A Complex Calculus: How Message Format and Processing Route Coordinate to Influence HPV Vaccination Message Persuasiveness Among Young Adults

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A COMPLEX CALCULUS: HOW MESSAGE FORMAT AND PROCESSING ROUTE COORDINATE TO INFLUENCE HPV VACCINATION MESSAGE PERSUASIVENESS AMONG YOUNG ADULTS

by

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ABSTRACT

Human papillomavirus (HPV) infection may lead to cancer and genital warts yet can be prevented by a safe and effective vaccine recommended for individuals up to 26 years old. HPV vaccination rates remain low among college aged adults that represent a catch-up population still eligible to receive the HPV vaccine. This present study is a theory-based investigation employing the Heuristic Systematic Model to explore the effect of message format and processing route on attitude and behavioral intention in the context of HPV vaccination. Undergraduate students aged 17-26 years old (N = 261) from various majors (e.g., STEM, social sciences, humanities) participated in the study. An online message exposure experiment randomly assigned participants one of three messages in different message formats (i.e., accessible, scientific jargon, scientese) promoting HPV vaccination to examine the persuasive potential of clearly worded messages (i.e., accessible message), appropriately used scientific language (i.e., jargon message) and inappropriately used scientific terminology (i.e., scientese message) and the effect of processing route on attitude and behavioral intention pertaining to HPV vaccination. Additionally, the potential impact of scientific literacy was investigated. The three experimental conditions were compared to the control condition that corresponded to no message exposure. Quantitative data analyses revealed the scientese message was associated with higher intention to receive the HPV vaccine than the simply worded message among systematic processors only. Further, systematic processing was related to more favorable attitude toward the message and greater intention to obtain the vaccine. Findings of the current study can help inform future message development to design targeted persuasive messages aiming to encourage vaccination in an effort to augment HPV vaccination rates among the catch-up population.

DEDICATION

To my parents, Thierry and Danielle Boutemen who have immensely encouraged and supported me in so many ways and have always believed in me. I love you.

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CHAPTER ONE: INTRODUCTION

The construction of effective health messages is essential as these messages may help prompt behavior change. This present thesis focuses on the potential effects of health messages in the context of HPV vaccination. Human papillomavirus (HPV) infection is a current and important health issue as it can lead to various types of cancer (e.g., cervical, vaginal, penile) and genital warts, but can also be prevented by a safe and effective vaccine (Centers for Disease Control and Prevention [CDC], 2017). HPV infection is the most prevalent sexually transmitted infection and currently affects about 79 million individuals in the United States. Approximately 14 million new cases are diagnosed each year (CDC, 2017). Only about 50% of college students in the United States report being immunized against the virus (American College Health Association [ACHA], 2015). This is alarming as the HPV vaccine is recommended for young adults up to 26 years old (CDC, 2017) and was found to be safe and effective (CDC, 2017; Fu, Bonhomme, Cooper, Joseph, & Zimet, 2014). Therefore, young adults who are unvaccinated against HPV are eligible for catch-up vaccination until they reach 26 years old. Few studies have focused on this catch-up population that is likely to make decisions concerning HPV vaccine uptake independently from their parents (Barnard, George, Perryman, & Wolff, 2017). Consequently, focusing on message development targeting young adults as a strategy to help increase HPV vaccine uptake rates among the catch-up population, rather than interpersonal communication with parents, may be an effective approach to reach this goal.

Individuals exposed to persuasive messages use different strategies to process information presented in such messages. Specifically, the Heuristic Systematic Model, also known as HSM, posits message recipients process information utilizing the systematic or heuristic processing routes (Chaiken, 1980). The former relies on in-depth analysis and leads to

more stable attitude, while the latter relies on cues or cognitive shortcuts to evaluate information (Chaiken, 1980). The model further predicts systematic processing requires both ability (i.e., cognitive capacity) and motivation (i.e., a desire) to process information systematically (Chaiken, 1980; Chaiken, Liberman, & Eagly, 1989). It is important to better understand how message format and processing route may impact young adults' attitude toward HPV vaccination, intention to receive the vaccine, as well as how they perceive different types of messages, in order to provide an insight into possible strategies to create more effective and impactful messages targeting young adults.

