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Examining HPV Threat-to-Efficacy Ratios in the Extended Parallel Process Model

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The Extended Parallel Process Model (EPPM) posits that an effective fear appeal includes both threat and efficacy components; however, research has not addressed whether there is an optimal threat-to-efficacy ratio. It is possible that varying levels of threat and efficacy in a persuasive message could yield different effects on attitudes, beliefs, and behaviors. In a laboratory experiment, women ($n = 442$) were exposed to human papilloma virus (HPV) prevention messages containing one of six threat-to-efficacy ratios and one of two message frames (messages emphasizing the connection between HPV and cervical cancer or HPV and genital warts). Multiple mediation analysis revealed that a 1-to-1 ratio of threat to efficacy was most effective at increasing prevention intentions, primarily because it caused more fear and risk susceptibility than other message ratios. Response efficacy significantly mediated the relationship between message framing and intentions, such that participants exposed to a genital warts message reported significantly higher intentions, and this association can be explained in part through response efficacy. Implications for future theoretical research as well as campaigns and intervention research are discussed.

Communication researchers have long known that the most effective fear appeals accomplish two main goals: (1) emphasize the threat of a particular concern, and (2) foster a sense of efficacy to deal with that concern. In fact, several models that are used to develop and assess fear messages, while different in some capacities, all treat threat and efficacy as principle theoretical components, including the health belief model (Rosenstock, Strecher, & Becker, 1988), protection motivation theory (Rogers, 1975), the risk perception attitude framework (Rimal & Real, 2003), and the Extended Parallel Process Model (EPPM, Witte, 1994).

Despite general agreement about the centrality of threat and efficacy, few studies have explored the ways in which different threat-to-efficacy ratios impact receivers. Notice, for example, that a message can be manipulated to portray more threat, more efficacy, or equal levels of both. It is

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possible that varying levels of threat and efficacy in a persuasive message could yield different effects on attitudes, beliefs, and behaviors. Moreover, it may be the case that certain threat-to-efficacy ratios are more persuasive than others in specific contexts or situations.

To date, the majority of the work that has examined the issue of threat-to-efficacy ratios has been conducted using the EPPM. In a study exploring reasons for the success and failure of health campaigns, the authors found that campaigns addressing only efficacy may be more likely to fail and that in order to act, individuals must first feel threatened (Witte, Berkowitz, Cameron, & McKeon, 1998). Another study looked at two different types of messages, high threat/no efficacy and high efficacy/no threat, finding that messages that contained only an efficacy component were more effective among participants who previously reported high levels of fear (Gore & Bracken, 2005). However, these studies only explored whether the presence or absence of threat or efficacy components affects persuasive outcomes, as opposed to differing threat-to-efficacy ratios. Additionally, a meta-analysis of EPPM studies recommends that messages contain strong threat components and even stronger efficacy components to maximize persuasion (Witte & Allen, 2000).

Aside from these studies, no research has explicitly explored the relationship concerning the ratio of threat to efficacy in persuasive fear appeals. Thus, the primary focus of the current study is to investigate the relationship of threat and efficacy levels on persuasive outcomes. In particular, we explore how various threat-to-efficacy ratios impact college-aged females' intentions to vaccinate for human papilloma virus (HPV). HPV is an important context in which to investigate threat-to-ratio efficacy ratios, as vaccination among U.S. college-aged females (18- to 26-year-olds) remains low, about 10–12% (Grant, Kravitz-Wirtz, Breen, Tiro, & Tsui, 2009; Jain, Euler, Shefer, Lu, Yankey, & Markowitz; 2009); however in some countries, HPV vaccination rates are higher than 90% (Nelson, 2010).

In addition, the current study explores threat-to-efficacy ratios within the context of two different message framing strategies that are frequently used in HPV prevention efforts: messages emphasizing the relationship between HPV and cervical cancer, and messages emphasizing the relationship between HPV and genital warts. Previous survey research has shown that there are differing levels of awareness concerning the negative health effects of HPV. Although many people are aware of the connection between HPV and cervical cancer (around 83% of those unvaccinated, and 89% among the vaccinated), the knowledge that HPV can cause genital warts is less common (around 33% of those unvaccinated, and 45% among the vaccinated; Caskey, Landau, & Alexander, 2009).

