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Communicating Antibiotic Resistance via Linguistic Agency Assignment

Zhengyu Zhang[a], Mian Jia[b], and Matthew S. McGlone[b]

[a]Department of Communication Studies, Western Washington University; [b]Department of Communication Studies, The University of Texas at Austin

ABSTRACT
Antibiotic resistance is a serious health threat that healthcare providers must communicate to the public to decelerate its development. Prior studies have shown that linguistic agency assignment is a viable strategy to frame health threats in a way that both conveys their severity and preserves audience members' sense of self-efficacy. In the current study, we examined this messaging strategy in the context of antibiotic resistance. Individuals' perceptions of the threat and efficacy, behavioral intentions, fear appeals, and evaluations of the educational fact sheet were explored. Participants ($N = 449$) were randomly assigned to one of the eight conditions crossing threat agency (bacteria/human), temporal agency (antibiotic resistance/human) and imagery agency (taking antibiotics/antibiotics). The results revealed that individuals' perceived severity, susceptibility, response efficacy, and self-efficacy were positively associated with their intentions to use antibiotics judiciously. The interaction effects between perceived threat and efficacy predicted behavioral intentions and the persuasiveness of the fact sheet. Relative to bacteria threat agency, human agency assignment led to significantly higher behavioral intentions. Also, readers of the human temporal agency condition reported higher persuasiveness toward the fact sheet than readers of the resistance condition. The implications, limitations, and future research directions of the study are discussed.

Antibiotic resistance is one of the greatest health threats in the 21st century (Sabtu et al., 2015). It occurs when microbes like bacteria or fungi evolve mechanisms that protect them from antibiotic medications, making infections difficult or even impossible to treat (Centers for Disease Control and Prevention, 2021b). A number of factors contribute to the rise of antibiotic resistance, such as the lack of knowledge, over prescription by healthcare providers, and misuse by patients (Morehead & Scarbrough, 2018). Consequently, national and global organizations have enacted policies designed to slow the emergence of antibiotic resistance. In addition to accelerating research on new antibiotics and creating rapid diagnostics for resistant pathogens, these policies also entail informing healthcare providers and the public about this health threat and the strategies they can use to combat it (e.g., Aslam et al., 2018; Maillard et al., 2020). To serve this communication mission, the current study aims to explore the effects of messaging strategies on people's risk perception and behavioral intentions regarding their judicious use of antibiotics.

Understanding the persuasive effects of various messaging strategies is an important topic in health communication research. For example, scholars have examined the effects of using metaphor to increase individuals' perceived risk susceptibility of Zika and other zoonotic diseases (Lu & Schuldt, 2018), gain-loss message framing to deal with the public health crisis of COVID-19 pandemic (Gantiva et al., 2021), incentive appeals in the promotion of antibiotic stewardship (Smith et al., 2020). Recently, researchers have proposed linguistic agency assignment as a strategy to motivate danger control actions to reduce health threats (Ma & Miller, 2021). Agency refers to the ascription of action or change to one or more entities involved in an event (McGlone & Pfiester, 2009), which has been validated as an effective message design strategy in several studies (Bell et al., 2014a; Ma & Miller, 2021; McGlone et al., 2013; Zhang & McGlone, 2019). Similar to previous research on linguistic agency assignment, the current study employs the extended parallel process model (EPPM) to examine the effects of agency assignment in motivating people to act in recommended ways.

As an effective fear appeal framework, the EPPM has been frequently applied in risk communication messages to focus on individuals' perceptions of threat severity, susceptibility, self-efficacy, and response efficacy (Edgar & Volkman, 2012). Only a few studies, however, have examined the persuasive effects of messaging strategies based on an EPPM framework in supporting antibiotic stewardship. An important tenet of this stewardship is persuading the public to engage in infection control (e.g., washing hands) and judicious antibiotic use (e.g., consulting with the healthcare provider for the use of antibiotics) (Levy, 1998; Smith et al., 2020). Given its importance, this line of research on persuasive message design deserves more attention.

Linguistic agency assignment

As an intrinsic feature in language, linguistic agency assignment is defined as the ascription of action or change to one or more entities involved in an event (McGlone et al., 2013; McGlone & Pfiester, 2009). The agent is determined by the relationship to the action expressed by the verb in a sentence (Dowty, 1991;

CONTACT Zhengyu Zhang Tracy.Zhang@wwu.edu Department of Communication Studies, Western Washington University, 516 High Street, Communication Facility (CF) 287, Bellingham, WA 98225-9162, USA

Jackendoff, 1972). Prior studies on agentic language have demonstrated its effectiveness across different languages (McGlone et al., 2017; Zhang & McGlone, 2019), and dealing with various health issues (Chen et al., 2015; McGlone et al., 2013; Ma & Miller, 2021; Ma et al., 2021) as well as interpersonal issues (McGlone & Pfiester, 2009; Wang & McGlone, 2020). In a greater detail, McGlone et al. (2013) investigated the persuasiveness of linguistic agency assignment in communicating the risks of H1N1 pandemic. In their study, the agency was either assigned to the influenza (e.g., "HINI can strike in any month of the year") or to humans (e.g., "People can contract H1N1 in any month of the year"). The results revealed that assigning agency to the influenza rather than to humans significantly elevated participants' levels of perceived severity, susceptibility, and intention to seek for vaccination. The persuasive effects of agency assignment stem from the implicit hierarchy of selecting thematic roles in natural language. Linguists have pointed out that entities verbally encoded as agents performing action outrank entities that function as patients (grammatical object) and imply a stronger causality in an event. Following this logic, assigning agency to influenza rather than to humans suggests that the virus is taking control to infect humans. As a result, recipients of this message would feel more fearful because they are ceding control to this external pathogen. Human agency assignment, however, is more likely to promote healthy behaviors than threat agency assignment when the nature of the threat is endogenous rather than exogenous. For example, viral threat and radon gas are common external threats to human health, whereas cancer, diabetes, and obesity are internal threats to our health. Further, Chen and colleagues (2015) examined the effects of linguistic agency assignment and narrative point of view in crafting health messages about colon cancer. Their results revealed that human agentic language (e.g., "I developed cancer") elevated greater susceptibility beliefs, as compared to cancer agentic language (e.g., "Cancer developed in me"). They also found that under the first-person point of view narratives, human-approach language seemed to be more persuasive than the death-approach language. In a similar vein, McGlynn and McGlone (2019) explored how the linguistic agency framing affects people's attribution of obesity responsibilities, and their findings showed that assigning agency to humans rather than to obesity promoted higher attributions of individual responsibility and more supports for public policies. Overall, the mixed results seem to suggest that the nature of the threat (*i.e.*, internal *vs*. external) moderates the persuasiveness of agency assignment. Given that one of the reasons for antibiotic resistance is individuals' misuse of antibiotics, it is important to further explore how linguistic agency assignments influence individuals' perceptions of antibiotic resistance. As such, the current study explores the hypothesized effects of threat, temporal, and imagery agencies on people's perceptions of antibiotic resistance and their intentions to practice antibiotic stewardship.