This present study is a theory-based investigation focused on examining the effect of message format and message processing on attitude and behavioral intention in an emergent health context. An online message exposure experiment presented a message about HPV vaccination to college students and subsequently assessed attitude toward the message, attitude toward HPV vaccination, and intention to get immunized. In this experiment, participants were randomly assigned one of three messages (i.e., accessible, scientific jargon, scientese). The accessible message corresponded to information concerning HPV vaccination presented in plain language and simply worded, the scientific jargon message comprised scientific terms accurately utilized, and the scientese message incorporated scientific language employed inaccurately. Additionally, these three conditions were compared to the control condition (i.e., no message exposure).

The Heuristic Systematic Model (Chaiken, 1980) was the theoretical framework employed in the present study to assess how participants processed the message they read and whether systematic or heuristic processing would be associated with more positive attitude or greater intention to adhere to the recommended behavior (i.e., receiving the HPV vaccine).

Additionally, potential effects of participants' scientific literacy on attitude and behavioral intention were examined.

This present thesis proceeds by providing an overview of HPV and HPV vaccination before describing the importance of the formative research process, explaining the Heuristic Systematic Model (Chaiken, 1980), and examining the use and potential effects of scientific content (i.e., scientific literacy, scientific jargon, scientese). Then the methodology and results are presented before focusing on the discussion, where theoretical and practical implications are explicated.

CHAPTER TWO: LITERATURE REVIEW

Human Papillomavirus

Human papillomavirus, also known as HPV, comprises more than 150 viruses (CDC, 2016). HPV infection is pervasive and currently affects about 79 million people in the United States (CDC, 2017). Some strains of this sexually transmitted virus can lead to genital warts, while other strains can trigger different types of cancer, including cervical, vaginal and penile cancers (CDC, 2016). HPV infection is the most common sexually transmitted infection in the United States and about 14 million individuals acquire the virus each year (CDC, 2017). HPV infection was found to be the cause of about 90% of cases of cervical cancer (Fu et al., 2014), which is the fourth most prevalent type of cancer affecting women worldwide (Ferlay et al., 2015).

Since the HPV vaccine is effective only prior exposure to the virus, the CDC recommends this vaccine for pre-adolescents aged 11-12 years old before sexual debut (CDC, 2017). However, the vaccine can still be administered to young adults up to 26 years old, who represent a catch-up population, because young adults not previously exposed to the virus can be protected by the HPV vaccine. Gardasil®, Gardasil 9®, and Cervarix™ are three vaccines licensed by the United States FDA that help protect against HPV-related diseases (Hendry, Lewis, Clements, Damery, & Wilkinson, 2013; U.S. Food and Drug Administration [FDA], 2018). Gardasil® is effective against the types of viruses inducing more than 90% of warts (Bryan, 2007) and Cervarix™ is effective against those leading to approximately 70% of cervical cancer (Munoz et al., 2004). Full vaccination coverage implies being administered three doses over six months for individuals aged 15-26 (FDA 2018). Pre-adolescents aged 9-14 receive a two-dose series over a six to twelve months period (CDC, 2017).

Attitude toward HPV Vaccination

Previous research has examined attitude held by young adults toward HPV vaccination. A study where young women aged 18 - 26 years old (N = 50) were interviewed indicated some unvaccinated women considered the HPV vaccination was unnecessary if they were not sexually active, had few sexual partners, or were in monogamous relationships (Thompson, Vamos, Straub, Sappenfield, & Daley, 2017). Other studies reported similar results (Cohen & Head, 2013; Ratanasiripong, 2012). Further, Pitts and colleagues (2017) found some college aged males considered it was unnecessary to be immunized against HPV after commencement of sexual activity, and also viewed the vaccine as primarily targeting 11 to 12 year olds. Manika and colleagues (2014) also found college women to misperceive the HPV vaccine as not targeting individuals their age group. In contrast, other studies revealed young women may perceive HPV vaccination as necessary because of their uncertainty concerning their partner's sexual history (Thompson et al., 2017).

