



The Influence of Framing Effects on Public Opinion of Antibiotic use in Livestock

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Abstract

After years of debates and opposition from pharmaceutical companies, the Final rule of the Veterinary Feed Directive (VFD) went into effect in January 2017 requiring antibiotics used for both humans and animals for the purpose of growth promotion to be discontinued. This study sought to determine the effects framing content regarding antibiotic use in livestock and antibiotic resistance had on public opinion. Using a between-subjects experimental survey research design, 297 respondents indicated their perceptions of antibiotic use in livestock and the development of antibiotic resistant bacteria before being randomly assigned to one of three conditions. Each condition was a mock Twitter account framed differently based on findings from previous studies. After reading their assigned mock Twitter page, respondents indicated their trust of the information contained in the account, their information seeking behavior, demographics, and their support for antibiotic use in livestock. Using an ANCOVA, results indicated the frame influenced trust of information ($F = 8.7, p < .05$) and information seeking behavior ($F = 4.48, p = .01$) while support was not significant ($F = 2.7, p = .07$). Results suggest the blame frame has the greatest influence on shaping public opinion of antibiotic use in livestock and the development of antibiotic resistance.

Keywords

Framing, Public Opinion, Livestock, Antibiotic Resistance

Cover Page Footnote/Acknowledgements

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Introduction

Scientific discoveries and consumer preferences continually bring about changes in the food production system (Koba, 2015). For example, in 2005, due to consumer demands, Panera Breads began using antibiotic-free chicken, and in 2014, said it would cut back on giving its pork supply antibiotics (Koba, 2015). Similarly, in 2014, Perdue Foods said it would no longer use human antibiotics in its chicken hatcheries (Koba, 2015). In 2015, McDonalds said it would phase out the routine use of antibiotics in chicken while Tyson Foods, the largest chicken producer in the United States, promised to stop feeding chickens antibiotics used in humans (Koba, 2015). These changes were primarily brought about from mounting pressure from consumers to provide a food product that uses fewer antibiotics in an effort to preserve antibiotics important for public health (Koba, 2015).

Using antibiotics important in human medicine for livestock production is continually being challenged by scientific evidence that points toward this use as a key contributor to the proliferation of antibiotic resistant bacteria (McKenna, 2017). Scientists and the public are now more loudly calling for changes in regulations regarding how these antibiotics are used in the production of livestock (McKenna, 2017). After years of debates and opposition from pharmaceutical companies, the Veterinary Feed Directive (VFD) went into effect in June 2015 that requires antibiotics used for both humans and animals for the purpose of growth promotion be discontinued (Food and Drug Administration, 2015). This ruling had the greatest impact on the poultry and pork industries as these animals experience the greatest increases in growth from the use of growth promoting antibiotics (McKenna, 2017). An additional portion of this rule stated any antibiotics of medical importance to humans must be prescribed and overseen by a veterinarian if they are to be used in animals (FDA, 2015). This legislative change was brought about by the mounting evidence that providing antibiotics to livestock for the purpose of growth promotion was increasing the occurrence of human illnesses that were untreatable with antibiotics that were traditionally effective (McKenna, 2017).

While legislation ultimately has the greatest impact on the food system, legacy and social media coverage plays a significant role in influencing what the public knows and understands about food risks (McCluskey & Swinnen, 2011). An early example of print communication influencing public opinion and ultimately legislation can be found in Upton Sinclair's 1906 novel *The Jungle*. In his book, Sinclair discussed the horrific conditions workers in Chicago's meat packing industry faced (Sinclair, 1985). In doing so, he also highlighted the vast amounts of contamination that could be found in meat at the time including rodent carcasses and droppings, metal shavings, and even human remains from on-the-job injuries (Sinclair, 1985). While Sinclair hoped the book would bring about change for the workers in the meat industry, public outcry regarding meat contamination ultimately brought about the passing of the Pure Food and Drug Act (History, Art, & Archives, n.d.)

Another example of the media influencing public opinion can be found in Jamie Oliver's depiction of lean finely textured beef (LFTB) as "pink slime" on network television (Green, 2012). This devastated Beef Products Incorporated (BPI) and the beef industry at the time (Green, 2012). Retailers and school lunch programs across the country halted the purchase of

products with LFTB which resulted in BPI closing plants and suspending plant production (Green, 2012). This demonstrates how easily the public can be swayed by fear and absence of information in the media (McCluskey & Swinnen, 2011).

