaccines credible, even when presented by an authoritative source, in this case, a medical doctor. Even daily users of Twitter were not more strongly affected by authority, which gives hope that even though young adults frequently use social media, it does not follow that they automatically

trust the misinformation on it. However, the study was limited to source characteristics. To gain a complete picture of how young adults perceive the credibility of health information online, user characteristics also need to be taken into account, like educational level and attitudes toward the health topic at hand.

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Appendix A

Table of Questionnaire Items with Reliability Scores

Measure	Scale	Reliability
Experiment 1		
High Authority Condition – Perceived Credibility Measure		
The Twitter post is believable	7-Point Likert Scale (Strongly Disagree to Strongly Agree)	α = .84
The Tweet is fair (free from bias)		
The content of the Tweet is accurate (correct)		
Manipulation Check Questions		
I think the Tweet is by an expert	3-Point Likert Scale (Yes to No)	
The author of the Tweet is specialized on vaccines		
I read through the profile description of the author		
Low Authority Condition – Perceived Credibility Measure		
I think the post is believable	7-Point Likert Scale (Strongly Disagree to Strongly Agree)	α = .84

I think the post is accurate (correct)

I think the post is fair (free from bias)

Experiment 2

Low Credibility Condition – Perceived Credibility Measure		
I think the post is believable	7-Point Likert Scale (Strongly Disagree to Strongly Agree)	α = .89
I think the post is accurate (correct)		
I think the post is fair (free from bias)		
Manipulation Check Questions		
The text was written on Facebook	5-Point Likert Scale (Definitely yes to Definitely no)	
I paid attention to the author of the text		
Information on Facebook is trustworthy		
I have read through the text carefully		
High Credibility Condition - Perceived Credibility Measure		
I think the article is believable	7-Point Likert Scale (Strongly Disagree to Strongly Agree)	α = .89

I think the article is accurate (correct)		
I think the article is fair (free from bias)		
Manipulation Check Questions		
The text was written in a newspaper	5-Point Likert Scale (Definitely yes to Definitely no)	
Information in newspapers is trustworthy in general		
I have read through the text carefully		

Experiment 3

High Credibility Condition - Perceived Credibility Measure		
I think the article is believable	7-Point Likert Scale (Strongly Disagree to Strongly Agree)	α = .87
I think the article is accurate (correct)		
I think the article is fair (free from bias)		
Manipulation Check Questions		
I read the text until the end	3-Point Likert Scale (Yes to No)	
The newspaper has a professional look		
There was advertisement		

The advertisements were intrusive	5-Point Likert Scale (Definitely yes to Definitely no)
The advertisements distracted me from the text	
Low Credibility Condition – Perceived Credibility Measure	
I think the article is believable	7-Point Likert Scale
I think the article is accurate (correct)	
I think the article is fair (free from bias)	
Manipulation Check Questions	
I read the text until the end	3-Point Likert Scale (Yes to No)
The newspaper has a professional look	
There was advertisement	
The advertisements were intrusive	5-Point Likert Scale (Definitely yes to Definitely no)
The advertisements distracted me from the text	

Demographics

Indicate which of these platforms you use daily.

Twitter	Multiple Options possible
Facebook	
Online Newspapers	
YouTube	
Instagram	
Reddit	
Other	
None	

Indicate which of these platforms you use.

	Multiple Options possible
Twitter	
Facebook	
Online Newspapers	
YouTube	
Instagram	
Reddit	
Other	
None	