Furthermore, prior research revealed some variability in attitude concerning other aspects of the HPV vaccination. For example, young adults were found to perceive the vaccination as useful, beneficial, and favorable, regardless of their HPV vaccination status (Ratanasiripong, 2015; Staggers, Brann, & Maki, 2012), but also expressed concerns pertaining to HPV vaccine safety (Barnard et al., 2017; Staggers et al., 2012). A study that surveyed 383 undergraduate students aged 21 years old on average reported nearly half participants viewed the HPV vaccine as safe and effective against HPV infections (Barnard et al., 2017), but about 19% believed side effects would be associated with vaccine uptake, and 12% thought obtaining the HPV vaccine would be likely to lead to health problems.

Additionally, college-aged adults can hold negative attitude toward the HPV vaccination, as they associate this recommended behavior with sexually transmitted infection stigmatization

(Pitts, Stanley, & Kim, 2017). Further, engaging in conversations related to the HPV vaccination with peers and health care providers can be embarrassing for college students (Pitts et al., 2017). Receiving the HPV vaccination can also be associated with the fear of being negatively perceived by others (Bynum, Wright, Brandt, Burgis, & Bacon, 2009).

Intention to Receive the HPV Vaccine

Much prior research applied the theory of planned behavior and health belief model to explore factors that predict young adults' intention to get vaccinated against HPV. Using the theory of planned behavior, Catalano and colleagues (2017) found attitude toward the behavior and subjective norms to predict intention among unvaccinated young men aged 18-26 attending college, accounting for 58% of its variance. Other studies reported similar findings (Bennett, Buchanan, & Adams, 2012; Krawczyk et al., 2012; Ratanasiripong, 2015).

Studies utilizing the health belief model found perceived benefits of the vaccine to predict HPV vaccination intention (Bennett et al., 2012; Donadiki et al., 2014), self-efficacy, perceived susceptibility (Bennett et al., 2012; Grace-Leitch & Shneyderman, 2016) and perceived barriers (Donadiki et al., 2014). In other studies, participants cited various perceived barriers such as cost and health insurance coverage (Staggers et al., 2012; Fontenot, Collins, Charyk, & Sutherland, 2014), detrimental health consequences of HPV vaccine uptake (Fontenot et al., 2014; Krawczyk et al., 2012; Pitts et al., 2017; Staggers et al., 2012; Stephens, Tamir, & Thomas, 2016), stigmatization of the vaccine (Pitts et al., 2017), viewing HPV vaccination as unnecessary (Fontenot et al., 2014) and unsafe and ineffective (Cohen & Head, 2013). Importantly for the catch-up population, other misperceptions concerning the HPV vaccination identified as barriers were the belief the vaccine can only be administered to females (Fontenot et al., 2014) and college aged individuals are too old to receive the vaccine (Pitts et al., 2017).

Formative Research

Formative research is the first stage in the process of research evaluation of campaigns, and takes place before the creation of a campaign in order to increase the likelihood of campaign success (Atkin & Freimuth, 2013). According to Rogers and Storey (1987), a campaign "intends to generate specific outcomes or effects (2) in a relatively large number of individuals, (3) usually within a specified period of time, and (4) through an organized set of communication activities'' (p. 821). The evaluation process aims to increase campaign effectiveness through a three-phase process: formative, process, and summative evaluation (Atkin & Freimuth, 2013). The formative evaluation phase is followed by process evaluation that assesses whether a campaign is successfully implemented (Atkin & Freimuth, 2013). Last, the final stage of campaign evaluation, known as summative research, is conducted to gauge the actual effects and success of a campaign (Atkin & Freimuth, 2013).

