The Impact of Evidence Type and Message Framing on Promoting HPV Vaccination in Online Health Communities

Xiaoting Xu^{1[0000-0003-3536-8983]}, Mengqing Yang^{1[0000-0002-6401-2268]}, Yuxiang (Chris) Zhao^{2[0000-0001-9281-3030]}, and Qinghua Zhu^{1[0000-0002-4879-399X]}

¹ Nanjing University, Nanjing 210023, China
² Nanjing University Of Science And Technology, Nanjing 210094, China xxt9337@163.com

Abstract. Message features and type are crucial in health-related communication, especially due to the potential impact these messages can have on an individual's health. This study uses a 2 × 2 experimental design (evidence type: statistical evidence vs. narrative evidence; message framing: gain-framed message vs. loss-framed message), to investigate how evidence type and message framing affect the attitudes, health beliefs, and intentions of college students in online health communities, regarding getting the HPV vaccination. Preliminary results (N=300) indicated that; (1) evidence type and message framing both influence attitudes and intentions significantly; Statistical evidence will lead to more favorable views than narrative evidence, and loss-framed messages will lead to more favorable views than gain-framed messages. (2) Concerning the interactions, we used construal level theory and found that, for gain-framed message, narrative evidence will lead to more favorable attitudes, free intentions, perceived benefits and barriers of HPV vaccination than statistical evidence; for loss-framed message, statistical evidence will lead to more favorable attitudes, intentions, perceived seriousness, benefits and barriers of HPV vaccination than narrative evidence.

Keywords: Evidence Type, Message Framing, Construal Level Theory, HPV, Online Health Communities.

1 Introduction

Human papillomavirus (HPV) is the most common sexually transmitted infection and is the main cause of cervical cancer and genital warts. In recent years, the incidence and mortality of HPV associated cancers have been increasing. In 2008, cervical cancer was within the top ten (Bray et al., 2018). The HPV vaccination has been shown to have a high efficacy in preventing an HPV infection and has attracted worldwide attention. However, despite this having the potential to alleviate the high incidence and mortality rates, public acceptance of the HPV vaccine is not satisfactory, especially among young adults (Centers for Disease Control and Prevention [CDC], 2012). According to the CDC, only 1/4 of people have received HPV vaccines in the United States (CDC, 2015). Additionally, in China, women aged between 30 to 40 had 0.4% screening rate (Beijing Municipal Science & Technology Commission [BMS&TC], 2018). So, vaccination rates are dangerously low, which should be of great concern.

Online health communities (OHCs) can help users access professional health knowledge, promote the dissemination of information and publicize prevention and screening programs. OHCs can guide users with health management, which attracts health-conscious users. (Lamberg, 2003; Lu & Zhang, 2019). Haodf.com (OHC) alone has more than 3 million visitors per day (Haodf, 2019). OHCs play an important role in guiding individuals with health management, education, etc. Especially as, the information found on online health communities tends to be reliable compared to other sources, mostly as it is from doctors (Nambisan, 2011), this makes OHCs very popular and trusted within China. As a controversial topic, HPV conversations are active across OHCs, for example, Haodf.com and chunyu.com. Doctors generate a lot of information about HPV daily, of which the messages are diverse. Therefore, scholars are exploring how the structure, type, and organization of the information itself affects persuasion behavior.