It is possible that college-aged females may respond more favorably to one message framing strategy over another. For instance, a recent study has found that participants who had ever gotten diagnosed with genital warts were more likely to have gotten vaccinated for HPV (Bendik, May, & Parker, 2011). Similarly, those who perceived cervical cancer to be a serious disease were more likely to have gotten the HPV vaccine; however, there was no relationship found between the likelihood of developing cervical cancer and previous HPV vaccination (Bendik et al., 2011). On the other hand, cancer is often viewed as a distal outcome to exposure to a host of cancer-causing agents (e.g., indoor tanning beds and cigarette smoking). In fact, behavioral research in skin cancer prevention has found that by and large, the prospect of getting cancer is perceived as a distal, and therefore less influential, consequence of sunbathing (Pagoto, McCargue, Schneider, & Cook, 2004). Still, there has been little research directly comparing the effectiveness of HPV prevention campaigns framed as assisting in either cervical cancer prevention or genital warts prevention. Considering these issues, the current study utilizes the EPPM as a conceptual framework to investigate the effect of differing threat-to-efficacy ratios and message framing techniques on intentions to vaccinate for HPV.

EXTENDED PARALLEL PROCESS MODEL

At its core, the EPPM is a model that suggests several mediational relationships. The model states that upon viewing an external stimulus (e.g., a pamphlet, public service announcement [PSA], billboard, etc.), people will then engage in cognitive appraisals of susceptibility, severity, response efficacy, self-efficacy, and fear (Witte, 1994). These appraisals go on to affect subsequent outcomes, such as intentions and behavior. The current paper assesses these mediational relationships in the context of HPV prevention intentions.

Considering the variables in the model, previous research suggests that women perceive both cervical cancer and genital warts to be severe (Witte, Berkowitz, Cameron, & McKeon, 1998), yet there is no direct research that demonstrates that perceived severity of HPV is related to higher vaccination rates (Brewer & Fazekas, 2007). However, perceived susceptibility to HPV has been linked to vaccination uptake (Friedman and Shepeard, 2007). In regard to efficacy, research has found that both perceived self-efficacy and perceived response efficacy are predictors of vaccination. Caskey and colleagues (2009) report that cost and availability of the vaccine—which can influence self-efficacy—are predictive of vaccination intentions, and one study found that perceived effectiveness of the vaccine to prevent HPV was predictive of intentions as well (Gerend, Lee, & Sheperd, 2006).

MESSAGE RATIO

The idea of dose in the social sciences first appears in research that has biological origins: inoculation theory.

Inoculation theory suggests that giving individuals weakened "doses" of a message can foster resistance, so that those individuals may successfully counter stronger arguments on the same topic, an idea that is analogous to disease vaccination efforts (Anderson & McGuire, 1965). Although dose has been recognized as a potential source of influence in persuasive messages for about 50 years, to this day it remains an understudied message feature that deserves further scrutiny.

Conventionally, we can think of dose in terms of the quantity, strength, and/or length of a persuasive message to which one is exposed, or even the ratio of one particular construct to another within a persuasive message. For instance, previous EPPM research has addressed dose in terms of strength of a persuasive message (Witte, Berkowitz, Cameron, & McKeon, 1998); however, the EPPM offers a unique framework to study dose in terms of ratio. In this article, message dose is conceptualized as the ratio of threat to efficacy in persuasive HPV prevention messages. Although message ratio has always been an implicit variable in fear appeals research, little work has been conducted investigating how different ratios of message components influence persuasion.

In essence, previous research supports the notion that both threat and efficacy components are necessary to induce persuasion, yet no existing research has explored whether certain ratios of threat to efficacy are more effective than others. The current study attempts to rectify this by comparing various threat-to-efficacy ratio messages to a control fear appeal message, or what is referred to here as the "standard" EPPM message: a message containing one threat component and one efficacy component. In this study, ratio is operationalized as different doses (i.e., zero, one, two) of threat and efficacy across persuasive messages. In all, six different combinations of threat-to-efficacy ratios will be assessed.

MESSAGE FRAMING

As the HPV vaccine is designed to protect against cervical cancer and genital warts, interventions to increase vaccination uptake generally focus on one or both of those benefits. For example, Witte and colleagues (1998) found that fear appeals can be an effective tool to increase condom usage to stop the spread of HPV and subsequently genital warts; they contend that these campaigns can be most effective among sexually active individuals, and that an effort should be made to stress individuals' susceptibility to—and the severity of—genital warts.

However, in other cases, particularly the corporate marketing campaigns of Gardasil, the vaccine was framed in terms of its benefits in preventing cervical cancer. Rothman and Rothman (2009) assert that framing HPV prevention messages in this way may achieve two outcomes: (1) The sexual transmission of HPV is minimized, and (2) the threat of cervical cancer (as opposed to genital warts) to adolescents is maximized. A recent meta-analysis on gain-framed and loss-framed messages suggests that this may be a good strategy, as gain-framed cancer prevention messages—or those that stress the benefits of preventing cervical cancer —were found to be more effective than loss-framed cancer prevention messages (O'Keefe & Jensen, 2007). Focusing on the cancer preventive benefits of the HPV vaccine may increase parents' willingness to vaccinate their children, potentially yielding higher vaccination rates among adolescents. Still, framing HPV prevention messages in this way may have deleterious effects as well, serving to reduce the number of sexually active college students who are vaccinated, as cervical cancer may not be a proximal concern among female college students.