McCluskey and Swinnen (2004) found the public to be “rationally ignorant” as they do not work to fully inform themselves about issues related to food. Further, popular press and television are the primary sources from which the public receives information regarding food and biotechnology; therefore, these forms of media play a significant role in shaping public opinion of these topics (McCluskey & Swinnen, 2011; Pew, 2016). Because public opinion ultimately plays a role in shaping legislation on a national level as well as company-level changes, an ill-informed public, motivated by fear, could wreak havoc on an industry with a complex problem such as this (McCluskey & Swinnen, 2011). By understanding how the framing and sentiment of messages communicated to the public influence public opinion about antibiotic use in livestock, agricultural and health communicators can be better prepared to develop campaigns and communications materials to alleviate the “rational ignorance” of the public regarding this topic while also determining how to use these frames to communicate shared values with the public with the goal of bringing out change.

Public concern regarding antibiotic use and resistance in livestock has been previously studied by the United States Farmers and Ranchers Alliance (USFRA). That study evaluated the familiarity, concerns, and perceptions of the use of antibiotics in livestock. However, that study was limited to consumer food connectors, a group USFRA defined as individuals between the ages of 21 – 65 who take an interest in news and politics, make all household decisions and purchases related to food, and engage in advocacy activities related to food and the food industry on a regular basis (USFRA, 2016).

Findings from that survey indicated 41% of this group felt familiar with what antibiotics were used for and 47% felt concerned about antibiotic resistance. Forty-three percent of their respondents felt somewhat negative about how antibiotics were being used in livestock production. When questioned about why they think antibiotics are used in livestock production, 53% believed they were used as prevention to keep animals healthy and free from disease while 47% believed they were used to promote greater and faster growth. Fifty percent indicated antibiotic use in agriculture contributed to antibiotic resistance in human health. Finally, when questioned about what the number one concern was regarding the development of antibiotic resistance, 62% of respondents indicated human medical doctors overprescribing antibiotics to patients was the major culprit of the development of antibiotic resistance (USFRA, 2016). Although these findings provide some insight as to public opinion of antibiotic use in livestock and the development of antibiotic resistant bacteria, the limited scope of the audience surveyed suggests a need to understand the opinions of a broader audience.

The literature is limited regarding public opinion of antibiotic use in livestock; however, a considerable amount of research has explored public opinion about agricultural biotechnologies such as genetic modification (GM). Consumer acceptance of GM foods was reported at more than 70% among Americans in 1992, 1995, and 1998 (Hoban, 1998). However, a 2016 Pew Research study found 39% of Americans believed GM foods are worse for your health than non-GM foods (Funk & Kennedy, 2016). The American eating habits have experienced a significant

shift over the past two decades (Funk & Kennedy, 2016). This shift has been brought on by personalized ideologies that dictate how people process information about and consume food (Funk & Kennedy, 2016).

Frames the media uses to discuss the topic of GM foods has indicated the public can be easily swayed with positively and negatively framed information regarding GM food (Heiman & Zilberman, 2011). Through an experimental survey, Heiman and Zilberman (2011) randomly assigned respondents to messages regarding GM bell peppers, framing the topic as either positive, negative, or a control neutral group. Respondents then responded on a Likert-type scale their level of agreement with statements regarding genetic modification. The authors additionally found that although consumers were not very fearful regarding the perceived health hazards associated with GM foods, framing the topics differently did increase fear and uncertainty in the safety of GM foods (Heiman & Zilberman, 2011).

Fear associated with agricultural biotechnologies may stem from the media's harsher evaluations of agricultural biotechnologies than those of medical biotechnologies (Marks, Kalaitzandonakes, Wilkins, & Zakharova, 2007). Although advances in agricultural biotechnologies serve the purpose of increasing the ability to feed and clothe a growing world, they are often additionally seen as a means to make more money for farmers, ranchers, and biotechnology companies (Marks et al., 2007). Marks et al. (2007) identified this by completing a content analysis of three international newspapers where they evaluated how two biotechnology topics were framed – genetic modification and xenotransplantation. The results indicated newspapers were much more likely to use frame elements that highlighted the potential risks associated with genetic modification than the potential risks associated with xenotransplantation (Marks et al., 2007). These results highlight the impact media has on shaping how an agricultural topic, such as genetic modification and antibiotic use, is discussed and portrayed to the public.