Conducting formative research before designing and implementing health campaigns is a crucial phase that increases the chances of campaign success (Atkin & Freimuth, 2001; Noar, 2006). Formative research enables researchers to identify a specific target audience in the population, and determine and understand the behaviors adopted by this audience related to specific health issues, as well as assess the effectiveness and appropriateness of messages by pretesting them with this audience (Atkin & Freimuth, 2013; Noar, 2006). Further, different subgroups, or segments, of the target audience are identified, and campaigners opt for different strategies and messages to disseminate depending on the characteristics of each subgroup (Atkin & Freimuth, 2013). This preliminary evaluation of campaign materials helps prevent counterproductive effects among the target audience (Atkin & Freimuth, 2013). Essentially, formative research encompasses two stages: preproduction and production testing, also called pretesting (Atkin & Freimuth, 2001; Atkin & Freimuth, 2013). During both the preproduction

and pretesting stages, data can be collected quantitatively and qualitatively (Atkin & Freimuth, 2013) via surveys, focus groups, and interviews (Greene et al., 2016; Lambert, Bishop, Guetig, & Frew, 2014).

The preproduction phase aims to collect as much information as possible concerning the characteristics of the target audience (Atkin & Freimuth, 2013). Obtaining this information is then employed to determine effective strategies to guide the development of the campaign (Atkin & Freimuth, 2013). Specifically, data obtained in preproduction help identify and better understand problematic behaviors adopted by the target audience in order to determine specific actions that will be promoted in campaigns to prompt behavior change (Atkin & Freimuth, 2013; Noar, 2006). In order for the campaign to be effective, campaign designers should also determine the predispositions of the target audience, including its attitude (Atkin & Freimuth, 2013; Slater, 1996), interests, needs (Atkin & Freimuth, 2013; Wiehagen et al., 2007), knowledge, beliefs, potential misperceptions, and personal efficacy regarding the recommended behavior (Atkin & Freimuth, 2013). Additionally, preproduction allows identifying the channels to select when implementing the campaign to reach most effectively the target audience (Atkin & Freimuth, 2013; Noar, 2006). To do so, campaign designers have to discern audience preferences (e.g., traditional, new media) and sources influencing the audience in the context of interpersonal communication (Atkin & Freimuth, 2013). Data collected in the preproduction phase are then utilized to create draft messages tested in the pretesting phase of formative research (Atkin & Freimuth, 2013). For example, the previous section of this present paper, that discusses HPV, is based on previously collected data in preproduction research.

The pretesting stage attempts to reveal how the target audience perceives initial versions of messages, and helps predict whether these messages will be effective (Atkin & Freimuth,

2013). The current project is focused on this pretesting phase of formative research. The pretesting phase enables researchers to identify potential weaknesses of the messages and address them before implementing the campaign (Atkin & Freimuth, 2013). During pretesting, concepts that will be utilized to create messages are assessed, and then complete preliminary versions of messages are tested to determine whether they attract the target audience's attention, are understandable, personally relevant, and most importantly effective in influencing audiences to adopt the recommended response (Atkin & Freimuth, 2013). Testing messages also allows identifying their strengths and weaknesses, and ensuring they do not generate a negative sentiment among the audience (Atkin & Freimuth, 2013). The current study uses these pretesting formative research techniques to assess the persuasive impact of HPV vaccination messages in various formats. Additionally, it is important to investigate message processing to better predict persuasive potential.

Heuristic Systematic Model

The Heuristic Systematic Model (HSM) suggests individuals exposed to persuasive messages process the content to evaluate message validity (Chaiken et al., 1989). The model assumes two processes, known as systematic processing and heuristic processing, allow recipients to examine the validity of messages (Chaiken, 1980; Chaiken et al., 1989). When individuals process messages systematically, they focus on message content, especially argumentation and relevant information (Chaiken, 1980; Chaiken et al., 1989). Specifically, systematic processing utilizes cognitive capacities and critical-thinking skills to assess the validity of messages, and individuals using this processing mode usually recall more arguments from persuasive messages compared to those who process heuristically (Chaiken, 1980; Chaiken et al., 1989). Furthermore, when individuals process information systematically, they generally

use this processing route intentionally and in a controlled manner (Chaiken et al., 1989). For example, an individual considering HPV vaccination might intensely scrutinize relevant information, consult multiple sources, and contrast viewpoints when processing systematically.