Using literature review, we found that message framing has proven a persuasive factor in health communication promotion (e.g., Rothman & Salovey, 1997; Rothman, Bartels, Wlaschin & Salovey, 2006; Gallagher & Updegraff, 2012; Updegraff, Brick, Emanuel, Mintzer & Sherman, 2015). Emphasizing the benefit of taking action seen with gain-framed messages (e.g., exercising can reduce the risk of heart disease), while conversely the cost of not taking action as seen in loss-framed messages (e.g., not keeping exercising can increase the chance of heart disease) (Rothman & Salovey, 1997). The result shows that individuals make different choices according to gainframed/ loss-framed message use (Detweiler, Bedell, Salovey, Pronin & Rothman, 1999). Equally, due to the influence of the readers' personality, studies about message framing may be inconsistent (O' Keefe & Jensen, 2006, 2007, 2008, 2009). In addition, evidence type also meaningfully impacted persuasion (Perloff, 2003; Kazoleas, 1993; de Wit, Das & Vet, 2008). Statistical evidence is based on abstract data. (Perloff, 2003) suggested empirical data is hard to argue against. Contrariwise, narrative evidence references specific people and events, which is subjective (Dahlstrom & Ho, 2012). A meta-analysis found that statistical evidence is often more persuasive than narrative evidence (Allen & Preiss, 1997), but some scholars doubt the persuasion effects relevance (Winterbottom, Bekker, Conner & Mooney, 2008). Building on this, current research focuses on the interaction between message framing or evidence type and another factor, such as message framing and behavior type (prevention vs. promotion behaviors) (Lee & Aaker, 2004), media channels (Lee & Cho, 2017), consideration of future consequences (CFC) (Liu, Yang & Chu, 2019) and so on. Evidence type has been combined with temporal framing (present-oriented vs. future-oriented messages) (Kim & Nan, 2019), narrative type (first-person or third-person) (Nan, Dahlstrom, Richards & Rangarajan, 2015), the recipients' values (Slater & Rouner, 1996), etc. Although interaction research is the focus of current scholars, few studies have covered the interaction between message framing and evidence type. This research, therefore, aims to explore how message framing, evidence type and the interacts to impact younger adults in OHCs, to determine what type of messages work best for persuasion in relation to the HPV vaccination.

2 Conceptual Background

2.1 Evidence Type

Previous studies have found that including favorable arguments in the information content can enhance persuasion (Reinard, 1988) namely, statistical evidence that emphasizes objective, abstract data and narrative evidence that reflects subjective, concrete experience (Perloff, 2003). For example, the 2018 global cancer statistics report found the highest incidence of lung cancer was (31.5%) and mortality (27.1%) in men, this report utilizes empirical data. However, an example of narrative messaging would be if, a woman with breast cancer detailed her personal experience, supported by background, characters, events, expressing her emotions, and providing advice. This sense of personal identity doesn't exist in statistical evidence (Kazoleas, 1993). The persuasion effect of these two types of messages is different; the narrative evidence is more instructive (Rothman & Schwarz, 1998). However, some studies believe that the persuasiveness effect depends on the consistency of the information and the receiver's values, when consistent, the statistical evidence is more credible. Conversely, impactful narrative evidence results in better persuasion (Slater & Rouner, 1996).

The effects of evidence type on attitudes and intentions are also different. Narrative evidence is more effective than statistical evidence at changing risk perception and vaccination intention in gay men infected with Hepatitis B (de Wit, 2008) and women's attitudes towards breast screening (McQueen, 2011). However, inducing female college students to change tanning bed behavior, statistical evidence is more persuasive (Greene & Brinn, 2003). But there is no difference when changing attitudes towards polio vaccination (Wilson, Mills, Norman & Tomlinson, 2005).

In this study, college students' overall knowledge is relatively high, and the statistical evidence supported by hard data may hold more weight, so we propose the following hypothesis:

Hypothesis 1(H1): Evidence type affects HPV vaccination, and statistical evidence will lead to more favorable attitudes and intentions towards HPV vaccination than narrative evidence.

2.2 Message Framing

Message framing has a more significant persuasive effect when preventing behaviors, specifically gain-framed vs. loss-framed messages. Message framing falls under the prospect theory (Kahneman & Tversky, 1979), which suggests that when people are exposed to negative consequences of actions, they seek risks, but when exposed to the positive consequences, they are more risk-averse (Tversky & Kahneman, 1981). A literature review revealed that health behaviors are moderated by message framing. The loss-framed messages were more effective in promoting behaviors, while the

gain-framed messages were more favorable in preventive behaviors (Rothman, Salovey, Antone, Keough & Martin, 1993; Rothman, Martino, Bedell, Detweiler & Salovey, 1999; Rothman, Bartels, Wlaschin & Salovey, 2006). A meta-analysis found that gain-framed messages were more effective in areas such as skin cancer prevention and smoking cessation, and loss-framed messages were more persuasive in areas such as mammography and colorectal cancer screening (Gallagher & Updegraff, 2012; Lipkus et al., 2019). Overall, gain-framed messages where more convincing for people at lower risk, vice versa for loss-framed messages (Updegraff, Brick, Emanuel, Mintzer & Sherman, 2015).