Threat agency

Two primary forms of agentic language in health message design reside in how people perceive the health threat (threat agency) and how they experience with it (human agency) (Bell et al., 2014a; McGlone et al., 2013). For example, assigning agency to antibiotic resistant bacteria indicates that the bacteria are actively responsible for the loss of lives (e.g., "Antibiotic-resistant bacteria can prey on people at any stage of life"). When humans serve as the agent, they are placed in an active position, and are responsible for protecting themselves (e.g., "People can pick up antibiotic-resistant bacteria at any stage of life"). Agency assignment thus affects individuals' perceptions of the threat, and further, their perceptions may vary by different ascriptions of linguistic agency (e.g., Bell et al., 2014a, 2014b; Glowacki et al., 2016; Ma & Miller, 2021). As noted earlier, Chen and her colleagues (2015) found that human agency induced a greater level of perceived susceptibility as compared to the colon cancer agency condition. They indicated that this finding may be due to the locus of threat, in which the threat is the individual's own mutating cells. Further, they suggested that future research needs to explore the disease agency assignment in various threat contexts including internal (*i.e.*, endogenous) and external (*i.e.*, exogenous) causes.

Although antibiotic resistant bacteria can emanate from the outside environment, it is also developed due to human behaviors, especially through the overuse of antibiotics. The bacteria can become difficult to kill due to a person's overuse and wrong use of antibiotics (e.g., taking antibiotics for viral infections). Based on the locus of threat in using agentic language, we suspect that people may have more positive reactions toward antibiotic stewardship when reading the educational material that assigned agency to humans. Since few studies have tested this, a set of related research questions will be proposed to explore the complexity of demarcating antibiotic resistance transportation in threat agency and the different results found in assigning linguistic agencies.

Temporal agency

Scholars have observed that people's sense of time is closely related to their communication patterns (McGlone & Pfiester, 2009). For example, if someone is certain about when an event will occur, they are likely to describe themselves as the agent (e.g., "we are approaching the weekend;" "I am getting close to my birthday"). However, when events are not welcomed and they feel passive or are losing control of them, they are likely to place the event as the agent (e.g., "Monday is approaching;" "the deadline of this year's tax filing is getting close") (McGlone & Pfiester, 2009; Kurlak et al., 2018). The persuasiveness of temporal agency framing has been examined in narrative health messages about colon cancer (Chen et al., 2015). The researchers assigned agency to death itself (e.g., "as death closes in on patients") or to humans (e.g., "as patients close in on death") when describing the consequences of colon cancer to patients. They found that the associated passivity in death-approach language led to a greater fearful emotion than human-approach language. In the present study, temporal agency is attributed to antibiotic resistance (e.g., "the era of antibiotic resistance is fast approaching") or humans (e.g., "we are fast approaching the era of antibiotic resistance"). Based on findings reported in Chen et al. (2015), assigning agency to antibiotic resistance might promote readers to perceive the educational fact sheet as more persuasive, making them more likely to take actions to use antibiotics appropriately. Since antibiotic resistance is mainly an internal threat that originates within a person, however, it is also possible that individuals are more persuaded by reading the education material with the human agentic language, as compared to the threat agentic language. Given this, a set of research questions will be proposed for exploratory purposes.

Imagery agency

One simple function of images is to enhance the verbal portion of a persuasive message (Seo et al., 2013). This phenomenon can be explained through the *picture superiority effect* where texts paired with imagery are more memorable than texts alone (Nelson et al., 1976; Seo et al., 2013). For example, Seo et al. (2013) found that participants reported greater fearful emotional reactions in the loss framing condition paired with an image, as compared to loss framing condition without the image. Given these, we are interested in extending the enhanced persuasive effect of image in agentic language framing. Similarly, McGlone et al. (2013) studied the effects of imagery agency (literal *vs*. agentic) on individuals' perceived threat of the H1N1 influenza virus, their efficacies, and their intention to seek for recommended vaccinations. Although the manipulation of imagery agency did not significantly improve the message persuasiveness, they suggested that the hypothesized effects might be obtained with different visual depictions of agency in future research. To further test the mixed findings on message framing and image persuasiveness, we set to compare the effects invoked by an image depicting agentic activity (i.e., a person is taking antibiotics) and an agentless image (i.e., an image of antibiotics). Taken together, the following research questions are proposed:

RQ1: How do linguistic agency assignments (i.e., threat agency, temporal agency, imagery agency) affect individuals' perceived severity, susceptibility, self-efficacy and response efficacy of antibiotic resistance?

RQ2: How do linguistic agency assignments (i.e., threat agency, temporal agency, imagery agency) impact: a) individuals' behavioral intentions to the judicious use of antibiotics, b) individuals' emotional reactions after reading the antibiotics related fact sheet, and c) evaluations of the fact sheet?

Extended parallel process model (EPPM)

Based on Leventhal's (1970) danger control/fear control framework, Witte (1992, 1994) proposed EPPM to model individuals' perceptions and behavioral intentions when facing risks. Grounded in fear appeals, EPPM includes four factors of effective health message design: threat severity, personal susceptibility, self-efficacy, and response efficacy (Edgar & Volkman, 2012; Meadows et al., 2020; Witte, 1994). Among the four elements, severity and susceptibility represents the threat appraisal; self-efficacy and response efficacy represent the efficacy appraisal. Studies have applied linguistic agency assignment in health contexts and further examined its effect on people's perception of the health issue with regard to their perceived severity, susceptibility, self-efficacy and response efficacy (e.g., Bell et al., 2014a, 2014b; Chen et al., 2015; Glowacki et al., 2016). These findings demonstrate that EPPM is a viable framework to explain the persuasiveness of agency assignment in health message design.

An effective health message employed with the linguistic agency assignment needs to induce adequate levels of threat and preserve sufficient levels of efficacy (Birmingham et al., 2015; McGlynn, 2014). As suggested by Birmingham et al. (2015), when individuals perceive threat and efficacy both to be high, they will enter a cognitive process to control the danger and engage in adaptive behaviors to cope with the threat. Specifically, when antibiotic resistance is considered a severe threat and people think they can cope with it, they are likely to practice antibiotic stewardship and have the intention to use antibiotics judiciously. Given that EPPM centers on fear experience, individuals' perceived seriousness, susceptibility, self-efficacy and response efficacy are likely to link with people's emotions after reading the fact sheet and their perceptions of the persuasiveness of the designed fact sheet.

According to EPPM, threat and efficacy appraisals function together to determine people's perceptions. Based on this theory, we advance three hypotheses to not only explore the individual effects of threat (severity and susceptibility), and efficacy (self-efficacy and response efficacy) on behavioral intentions, emotional reactions, and evaluations of the fact sheet, but also examine the interaction effects between threat and efficacy on the aforementioned dependent variables. We are also interested in the mediating effects of threat and efficacy appraisals between linguistic agency assignment and individuals' behavioral intentions, emotional reactions, and evaluations of the fact sheet. The hypotheses and research questions are as follows:

H1: Severity, susceptibility, self-efficacy, and response efficacy positively predict individuals' intentions to use antibiotics judiciously such that the higher perceived severity, susceptibility, response efficacy, self-efficacy, the higher individuals' intentions to take antibiotics carefully.

H2: Severity, susceptibility, self-efficacy, and response efficacy will predict: a) individuals' emotional reactions after reading the antibiotics related fact sheet, and b) their evaluations of the fact sheet.

H3: The interactions of threat (severity, susceptibility) and efficacy (self-efficacy, response efficacy) will predict: a) individuals' behavioral intentions, b) emotional reactions, and c) evaluations of the fact sheet.

RQ3: Do linguistic agency assignments (i.e., threat agency, temporal agency, imagery agency) affect individuals' behavioral intentions, emotional reactions, and evaluations of the fact sheet through threat and efficacy?