Appendix B

A List of All Images That Were Used in the Study

Figure 2. High authority condition

Figure 3. Low authority condition

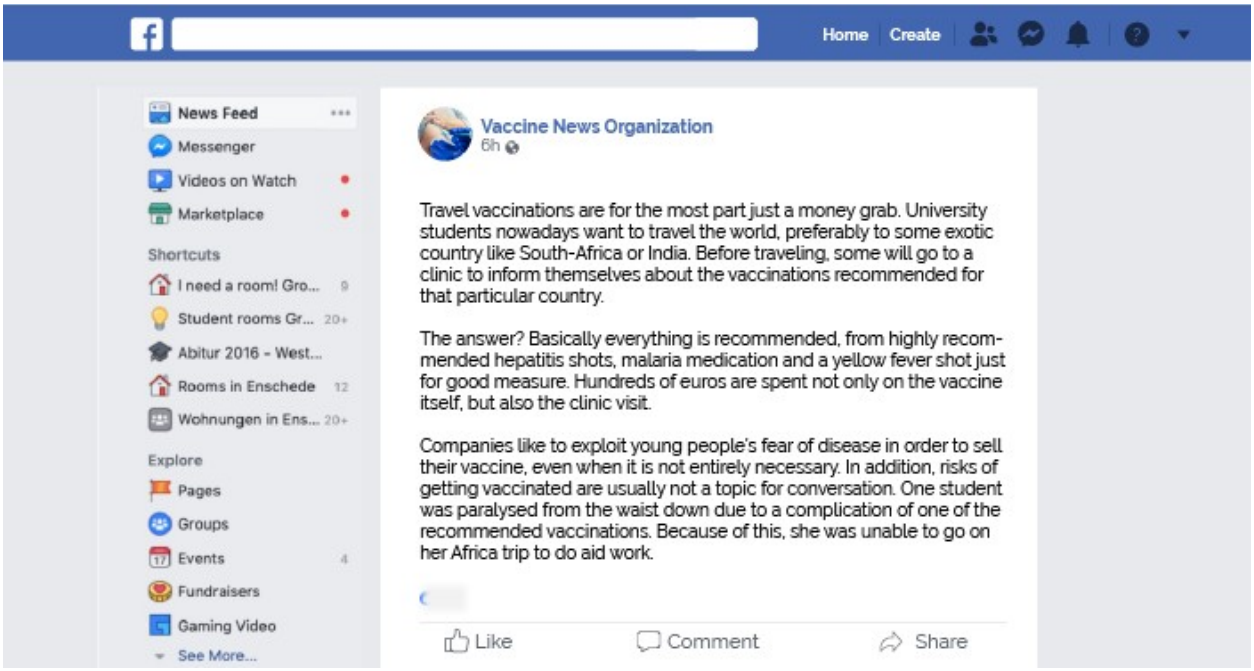

Figure 4. Facebook condition