The effect of message framing on vaccination has a differing result. One view being, vaccination is a preventive behavior, therefore is more convincing on attitudes and intentions to emphasize gain-framed messages of vaccination than the impact of loss-framed messages on non-vaccination (Nan, 2012). On the other hand, some argue that vaccination is relatively high risk (Ball, Evans & Bostro, 1998), in which case loss-framed messages have a strong effect on intentions surrounding the HPV vaccination, especially when the participants were more sexually active. (Gerend & Shepherd, 2007; Nan, 2012). Equally, some studies have found that neither the gain nor loss-framed messages have a significant effect on intentions of receiving the influenza vaccination in the elderly (McCaul, Johnson & Rothman, 2002). Regarding, the HPV vaccine, college students tend to be cautious despite, the safety of the vaccine being the focus of the world health organization. In conclusion, we propose the following hypothesis:

Hypothesis 2(H2): Message framing affects HPV vaccination, and loss-framed messages will lead to more favorable attitudes and intentions towards HPV vaccination than gain-framed messages.

2.3 Interaction of Evidence Type and Message Framing

Evidence type and message framing make for mixed results on attitudes/intentions. However, the literature review indicates that there is a potential interaction between the two. Construal level theory (CLT) is a psychology theory, which states that individuals have differences in psychological distance, (comprised of time and social distance). A person's thinking is abstract or concrete, determined by psychological distance. Abstract plans/thoughts are complex and unstructured and demand high distance thinking, vice versa for simple and structured goals (Liberman & Trope, 1998; Trope & Liberman, 2000). Studies suggest narrative evidence involves events, characters emotions, which is correlated with low-level construal thinking. Whereas, statistical evidence contains abstract data, which requires high-level construal thinking (Kim & Nan, 2019). High-level construal thinking is related to long-term goals and abstract results, while low-level construal thinking looks at immediate temptations and concrete details (Fujita, Trope, Liboman, Levinsagi, 2006; Szeles, 2016). For example, individuals with high-level construal are more willing to choose apples, while those with low-level construal tended to choose high-calorie candies for shortterm satisfaction (Fujita & Han, 2009).

We can tentatively conclude, therefore, that gain-framed messages imply vaccination prevents an HPV infection, individuals have an immediate outcome, which is low-level construal. Loss-framed messages emphasize the cost of no vaccination, namely cervical cancer, therefore thinking in future terms, which is a high-level construal's view. According to the research conclusion of interaction between message framing and other factors such as behavioral frequency, racial identity, media choice, temporal framing and so on (Lee & Aaker, 2004; Lee & Cho, 2017; Gerend, Shepherd & Monday, 2008; Liu, Yang & Chu, 2019; Seoa &Park, 2019; Lucas, Manning, Hayman & Blessman, 2018), it indicates that the matched conditions resulted in better persuasion. As such, we hold that matching statistical evidence with loss-framed messages will lead to more favorable persuasive outcomes, and matching narrative evidence with gain-framed messages should lead to greater persuasive effects, so we propose the following hypothesis:

Hypothesis 3(H3):Evidence type and message framing will interact such that (a) for gain-framed message, narrative evidence will lead to more favorable attitudes and intentions to get HPV vaccination than statistical evidence and (b) for loss-framed message, statistical evidence will lead to more favorable attitudes and intentions to get the HPV vaccination than narrative evidence.

In addition, studies have found that evidence type and message framing can affect health beliefs, for example, statistical evidence can change beliefs demonstrated by (Baesler & Burgoon, 1994), hybrid evidence leads to higher perceived risk, and the first-person narrative type has a stronger effect on perceived risk than the third-person (Nan, Dahlstrom, Richards & Rangarajan, 2015), and the interaction of temporal framing and evidence type affect perceived efficacy and perceived severity of the HPV vaccine (Kim & Nan, 2019). For message framing, has a role in perceived susceptibility, perceived efficacy, anticipated regret, anticipated anxiety and so on (Nan, Maddena & Richardsb, 2016; Kim, Pjesivac & Jin, 2019; Kim, 2019). However, it is unclear, if or how the interaction between evidence type and message framing would impact specific health beliefs. And previous literature focused on attitudes and/or intentions as indicators of persuasive outcomes. No previous study has examined the interactive effects of evidence type and message framing on health beliefs. So our research question is:

Research Question 1(RQ1): will evidence type interact with message framing to influence specific health beliefs including perceived susceptibility, perceived seriousness, perceived benefits, and perceived barriers of the HPV vaccination?