Framing in social media and the impact framing has on public opinion has been emerging as an important line of communication research in recent years. Previous literature has evaluated the role framing plays in shaping public opinion surrounding the gun control debate (Wasike, 2017). Wasike (2017) used a 2 x 2 x 4 experimental design to examine how pro and anti-gun control arguments were posited following the Sandy Hook shooting. Results indicated pro-gun control frames tended to be more persuasive and were found to be more credible than anti-gun control frames (Wasike, 2017).

Although a great deal of research has demonstrated the negative impact growth promoting antibiotics have had on the development of antibiotic resistance (Casewell, Friis, Marco, McMullin, & Phillips, 2003; Engster, Marvil, & Stewart-Brown, 2002; Hammerum et al., 2007), traditional media tend to more commonly discuss antibiotic use in livestock in terms of broad use rather than specifying the important role some antibiotics play in maintaining and promoting animal health (Authors, 2019). Further, a qualitative content analysis of frames used in discussing antimicrobial resistance in newspapers in the U.S. found antibiotic use in livestock is a “public health failure” (Warner, Oesterreicher, & Rumble, 2018). Thus, the public could be led to believe that all uses of antibiotics in livestock negatively impact human health. Studying what, if any, influence traditional and online media have on shaping public opinion of antibiotic

use in livestock and antibiotic resistance is important as it can allow communication practitioners to better develop communications materials to address public concern and misinformation regarding the science of antibiotics (Edgar, Johnson, & Estes, 2017).

Theoretical Framework

Framing effects served as the theoretical lens for this study. Tversky and Kahneman (1981) theorized that information framed to the public is encoded as either positive or negative, thus when information is provided to an audience, the audience walks away with either a positive or negative viewpoint regarding the subject. When small, inconsequential changes in how information is communicated to the audience are made, the choices made by the audience can easily be changed (Tversky & Kahneman, 1981). Levin and Gaeth (1988) demonstrated this in a study of ground beef packaging. One package was labeled “75% lean” (positive frame) and one package was labeled “25% fat” (negative frame). Both packages contained the same product, however when consumers made their purchase and tried both products, consumers felt the “75% lean” beef was better tasting and less greasy (Levin & Gaeth, 1988).

Framing effects have additionally been studied within a media context. Previous media effects research found that as agricultural biotechnology was discussed more negatively in the media in the U.K. and America, public support for agricultural biotechnology decreased (Marks et al., 2007). De Vreese, Boomgaarden, and Semetko (2011) completed a framing content analysis of news media regarding the addition of Turkey into the European Union. Using the findings from this study, the frames were tested in two experimental public opinion studies. Findings from this study indicated the frames used directly influenced public opinion of two groups on regarding the addition of Turkey into the European Union (De Vreese, 2011).

Entman (1993) described how the way a story is framed brings particular importance to pieces of information within the story through the inclusion or exclusion of particular elements of the frame, how and where they are placed within the story, and how often they occur. The frame elements that occur most commonly together make up the frame (Matthes & Kohring, 2008). These frame elements can thus communicate the issue to the public positively or negatively depending on what frame elements are present, how they occur and co-occur, and which are omitted (Matthes & Kohring, 2008).

Purpose and Research Questions

The purpose of this study was to determine the effects framing of content regarding antibiotic use in livestock and antibiotic resistance has on public opinion. Thus, the following research questions (RQ) are proposed:

RQ1: Does framing of Twitter content influence trust of information regarding antibiotic use in livestock and antibiotic resistance?

RQ2: Does framing of Twitter content influence information seeking behavior regarding antibiotic use in livestock and antibiotic resistance?

RQ3: Does framing of Twitter content influence support of antibiotic use in livestock?

Methods

In order to answer the research questions, data were collected using a between-subjects experimental survey research design during one session (March 9, 2018). A between-subjects experimental survey is appropriate as it allows a researcher to look at differences between groups and lends itself to interpreting causal inferences (Field, 2015).