Unlike systematic processing, heuristic processing does not rely on an examination of the argumentation, but rather uses shortcuts or cues present in the message to evaluate validity (Chaiken, 1980). Specifically, when processing information in a heuristic manner, individuals examine cues such as source identity, credibility, expertise, likability, and perception that the message is accepted by most individuals (Chaiken, 1980; Chaiken et al., 1989). Perceivers do not always use cues self-consciously; therefore, unlike systematic processing, heuristic processing can be either an automatic or an intentional and controlled process (Chaiken et al., 1989). Utilizing heuristic cues to evaluate message validity can be seen as employing cognitive shortcuts to efficiently form an opinion (Chaiken & Ledgerwood, 2012; Chaiken et al., 1989). In the context of HPV vaccination, an individual relying on heuristic processing may view his or her physician as an authority possessing expertise, and simply take the physician's recommendation regarding HPV vaccination without carefully scrutinizing HPV vaccination message content.

Additionally, a distinction between systematic and heuristic processing routes lies in the fact that the former can lead to persuasion when individuals consider the argumentation of the message is valid, whereas the latter can result in persuasion without necessarily accepting the argumentation presented in the message (Chaiken, 1980). For instance, an individual exposed to a message from the CDC promoting the HPV vaccine may process information heuristically and decide to receive this vaccine merely because the source of the message is the CDC, but without truly engaging with message content and thinking about the benefits of the HPV vaccination.

Conversely, another individual exposed to the same message may process the message systematically and decide to get immunized against HPV only after an in-depth analysis of the arguments presented by the CDC's message. The two processes also differ in that heuristic processing requires a limited use of one's cognitive capacity and critical-thinking, while the systematic strategy relies on in-depth analysis of information and demands more effort (Chaiken, 1980; Chaiken et al., 1989). Further, heuristic processing is a more rapid process compared with systematic processing (Chaiken, 1980; Chaiken et al., 1989), and attitudinal change reached through systematic processing lasts longer than that attained using heuristic processing (Chaiken, 1980).

Motivation and Ability

Since systematic processing requires more effort than heuristic processing to form an opinion, the HSM predicts individuals must be motivated in order to process information in a systematic manner (Chaiken et al., 1989). The model further assumes processors must have a high ability to process messages systematically (Chaiken et al., 1989). Moreover, if message recipients are under circumstances that diminish their ability to process content (e.g., constraint of time, limited expertise, reduced cognitive capacity), they will be less likely to engage in systematic processing, even if they are highly motivated to process information systematically (Chaiken et al., 1989). For example, an individual at his or her physician's waiting room before an appointment may see a message recommending HPV vaccination, and be highly motivated to analyze message content, but he or she may be distracted by other patients talking loudly, and not be able to focus on the message argumentation. This is an example of an individual being motivated, but not able to engage in systematic processing, thus resulting in heuristic processing. Systematic processing thus requires both motivation and ability (Chaiken, 1980; Chaiken et al.,

1989), and individuals who lack either motivation or ability will necessarily process heuristically. Additionally, the persuasiveness of heuristic cues is generally mitigated under the conditions where motivation and ability are both high, and enhanced when levels of motivation or ability are low (Chaiken et al., 1989). The Heuristic Systematic Model also posits engaging in systematic or heuristic processing may be explained by the sufficiency principle (Chaiken, 1980; Chaiken & Ledgerwood, 2012). The latter asserts message perceivers hold a certain actual level of confidence in their judgment and a desired level of confidence (i.e., sufficiency threshold) when assessing information validity. When the sufficiency threshold outweighs actual level of confidence, individuals produce more effort to form opinions and engage in systematic processing.