This study focuses on the cognitive and affective components of the EPPM that mediate, or explain the association between exposure to message framing and message ratio on subsequent intentions. As such, the following research questions are posed:

RQ1: Are threat-to-efficacy ratios directly related to intentions regarding HPV vaccination?
RQ2: Are threat-to-efficacy ratios indirectly related to intentions through fear (RQ2a), severity (RQ2b), susceptibility (RQ2c), self-efficacy (RQ2d), or response efficacy (RQ2e)?
RQ3: Is message frame directly related to intentions regarding HPV vaccination?
RQ4: Is message frame indirectly related to intentions through fear (RQ4a), severity (RQ4b), susceptibility (RQ4c), self-efficacy (RQ4d), or response efficacy (RQ4e)?

METHODS

Research Design

This study was a between-subjects experiment with participants randomly assigned to one of 12 conditions. The conditions were created by crossing two types of messages (cervical, genital warts) with six different threat-to-efficacy ratios, which are described in detail in the stimulus materials section.

Participants

The initial sample included 1086 undergraduate females from a large Midwestern university. From this sample, in total 442 participants, who during data collection had not begun or were not yet fully vaccinated for HPV, were included in this experiment. The average age of the sample was 20.0 years ($SD = 1.57$), ranging from 18 to 26. In all, 71.2% of participants were Caucasian ($n = 314$), 15.7% Asian ($n = 70$), 6.3% African American ($n = 28$), 2.5% Latino ($n = 11$), and 4.3% identified as other ($n = 19$). The HPV vaccination process involves three shots delivered

months apart. The vast majority, 92.1%, of participants had not begun the vaccination process ($n = 408$); 7.7% of participants were in the process but had not completed vaccination ($n = 34$). A decision was made to retain these participants in the sample and enter vaccination status as a covariate. Because the vaccine is delivered in a series of three shots over several months, persuasive communications may still be required to convince these participants to complete the vaccination process. Additionally, it was decided that race (African American vs. all others) should be added as a covariate to the analysis, as African American women in this sample were more likely to report higher intentions regarding HPV vaccination than others, which is inconsistent with a recent national survey on young adult HPV vaccination rates (Caskey, Tessler, Lindau, & Alexander, 2009).

Stimulus Materials

Participants were randomly exposed to one of six messages that framed HPV vaccination in terms of preventing cervical cancer, or one of six messages that framed HPV vaccination in terms of preventing genital warts. The six message conditions represented different threat-to-efficacy ratios. Each message contained zero, one, or two threat and efficacy components. All threat components included a severity statement and a susceptibility statement. All efficacy components included a self-efficacy and a response efficacy statement. An example of a threat-only, cervical cancer-framed message used in this study is: "HPV infection rates are highest in women between the ages of 14 and 24 (susceptibility). HPV types 6 & 11 cause nearly 90% of all cases of genital warts (severity)." The first ratio[1] condition was what can be considered a typical EPPM message consisting of one threat component and one efficacy component (1/1 ratio, referred to as "standard"). The second ratio contained one explicit threat component with no explicit efficacy components (1/0 ratio, referred to as "low efficacy"). The third contained one explicit efficacy component with no explicit threat component (0/1 ratio, referred to as "low threat"). The next two ratios explored contrasting ratios of threat-to-efficacy; an efficacy-intensive condition featuring one threat message and two efficacy messages (1/2 ratio, referred to as "high efficacy"), and a threat-intensive condition containing two threat messages and one efficacy message (2/1 ratio, referred to as "high threat"). The final ratio represented a double dose of the typical EPPM message, containing two threat statements and two efficacy statements (2/2 ratio, referred to as "overload"). Message testing was conducted within the population of interest to select optimal susceptibility, severity, self-efficacy, and response efficacy statements.