Respondents

Respondents for the study were recruited through Amazon's Mechanical Turk (MTurk) worker platform. MTurk is an online platform that allows for the recruitment and paying of subjects to perform tasks such as survey participation and market research (Berinsky, Huber, & Lenz, 2012). Though not without their criticisms, MTurk workers have been shown to better represent general demographic distributions in the United States than some other types of Internet and convenience samples (Buhrmester, Kwang, & Gosling, 2011; Berinsky, Huber, & Lenz, 2012).

Survey participation was open to MTurk workers residing in the U.S. Respondents were compensated for their participation monetarily at a rate of \$2.50 per response. Responses were limited to one response per MTurk worker. A total of 314 responses were recorded; however, after the data were cleaned, 297 usable responses were included for subsequent analysis. Responses were removed from the sample that were incomplete or if the respondent did not respond appropriately to the filter question.

Procedure

Each respondent first saw a brief description of the research and opted to participate by clicking on a link to then enter the study. Next, respondents saw a definition of terms page where the terms "livestock," "antibiotic," and "antibiotic resistance" were defined. Respondents then responded to eight Likert-type statements regarding their perceptions of antibiotic use in livestock and antibiotic resistance. Next, respondents were exposed to a randomly assigned stimulus, which served as the experimental treatment for the study. The researchers developed three mock Twitter accounts in Adobe Photoshop based on opinion leaders and frames identified from previous sentiment and content analysis studies of Twitter content and U.S. newspaper content regarding antibiotic use in livestock and antibiotic resistance (Authors, 2018; Authors, 2019). Twitter accounts were standardized across all three treatments with 10 tweets populating the mock accounts. Each account used the same header photo, profile photo, biography, and Twitter handle. The specific tweets written for each account were developed by the researchers to emphasize the frame elements identified in a previous framing study of national U.S. newspapers (Authors, 2019). Example tweets from each frame can be found in Table 1.

Table 1
Example Tweets Used in the Mock Twitter Profiles

Frame	Tweet
Human Impact Frame	#AntibioticResistance can be developed due to overprescribing of antibiotics from medical professionals as well as poor antibiotic usage by patients. [Link]
Blame Frame	#FactoryFarms use 80% of the antibiotics in the U.S. each year.
Change Frame	Fattening animals with #Antibiotics is a threat to human health. We are here to make a change!

After reading their randomly assigned Twitter page, respondents responded to four Likert-type items regarding their trust of the messages within the Twitter account and four Likert-type items regarding information seeking behaviors after exposure. Finally, respondents responded to demographic questions: age, income, gender identity, racial and/or ethnic background, education level, and political views. Participants ended the survey by responding to the statement “I support the use of antibiotics in livestock production” on a 5-point Likert-type scale.

Measures

Perceptions of antibiotic use in livestock and antibiotic resistance. Six Likert-type items were used to determine perceptions of antibiotic use in livestock and antibiotic resistance. These items were modified from a previous measure used to determine perceptions of genetically modified organisms (Hallman, Hebden, Aquino, Cuite, & Lang, 2003). Respondents were asked to identify their level of agreement with a series of statements about antibiotic use in livestock and antibiotic resistance on a five-point Likert-type scale (1 = *Strongly Disagree* to 5 = *Strongly Agree*). A sample statement from the measure was “I think it is safe for me to eat food from animals who were administered antibiotics.” Responses to these questions were then collapsed into a mean score as a measure of perceptions of antibiotic use in livestock and antibiotic resistance ($M = 2.91$, $SD = .85$). Reliability was established *a priori* at Cronbach’s $\alpha = .84$.

Message Trust. Four Likert-type items were used to determine respondents’ trust in the messages they viewed on the Twitter account. These items were modified from a previous measure used to determine trust of Twitter messages regarding assault weapon ban legislation (Wasike, 2016). Respondents were asked to identify their level of agreement with a series of statements about their trust of the messages contained in the Twitter account on a five-point Likert-type scale (1 = *Strongly Disagree* to 5 = *Strongly Agree*). A sample statement from the measure was “the information provided is accurate.” The responses to these questions were then collapsed into a mean score as a measure of message trust ($M = 3.57$, $SD = .77$). Reliability was established *a priori* at Cronbach’s $\alpha = .839$.