Methods

Participants

The purpose of the study is to examine the EPPM framework and the persuasive effects of linguistic agency assignment in promoting antibiotic stewardship. A total of 489 participants aged 18 years or older were recruited using Amazon.com's Mechanical Turk website (MTurk; http://www.mturk.com). To eliminate the confounding effect of participants' language proficiency, we restricted the participants to native English speakers. Research also suggests that MTurk's workers come from a variety of demographics and their reasoning is comparable to, especially when workers' approval ratings on the Human Intelligence Task (HIT) are above 95% (Peer et al., 2014; Sheehan, 2018). Thus, MTurk workers whose HIT approval ratings are above 95% were recruited as participants. Samples recruited through Mechanical Turk tend to be similar to those collected through other online sources (Rouse, 2015; Sheehan, 2018). This online experiment took approximately 15 minutes to complete, and each participant received $0.50 through MTurk. All participant responses were kept anonymous and confidential. To validate the data, we created five questions to check participants' attention to the fact sheet they just read. Following previous recommendations (Chmielewski & Kucker, 2020), individuals who correctly answered at least three out of the five questions were included ($N = 449$).

The sample consisted of 62.4% female ($n = 280$) and 37.6% male ($n = 169$). Respondents' age ranged from 18 to 76 years and averaged 38.94 years ($SD = 14.3$, $Mdn = 36$). Their ethnicity included White or Caucasian ($n = 340$, 75.7%), Asian or Pacific Islander ($n = 28$, 6.2%), Black or African American ($n = 35$, 7.8%), Hispanic or Latino ($n = 23$, 5.1%), Native American ($n = 1$, 0.2%), and multiple ethnicities ($n = 3$, 4.8%). Since participants' knowledge of antibiotic resistance may moderate their attitudes regarding the fact sheet (Hermsen et al., 2020), we also collected data on participants' educational level and history of talking with their primary care physician on antibiotic resistance. Most participants (91.4%) reported that they at least had some college education. Around 27.8% ($n = 125$) participants stated that a doctor has talked to them about antibiotic resistance, 47 (10.5%) revealed that a doctor has told them that they were at risk for getting antibiotic-resistant bacteria infection, and 131 (29.2%) reported that they have taken actions for preventing antibiotic resistance. A detailed demographic profile of the sample is presented in Table 1.

Table 1. Demographic profile of the sample ($N = 449$).

Measure	n	%
Female	280	62.4
Age (years)		
18-29	126	28.1
30-39	139	30.9
40-49	78	17.4
50-59	50	11.1
60 and older	44	9.8
White or Caucasian	340	75.7
Education		
High school or less	37	8.6
Some college	103	22.9
2-year college degree	59	13.1
4-year college degree	178	39.6
Graduate degree	72	16.0
Political Orientation		
Conservative	144	32.1
Neutral	72	16.0
Liberal	233	51.9
Employment Status		
Employed full-time	284	63.3
Employed part-time	60	13.4
Unemployed and looking for work	18	4.0
Full-time student	27	6.0
Homemaker	25	5.6
Retired	21	4.7
Other	14	3.1
Marital Status		
Married	216	48.1
Not married but in a committed relationship	80	17.8
Separated	10	2.2
Divorced	32	7.1
Widow/Widower	5	1.1
Never married	106	23.6

Experimental design and stimulus materials

Participants were randomly presented to one of eight versions (unknown to them) of the antibiotic resistance fact sheet for at least 3 minutes. The stimulus material is a two-page educational fact sheet that recommends people taking actions to fight against antibiotic resistance. The information in the sheet was adapted from the information posted on the Centers for Disease Control and Prevention website (https://www.cdc.gov/drugresistance/index.html) and was attributed to a fictitious institution called Association of Public Health Services. In the current study, a 2 (**threat agency**: antibiotic-resistant bacteria *vs.* human) × 2 (**temporal agency**: antibiotic resistance *vs.* human) × 2 (**imagery agency**: taking antibiotics *vs.* static display of antibiotics) between-subject factorial design was employed. Samples of language manipulations are provided in Table 2. Each version of the fact sheet includes 12 linguistic manipulations of threat agency, four of temporal

Table 2. Sample language manipulations in the educational fact sheet of antibiotic resistance, defined by 2 × 2 × 2 (threat agency × temporal agency × imagery agency) experimental design.

Threat agency: Bacteria assignment	**Threat agency: Human assignment**
Resistance bacteria infect people, making them encounter urgent situations and serious consequences.	People encounter urgent situations and serious consequences by contracting resistant bacteria.
Antibiotic-resistant bacteria can prey on people at any stage of life …	People can pick up antibiotic-resistant bacteria at any stage of life …
Temporal agency: Antibiotic resistance	**Temporal agency: Human**
Antibiotic resistance is quickly moving into an epidemic phase.	We are quickly moving into an epidemic phase of antibiotic resistance.
Antibiotic resistance is arriving at a critical point for us.	We are arriving at a critical point of antibiotic resistance.

To avoid repetition, the imagery agency (taking antibiotics vs. antibiotics) is not included. The manipulated pictorials are shown in the Appendix.

agency, one of imagery agency. All versions were comparable in length (range = 365–381 words). For illustrative purposes, sample versions of the fact sheet are provided in the Appendix.

Measures

After reading the fact sheet, participants were asked about their attitudes and perceptions of antibiotic resistance. Following Bell et al. (2014a, 2014b), the back button in the Qualtrics survey was disabled to prevent participants from returning to the material when answering questions about the content of the fact sheet. In addition to the manipulated linguistic agency effects, the EPPM construct was also examined in the current study, which includes: (a) perceived severity (4 items; e.g., "Antibiotic resistance poses a serious risk to health." Cronbach's $\alpha = .93$; $M = 6.20$, $SD = .92$), (b) perceived susceptibility (5 items; e.g., "I am at risk for antibiotic resistance." Cronbach's $\alpha = .81$; $M = 4.96$, $SD = 1.13$), (c) self-efficacy (3 items; e.g., "I am able to determine when it's appropriate for me to take antibiotics." Cronbach's $\alpha = .59$; $M = 5.44$, $SD = .92$), (d) response efficacy (3 items; e.g., "The recommendations presented in the article are effective." Cronbach's $\alpha = .84$; $M = 5.25$, $SD = 1.17$).

In addition to the construct of EPPM, we also collected data on participants' behavioral intentions, emotional reactions, evaluation of the fact sheet, and language intensity of the fact sheet. The behavioral intentions scale was employed to assess individuals' tendency to take antibiotics appropriately, including 3 items (e.g., "I am intended to take antibiotics appropriately after reading this fact sheet;" Cronbach's $\alpha = .84$; $M = 5.93$, $SD = .97$). The scale of emotional reactions included 6 items and was employed to test participants' fear arousal after reading the fact sheet (e.g., "The fact sheet frightened me." Cronbach's $\alpha = .98$; $M = 4.26$, $SD = .98$). Moreover, participants were asked to report their evaluations of the fact sheet using a 16-item semantic differential scale ranging from −5 to 5 (e.g., "inaccurate – accurate, unprofessional – professional;" Cronbach's $\alpha = .98$; $M = 9.38$, $SD = 1.76$), and a 4-item semantic differential scale ranging from −5 to 5 (e.g., "not intense – very intense, powerless – powerful;" Cronbach's $\alpha = .92$; $M = 8.36$, $SD = 1.82$) to assess participants' perceived language intensity of the fact sheet. In case of containing negative values, we transformed the −5–5 scale point to a 1–11 scale in the subsequent analysis.