All materials were constructed by consulting with the Women's Oncology Research and Dialogue (WORD) group. Initially, 14 statements were developed for each EPPM message component (i.e., susceptibility, severity, self-efficacy, and response efficacy). These messages were pretested using 240 female college students to determine which evoked the highest levels of perceived susceptibility to HPV, severity of HPV, self-efficacy toward vaccination, and response efficacy toward vaccination. A median split was conducted, and the top-performing messages (i.e., high mean scores, low standard deviations) were used in the current study. This was done to be sure that the statements included in this study had similar effects on outcomes, to avoid possible confounding variables. When possible, the same message was used across both message framing conditions. For instance, the susceptibility statement "HPV infection rates are highest for women between the ages of 14 and 24" was used for both the genital warts and cervical cancer conditions. However, in some cases the messages needed to be slightly modified between conditions to remain factually correct. As an example, a response efficacy statement in the cervical cancer condition reads "The HPV vaccine recommended by the CDC is 98% effective at preventing HPV types 16 & 18" (which are the types that are associated with increased cervical cancer risk), and the comparable severity statement in the genital warts condition reads "The HPV vaccine recommended by the CDC is nearly 100% effective at preventing HPV types 6 & 11" (which are the types that are associated with increased genital warts risk). The messages were then entered into an online template that WORD developed.

Procedure

All participants were recruited through an online research participation system managed by the Department of Communication. All participants received extra credit in a communication class for their participation. Although all students were enrolled in a communication class, they were from a variety of majors on campus, as several communication classes are required for different majors on campus. Once enrolled in the study, participants were randomly assigned to view one of the 12 different stimulus messages and then respond to a Web-based questionnaire.

Measures

Items from a previous study using the EPPM (Witte, 2000) were modified for use in the current study. Five items were used to measure fear (e.g., *how much did this message make you feel frightened;* $\alpha = .93$). Three items were used to measure susceptibility (e.g., *I am at risk for HPV;* $\alpha = .87$). Three items were initially used to measure severity (e.g., *I believe that HPV is a severe health problem*), but removing

[1]Some may take issue with the term "ratio" used to describe the current operationalization of dose, as 1/1 and 2/2 are technically the same ratio, by conventional definitions of the term. Still, we argue that the term is appropriate in the current context as it emphasizes the dose of one component (threat) as compared to the dose of another (efficacy).

one item increased scale reliability from $\alpha = .79$ to $\alpha = .85$. Three items were initially used to measure self-efficacy (e.g., *I am able to get vaccinated for HPV*); however, scale reliability increased from $\alpha = .71$ to $\alpha = .83$ by removing one item. Three items were initially developed to measure response efficacy: *the HPV vaccine is important to limiting the spread of HPV, the HPV vaccine is effective at preventing cervical cancer,* and *the HPV vaccine is effective at preventing genital warts.* Originally, we had intended to use two items to measure response efficacy for each condition: the first and second item in the cervical cancer condition, and the first and third item in the genital warts condition. However, the reliabilities in each were unacceptable. This could be due to the fact that besides HPV, there are other factors that could contribute to both cervical cancer and genital warts. Thus, only the first item listed in the preceding group was used to assess response efficacy. Finally, five items were used to measure HPV prevention intentions, including *I plan on talking to my friends/family/doctor about HPV vaccination within the next 2 weeks, I plan on searching online for information about HPV within the next 2 weeks*, and *I plan on beginning vaccination for HPV within the next 2 weeks.* These items demonstrated acceptable internal reliability ($\alpha = .86$); therefore, they were combined together in an intentions scale. All responses were scored on a 7-point scale ranging from *strongly disagree* to *strongly agree.*

RESULTS

Message Ratio Analysis

To assess RQ1 and RQ2a–2e, the Hayes (2011) mediate macro for SPSS was used. Mediate is a tool that allows researchers to assess the effect of a categorical independent variable on outcomes with multiple mediators and covariates entered into the model. See Figure 1 for a visualization of the model tested. Indicator coding was used for this analysis, which compares all conditions of the ratio variable to a control condition. In this analysis, the standard (1/1) EPPM condition was used as a control to which the five other messages ratios were compared. The 95% confidence intervals (CIs) for mediation were estimated using bootstrapping procedures with 2000 resamples. See Table 1 for the bivariate correlations between all continuous predictor variables and intentions, and Table 2 for all direct and indirect relationships between message ratio and intentions.

There were no significant differences between message ratio conditions and the standard condition on intentions (RQ1). Although no direct effect was observed, there were four significant mediating relationships between message ratio and intentions (RQ2). Compared to the standard condition, the low threat (0/1) condition elicited significantly lower intentions in participants, and this association can be explained through fear, $b = –.111$, 95% CI [–.2317, –.0185]. The low threat condition elicited significantly less fear than the standard condition, which resulted in significantly lower intentions than the standard message condition.

