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"Vaccinations are Safe and Effective": Inoculating Positive HPV Vaccine Attitudes Against Antivaccination Attack Messages

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This study examined the use of two different inoculation messages to confer resistance to persuasive messages attacking the efficacy and safety of the human papilloma virus (HPV) vaccine. A three-phase experiment was conducted involving 110 participants to determine if young women who held positive attitudes toward the HPV vaccine could be inoculated against counterattitudinal attack messages using both a specific and generalized form of an inoculation message. Results found that inoculation treatments aimed at protecting positive attitudes toward vaccinations in general (i.e., all vaccines are safe and effective) were as effective at thwarting attacks on the HPV vaccine as the use of a more specific inoculation treatment (i.e., the HPV vaccine is safe and effective).

Keywords: Inoculation Theory; HPV Vaccination; Vaccine Safety; Vaccine Efficacy

Inoculation theory (McGuire, 1961; Papageorgis & McGuire, 1961) offers a compelling theoretical framework for thwarting influence attempts through the induction of resistance to persuasion (see Compton & Pfau, 2005 for a complete review). The combined function of motivating individuals to protect their attitudes by revealing the vulnerability of those attitudes to attacks and equipping them with arguments to respond to counterattitudinal challenges have been credited as the active ingredients in the inoculation process (Compton & Pfau, 2005; McGuire, 1961). Simply put, when individuals are informed they will encounter arguments that challenge their views on an issue,

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> a response analogous to inoculating with a weakened virus a person who has been raised in a germ-free environment would be expected to stimulate the person's belief defenses, thus making him or her better able to resist the subsequent massive exposure. (McGuire, 1961, p. 184)

Inoculation triggers threat, which in turn motivates counterarguing, and as a result, the person becomes more resistant to influence attempts.

Inoculation Theory and Health Behaviors

Inoculation is a strong metaphor for the resistance process, with the use of inoculation treatments shown to be an effective strategy at promoting resistance to influence in many persuasion contexts. For instance, inoculation treatments have effectively conferred resistance to negative health behaviors and protected positive attitudes about healthy behaviors from declining over time. Inoculation theory is tested within the vaccination context in the present study.

Pfau and van Bockern (1994) examined whether inoculation treatments could help confer resistance to smoking initiation among adolescents who held negative attitudes toward smoking. Inoculation treatments successfully helped to protect the negative attitudes adolescents had about smoking from declining at both year 1 following the administration of the inoculation pretreatment (Pfau, van Bockern, & Kang, 1992) and year 2 (Pfau & van Bockern, 1994). Further, Godbold and Pfau (2000) applied inoculation treatments to help confer resistance to peer pressure among adolescents to discourage alcohol use. Specifically, they inoculated nondrinking sixth graders with a normative inoculation message against drinking, as opposed to an informational or control message. Results indicated that those who received a normative inoculation message reported lower estimates of peer acceptance of alcohol and experienced less attitude change (i.e., remained negative about alcohol) than those who received the informational message or the control message (Godbold & Pfau, 2000).

HPV Vaccine Debate and Inoculation Theory

The HPV vaccine has been attacked in recent years concerning its safety and efficacy, following widespread news reports documenting cases of adverse reactions following HPV vaccinations in young women ranging from paralysis to death (Abdelmutti & Hoffman-Goetz, 2009; Fisher, 2012). Despite these reports, the public health community continues to recommend that young women receive the HPV vaccine as a means of protecting against cervical cancer, disseminating messages that argue the benefits of getting vaccinated against HPV far outweigh the potential costs of not getting vaccinated (Chao et al., 2012; Klein et al., 2012). In fact, the Centers for Disease Control and Prevention (CDC) and other health professionals have created messages aimed at dispelling the myths surrounding the HPV vaccine, often directly addressing the attacks launched by members of the antivaccine community (CDC, 2015a). This controversy thus provides the opportunity to conduct an applied test of inoculation theory within the vaccination context.