The questionnaire consisted of items adapted from previous research (Chen et al., 2015; Zhang & McGlone, 2019). Other than stated above, the items included in this study were measured on 7-point Likert-type scales ranging from 1 = *very strongly disagree* to 7 = *very strongly agree*. Certain items were reverse coded with higher scores indicating higher degrees of perceived severity, susceptibility, self-efficacy, response efficacy, greater fear toward antibiotic resistance after reading the fact sheet, and higher intention to avoid overusing of antibiotics. At the end of the survey, participants were also asked about a set of demographic information such as age, sex, ethnicity, educational level, marital status, and political orientation. The correlations among the main study variables are reported in Table 3.

Results

Preliminary analysis

Randomization checks

The association between the linguistic agency assignment factors (i.e., threat, temporal and imagery linguistic agency) and participants' characteristics (e.g., sex, educational level, employment status, marital status, and political orientation) were examined through cross-tabulation. The Chi-square tests indicated no significant association ($p > 0.05$) between demographic factors and the linguistic agency factors, suggesting that randomization functioned well in the design.

Main analysis

Test of hypotheses and research questions

RQ1 asked the effects of linguistic agency assignment on individuals' perceived severity, susceptibility, self-efficacy, and response efficacy. Given that multiple continuous dependent variables were being tested, RQ1 employed a multivariate analysis of covariance (MANCOVA), and the perception of language intensity of the fact sheet was included as a control variable. The results indicated that individuals' perception of language intensity varied on the EPPM [$\lambda = .85$, $F(4, 437) = 19.26$, $p < .001$, $\eta_p^2 = .15$]. The multivariate analysis also showed interaction effects of threat and temporal agency on response efficacy and self-efficacy [$\lambda = .97$, $F(4, 437) = 2.87$, $p = .023$, $\eta_p^2 = .026$]. Specifically, compared to those who read the antibiotic resistance condition, participants who read the human condition of the temporal agency manipulation perceived the remedies suggested in the fact sheet as more effective (response efficacy; $M_{Temporal\ (human\text{-}resistance)} = .43$, $SE = .15$, $p = .005$) and they believe that they are more capable of taking antibiotics appropriately (self-efficacy; $M_{Temporal\ (human\text{-}resistance)} = .26$, $SE = .12$, $p = .028$). This effect is only significant

Table 3. Correlations among main study variables ($N = 449$).

	1	2	3	4	5	6	7	8
1. Severity	–							
2. Susceptibility	.45**	–						
3. Response efficacy	.25**	.01	–					
4. Self-efficacy	.36**	.16**	.44**	–				
5. Behavioral Intention	.56**	.34**	.39**	.56**	–			
6. Emotional Reaction	.23**	.32**	−.12**	−.10**	.14**	–		
7. Evaluation of the fact sheet	.46**	.21**	.25**	.38**	.46**	.001	–	
8. Perception of language intensity	.30**	.11*	.23**	.31**	.32**	.15**	.58**	–

*p <0.05; **p <0.01.

when the fact sheet they read assigned threat agency to antibiotic resistant bacteria.

Additionally, individuals' perceived severity, susceptibility, self-efficacy, and response efficacy did not vary by the interaction effect between temporal and imagery agency [$\lambda = .98$, $F(4, 437) = 1.95$, $p = .10$, $\eta_p^2 = .018$]. Nevertheless, when further examining the univariate analysis, we found that the interaction effects on self-efficacy approached significant difference with $p = .053$. In the resistance condition, participants who saw the picture with antibiotic pills tend to believe that they are equipped with the ability to cope with the antibiotics overuse situation (self-efficacy; $M_{Imagery\ (antibiotics\text{-}taking\ antibiotics)} = .21$, $SE = .12$, $p = .077$), as compared to the taking antibiotics pictorial condition. The univariate results and marginal means for each dependent variable are provided in Table 4. These marginal significant results might provide heuristic values for future research.

Regarding to RQ2, MANCOVA was employed to assess how linguistic agency assignment (*i.e.*, threat agency, temporal agency, and imagery agency) impacts individuals' behavioral intentions to the judicious use of antibiotics (RQ2a), individuals' emotional reactions after reading the antibiotics related fact sheet (RQ2b), and evaluations of the fact sheet (RQ2c). The perception of language intensity was entered as a covariate, and the results indicated that individuals' behavioral intentions, emotional reactions, and their evaluations of the fact sheet varied on their perceptions of language intensity of the fact sheet [$\lambda = .64$, $F(3, 438) = 82.10$, $p < .001$, $\eta_p^2 = .36$]. We found a main effect of threat agency on people's behavioral intention [$\lambda = .98$, $F(3, 438) = 3.81$, $p = .01$, $\eta_p^2 = .025$]. Compared to those who read the bacteria condition ($M_{bacteria} = 5.80$), people who read the human agency condition ($M_{human} = 6.06$) were more likely to follow the recommendations in the fact sheet. Moreover, temporal agency assignment also showed a main effect on readers' evaluation of the fact sheet [$\lambda = .98$, $F(3, 438) = 2.78$, $p = .041$, $\eta_p^2 = .019$]. Readers of the human agency condition ($M_{human} = 9.57$) tended to perceive the fact sheet as more persuasive, as compared to readers of the resistance condition ($M_{resistance} = 9.19$). See Table 4 for specific results of the multivariate analysis.

H1 proposed that the perceived severity, susceptibility, response efficacy, and self-efficacy positively predicted individuals' intentions to use antibiotics judiciously. To test this hypothesis, a hierarchical multiple regression was conducted. To account for differences based on individuals' perceptions of the antibiotic resistance fact sheet, language intensity was included as a control variable on the first step. Ratings of perceived severity, susceptibility, response efficacy, and self-efficacy were entered on the second step. The regression results are presented in Table 5. In sum, results of the second step showed that severity, susceptibility, response efficacy, and self-efficacy were positively related to behavioral intention. Thus, H1 was supported.

We also hypothesized that individuals' perceived severity, susceptibility, self-efficacy, and response efficacy will be associated with their emotional reactions (H2a) and evaluations of the fact sheet (H2b). Similarly, two sets of hierarchical multiple regression were employed to assess these hypotheses. In case of the compound effect of perceived language intensity, it was entered as the first step. Severity, susceptibility, self-efficacy, and response efficacy were entered in the second step. Participants' reported emotional reactions are positively

Table 4. Estimated marginal means, standard errors and univariate results from MANCOVAs (RQ1–2).

	Linguistic Agency Assignment							
	Threat Agency		Temporal Agency		Imagery Agency			
	Human $n = 230$ *M (SE)*	Bacteria $n = 219$ *M (SE)*	Human $n = 225$ *M (SE)*	Resistance $n = 224$ *M (SE)*	Antibiotics $n = 234$ *M (SE)*	Taking Antibiotics $n = 215$ *M (SE)*	Univariate *F*	η_p^2
Severity	6.23 (.06)	6.16 (.06)	6.24 (.06)	6.15 (.06)	6.20 (.06)	6.19 (.06)	6.02***	.10
Susceptibility	4.99 (.07)	4.92 (.08)	5.02 (.08)	4.88 (.08)	4.95 (.07)	4.95 (.08)	1.21	.02
Response Efficacy	5.34 (.07)	5.15 (.08)	5.32 (.08)	5.17 (.08)	5.31 (.07)	5.18 (.08)	5.46***	.09
Self-Efficacy	5.48 (.06)	5.40 (.06)	5.49 (.06)	5.40 (.06)	5.47 (.06)	5.42 (.06)	7.37***	.12
Behavioral Intention	6.06 (.06)	5.80 (.06)	5.95 (.06)	5.91 (.06)	5.94 (.06)	5.92 (.06)	8.27***	.13
Emotional Reaction	4.30 (.06)	4.21 (.07)	4.25 (.07)	4.27 (.07)	4.23 (.06)	4.29 (.07)	1.45	.03
Evaluation of the fact sheet	9.37 (.10)	9.39 (.10)	9.57 (.10)	9.19 (10)	9.44 (.09)	9.32 (.10)	29.53***	.35

*$p < .05$, **$p < .01$, ***$p < .001$.