Susceptibility was a significant mediator of the effect of three different message conditions on intentions: the low efficacy condition, $b = –.074$, 95% CI [–.1813, –.0034], the low threat condition, $b = –.107$, 95% CI [–.2278, –.0165], and the high efficacy condition, $b = –.070$, 95% CI [–.1661, –.0002]. In general, the low efficacy condition, the low threat condition, and the high efficacy condition resulted in significantly reduced intentions, and this association can be explained in part through susceptibility. These three conditions caused less susceptibility than the standard

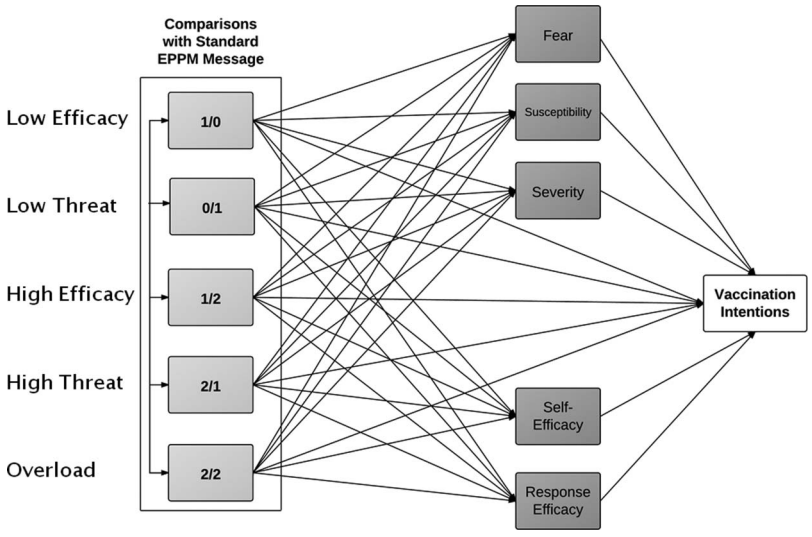

FIGURE 1 Assessing the variables of the EPPM as mediators of the association between message ratio and vaccination intentions, with race, vaccination status, and message framing entered as covariates.

TABLE 1
Bivariate Correlations

	Intentions	*Fear*	*Susceptibility*	*Severity*	*Self-Efficacy*	*Response Efficacy*
Intentions	—					
Fear	.25***	—				
Susceptibility	.26***	.27***	—			
Severity	.27***	.32***	.38***	—		
Self-efficacy	.09	.03	.14**	.20***	—	
Response efficacy	.24***	.16***	.18***	.37**	.28***	—

***$p < .001$; **$p < .01$.

EPPM message, which in turn resulted in significantly lower intentions than the standard message condition.

Message Framing Analysis

To assess RQ3 and RQ4a–4e, the Hayes (2011) mediate macro for SPSS was used. The 95% confidence intervals for mediation were estimated using bootstrapping procedures with 2000 resamples. In the model tested to address RQ3, messages framing (cervical cancer vs. genital warts) was entered as the predictor variable, the constructs of the EPPM (fear, susceptibility, severity, self-efficacy, and response efficacy) were entered as mediators, and intentions was entered as the dependent variable. Four covariates were entered into the model, race (African Americans vs. others), vaccination status (unvaccinated vs. incomplete vaccination), and two proxy measures of message ratio. To properly covary the effects of message ratio, six different dummy-coded conditions would have to be created and entered into the model as covariates. However, the statistical package utilized is only capable of handling four covariates. Thus, two variables were created to covary the effects of message ratio: threat component and efficacy component. Threat component scores ranged from 0 to 2, describing the amount of threat statements in a message. Likewise, efficacy component scores ranged from 0 to 2, describing the amount of efficacy statements in a message. See Table 3 for direct and indirect relationships between the message framing and intentions.

Regarding RQ3, there was no direct relationship found between message framing and intentions, $b = –.106$, $t = –0.87$, $p = .387$. Although there was no direct effect, there was a significant indirect effect (RQ4). Response efficacy significantly mediated the relationship between message framing and intentions, $b = .038$, 95% CI [.0015, .0891]. Those in the genital warts message condition were significantly more likely to perceive the vaccine as efficacious and that belief was related to vaccination intentions. In other words, the genital warts message condition was significantly more effective at increasing vaccination intentions through perceived response efficacy. Aside from response efficacy, no other variables (fear, susceptibility, severity, self-efficacy) functioned as a significant mediator of the relationship between message framing and intentions.

DISCUSSION

Despite the centrality of threat and efficacy components in the EPPM, previous research has not explored how exposure to intervention materials constructed with different threat-to-efficacy ratios impacts subsequent cognitions and emotion, which in turn influence outcomes. Mediation analysis was conducted to determine the cognitive and affective constructs most influenced by these materials, and in turn how those variables influenced intentions regarding HPV vaccination. Specifically, this study assessed six different threat-to-efficacy ratios to determine their impact on intentions regarding the HPV vaccine. Additionally, the effectiveness of framing HPV prevention messages in terms of the ability of the vaccine to prevent genital warts versus the ability of the vaccine to prevent cervical cancer was also assessed.