Other Dual Process Models

The Elaboration Likelihood Model (ELM) (Petty & Cacioppo, 1986) is another theory of persuasion, to some extent similar to the HSM (Carpenter, 2015), that also posits two processing routes can be employed when examining persuasive messages (Petty & Cacioppo, 1986). The ELM consists of the central route that corresponds to the systematic processing in the HSM and the peripheral route, analogous to the heuristic processing (Chaiken & Ledgerwood, 2012; Chen & Chaiken, 1999; Petty & Cacioppo, 1986). Important differences distinguish the HSM from the ELM (Chaiken & Ledgerwood, 2012). One difference lies in the fact that the HSM assumes individuals can employ simultaneously systematic and heuristic processing paths when assessing information presented in argumentative messages (i.e., concurrent processing) (Chaiken et al., 1989), whereas the ELM predicts the two processing routes cannot co-occur (Chaiken & Ledgerwood, 2012). The HSM is the theoretical framework used to guide this present research because it will allow determining whether participants process HPV vaccination messages

simultaneously systematically and heuristically. The HSM and ELM also differ in that the former assumes individuals generally prefer to expend less effort when assessing message validity to maximize their cognitive efficiency (i.e., the sufficiency principle). However, if recipients are concerned with drawing accurate conclusions from the information they process, they will be willing to expend more effort to reach their goal, privileging reliability over economy (Chaiken, 1980). Under these circumstances, individuals are more likely to process information systematically, if they possess high motivation and ability to do so (Chaiken, 1980). Additionally, the HSM predicts different types of involvement result in different effects, while the ELM posits all types of involvement result in similar effects (Carpenter, 2015).

Heuristics and Heuristic Cues

In the HSM, persuasion heuristics are considered to be knowledge structures learned and memorized by individuals (Chaiken & Ledgerwood, 2012; Chaiken et al., 1989). Persuasion heuristics correspond to beliefs or rules such as "messages delivered by experts are trustworthy", "people adhere to a message if they like its source", or "lengthy messages have a strong argumentation" (Chaiken et al., 1989). For example, if a message promoting the HPV vaccine contains a narrative and a photo of a good-looking young adult, individuals exposed to this message may like the source of the message, engage in heuristic processing, and favorably view HPV vaccination. These heuristics can be learned over time through experience, observations or education (Chaiken & Ledgerwood, 2012; Chaiken et al., 1989). Furthermore, heuristic cues are components that can be present in persuasive messages, such as source expertise and likability, and message length (Chaiken et al., 1989).

Message recipients can associate heuristic cues with persuasion heuristics to form opinions (Chaiken et al., 1989). Specifically, when individuals who have acquired such heuristics

are exposed to persuasive messages, these heuristics are likely to increase message persuasiveness (Chaiken et al., 1989). For example, if people notice experts repeatedly deliver accurate messages, these individuals may assume all experts will consistently convey reliable information. Therefore, these individuals are likely to adhere to messages conveyed by experts without examining or questioning their arguments. In this case, source expertise constitutes a heuristic cue for these individuals who strongly associate heuristic cue (i.e., source expertise) with persuasion heuristic (i.e., "experts are trustworthy") (Chaiken et al., 1989). Prior research suggests individuals employ persuasion heuristics to assess message validity merely if heuristics are available (i.e., present in memory) and accessible to them (i.e., ready to be retrieved), as well as if they consider these heuristics are reliable (i.e., relevant to the topic of the message) (Chaiken & Ledgerwood, 2012; Chaiken et al., 1989; Chen & Chaiken, 1999).

Assessing Systematic and Heuristic Processing Routes

Diverse methods have been employed in previous research to assess whether participants process information systematically or heuristically when examining messages. Many studies use thought-listing (e.g., Cacioppo, Von Hippel, & Ernst, 1997) where participants are asked to write in a limited time any thoughts they have related to the message they had been exposed to (Giner-Sorolla & Chaiken, 1997; Koh & Sundar, 2010; Nazione, 2016). Then, these data are coded to distinguish thoughts pertaining to systematic processing from thoughts related to heuristic processing (Giner-Sorolla & Chaiken, 1997; Koh & Sundar, 2010; Nazione, 2016). Utilizing self-reported perceptions of processing route is another method to measure systematic and heuristic processing modes (Griffin, Neuwirth, Giese, & Dunwoody, 2002; Kim & Paek, 2009; Neuwirth, Frederick, & Mayo, 2002; Trombo, 2002). These scales aim to assess the extent to which participants made an effort when examining the message (Griffin et al., 2002; Neuwirth et