Table 5. Hierarchical regressions: Associations between severity, susceptibility, self-efficacy, response efficacy and behavioral intention, emotional reaction, and evaluation of the fact sheet (H1-H2).

	Behavioral Intention			Emotional Reaction			Evaluation of the Fact Sheet		
	β	Δ*F*	ΔR^2	β	Δ*F*	ΔR^2	β	Δ*F*	ΔR^2
EPPM Construct									
Step 1		51.81	.10***		9.64	.02**		222.61	.33**
Perception of Language Intensity	.32***			.15**			.58***		
Step 2		84.38	.39***		21.05	.16***		21.11	.44***
Severity	.32***			.16**			.26***		
Susceptibility	.13***			.27***			.02		
Response Efficacy	.14***			−.11**			.01		
Self-Efficacy	.34***			−.20***			.14***		

*$p < .05$, **$p < .01$, ***$p < .001$, $^{m}p \le .07$.

associated with their perceived severity and susceptibility, and are negatively associated with their response efficacy and self-efficacy (see Table 5). As such, H2a was supported. Following a similar procedure, the results indicated that severity and self-efficacy positively contributed to individuals' evaluation of the fact sheet (H2b; see Table 5). H2b was partially supported as participants with higher perceived severity and higher self-efficacy rated the fact sheet as more persuasive.

A path analysis using AMOS 28.0 software was conducted to examine the interaction effects between threat and efficacy (H3), as well as the indirect effects of linguistic agency assignments (RQ3) on behavioral intentions, emotional reactions, and evaluations of the fact sheet. To gain a full understanding of all inductions, the interaction term of linguistic agency assignments was also modeled (See Figure 1). To avoid an extremely complex model, the scores of each two dimensions were averaged and combined into a single score for perceived threat (*i.e.*, severity and susceptibility) and efficacy (*i.e.*, self-efficacy and response efficacy) in which a higher combined score indicates higher threat and efficacy ratings from participants (Zhao & Wu, 2021). Model fit was evaluated on the basis of the model χ^2 statistic; the normed χ^2 value (the ratio of χ^2/df), with a value <3.0 indicating an adequate fit (Bollen, 1989; also see Crockett, 2012); Hu and Bentler, (1998) have also suggested the cutoff values for the CFI (≥0.95) and RMSEA (≤0.08). Based on Preacher and Hayes (2008), indirect associations were explored using a bootstrapping procedure in which resampling ($n = 2000$) was conducted to provide estimates of the 95% confidence intervals (*i.e.*, bias-corrected confidence intervals).

The results of the analysis suggested an insufficient model fit with $\chi^2(30) = 2325.17$, $p < .001$, $\chi^2/df = 77.51$, CFI =.20, TLI = −1.08, RMSEA =.41. Based on the requested model modification indices and the logical reasoning, covariances among linguistic agency assignments were added. Thus, the model yielded a good model fit with $\chi^2(15) = 8.87$, $p = .88$, $\chi^2/df = .59$, CFI = 1.00, TLI = 1.01, RMSEA <.001. As hypothesized by H3, the interaction term of threat and efficacy showed a statistically significant effect on individuals' behavioral intentions of the judicious use of antibiotics (H3a) and perceptions on the persuasiveness of the fact sheet (H3c), but no effect was shown on people's emotional reactions (H3b). Thus, H3 was partially supported. Further, the two interaction effects were decomposed based on Aiken and West (1991). When individuals perceived antibiotic resistance as a highly serious issue, a difference occurred in their intention to use antibiotics judiciously in terms of the efficacy level – the higher efficacy, the higher behavioral intentions. Threat and efficacy tend to interact when threat is perceived at a high level, which implied that people are likely to take actions regardless of their perceived efficacy level (see Figure 2). Another interaction term of threat and efficacy regarding individuals' evaluation of the fact sheet was also decomposed (see Figure 3). The graph displayed a similar pattern with behavioral interactions. The results indicated that the interaction effects are likely to occur when the perceived threat is high. When antibiotic resistance was perceived as high, people were more likely to evaluate the fact sheet as high in persuasiveness. When the risk of antibiotic resistance was rated as low, people with relatively high efficacy level were likely to consider the fact sheet as persuasive, accurate, and professional, as compared to those with low efficacy ratings.

RQ3 explored whether the effects of linguistic agency assignments on individuals' behavioral intentions, emotional reactions and the evaluation of the fact sheet were mediated by threat and efficacy. The results of the path model revealed significant indirect effects from the linguistic agency assignments to dependent variables. Specifically, individuals'

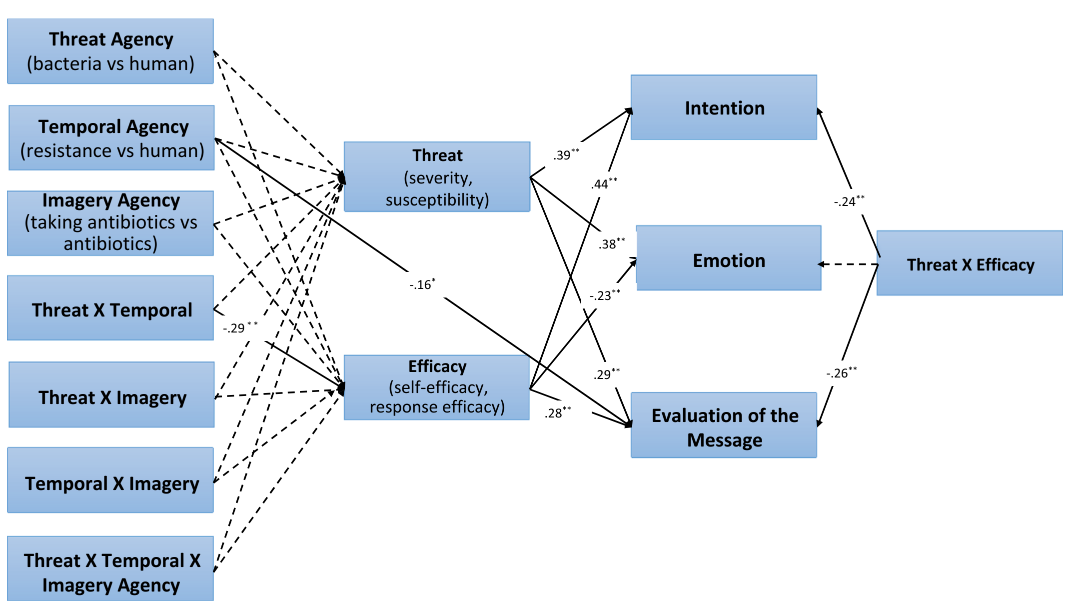

Figure 1. Tested model of linguistic agency assignment on intentions/emotions/evaluation via threat and efficacy. *Note*. Perceived threat and efficacy were tested as mediators between the linguistic agency assignments and intention/emotion/evaluation, respectively. The dotted lines represent for non-significant paths, and the solid lines represent for the significant paths (*$p < .05$, **$p < .01$). Given that threat agency (human = 0, bacteria = 1), temporal agency (human = 0, antibiotic resistance = 1), and imagery agency (antibiotics = 0, taking antibiotics = 1) are categorical variables, the negative values indicated that the category that coded as 0 have stronger effects than the category coded as 1.