The efficacy of utilizing different threat-to-efficacy ratios was assessed. Five different threat-to-efficacy ratios were compared to the standard EPPM message of one threat component and one efficacy component. When looking at the entire relationship between message ratio, cognitive and affective mediators, and intentions, no message ratio outperformed the standard condition; however, there were several message ratios that resulted in reduced intentions compared to the standard condition.

In particular, the low threat (0/1) condition did not influence intentions as well as the standard condition, and this effect could be explained in part because the low threat message elicited less fear and susceptibility than the standard message. This makes, sense, as there was no explicit threat component in the low threat message, so any threat that participants might have felt was due explicitly to the threat that may be inferred from the efficacy statement, or possibly to their prior knowledge of HPV. This outcome is one that would be predicted in the EPPM. If one does not experience enough fear or threat related to the health outcome, it is likely that there will be no change in behavior (Witte, 1994).

TABLE 2
Direct and Indirect Effects for Message Ratio and Intentions

	Coefficient (SE)	*t*	*95%CI*
Direct effects			
Low efficacy (1/0)	407(.21)	1.93	—[a]
Low threat (0/1)	.201(.22)	0.92	—[a]
High efficacy (1/2)	.403(.21)	1.90	—[a]
High threat (2/1)	.370(.21)	1.75	—[a]
Overload (2/2)	.202(.21)	0.96	—[a]
Indirect effects			
Low efficacy			
Fear	.017(.03)	—	[–.0455, .0964]
Susceptibility	−.074(.05)*	—	[–.1813, –.0034]
Severity	−.023(.03)	—	[–.0902, .0251]
Self-efficacy	.001(.01)	—	[–.0223, .0333]
Response efficacy	.013(.04)	—	[–.0503, .0884]
Low threat			
Fear	−.111(.06)*	—	[–.2317, –.0185]
Susceptibility	−.107(.05)*	—	[–.2278, –.0165]
Severity	−.071(.04)	—	[–.1712, .0011]
Self-efficacy	.005(.02)	—	[–.0276, .0474]
Response efficacy	−.028(.04)	—	[–.1070, .0366]
High efficacy			
Fear	−.013(.03)	—	[–.0818, .0582]
Susceptibility	−.070(.04)*	—	[–.1661, –.0002]
Severity	−.030(.03)	—	[–.1051, .0169]
Self-efficacy	−.005(.02)	—	[–.0456, .0369]
Response efficacy	.005(.03)	—	[–.0589, .0745]
High threat			
Fear	.047(.04)	—	[–.0127, .1442]
Susceptibility	−.010(.03)	—	[–.0805, .0577]
Severity	−.008(.03)	—	[–.0754, .0465]
Self-efficacy	−.010(.03)	—	[–.0663, .0566]
Response efficacy	−.018(.04)	—	[–.0957, .0463]
Overload			
Fear	.040(.04)	—	[–.0243, .1282]
Susceptibility	−.013(.03)	—	[–.0827, .0576]
Severity	−.030(.03)	—	[–.1040, .0230]
Self-efficacy	−.005(.02)	—	[–.0470, .0343]
Response efficacy	−.007(.03)	—	[–.0635, .0793]
Covariates			
Race	−.544(.25)*	−2.16	—[a]
Vaccination status	.478(.24)*	2.03	—[a]
Message framing	−.105(.12)	−0.85	—[a]

Note. This table displays the direct effects and indirect effects of message ratio on intentions. The relationships displayed for each IV condition reflect its deviation from the standard EPPM condition, using the standard condition as a comparison. Those 95% confidence intervals that do not include 0 (null association) are significant at the $p < .05$ level.

[a]The macro used to test this model does not provide bootstrapped confidence intervals for direct relationships.

*$p < .05$.

TABLE 3
Direct and Indirect Effects for the Relationship Between Message Framing and Intentions

	Coefficient (SE)	*t*	*95%CI*
Direct effect			
Message framing	−.106(.12)	−0.87	—[a]
Indirect effects			
Fear	.031(.02)	—	[–.0048, .0880]
Susceptibility	−.002(.02)	—	[–.0378, .0320]
Severity	−.016(.02)	—	[–.0565, .0122]
Self-efficacy	−.001(.01)	—	[–.0215, .0190]
Response efficacy	.038(.02)*	—	[.0015, .0891]
Covariates			
Race	−.537(.25)*	−2.13	—[a]
Vaccination status	.447(.24)	1.90	—[a]
Threat statements	.048(.10)	0.48	—[a]
Efficacy statements	−.039(.09)	−0.43	—[a]

Note. The direct effect reflects the deviation between the genital warts condition and the cervical cancer (comparison) condition. Those 95% confidence intervals that do not include 0 (null association) are significant at the $p < .05$ level.