Information Seeking Behavior. Four Likert-type items were used to determine respondents' desire to seek out more information regarding antibiotic use in livestock and antibiotic resistance. With these researcher-developed items, respondents were asked to identify their level of agreement with a series of statements about their desire to seek out more information regarding antibiotic use in livestock and antibiotic resistance on a five-point Likert-type scale (1 = *Strongly Disagree* to 5 = *Strongly Agree*). A sample statement from the measure was "this Twitter account makes me want to seek out more information about antibiotic resistance." The responses to these questions were then collapsed into a mean score as a measure of information seeking behavior ($M = 3.32$, $SD = .55$). Reliability was established *a priori* at Cronbach's $\alpha = .772$.

Support of Antibiotic Use in Livestock. One Likert-type item was used to determine respondents' support for the use of antibiotics in livestock. This researcher-developed item asked respondents to indicate their level of agreement with the statement "I support the use of antibiotics in livestock production" on a five-point Likert-type scale (1 = *Strongly Disagree* to 5 = *Strongly Agree*). The response to this question was then used as a measure of support of antibiotic use in livestock ($M = 2.9$, $SD = 1.23$).

Manipulation Check

Prior to performing the pilot test, a manipulation check was conducted to ensure the mock Twitter profiles reflected the frame they were designed to present. All three mock Twitter profiles were randomly presented in a Qualtrics survey to 31 respondents not included in the sample population. Each respondent viewed each mock Twitter profile and answered the same question following each mock Twitter profile: "Based on the tweets you just read, which of the following statements best describes the stance of the organization?" Respondents then chose one response from the following choices: "Animal agriculture is the main contributor to the development of antibiotic resistant bacteria," "Policy changes are needed to combat livestock's contribution to the development of antibiotic resistant bacteria," or "The misuse of antibiotics that are important to human medicine significantly contribute to the development of antibiotic resistant bacteria."

Each answer was designed to correspond with one of the mock Twitter profiles. Eighty percent of respondents correctly identified the blame frame Twitter profile as "Animal agriculture is the main contributor to the development of antibiotic resistant bacteria," 69% of respondents correctly identified the change frame Twitter profile as, "Policy changes are needed to combat livestock's contribution to the development of antibiotic resistant bacteria," and 80% of respondents correctly identified the human impact frame as "The misuse of antibiotics that are important to human medicine significantly contribute to the development of antibiotic resistant bacteria." The researchers were confident with these levels of agreement and proceeded with the pilot test phase.

Pilot Test

A pilot test was conducted on undergraduate students ($N = 107$) to establish reliability of the instrument used. Respondents were recruited through an online recruitment portal provided by the [College Communication Program] at [University]. Cronbach's alpha was used to determine reliability of the measures. The perceptions of antibiotic use in livestock and antibiotic resistance measure had a Cronbach's $\alpha = .729$; however, after the removal of two items, a Cronbach's $\alpha =$

.84 was established. Message trust and information seeking behavior were found to have a Cronbach's $\alpha = .839$ and Cronbach's $\alpha = .772$, respectively. Removal of items from these measures did not increase reliability so these measures remained intact.

Data Analysis

Upon completion of data collection, the data were cleaned and any unusable responses were eliminated. Descriptive statistics were used to describe the population. To answer the research questions, individual ANCOVAs were conducted to test the effects of condition (frame of the Twitter account) on trust of information, information seeking behavior, and support of antibiotic use in livestock and antibiotic resistance.

At the end of the survey, demographic data were collected to describe the respondents and data were used as covariates when appropriate. The majority of respondents identified as a man and accounted for 187 (63%) of the respondents while 110 (37%) identified as a woman. One hundred ninety (64%) respondents were white, 63 (21.2%) were Asian, and 30 (10.1%) were black or African American. The average age of respondents was 33.9 ($SD = 9.9$) with a minimum age of 20 and a maximum age of 69.