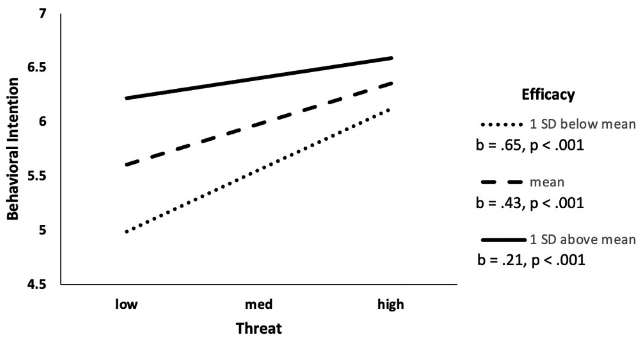

Figure 2. Interaction of threat and efficacy in predicting behavioral intention.

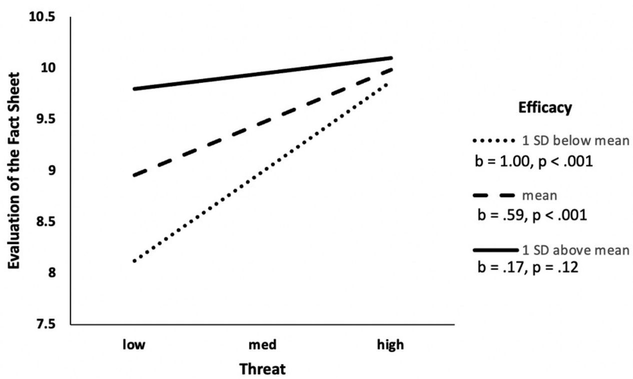

Figure 3. Interaction of threat and efficacy in predicting evaluation of the fact sheet.

perceived efficacy mediated the association between the interaction term of threat and temporal agency and behavioral intentions (−.18, 95% CI [−.33, −.03], $p = .01$), as well as the evaluation of the fact sheet (−.12, 95% CI [−.24, −.02], $p = .02$).

Discussion

To better communicate health risk information to the public and motivate them to take actions, the current study examines the persuasive effects of linguistic agency assignments (*i.e.*, threat, temporal, and imagery agency) on people's perceptions of severity, susceptibility, self-efficacy, and response efficacy (*i. e.*, EPPM) toward antibiotic resistance. Two main inferences can be drawn from this study: a) linguistic agency assignment is an effective health message design strategy to promote individuals' intentions to practice antibiotic stewardship, and b) EPPM is a viable framework to explain and motivate individuals' judicious use of antibiotics.

Linguistic agency assignment in practicing antibiotic stewardship

Tests of RQ1 and RQ2 showed that the locus of threat (*i.e.*, exogenous or endogenous) may moderate the effect of agency assignment in that assigning agency to the threat is more persuasive for exogenous threats, and assigning agency to humans is more persuasive for endogenous threats. On one hand, previous studies on exogenous threats such as various viruses, tornado, and radon gas have consistently found that placing the threat as the agent is more effective than placing humans as the agent because the threat agent makes people feel that they have less control over the threat and feel more fearful about it (Bell et al., 2014a, 2014b; Dragojevic et al., 2014; Ma et al., 2021; McGlone et al., 2013; Zhang & McGlone, 2019). On the other hand, studies examining endogenous threats tend to show a stronger effect of human agency framing (Chen et al., 2015; Glowacki et al., 2016; Khan & Pena, 2017). For example, Chen et al. (2015) found that individuals perceived a higher susceptibility when human rather than colon cancer served as the agent. Glowacki et al. (2016) reported that people held more positive attitude in the human agency condition instead of Type 2 diabetes agency condition. Moreover, Khan and Pena (2017) found a significant interaction effect of linguistic agency assignment and depression causality on participants' time spent in a health game app. Specifically, framing depression as exogenous is significantly more persuasive when delivered with human agency rather than threat agency because human agency affords people the ability to control the threat of depression. Consistent with Ma and Miller's (2022) findings, a partial matching effect was noted that threat agency may induce individuals' greater intention to take actions than human agency for threats not ascribed to humans. This further upholds our speculation that differences in attitudes may occur with different types of threat. People are motivated to take the recommended actions under threat agency assignment if the threat is external to human bodies (e.g., bacteria). In contrast, people are more likely to follow the recommendations under human agency assignment when people perceive the threat as internal to their bodies (e.g., mutated cell).

One important factor to consider when assigning agency to an exogenous and endogenous threat is individuals' efficacy. Exogenous threat implies that people lose control in situations such as viral attack and natural disaster. People may have no other choice than following experts' recommendations to protect themselves. Based on this, most linguistic agency assignment research findings on significantly elevating efficacy (self-efficacy and response efficacy) are shown with the external threat manipulations, especially when the exogenous threat serves as the threat (e.g., Bell et al., 2014a, 2014b; Dragojevic et al., 2014; McGlone et al., 2013; Zhang & McGlone, 2019). In contrast, the nature of endogenous threat determines that the threat develops inside of one's body, and human gains control. In this sense, individuals may feel motivated to take actions if they are granted the agency to protect themselves. Consistent with prior research on endogenous threat (e.g., Chen et al., 2015; Glowacki et al., 2016; Khan & Pena, 2017), our results of the interaction effects between threat and temporal agency on efficacy corroborate the endogenous threat finding since one of the major reasons for antibiotic resistance is people's overuse or wrong use of antibiotics.

Another possible angle to explain the effectiveness of linguistic agency assignment and threat type is the perceived short-term or long-term efforts in coping with the threat. For example, HPV or other acute diseases can be managed through a one-time fashion (e.g., vaccine). When threat serves as the agent, people are likely to experience a greater fear toward the threat and tend to take actions than in human agency assignment (e.g., Bell et al., 2014a, 2014b; McGlone et al., 2013). However, health risks like diabetes, obesity, and antibiotic resistance require people to cope with the threat via persistent efforts. When people read the educational message with humans serving as the agent, people might feel that they are enabled to manage their health issues with persistent efforts so that they are more likely to take the recommended actions, as compared to a reading threat agency condition (e.g., Glowacki et al., 2016; McGlynn & McGlone, 2019).

In addition to the interaction effects among agency assignments, the main effects of agency on people's perceived threat and efficacy were not revealed based on the current data. It is possible that the linguistic agency manipulation is too subtle to influence people's existing beliefs toward antibiotic resistance. However, the interaction effects between different forms of linguistic agency assignments were found. Temporal agency interacted with threat agency on predicting the efficacy items. Under the bacteria threat condition, participants who read the human agency fact sheet perceived the efficacy (including self-efficacy and response efficacy) level as higher than those who read the resistance agency fact sheet. This finding is consistent with the above discussion on the strengthened human initiatives to handle endogenous threats. Our observation of interaction but not main effects of agency assignment suggests that it is more effective to use the combination of multiple types of agency manipulation (e.g., threat agency and temporal agency) when designing educational materials about antibiotic resistance.