[a]The macro used to test this model does not provide bootstrapped confidence intervals for direct relationships.

*$p < .05$.

Additionally, the low efficacy (1/0) condition also yielded lower intentions when compared to the standard condition. However, this effect was opposite to what would be predicted by the EPPM. The EPPM states that a message that contains threat but no efficacy, or too little efficacy, will result in increased perceptions of fear and threat, and participants may ultimately reject or derogate the message in an effort to control their fear rather than the danger represented by the health threat. In the current study, the low efficacy message resulted in decreased susceptibility, rather than increased perceptions of susceptibility, which in turn resulted in decreased intentions. Although this appears inconsistent, one possible explanation is that participants reported reduced susceptibility as a form of defensive motivation, as specified in the EPPM (Witte, 1994). If participants did not feel the requisite efficacy to deal with the threat of HPV, perhaps they downplayed their own susceptibility to HPV as a means of dealing with the threat of the message. Alternatively, perhaps this outcome is due to psychological reactance (Brehm, 1966), or the act of rejecting a persuasive message that one believes is designed to restrict personal freedom. It may be possible that individuals who received a threatening message with no efficacy message experienced more reactance than participants in other conditions, leading them to reject the message and deny their susceptibility to HPV.

In spite of the fact that previous research has not often focused on the ratio of threat to efficacy in EPPM messages, one recommendation that researchers often give is to devote as much or more attention to efficacy as to threat (Witte & Allen, 2000). Yet in the current analysis, the high efficacy message (1/2) did not have as strong of a relationship with intentions as the standard EPPM message, and this relationship could be explained in part through susceptibility. Generally, the high efficacy message yielded lower perceptions of susceptibility than the standard message, which in turn resulted in lower intentions regarding HPV vaccination. One possible explanation for this finding, which is contrary to previous EPPM recommendations, is that perhaps

a message ratio of this magnitude—one threat component and two efficacy components—gives participants an inflated sense of security, and thus a reduced sense of the danger associated with HPV. After all, if it is an easy disease to prevent, does that diminish its potential threat in the minds of participants?

The influence of message framing on intentions was most affected by response efficacy. Specifically, the genital warts condition was associated with increased perceptions of response efficacy when compared to the cervical cancer condition, which in turn led to higher intentions in the genital warts condition than in the cervical cancer condition. Participants believed that the HPV vaccine is more likely to be able to prevent genital warts than cervical cancer. Consistent with the findings of Witte and colleagues (1998), these results suggest that campaigns would likely benefit from emphasizing the protection that the HPV vaccine offers concerning genital warts to a college-aged audience.

Limitations and Future Research

Possible limitations include the fact that response efficacy was operationalized with a one-item measure, which may have negatively impacted its predictive ability. Similarly, the operationalizations of self-efficacy and severity only consisted of two items each. Future research on this topic would benefit from more comprehensive construct measurements. Another limitation of the current study is that an HPV prevention intervention was conducted on campus during the semester before this study was conducted. This intervention could have limited the ability of the current study to detect differences between message framing conditions, as both cervical cancer and genital warts were addressed in that intervention.

This study presents preliminary evidence in support of investigating the effect of threat-to-efficacy ratios in health messages. Future work should explore how different threat-to-efficacy ratios can affect other outcomes, such as actual behavior. For instance, it remains to be seen whether the effects witnessed here hold up when actual vaccination rates are the outcomes of interest. Further study should also explore different message ratios as comparison groups. As an example, the current study explores the standard EPPM message as a comparison, yet how do the results change when one compares all messages to the overload condition? Perhaps there is something to be said for the more equals better hypothesis. Another area that should be pursued is the potential interaction between message framing and message ratio. Perhaps some message ratios work better in a cancer-framed message than a genital-warts-framed message, and vice versa.

Finally, the current study assesses the components of the EPPM as simultaneously and temporally indistinct; however, the model suggests that there may be an interaction between threat and efficacy variables, and that fear may act as a moderator in the model, determining whether individuals adopt the danger control process or the threat control process. Subsequent research should take this into consideration to determine the exact mechanism of effect that occurs between exposure to a persuasive message, cognitions and affect as a response to that exposure, and outcomes.

Conclusion

The current study assessed the relationship between message framing (cervical cancer vs. genital warts), threat-to-efficacy ratio, and intentions regarding HPV vaccination. Preliminary evidence suggests that future campaigns targeted at college women may be more successful if the connection between HPV and genital warts is emphasized, as participants believed that HPV is more efficacious in preventing genital warts than cervical cancer. Additionally, this study demonstrates that different threat-to-efficacy ratios in EPPM messages can have varying effects on intentions regarding HPV vaccination.