Specifically, two forms of the inoculation message are tested here. The first is a direct inoculation message (i.e., counterarguments focused on addressing attacks concerning the HPV vaccine) while the second was more indirect and broader in scope (i.e., counterarguments focused on attacks regarding vaccines in general). It is of interest to know whether a generalized inoculation message would work, given that such a message could help inoculate against attacks on other vaccines (e.g., HIV) that could be developed in the future. Multiple tests of inoculation theory have repeatedly confirmed the general immunizing effect of inoculation messages (Pfau & Burgoon, 1988; Pfau, Park, Holbert, & Cho, 2001; Pfau et al., 1997, 2003). As a result, it is likely that a generalized inoculation message protecting attitudes regarding a broad topic domain of vaccinations can effectively protect attitudes about a specific object of HPV vaccinations within the broader topic domain. Thus, two hypotheses are posited:

H1: Compared to controls, participants receiving the HPV vaccine inoculation treatment will report more positive attitudes and greater perceptions of safety and efficacy toward the HPV vaccine, and higher intent to get the HPV vaccine.

H2: Compared to controls, participants receiving the generalized vaccination inoculation treatment will report more positive attitudes and greater perceptions of safety and efficacy toward the HPV vaccine, and higher intent to get the HPV vaccine.

Method

Participants

Participants were 110 female students recruited from communication courses at a large southern university between the ages of 18 and 26 (M = 19.84, SD = 1.47) who had not completed any of the three required doses of the HPV vaccination. The majority of the participants were White (82.7%), followed by individuals who identified as Asian (5.5%), Black (5.5%), Native American (3.6%), and Hispanic (2.7%). Participants received course credit in exchange for their participation in the study. The university's Institutional Review Board approved the study.

Design

The study used a 1 × 3 between-subjects design, where all participants were exposed to two HPV vaccine attack messages (news reports of young women experiencing serious adverse reactions after getting the HPV vaccine) following exposure to one of two inoculation treatments (HPV vaccine inoculation, generalized vaccine inoculation) or to a control condition (no inoculation).

Procedures

A secure online survey collector collected the data for this three-phase study. During Phase 1 (initial screening), participants completed a brief survey to determine if they had

favorable attitudes toward the HPV vaccine. Only individuals reporting positive attitudes toward the topic (i.e., scored above the median) were allowed to participate because inoculation treatments reinforce existing positive attitudes. Before Phase 2, the remaining participants were randomly assigned to an inoculation message condition or the control condition. There was a 2-day delay between the administration of Phases 1 and 2. Participants were e-mailed a link that directed them to the assigned condition.

During Phase 2, participants were first asked to complete a set of pretest measures. Next, participants in the inoculation message conditions were exposed to the threat manipulation, followed by the inoculation messages. Participants in the control condition were exposed to neither the threat message nor the inoculation messages. Finally, counterarguing output was assessed for all participants. There was a 7-day delay between Phases 2 and 3. Participants were e-mailed a link that directed them to the appropriate experimental condition. During Phase 3, participants viewed two attack messages related to the safety and efficacy of the HPV vaccine. After participants viewed the news stories, they completed posttest measures and then were debriefed. In this debriefing, participants were told the news reports depicted rare incidents of severe adverse reactions, reassured the vaccine has been extensively tested and safety is continually monitored, and a link to the CDC website addressing HPV vaccine safety was provided (CDC, 2015b). The debriefing was done to mitigate potential harm for participants assigned to the control condition.

Experimental Materials

Threat Manipulation

To manipulate threat in the inoculation conditions, participants read a short message designed to warn them of a potential attack on their positive attitudes toward the HPV vaccine. Specifically, participants read a message that said, "Despite your positive attitude and feelings toward the HPV vaccine, there exists out there many reports and stories by the media and various interest groups aimed at attacking your attitude and feelings on this issue, and there is a real possibility that you will come into contact with these arguments in the near future, some of which are so persuasive that they may cause you to question your attitude and feelings toward getting the HPV vaccine." This threat message was modeled after those used in past inoculation studies (e.g., Ivanov, Pfau, & Parker, 2009; Pfau et al., 2009).