We also reported an exploratory finding that the interaction effects between temporal agency and imagery agency approached significant difference on the perceived self-efficacy. Specifically, when resistance rather than humans in the temporal condition served as the agent, people who saw the picture of pills consider that they are more capable of taking antibiotics judiciously, as compared to the picture of someone taking pills. This might be because people feel more scared or reluctant when reading the antibiotic resistance temporal condition (e.g., Antibiotic resistance is quickly moving into an epidemic phase) rather than the human temporal condition (e.g., We are quickly moving into an epidemic phase of antibiotic resistance). Without control on time when facing an antibiotic resistance urgency, individuals may not believe in their ability to take actions to protect themselves, especially when they saw the picture depicting the ongoing behavior that someone is opening their mouth and taking the pill (see the Appendix for described pictures). This is in accordance with the emotion control path in EPPM that people's fearful feelings may drive them to be defensive and perform maladaptive actions. Also, this combination might provide thoughts on future message crafting, especially for incorporating imagery in that threat control and emotion control need to be balanced. With the marginal significant results in the current study, we cannot affirm the effects of imagery agency in message design, but it is worth a future inspection.

EPPM as a viable framework in explaining antibiotic stewardship

Our findings showed that severity, susceptibility, self-efficacy, and response efficacy predicted people's behavioral intentions. When individuals consider antibiotic resistance as a serious and susceptible threat, they are likely to engage in the judicious use of antibiotics. Additionally, if people believe that they can deal with the threat and evaluate the recommendations as effective, they tend to follow these recommendations to guard themselves. Our results are consistent with the EPPM prediction in that an effective fear appeal message aims at elevating readers' perceived threat and efficacy at the same time (Witte, 1992; Meadows et al., 2020). In the context of antibiotic resistance, the positive association between EPPM and behavioral intention showed that the designed fact sheet was effective, and implied people's positive attitude toward combating antibiotic resistance. Although a wide array of literature has focused on the application of EPPM, few studies have examined EPPM in an antibiotic resistance context. For example, Botta et al. (2008) use EPPM to understand and change hand-washing behaviors on campus. Chen and Chen (2021) employ an extended EPPM framework with other-oriented threat in promoting smoking cessation in China. The current study extends and further affirms the effectiveness of EPPM in the antibiotic resistance context, especially in promoting individuals' behavioral intentions to take antibiotics judiciously.

The results also showed that individuals' perceived threat (severity and susceptibility) was positively, and perceived efficacy (self-efficacy) was negatively associated with their fearful feelings after reading the antibiotic resistance fact sheet. This partial support for H2 validated that the mechanism of EPPM is grounded in fear appeals. Further, the EPPM provided a guidance on health message design and public health promotion by steering the target audience toward a threat appraisal and then emphasizing effective prevention action (Edgar & Volkman, 2012). In addition, the current investigation also provides evidence for the association between EPPM (severity and self-efficacy) and perceived persuasiveness of the antibiotic resistance educational fact sheet. However, it is not clear why susceptibility and response efficacy are not related to individuals' perceived persuasiveness. This non-association finding might be a simple Type II error but needs a closer inspection of the EPPM variables in the future.

In addition, threat and efficacy were explored as mediators in the path model between the message manipulation (i.e., threat, temporal, imagery agency) and distal outcomes (i.e., behavioral intention, emotion, evaluation) to further understand how linguistic agency assignment influences individuals' perceptions and attitudes toward antibiotic resistance (RQ3). The results indicated that threat and efficacy mediated the relationship between the interaction term of threat and temporal agency and the behavioral intentions, as well as the evaluation of the fact sheet. One direct effect from the temporal agency to the evaluation of the fact sheet was also found. Under the condition of temporal agency, human agency displayed a stronger effect than the antibiotic resistance agency condition when predicting the perceived persuasiveness of the fact sheet ($b = -.10$, $p = .03$, $SE = .04$, CI: $-.18$,

−.01; see Figure 1). In the current study, the direct and indirect effects on temporal agency implies its relatively strong effect on mediators and the distal factors. Also, prior empirical studies on linguistic agency assignment treating factors of EPPM as outcome variables instead of mediators (e.g., Bell et al., 2014a, 2014b; McGlone et al., 2013). The current finding on the indirect effects may expand the viable application of EPPM in designing antibiotic resistance educational materials.

In fact, the current findings regarding interactions between threat and efficacy may help clarify the route of danger control in EPPM. As shown in Figure 2, threat interacted with the efficacy in predicting behavioral intentions at a high level. Generally, people with high efficacy in managing antibiotic resistance held a higher behavioral intention to the judicious use of antibiotics than those with a low efficacy level. When antibiotic resistance is considered as a serious threat, people who think they have low capability of managing the resistance showed a heavily increase in the judicious use of antibiotics. Like the interaction effects in predicting behavioral intentions, the evaluation of the fact sheet also showed a similar pattern that individuals with high efficacy held a generally positive view toward the fact sheet as compared to the low efficacy group (Figure 3). However, the different groups of efficacy measures are likely to interact when antibiotic resistance is considered highly threatening to human health. This may depict people's intention to engage in adaptive behaviors when facing a threat, which might also provide practical implications for message design in antibiotic resistance that having people realize the importance of the antibiotic resistance is the key. Given that people with various efficacy levels have different reactions, enabling people to manage the health issue also seems substantial. Finally, our results did not indicate a significant finding toward the individuals' fearful emotional reactions. Our speculation is that the interaction effects between threat and efficacy might be counterbalanced.

Implications

There are several notable implications of our findings. First, although studies have examined the linguistic agency assignment in various health and risk communication contexts, extending it to the study of antibiotic resistance is novel. Taken together with our discussion on the exogenous and endogenous threats, and short- and long- term treatments, our study suggests the potential to adapting messages based on the types of threat as well as the lengths of the effort to cope with the threat. That is, assigning human agency to a threat originated internally and recommended actions that requires people's persistent effort; assigning threat agency to a threat emanated externally and suggested treatments that human efforts are only required in a short period of time. This might provide insights to health communication scholars and practitioners for future public health message design and campaign promotion.

Second, by exploring threat and efficacy as mediators, the present study further describes how linguistic agency assignment influences distal outcomes after reading the designed fact sheet. By showing the associations of severity, susceptibility, response efficacy, and self-efficacy with individuals' behavioral intentions, emotional reaction and evaluation of the fact sheet, the current study has illustrated the utility of explaining fear control and danger control processes when facing a global health threat. More practically, the interaction pattern between threat and efficacy in predicting behavioral intentions and evaluation of the fact sheet emphasized the importance of health education on antibiotic resistance. Given the educational nature of public health messages, the current study could help individuals to realize the importance of halting antibiotic resistance. Although only marginal significant effects were found with the imagery agency, it may provide heuristic values for future health message design by incorporating theoretically informed visual messages in practice, especially with a focus on the balance of fear and danger control.