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REFERENCES

Anderson, L. R. & McGuire, W. J. (1965). Prior reassurance of group consensus as a factor in producing resistance to persuasion. *Sociometry*, 28, 44–56.

Bendik, M., Mayo, R., & Parker, V. (2011). Knowledge, perceptions, and motivations related to HPV vaccination among college women. *Journal of Cancer Education*, *26*, 459–464. doi:10.1007/s13187-011-0200-8

Brehm, J. W. (1966). *A theory of psychological reactance*. New York, NY: Academic Press.

Brewer, N. T., & Fazekas, K. I. (2007). Predictors of HPV vaccine acceptability: A theory-informed, systematic review. *Preventive Medicine*, *45*, 107–114. doi:10.1016/j.ypmed.2007.05.013

Caskey, R. C., Tessler Lindau, S., & Alexander, G. C. (2009). Knowledge and early adoption of the HPV vaccine among girls and young women: Results of a national survey. *Journal of Adolescent Health*, *45*, 453–462.

Friedman, A. L., & Shepeard, H. (2007). Exploring the knowledge, attitudes, beliefs, and communication preferences of the general public regarding HPV. *Health Education & Behavior*, *34*, 471–485. doi:10.1177/1090198106292022

Gerend, M. A., Lee, S. C., & Shepherd, J. E. 2006. Predictors of human papillomavirus vaccination acceptability among underserved women. *Sexually Transmitted Disease*, *33*(1), 1–4. doi:10.1097/01.olq.0000245915.38315.bd

Gore, T. D., & Bracken, C. C. (2005). Testing the theoretical design of a health risk message: Reexamining the major tenets of the extended

parallel process model. *Health Education & Behavior*, *32*, 27–41. doi:10.1177/1090198104266901

Grant, D., Kravitz-Wirtz, N., Breen, N., Tiro, J. A., & Tsui, J. (2009). One in four California adolescent girls have had human papillomavirus vaccination. *Policy Brief UCLA Center for Health Policy Research* (PB2009-3), pp. 1–6.

Hayes, A. F. (2011). Mediate. Unpublished manuscript. Retrieved from http://www.afhayes.com/public/mediate.pdf

Jain, N., Euler, G. L., Shefer, A., Lu, P., Yankey, D., & Markowitz, L. (2009).Human papillomavirus (HPV) awareness and vaccination initiation among women in the United States, National Immunization Survey-Adult 2007. *Preventive Medicine*, *48*, 426–431. doi:10.1016/j.ypmed.2008.11.010

Nelson, B. (2010). Lagging HPV vaccination rates dampen outlook in US. *Cancer Cytopathology*, *118*(3), 113–114. doi:10.1002/cncy.20084

O'Keefe, D. J., & Jensen, J. D. (2007). The relative persuasiveness of gain-framed loss-framed messages for encouraging disease prevention behaviors: A meta-analytic review. *Journal of Health Communication*, *12*, 623–644. doi:10.1080/10810730701615198

Pagoto, S. L., McChargue, D. E., Schneider, K., & Cook, J. W. (2004). Sun protection motivational stages and behavior: Skin cancer risk profiles. *American Journal of Health Behavior*, *28*, 531–541. doi:10.5993/ajhb.28.6.6

Rimal, R. N., & Real, K. (2003). Perceived risk and efficacy beliefs as motivators of change. *Human Communication Research*, *29*, 370–399. doi:10.1111/j.1468-2958.2003.tb00844.x

Rogers, R. W. (1975). A protection motivation theory of fear appeals and attitude change. *Journal of Psychology*, *91*, 93–114.

Rosenstock, I., Strecher, V., & Becker, M. (1988). Social learning theory and the health belief model. *Health Education & Behavior*, *2*, 175–183.

Rothman, S. M., & Rothman, D. J. (2009). Marketing HPV vaccine: Implications for adolescent health and medical professionalism. *Journal of the American Medical Association*, *302*, 781–786. doi:10.1001/jama.2009.1179

Witte, K. (1994). Fear control and danger control: A test of the extended parallel process model (EPPM). *Communication Monographs*, *61*, 113–134.

Witte, K. (2000). *EPPM: Examples of items*. Retrieved from http://www.msu.edu/~wittek/scale.htm

Wiite, K., & Allen, M. (2000). A meta-analysis of fear appeals: Implications for effective public health campaigns. *Health Education & Behavior*, *27*, 591–615. doi:10.1177/109019810002700506

Witte, K., Berkowitz, J. M., Cameron, K. A., & McKeon, J. K. (1998). Preventing the spread of genital warts: Using fear appeals to promote self-protective behavior. *Health Education and Behavior*, *25*, 571–585.