Inoculation Messages

Two news reports and two messages from the CDC served as the inoculation messages. One set of messages directly addressed the safety and efficacy concerns raised about the HPV vaccine. The other set of messages directly addressed the safety and efficacy concerns raised about vaccinations in general. The news reports were comprised of detailed media interviews with medical doctors who first talked about the concerns that they have heard raised by both parents and other interest groups regarding the HPV vaccine (e.g., unsafe, causes severe side effects, can be fatal). Then, the doctors provided reassurances of the safety and

efficacy of getting the HPV vaccine (e.g., very few adverse reactions to the HPV vaccine have been reported among millions of doses given, HPV vaccine is approved by the FDA and endorsed by the CDC, and HPV vaccine shown to prevent HPV infections in scientific studies), or vaccinations in general (e.g., vaccines would not be on the market if unsafe, side effects occur with all medications, vaccinations save lives) in response to these claims. The CDC messages reinforced the arguments provided in the news reports by dispelling common myths about the HPV vaccine or vaccinations in general.

Attack Messages

Real news reports served as the attack messages in this study. The clips came from an online search and featured a combination of both national CBS news reports and local CBS affiliate station news reports. Specifically, safety concerns about the HPV vaccine were highlighted in two news reports, one summarizing a few cases nationally of young women experiencing paralysis, severe pain, or death after receiving the HPV vaccine, and the other focused on a local case where a young girl was diagnosed with a serious chronic health condition (i.e., autoimmune disease) after receiving the HPV vaccine from her family doctor.

Measures

HPV Vaccine Attitudes

Burgoon, Cohen, Miller, and Montgomery's (1978) attitude instrument, consisting of seven-interval bipolar adjective items, measured participants' attitudes toward the HPV vaccine. The statement: "Your overall attitude toward getting the HPV vaccine is that it is" was followed by six adjective pairs: negative/positive, wrong/right, foolish/wise, good/bad, unfavorable/favorable, and unacceptable/acceptable (Burgoon et al., 1978). Scale reliability was very good for both the pretest (M = 5.44, SD = 1.41, α = .96) and the posttest (M = 4.34, SD = 1.53, α = .97).

Perceived Vaccination Safety

Five items adapted from Gerend, Lee, and Shepherd (2007) were included in the pretest and posttest to assess participants' perceptions of the safety of the HPV vaccine. A sample item includes "How concerned are you about the negative side effects that may occur to (you/your child) if (you/your child) received (the HPV vaccine/their vaccinations)?" (1 = "*not at all concerned*," 7 = "*very concerned*"). The reliability of this scale was good for both the pretest (M = 3.72, SD = 1.38, α = .87) and posttest (M = 3.67, SD = 1.44, α = .90).

Perceived Vaccination Efficacy

Four items adapted from Gerend et al. (2007) were included in the pretest and posttest in order to assess participants' perceptions of the efficacy of the HPV vaccine. Participants responded by indicating whether they believed the vaccination to be (1) "*not at all*

effective" to (7) "*very effective*" (e.g., "How effective do you feel the HPV vaccine is in protecting people against HPV?"). The reliability for the measure was very good for the pretest (M = 4.98, SD = 1.20, α = .94) and posttest (M = 4.67, SD = 1.36, α = .96).

Behavioral Intention

Behavioral intentions to get the HPV vaccine in the future were measured with three items adapted from Wong (2014). A sample item includes "How seriously will you consider getting the HPV vaccine in the next year?" on a 7-point scale from "*not at all*" to "*very seriously*." The reliability for the measure was very good for the pretest (M = 4.16, SD = 2.07, α = .98) and posttest (M = 3.72, SD = 2.08, α = .94).

Manipulation Checks

Threat

Bipolar adjective pairs used in earlier inoculation studies measured attitudinal threat. Participants were asked to rate on a 7-point scale the extent to which the possibility of having their attitudes toward the HPV vaccine attacked to be: safe/dangerous, unintimidating/intimidating, nonthreatening/threatening, not harmful/harmful, and not risky/risky (Pfau, Haigh, Sims, & Wigley, 2007; Pfau et al., 2009). The reliability of the threat measure was very good (M = 3.83, SD = 1.59, α = .95). Higher scores reflected greater perceived attitudinal threat.