The respondents' mean annual household income was between \$30,000 and \$49,999 ($M = 4.65$, $SD = 2.74$). The most indicated income categories were \$20,000 to \$29,999 ($n = 65$, 21.9%), \$30,000 to \$39,999 ($n = 43$, 14.5%), and \$10,000 to \$19,999 ($n = 39$, 13.1%).

Respondents were additionally asked to indicate their level of education. The majority of respondents ($n = 146$, 49.2%) indicated they had a 4-year degree. Fifty-three (17.8%) indicated they had attended some college classes, and 38 (12.8%) indicated a high school diploma was the highest level of education attained. Finally, respondents indicated their political ideology. The largest percentage of respondents ($n = 82$, 27.6%) indicated they were liberal. Fifty-nine (19.9%) indicated they were middle of the road, and $n = 39$ (13.1%) indicated they were strongly liberal.

Results

RQ1: Does framing of Twitter content influence trust of information regarding antibiotic use in livestock and antibiotic resistance?

A one-way ANCOVA was conducted to determine if a statistically significant difference existed between exposure to human impact, change, or blame framed Twitter profiles on trust of information regarding antibiotic use in livestock and antibiotic resistance. The covariates in this analysis were perceptions of antibiotic use in livestock and antibiotic resistance, gender identity, education, income, and political ideology. The covariates were chosen to allow for the exploration of their effects on trust of information regarding antibiotic use in livestock and antibiotic resistance. Following Field's (2015) independence of treatment variable and covariate, homogeneity of regression slopes was evaluated to ensure no assumptions were violated with the covariates.

Means for trust of information were $M = 3.64$ ($SD = .70$) for respondents who saw the human impact framed mock Twitter account, $M = 3.38$ ($SD = .68$) for the change frame, and $M = 3.67$ ($SD = .88$) for the blame frame. The inferential statistics reported for this ANCOVA are

shown in Table 2. There was a significant difference ($F = 8.7, p < .05, \eta_p^2 = .057$) between the respondents' trust of information reported in the mock Twitter accounts between the three frame conditions.

Table 2

Analysis of Covariance of Trust of Information Regarding Antibiotic use in Livestock and Antibiotic Resistance, With Individual Difference Variables as Covariates

Source	<i>Df</i>	<i>F</i>	<i>p</i>	η_p^2
Frame Condition	2	8.7	< .05*	.057
Covariates				
Perceptions	1	21.30	< .05*	.069
Income	1	.36	.55	.001
Gender Identity	1	.01	.91	.000
Education	1	1.33	.25	.005
Political Ideology	1	.02	.89	.000

Note: *Indicates significance at $p \leq .05$

The pairwise comparison of the human impact frame condition with the change frame condition was non-significant. However, the pairwise comparison of the human impact frame condition with the blame frame condition was significant ($MD = -.511, SE = .149, p = .002$). The pairwise comparison additionally indicated a significant difference between the change frame condition and the blame frame condition ($MD = -.447, SE = .115, p < .05$).

RQ2: Does framing of Twitter content influence information seeking behavior regarding antibiotic use in livestock and antibiotic resistance?

A one-way ANCOVA was conducted to determine if a statistically significant difference existed between exposure to human impact, change, or blame framed Twitter profiles on information seeking behavior regarding antibiotic use in livestock and antibiotic resistance, controlling for perceptions of antibiotic use in livestock and antibiotic resistance, gender identity, education, income, and political ideology. The covariates were chosen to allow for the exploration of their effects on information seeking behavior regarding antibiotic use in livestock and antibiotic resistance. Following Field's (2014) independence of treatment variable and covariate, homogeneity of regression slopes was evaluated to ensure no assumptions were violated with the covariates.

Means for information seeking were $M = 3.31 (SD = .53)$ for respondents who saw the human impact framed mock Twitter account, $M = 3.22 (SD = .49)$ for the change frame, and $M = 3.40 (SD = .60)$ for the blame frame. The inferential statistics reported for this ANCOVA are shown in Table 3. There was a significant difference ($F = 4.48, p = .01$) between the respondents' information seeking behavior after viewing the mock Twitter accounts.