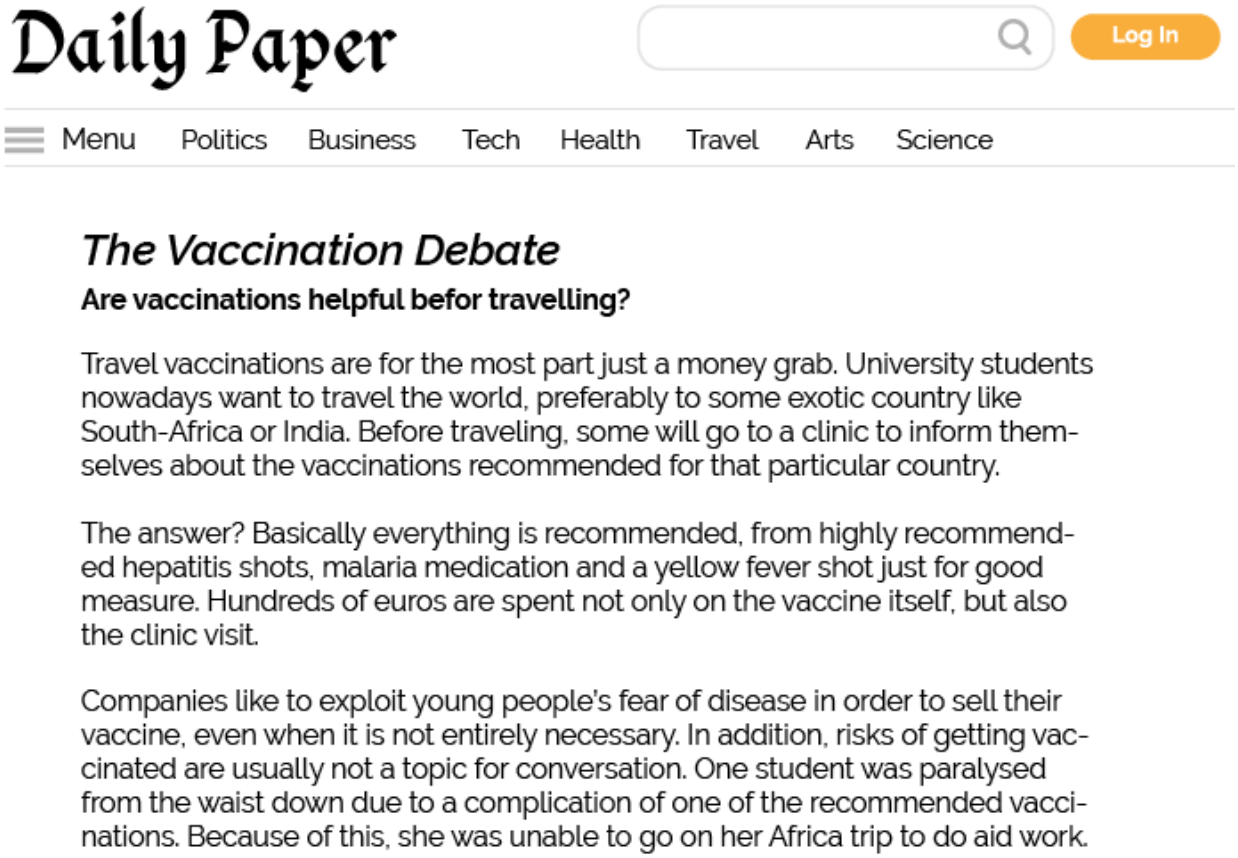

Figure 5. Online newspaper condition

Figure 6. No advertisements condition

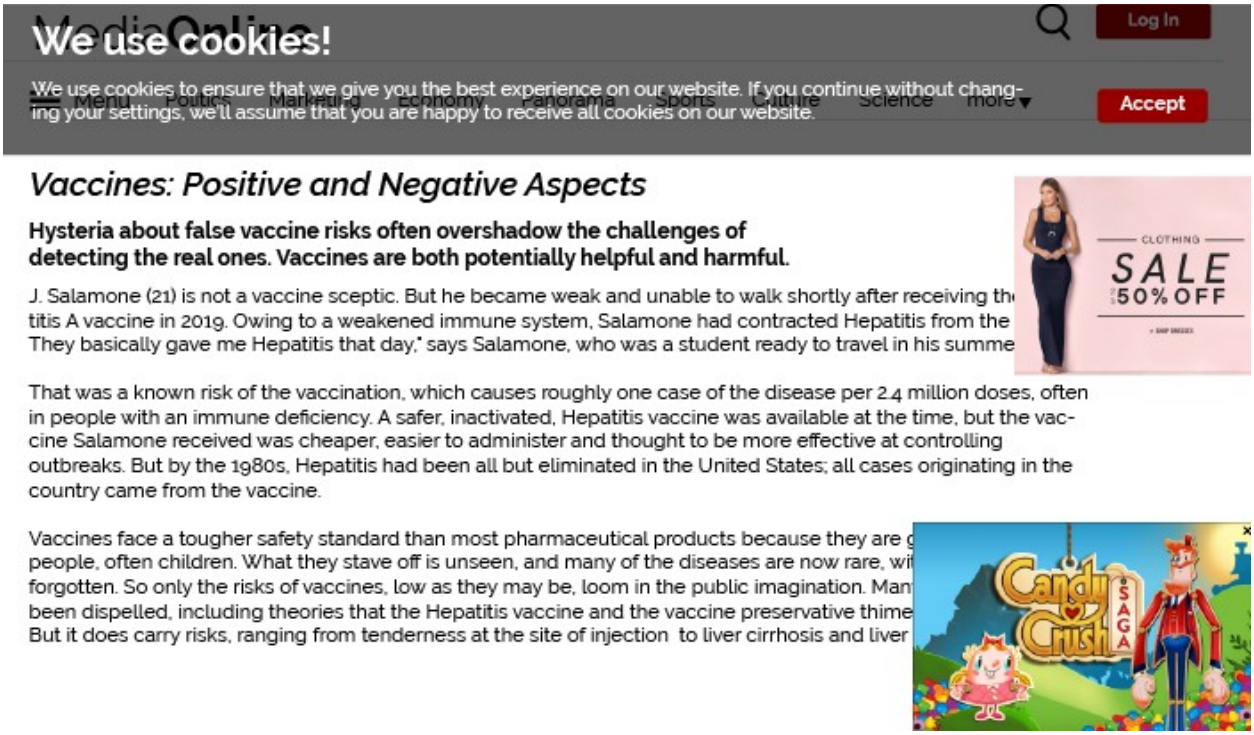

Figure 7. Advertisements condition