Counterarguing Output

A thought-listing procedure measured participants' level of counterarguing (Brock, 1967). This procedure has been used in previous inoculation studies (e.g., Pfau et al., 1997). First, participants identified as many possible (up to 10) persuasive arguments as they could that opposed their favorable view of the HPV vaccine. Participants then listed as many as possible responses (up to 10) as they could to these counterattitudinal arguments. Next, participants evaluated the strength of the counterattitudinal arguments and their responses to the counterattitudinal arguments using a 7-point rating system, with higher values indicating a stronger argument. Combining both sets of information, overall counterarguing output regarding the HPV vaccine was calculated using the formula developed and used by Pfau et al. (2007): (Total # of counterattitudinal arguments × strength of counterattitudinal arguments)–(total # of responses to counterattitudinal arguments × strength of responses to counterattitudinal arguments). The larger the negative number, the greater the amount of counterarguing output.

Results

Table 1 provides a summary of the means and standard deviations for the pretest measures. All of the pretest measures served as covariates in the analyses. Bonferroni-adjusted pairwise comparisons tested specific hypotheses. Table 2 summarizes the

Table 1 Means and Standard Deviations for Pretest Measures

Dependent measure	*M*	*SD*
Attitude toward the HPV vaccine	5.44	1.41
Perceived safety of HPV vaccine	4.72	1.38
Perceived efficacy of HPV vaccine	4.98	1.20
Intent to get HPV vaccine	4.16	2.06

Table 2 Dependent Measures as a Function of Experimental Conditions

	Experimental condition		
	Control	HPV vaccine inoculation	Generalized vaccine inoculation
Dependent measure	(n = 37)	(n = 37)	(n = 36)
HPV vaccine attitudinal threat	2.91 $(1.43)_b$	4.42 $(1.41)_a$	4.21 $(1.56)_a$
HPV vaccine counterarguing	−1.73 $(4.17)_c$	−6.06 $(8.97)_a$	−4.31 $(2.91)_b$
Attitude toward the HPV vaccine	3.47 $(1.69)_b$	4.71 $(1.38)_a$	4.67 $(1.17)_a$
Perceived safety of the HPV vaccine	2.88 $(1.39)_b$	4.30 $(1.41)_a$	4.06 $(1.39)_a$
Perceived efficacy of the HPV vaccine	4.46 $(1.45)_b$	5.11 $(1.11)_a$	4.96 $(1.31)_b$
Intent to get the HPV vaccine	2.94 $(1.77)_b$	4.37 $(1.81)_a$	4.61 $(1.89)_a$

Note. All of the dependent variables except for counterarguing were measured using 7-point scales. Pretest measures for attitude, perceived safety and efficacy, and intent regarding the HPV vaccine were controlled for as covariates. Higher scores indicate more positive attitudes, greater issue involvement, perceived threat, perceived vaccine safety and efficacy, and intent. The larger the negative value for counterarguing, the greater the counterarguing output. Differing subscripts within rows are significantly different at $p < .05$ based on Bonferroni-adjusted pairwise comparisons.

results of pairwise comparisons across the three conditions on the various dependent variables.

Manipulation Check

The first manipulation check assessed the level of perceived attitudinal threat generated by the threat message. An independent samples t-test was performed on the data set with inoculation message condition (present/absent) as the independent variable and perceived attitudinal threat as the dependent measure. On average, participants who received an inoculation message reported feeling greater perceived attitudinal threat (M = 4.35, SD = 1.53, n = 73) than those who received no inoculation message during Phase 2 of the study (M = 3.44, SD = 1.64, n = 37), $t(108) = 2.87$, $p < .01$, $\eta^2 = .07$.

The second manipulation check determined whether the inoculation was effective and whether it yields findings consistent with past inoculation research. If successfully

manipulated, those who received an inoculation message should report significantly greater counterarguing output compared to those who received no inoculation message. An independent samples t-test was conducted with inoculation condition (present/absent) as the independent variable and counterarguing output as the dependent measure. Those who received an inoculation treatment reported greater overall counterarguing output ($M = -5.17$, $SD = 6.88$, $n = 73$) than those who received no inoculation treatment during Phase 2 of the study ($M = -1.78$, $SD = 3.65$, $n = 37$), $t(108) = -2.79$, $p < .01$, $\eta^2 = .07$.