Table 3

Analysis of Covariance of Information Seeking Behavior Regarding Antibiotic use in Livestock and Antibiotic Resistance, With Individual Difference Variables as Covariates

Source	<i>Df</i>	<i>F</i>	<i>p</i>	η_p^2
Frame Condition	2	4.48	.01*	.030
Covariates				
Perceptions	1	3.91	.05*	.013
Income	1	.31	.58	.001
Gender Identity	1	1.49	.22	.005
Education	1	.16	.69	.001
Political Ideology	1	.15	.70	.001

Note: *Indicates significance at $p \leq .05$

The pairwise comparison of the human impact frame condition with the change frame condition was non-significant. Additionally, the pairwise comparison of the human impact frame condition with the blame frame condition was non-significant. However, the pairwise comparison of the change frame condition with the blame frame condition was significant ($MD = -.245$, $SE = .084$, $p = .01$).

RQ3: Does framing of Twitter content influence support of antibiotic use in livestock?

A one-way ANCOVA was conducted to determine if a statistically significant difference existed between exposure to human impact, change, or blame framed Twitter profiles on support of antibiotic use in livestock, controlling for perceptions of antibiotic use in livestock and antibiotic resistance, gender identity, education, income, and political ideology. The covariates were chosen to allow for the exploration of their effects on support of antibiotic use in livestock. Following Field's (2014) independence of treatment variable and covariate, homogeneity of regression slopes was evaluated to ensure no assumptions were violated with the covariates.

Means for support of antibiotic use in livestock were $M = 2.63$ ($SD = 1.16$) for respondents who saw the human impact framed mock Twitter account, $M = 2.78$ ($SD = 1.14$) for the change frame, and $M = 3.27$ ($SD = 1.29$) for the blame frame. There were no significant differences between the treatment groups. The inferential statistics reported for this ANCOVA are shown in Table 4.

Table 4

Analysis of Covariance of Support for Antibiotic use in Livestock, With Individual Difference Variables as Covariates

Source	<i>df</i>	<i>F</i>	<i>p</i>	η_p^2
Frame Condition	2	2.7	.07	.018
Covariates				
Perceptions	1	.702	.40	.002
Income	1	.003	.96	.000
Gender Identity	1	22.874	< .05*	.073
Education	1	15.091	< .05*	.050
Political Ideology	1	.387	.53	.001

Conclusions and Implications

Tversky and Kahneman (1981) hypothesized that when changes in how information is communicated to the audience are made, choices made by the audience can easily be changed as well. These choices or changes in support are caused by method in which the information was framed (Marks et al., 2007). Results from this study indicated that by changing the frame regarding the use of antibiotics in livestock and the development of antibiotic resistant bacteria are communicated to an audience, trust of the information can be affected. This finding aligns with those of Wasike (2017) who found that tweets framed as pro-gun control were found to be more credible than anti-gun control framed tweets. Additionally, this study found that desire to seek out more information after exposure to information regarding antibiotic use in livestock and the development of antibiotic resistant bacteria can be influenced by changing frames.

RQ1 indicated that although individuals who saw the human impact frame mock Twitter profile and those who saw the change frame mock Twitter profile did not differ significantly in their trust of the messages or their desire to seek out more information, those who saw the blame frame mock Twitter profile did. The blame frame mock Twitter profile discussed the use of antibiotics in livestock as a tool for combatting poor animal welfare practices such as overcrowding, dirty conditions, and poor care for animal health [Authors, 2018]. The blame frame mock Twitter profile additionally used the problematic FDA data that states 80% of all antibiotics used in the U.S. is used by animal agriculture [Authors, 2018]. Theoretical implications for this finding indicate that by framing the development of antibiotic resistant bacteria as an issue caused by the livestock industry, consumers are more likely to trust the information, thus taking the “blame” off of themselves and human medicine for the development of antibiotic resistant bacteria.

RQ2 indicated differences regarding information seeking behavior were not significant between the human impact frame condition and the change frame condition, or the human impact frame condition and the blame frame condition. However, there was a significant difference in information seeking behavior between the change frame condition and the blame frame condition. The findings from this research indicate that if the blame for developing antibiotic resistant bacteria is placed on the livestock industry, consumers are then more inclined to seek out more information about the topic. This information seeking behavior could be motivated by a desire to seek out “antibiotic free” food products or to better understand how antibiotics are used in livestock.