3 Research Design

3.1 Participants and Procedure

The study uses a 2×2 (statistical vs. narrative evidence /gain-framed vs. loss-framed message) quasi-experimental design. For the sample selection, we recruited college students who self-identify as using OHCs and haven't received the HPV vaccine. We will tell them about the purpose of the study and brief knowledge around HPV before

the experiment begins. Since there are four separate questions, the participants are randomly assigned to one of the four experimental conditions.

The questionnaire is divided into three parts. The first part is personal information, the second part, included an interface that reflects HPV knowledge in online health communities, and in order to avoid the extraneous influence, such as authority bias, names and institutions will be hidden during the experiment presentation. After reading this message, participants need to answer some questions about health beliefs. The last part is about attitudes and intention surrounding the HPV vaccination. It took about 15 minutes for participants to complete the study.

3.2 Message Stimuli

According to the characteristics of evidence type and message framing and combining the form and structure of the HPV paper from online health communities, as wells as acknowledging prior studies (Gerend & Shepherd, 2007; Kees, 2011; Nan, Maddena & Richardsb, 2016), we designed four kinds of message stimuli. At the same time, in order to avoid the impact of the amount of information, the number of words was controlled at 284-294 words.

3.3 Key Measures

All variables were adapted from prior studies. (1) Attitude towards HPV vaccination was adapted from Orbell (2004). (2) Intention towards HPV vaccination adapted from Fishbein & Ajzen (2010). (3) Health beliefs. Four specific health beliefs where measured, which were adapted from Champion (1985), Champion (1999), McRee & Brewe(2010).

So the three dependent variables are attitudes, attentions and health beliefs. The five core control variables are gender, age, education, whether they had heard of HPV and whether they had heard of the HPV vaccination. To address the hypothesis and research question, we plan to conduct a series of analysis of covariance (ANCOVA). Partial results can be referred to the Appendix.

References

- Allen, M., & Preiss, R. W. Comparing the persuasiveness of narrative and statistical evidence using meta-analysis. Communication Research Reports, 14, 125-131 (1997).
- Bray, F., Ferlay, J., Soerjomataram, I., et al. Global cancer statistics 2018_ globocan estimates of incidence and mortality worldwide for 36 cancers in 185 countries. Ca Cancer J Clin, 0, 1-31 (2018).
- Ball, L. K., Evans, G., & Bostro, A. Risky business: Challenges in vaccine risk communication. Pediatrics, 101, 453-458 (1998).
- 4. Becker, M., H. (Ed.). The health belief model and personal health behavior. Thorofare, NJ: Slack (1974).
- Baesler, E., & Burgoon, J. The temporal effects of story and statistical evidence on belief change. Communication Research, 21, 582-602 (1994)