Main Analyses

A multivariate analysis of covariance (MANCOVA) tested for a direct inoculation effect (i.e., matching of inoculation and attack messages) as well as an indirect inoculation effect (i.e., generalized immunization). All of the outcome measures related to the HPV vaccine (e.g., attitudinal threat, counterarguing output, attitudes toward the vaccine, perceived safety and efficacy of the vaccine, and HPV vaccination intent) were entered as dependent variables. Experimental condition served as the independent factor. Pretest measures of attitudes, perceived safety and efficacy, and behavioral intentions related to the HPV vaccine served as covariates. The overall model was significant, $F(12, 198) = 3.70$, $p < .001$, Pillai-Bartlett's $V = .37$. Pretest measures of perceived efficacy of the HPV vaccine, $F(6, 98) = 4.89$, $p < .001$, Pillai-Bartlett's $V = .23$, and HPV vaccine intention, $F(6, 98) = 6.38$, $p < .001$, Pillai-Bartlett's $V = .28$ were the only significant covariates.

Hypothesis 1

Compared to those not receiving the HPV vaccine inoculation message, H1 predicted the participants receiving the inoculation message would report more positive attitudes and perceptions of safety and efficacy toward the HPV vaccine, and higher intentions to get the HPV vaccine. Bonferroni-adjusted pairwise comparisons examining control and HPV vaccine inoculation condition means revealed that inoculated participants reported: more positive attitudes toward the HPV vaccine, $F(1, 72) = 11.74$, $p < .01$, $\eta^2 = .14$, greater perceptions of HPV vaccine safety, $F(1, 72) = 18.73$, $p < .001$, $\eta^2 = .21$, HPV vaccine efficacy, $F(1, 72) = 4.70$, $p < .05$, $\eta^2 = .06$, and greater intent to get the HPV vaccine, $F(1, 72) = 11.86$, $p < .01$, $\eta^2 = .14$. Adjusted means are shown in Table 2. H1 was supported.

Hypothesis 2

Compared to those receiving no HPV vaccine inoculation message, it was expected that participants inoculated about the safety and efficacy of vaccinations in general would be more resistant to attacks on the safety and efficacy of getting the HPV vaccine. This test of the general immunizing effect for inoculation messages was partially supported. Bonferroni-adjusted pairwise comparisons examining means between the control group and the generalized vaccination inoculation message condition revealed that those inoculated against attacks on the safety and efficacy of vaccinations in general reported: more positive attitudes toward the HPV vaccine, $F(1, 71) = 12.42$, $p < .01$, $\eta^2 = .15$, greater perceptions of

HPV vaccine safety, $F(1, 71) = 13.04$, $p < .01$, $\eta^2 = .16$, intent to get the HPV vaccine, $F(1, 71) = 15.25$, $p < .001$, $\eta^2 = .18$, and more counterarguing related to the HPV vaccine, $F(1, 71) = 9.34$, $p < .01$, $\eta^2 = .12$. However, the generalized vaccination inoculation condition did not differ from the control group in terms of perceived HPV vaccine efficacy, $F(1, 71) = 2.43$, $p = .12$. Adjusted means are reported in Table 2. H2 was partially supported.

Discussion

This study provided an applied test of inoculation theory within the vaccination context. Specifically, two forms of inoculation messages were examined: one that directly inoculated against attacks on the HPV vaccine, and the other inoculating against attacks on vaccinations in general. Hypothesis 1 tested the direct inoculation effect, whereby the inoculation message was designed specifically to refute the anticipated counterattitudinal arguments in the attack message. Consistent with past inoculation research, those who received inoculation pretreatments were less vulnerable to counterattitudinal attack messages compared to those that did not receive the inoculation pretreatments. Hypothesis 2 tested the general immunizing effect of inoculation asserted by Pfau and his colleagues (Pfau et al., 1997, 2001, 2003) that a generalized inoculation message aimed at protecting attitudes toward a broad topic domain (i.e., vaccinations) can be used to protect attacks on a specific topic within that domain (i.e., the HPV vaccinations). Consistent with past tests of the general immunizing effect, individuals exposed to generalized inoculation pretreatments aimed at eliciting counterarguing against attacks on the topic of vaccines in general were less susceptible to attacks against the HPV vaccine than individuals that were not inoculated.