RQ3 found no significant differences between the frame condition groups regarding support for antibiotic use in livestock. With a larger sample size or more respondents who received the change frame mock Twitter page, a significant difference between conditions may have been viewed. This single-item Likert-type statement simply asked for the respondents’ support of antibiotic use in livestock. This item did not measure the respondents’ knowledge or level of understanding regarding the use of antibiotics in livestock. Without a working knowledge of how antibiotics are used in livestock, respondents may be ill-equipped to respond to this statement with certainty.

Findings from this study indicate that changes to the frame in which information regarding antibiotic use in livestock and the development of antibiotic resistant bacteria are made

on Twitter can influence trust perceptions and desire to seek out more information. Additionally, support for antibiotic use in livestock could be influenced by framing. The findings from this study should be of concern to agricultural communicators as the role of misinformation in this context played the greatest role in influencing public opinion of antibiotic use in livestock and the development of antibiotic resistant bacteria.

Limitations

Several assumptions were made when conducting the study. First, it was assumed Twitter is a social media platform with a significant amount of public discussion regarding antibiotic use in livestock and antibiotic resistance. It was additionally assumed that Amazon MTurk workers can adequately represent the U.S. population. Though not without its criticisms, MTurk workers have been found to better represent general U.S. demographics than convenience samples (Buhrmester, Kwang, & Gosling, 2011; Berinsky, Huber, & Lenz, 2012). Finally, the experimental survey was conducted over a year after the final rule of Veterinary Feed Directive was implemented, thus information in the news might have slowed down, thus making this an issue less visible on the public radar.

Recommendations

This study specifically tested the framing of messages within the context of a Twitter account. Wasike (2017) found arguments regarding gun control transmitted via online news articles were more persuasive than those transmitted via Twitter. Thus, future research should test these frames in online print and broadcast media. These frames should also be tested in other online media contexts such as blogs, videos on YouTube, and with the visual element of an image on Instagram. Because the blame frame discussed antibiotic use in livestock as an animal welfare issue and used the debunked 80% FDA figure (Authors, 2019), the visual manner in which this frame is being presented could have a significant or stronger impact on public opinion of this topic than text-only.

A qualitative study using focus groups could additionally allow for a richer understanding of public opinion regarding the topic of antibiotic use in livestock and antibiotic resistance. While each of the frame elements identified were communicated in each mock Twitter profile, some may have had a stronger impact than others or sparked some specific emotion. Further, specific questions or concerns regarding information communicated about the topic could be brought to light. Focus groups could additionally allow for investigation of the public's recall of information or frequency of messaging regarding antibiotic use in livestock and the development of antibiotic resistant bacteria.

This study was unique from previous research in agricultural communications in that data from real-time social media conversations and print news were used to develop and test messages with a population. The field of agricultural communications can and should field test messages regarding the many controversial topics within food, agriculture, and natural resources science. By better understanding how the public perceives messages, agricultural communicators can better develop effective messages that resonate with the public by building their trust.

With misinformation regarding animal welfare and the percentage of antibiotics used in livestock production playing the greatest role in shaping public opinion, agricultural

communications practitioners have an up-hill battle ahead of them. Communication practitioners and professionals both within agriculture and outside of agriculture should prioritize their own research when communicating. The use of the problematic 80% FDA data played an important role in shaping public opinion, yet communicators continue to use this flawed data when reporting on the topic of antibiotic use in livestock and the development of antibiotic resistant bacteria.

Negative information can play the greatest role in shaping public support or implementing change (Tversky & Kahneman, 1981). Agricultural communication practitioners, particularly those working within the food animal sectors, should take on the task of communicating specifically about antibiotic use in livestock and the development of antibiotic resistant bacteria. Fear regarding how antibiotic resistant bacteria can impact human health can motivate the public's purchasing decisions. Thus, agricultural communicators should develop communications campaigns and programs that address animal welfare practices across livestock production. By addressing how farmers, ranchers, and veterinarians work to ensure animal health and welfare while judiciously using antibiotics, trust and support could possibly be improved. Further, as new scientific information is gathered regarding the impact the final rule of the VFD has on livestock production and antibiotic resistance, agricultural communicators should use this information to educate and ease the minds of consumers regarding the steps animal agriculture is taking to ensure the safety of humans and animals.

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