- Champion, V. Revised susceptibility, benefits, and barriers scale for mammography screening. Research in Nursing and Health, 22(4), 341–348 (1999).
- Champion, V L. Use of the health belief model in determining frequency of breast selfexamination. Research in Nursing & Health, 8, 373-379 (1985).
- Detweiler, J. B., Bedell, B. T., Salovey, P., Pronin, E., & Rothman, A. J. Message framing and sunscreen use: Gain-framed messages motivate beach-goers. Health Psychology, 18, 189-196 (1999).
- Dahlstrom, M. F., & Ho, S. S. Ethical considerations of using narrative to communicate Science. Science Communication, 34, 592-617 (2012).
- de Wit, J. B. F., Das, E., Vet, R. What works best: Objective statistics or a personal testimonial? An assessment of the persuasive effects of different types of message evidence on risk perception. Health Psychology, 27(1), 110 –115 (2008).
- 11. Fishbein, M., & Ajzen, I. Predicting and changing behavior: The reasoned action approach. New York, NY: Psychology Press (2010).
- Greene, K., & Brinn, L. S. Messages influencing college women's tanning bed use: Statistical versus narrative evidence format and a self-assessment to increase perceived susceptibility. Journal of Health Communication, 8,443-461 (2003).
- Gallagher, K. M., & Updegraff, J. A. Health message framing effects on attitudes, intentions, and behavior: A meta-analytic review. Annals of Behavioral Medicine, 43, 101-116 (2012).
- Gerend, M. A., & Shepherd, J. E. Using message framing to promote acceptance of the human papillomavirus vaccine. Health Psychology, 26, 745–752 (2007).
- Kim, J., & Nan, X. Effects of consideration of future consequences and temporal framing on acceptance of the HPV vaccine among young adults. Health Communication. Advance online publication, 31(9), 1089-1096 (2016).
- Kim, J., & Nan, X. Consideration of future consequences and HPV vaccine uptake among young adults. Journal of Health Communication, 20, 1033-1040 (2015).
- Kim, J. The Interplay of Message Framing and Consideration of Future Consequences on Energy Drink Consumption: Focusing on the Underlying Emotional Mechanism, Health Communication, DOI: 10.1080/10410236.2019.1613477 (2019).
- Kim, S., Pjesivac, I., Jin, Y. Effects of message framing on influenza vaccination: understanding the role of risk disclosure, perceived vaccine efficacy, and felt ambivalence. Health Communication, 34(1), 21–30 (2019).
- Kim, J., & Nan, X. Temporal framing effects differ for narrative versus non-narrative messages: The case of promoting HPV vaccination. Communication Research, 46(3), 401–417 (2019).
- Kahneman, D., & Tversky, A. Prospect theory: An analysis of decision under risk. Econometrica, 47, 263–292 (1979).
- 21. Lamberg, L. Online empathy for mood disorders: Patients turn to internet support groups. Journal of the American Medical Information Association, 289(23), 3073-3077 (2003).
- Lu, X., & Zhang, R. Impact of physician-patient communication in online health communities on patient compliance: Cross-sectional questionnaire study. Journal of Medical Internet Research, 21(5), 1-17 (2019).
- Lee, M. J., Cho, J. Promoting HPV vaccination online: message design and media choice. Health Promotion Practice, 18 (5), 645–653 (2017).
- Liu, S., Yang, J., Chu, H. Now or future? Analyzing the effects of message frame and format in motivating Chinese females to get HPV vaccines for their children. Patient Education and Counseling, 102(1), 61-67 (2019).

- Lipkus, I. M., Johnson, C., Amarasekara, S., et al. Predicting colorectal cancer screening among adults who have never been screened: Testing the interaction between message framing and tailored risk feedback. Journal of Health Communication, 24(3), 262-270 (2019).
- Liberman, N., & Trope, Y. The role of feasibility and desirability considerations in near and distant future decisions: A test of temporal construal theory. Journal of Personality and Social Psychology, 75(1), 5-17 (1998).
- Lee, A. Y., & Aaker, J. L. Bringing the frame into focus: The influence of regulatory fit on processing fluency and persuasion. Journal of Personality and Social Psychology, 86,205-218 (2004).
- Lucas, T., Manning, M., Hayman, Jr. LW., Blessman, J. Targeting and tailoring messageframing: the moderating effect of racial identity on receptivity to colorectal cancer screening among African–Americans. Journal of Behavioral Medicine, 41(6), 747–756 (2018).
- McQueen, A., Kreuter, M. W., Kalesan, B., & Alcaraz, K. I. Understanding narrative effects: The impact of breast cancer survivor stories on message processing, attitudes, and beliefs among African American women. Health Psychology, 30, 674-682 (2011).
- McCaul, K. D., Johnson, R. J., & Rothman, A. J. The effects of framing and action instructions on whether older adults obtain flu shots. Health Psychology, 21, 624–628 (2002).
- McRee, A. L., Brewer, N. T., Reiter, P. L., Gottlieb, S. L., & Smith, J. S. The Carolina HPV immunization attitudes and beliefs scale (CHIAS): Scale development and associations with intentions to vaccinate. Sexually Transmitted Diseases, 37, 234-239 (2010).
- Nan, X., Dahlstrom, M. F., Richards, A., Rangarajan, S. Influence of evidence type and narrative type on HPV risk perception and intention to obtain the HPV vaccine. Health Communication, 30(3), 301-308 (2015).
- Nan, X., Maddena, K., Richardsb, A, et al. Message framing, perceived susceptibility, and intentions to vaccinate children against HPV among African American parents. Health Communication, 31(7), 798–805 (2016).
- Orbell, S., Perugini, M., & Rakow, J. Individual differences in sensitivity to health communications: consideration of future consequences. Health Psychology, 23, 388-396 (2004).
- O'Keefe, D. J., & Jensen, J. D. Do loss-framed persuasive messages engender greater message processing than do gain-framed messages? A meta-analytic review. Communication Studies, 59, 51–67 (2008).
- O'Keefe, D. J., & Jensen, J. D. The relative persuasiveness of gain-framed and loss-framed messages for encouraging disease detection behaviors: A meta-analytic review. Journal of Communication, 59, 296–316 (2009).
- 37. Perloff R, M. The Dynamics of Persuasion (2nd ed.). Mahwah, NJ: Erlbaum(2003).
- Rosenstock, I. M. Why people use health services. Memorial Fund Quarterly, 44, 94-121 (1966).
- Rothman, A. J., Martino, S. C., Bedell, B. T., Detweiler, J. B., & Salovey, P. The systematic influence of gain- and loss-framed messages on interest in and use of different types of health behavior. Personality and Social Psychology Bulletin, 25, 1355–1369 (1999).
- 40. Rothman, A. J., Bartels, R. D., Wlaschin, J., & Salovey, P. The strategic use of gain- and loss-framed messages to promote healthy behavior: How theory can inform practice. Journal of Communication, 56, 202-220 (2006).
- Reinard, J. C. The empirical study of the persuasive effects of evidence: The status after fifty years of research. Human Communication Research, 1, 53–59 (1988),