Expanding beyond influences on protecting attitudes, the inoculation messages in this study were also somewhat effective at safeguarding individuals' initial perceptions of safety and behavioral intentions regarding vaccinations from attacks aimed at negatively altering those perceptions. Results showed that inoculation confers resistance to protect more than just a person's attitudes, but also other cognitions as well. In particular, results revealed that participants who received the inoculation pretreatments reported significantly higher intentions to get the HPV vaccine than those who did not receive the inoculation pretreatments following exposure to attack messages on the safety and efficacy of the HPV vaccine. This implies that inoculating against negative messages about vaccinations may be an effective strategy to help to bolster vaccination rates.

Study Limitations

This study is not without its limitations. First, counterarguing output was not assessed following the counterattitudinal attack message. It may be that when faced with a message that directly challenged people's beliefs about vaccinations (either the HPV vaccine or vaccines in general), that threat alone motivated a defensive response whereby people more strongly clung to their initial attitudes and beliefs as opposed to being impacted by the preemptive counterarguments provided in the inoculation

message. Measuring counterarguing output after exposing the participants to the attack messages would have provided a stronger indicator that the inoculation pretreatments was responsible for conferring resistance to influence.

Another limitation of this study was that I only looked at how a generalized inoculation treatment protected attitudes toward one specific vaccine, but not attitudes toward other vaccines (for the flu, meningitis, etc.) that could be attacked via different arguments. To more accurately test for the general immunizing effect of inoculation on vaccination perceptions, it would be important to look at whether we can replicate the results of this study examining people's attitudes toward other vaccines in future studies. Currently, we have only preliminary data to suggest that this can work.

Implications for Health Practitioners

The results of this study provide two important implications for public health practitioners. First, inoculation may be a very useful strategy to help people maintain their positive health beliefs and cognitions, as well as behaviors in the face of countermarketing messages that promote unhealthy lifestyles. If individuals can be forewarned that their positive beliefs about healthy behaviors could be challenged, and provided with refutational responses in advance, health consumers may become more resistant to advertisements that endorse unhealthy behaviors (e.g., alcohol or tobacco ads) or try to persuade people into thinking unhealthy products are healthy (e.g., fructose corn syrup is as healthy as natural sugar). One way that this could be done would be for public health educators to enact countermarketing advertisements similar to those used in the *Truth* campaigns to warn adolescents of the deceptive marketing practices that the tobacco industry will use to try to manipulate them to take up smoking (Zucker et al., 2000). The ads provide adolescents with the false claims they will likely hear from tobacco companies and offer counterarguments in the form of different truth messages that debunk the false claims (Zucker et al., 2000).

Second, this study demonstrated that an inoculation message designed to protect a person's *generalized attitude* toward a topic or behavior may be able to provide a blanket of protection for a person's attitudes toward specific topics that all fall within the same broad content domain. Practically, this would make it easier for public health practitioners to protect people's attitudes toward a variety of specific behaviors (e.g., drinking, unsafe sex, smoking) within a specific domain (i.e., risky behaviors) using a single inoculation message to thwart off attacks.

In conclusion, this study provides further empirical support of the general immunizing effect of inoculation messages (i.e., blanket of protection) found in recent inoculation studies (e.g., Parker, Rains, & Ivanov, in press). The data revealed both specific and generalized forms of inoculation treatments were effective at conferring resistance to anti-HPV vaccine messages through increasing counterarguing. Generalized inoculation treatments may be an effective message strategy for health communicators to use in combating health misinformation individuals are exposed to via

mass media or social networks. Inoculation messages could prevent individuals from choosing not to engage in positive health behaviors such as becoming an organ donor by dispelling myths about the organ transplantation process, or adopting negative health attitudes toward others such as those with mental illness by dispelling myths about bipolar disorder or depression. More work needs to be done in this area to further examine the boundaries of the blanket of protection offered by inoculation messages.

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