Limitations and future research directions

Notwithstanding the contributions, the present study is subject to several limitations. First, the participants were mostly white, employed full-time, and have some college education which may not represent the general population. Thus, findings on individuals' perceptions of threat and their behavioral intentions may not be able to generalize to other populations, especially for people who have lower level of economic status and educational level, given that health literacy is an important factor in understanding and promoting public health policies. The educational materials can be tailored to a different population group (e.g., the Hispanic community) or in a different language (e.g., Chinese, Spanish). Second, in linguistic agency assignment conditions, there were 12 manipulations of threat agency and 4 manipulations of temporal agency. Since more agency manipulation could produce a more salient effect on outcomes (Ma & Miller, 2021), future research could include more linguistic agency manipulations. Third, the present study focuses on testing people's behavioral intentions of practicing antibiotic stewardship and tendency to take antibiotics judiciously rather than their real actions. Research could further explore how to make people take a step further to perform the suggested actions in the fact sheet in the future. It is also important to note that the experimental data of the current study were collected before the COVID global pandemic. Given that antibiotics is important to treat serious and life-threatening conditions such as pneumonia and sepsis (CDC, 2020, https://www.cdc.gov/patientsafety/features/be-antibiotics-aware.html), people may have different perceptions toward its associated resistance during and after this global pandemic. As a future research direction, it would be helpful to conduct a naturalistic comparison to explore this. Also, although this study has examined three types of agency assignment, manipulating diverse agency features and employing other message design strategies are needed. In this way, it is helpful for health practitioners and scholars to identify the most effective way of communicating messages regarding antibiotic resistance to prevent another global pandemic.

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Appendix

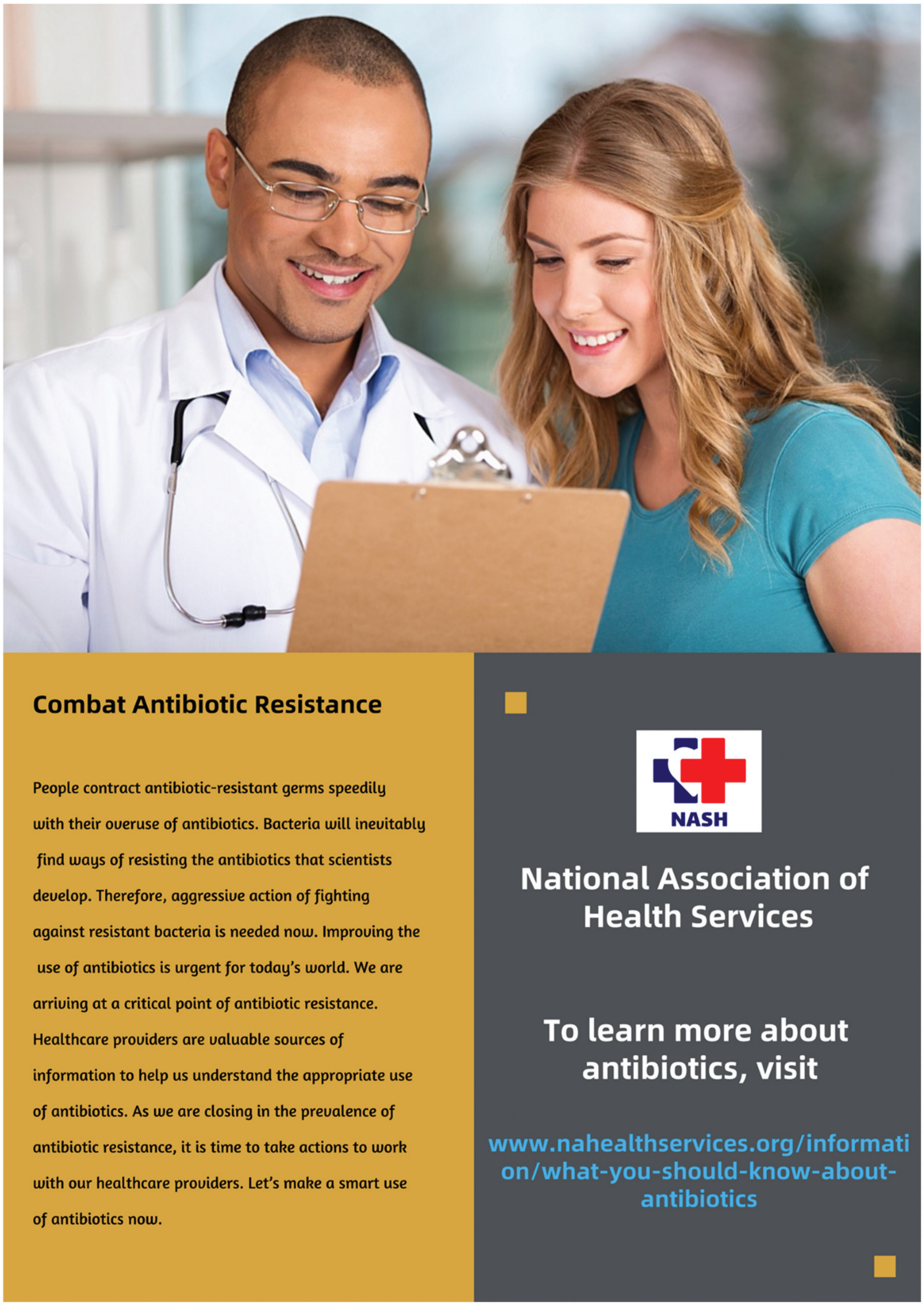
Educational fact sheet about antibiotic resistance for the human agency (threat)/ human agency (temporal)/taking antibiotics (imagery) experimental condition

Human Infection of Antibiotic-Resistant Germs

Antibiotic resistance, also referred to as antimicrobial resistance, is recognized as a growing global thereat. It happens when germs like bacteria and fungi develop the ability to defeat the drugs designed to kill them. People encounter urgent situations and serious consequences by contracting resistant bacteria. We are fast approaching the era of antibiotic resistance. People spread the associated resistant bacteria with remarkable speed across continents. Each year in the U.S., at least 2 million people catch serious forms of antibiotic-resistant bacteria and at least 23,000 people die. Patients' many more conditions can get complicated with an antibiotic-resistant germ. The associated infection demands prolonged and/or costlier treatments, extends hospital stays, necessitates additional doctor visits and healthcare use, and results in greater disability and death.

Contraction of Antibiotic-Resistant Germs

We are quickly moving into an epidemic phase of antibiotic resistance. People can pick up antibiotic-resistant bacteria at any stage of life, as well as healthcare, veterinary, and agriculture industries, which make them encounter one of the world's most pressing public health problems. Specifically, antibiotics are commonly used in food animals to prevent, control, and treat disease, and to promote the growth of food-producing animals. Like human contraction, food animals can get antibiotic-resistant bacteria. Further, people can be infected through their contact with contaminated food animals or eating animal products. More than 400,000 Americans get sick every year via contracting two common antibiotic resistant bacteria - Salmonella and Campylobacter - spread through food. The other major factor in the growth of antibiotic resistance is people spreading the resistant strains of bacteria speedily from person to person, or catching the bacteria from non-human sources in the environment.


Combat Antibiotic Resistance
People contract antibiotic-resistant germs speedily with their overuse of antibiotics. Bacteria will inevitably find ways of resisting the antibiotics that scientists develop. Therefore, aggressive action of fighting against resistant bacteria is needed now. Improving the use of antibiotics is urgent for today's world. We are arriving at a critical point of antibiotic resistance. Healthcare providers are valuable sources of information to help us understand the appropriate use of antibiotics. As we are closing in the prevalence of antibiotic resistance, it is time to take actions to work with our healthcare providers. Let's make a smart use of antibiotics now.
NASH
National Association of Health Services
To learn more about antibiotics, visit
www.nahealthservices.org/information/what-you-should-know-about-antibiotics