8

- 42. Seoa, B. G., Park, D. H. The effect of message framing on security behavior in online services: Focusing on the shift of time orientation via psychological ownership. Computers in Human Behavior, 93, 357–369 (2019).
- 43. Szeles, S. Self-control & construal-level in food-related decisions of female college students. Towson University (2016).
- Slater, M. D., & Rouner, D. Value-affirmative and value-protective processing of alcohol education messages that include statistical evidence or anecdotes. Communication Research, 23, 210 –235 (1996).
- 45. Trope, Y., & Liberman, N. Temporal construal and time-dependent changes in preference. Journal of Personality and Social Psychology, 79, 876-889 (2000).
- Updegraff, J. A., Brick, C., Emanuel, A. S., Mintzer, R. E., &Sherman, D. K. Message framing for health: Moderation by perceived susceptibility and motivational orientation in a diverse sample of Americans. Health Psychology, 34, 20–29 (2015).
- Wilson, K., Mills, E. J., Norman, G., & Tomlinson, G. Changing attitudes towards polio vaccination: A randomized trial of an evidence-based presentation versus a presentation from a polio survivor. Vaccine, 23, 3010-3015 (2005).

Appendix

Table 1. Means and Standard Deviations Related to the interactions for attitudes and intentions

Message	Evidence	Attitudes		Intentions_free		Intentions_pay	
Framing	Туре	M (SD)	Р	M (SD)	Р	M (SD)	Р
Gain	Statistical	5.522(0.883)*	0.017	5.807(0.745)*	0.034	4.753(1.200)	0.395
	Narrative	5.630(0.679)*		6.113(1.019)*		5.261(1.422)	
Loss	Statistical	6.140(0.730)*	0.000	6.433(0.897)*	0.000	6.009(0.736)*	0.000
	Narrative	5.225(0.185)*		5.474(1.363)*		4.564(1.349)*	

Table 2. Means and Standard Deviations Related to the interactions for health belief

Message Framing	Evidence	Susceptibility		Seriousness		Benefits		Barriers	
	Туре	M (SD)	Р						
Gain	Statistical	3.657(1.396)	0.607	5.498(1.332)	0.756	5.272(1.084)**	0.043	4.651(0.930)*	0.079
	Narrative	4.160(0.931)		5.547(0.867)		5.470(0.555)**		4.895(0.895)*	
Loss	Statistical	4.302(1.405)	0.369	6.045(0.931)**	0.004	5.977(0.685)**	0.000	5.230(1.295)**	0.000
	Narrative	3.915(1.341)		5.555(1.136)**		5.532(0.842)**		4.113(1.019)**	