al., 2002), the level of message relevance and perceived difficulty, the use of cognitive shortcuts (Neuwirth et al., 2002), whether participants are attentive to the message (Trombo, 2002) and trust experts (Griffin et al., 2002; Neuwirth et al., 2002). In addition, systematic processing was assessed in prior studies using a knowledge questionnaire subsequent to message exposure (Smith et al., 2013; Smith et al., 2017). Heuristic processing was assessed by measuring Perceived Message Quality (Cacioppo, Petty, & Morris, 1983) and source credibility (Smith et al., 2013; Smith et al., 2017). It is important to understand how processing route would impact message persuasiveness, but there may also be other factors (e.g., scientific literacy) that influence this process as well.

Scientific Content

Scientific Literacy

Scientific literacy can be described as "the ability of the individual to read about, comprehend, and express an opinion on scientific matters" (Miller, 1983, p.30). Scientific literacy differs from health literacy in that the former involves knowledge and understanding of scientific terms and concepts (Miller, 2004), whereas the latter relies specifically on health-related terminology (i.e., medical terms). Prior research suggests a lack of scientific literacy skills prevails nationwide. A study indicated that only about 28% of adults are scientifically literate in the United States (Miller, 2016). That is, they are able to use and understand scientific information. Prior studies operationalized scientific literacy by measuring self-reported confidence in scientific ability (Smith et al., 2013; Smith et al., 2017) and knowledge about scientific terms and concepts (Brossard & Shanahan, 2006). Scientific literacy levels may influence processing route. Past studies reported self-assessed scientific literacy was positively

associated with systematic processing (Smith et al., 2013; Smith et al., 2017).

Scientific Jargon and Scientese

The use of scientific jargon (i.e., technical scientific terminology) and scientese (i.e., scientific jargon inappropriately employed) has been explored in studies focusing on message processing, message persuasiveness, and perceived credibility (Haard, Slater, & Long, 2004; Hample & Hample, 2014; Joiner, Leveson, & Langfield-Smith, 2002; van Mulken & Hornikx, 2011). Processing information containing technical scientific terms often requires scientific knowledge and high cognitive capacity (Haard et al., 2004). According to the HSM, message recipients who are not able or motivated to process systematically messages with scientific terms would utilize the heuristic route to evaluate the validity of these messages. Haard and colleagues (2004) suggest recipients can view scientific jargon incorporated in messages as a cue indicating the source is knowledgeable, which can increase source credibility. These recipients are thus likely to process messages with scientific jargon heuristically (Haard et al., 2004). Furthermore, Haard and colleagues (2004) found including scientese in messages that they define as "the use of scientific jargon to create the impression of a sound foundation in science for claims, without substantive empirical evidence to support the jargon used" (p.412), enhanced the persuasive effect of messages. Consistent with this finding, van Mulken and Hornikx (2011) found the presence of “scientese” in cosmetics advertisements augmented source credibility.

Furthermore, research by Haard and colleagues (2004) showed scientific jargon may increase messages' persuasiveness, but others have found it can also lessen recipients' understanding (Joiner et al., 2002). Hample and Hample (2014) found the use of scientific jargon did not influence credibility of the message or attitude toward the behavior promoted by the message. Their results also indicate message evidence increased source credibility, affected

attitude toward the message recommendations, and influenced risk perceptions. Additionally, Hample and Hample (2014) found the presence of scientific jargon in health messages can be viewed as scientific expertise, and augment their perceived credibility and persuasiveness. To investigate the effect of message format and processing on message persuasiveness, the following research questions were asked:

RQ1: How would message format (i.e., accessible, jargon, scientese) influence a) attitude toward the message, b) attitude toward HPV vaccination, c) intention to receive the HPV vaccine?

RQ2: How would processing route (i.e., systematic, heuristic) influence a) attitude toward the message, b) attitude toward HPV vaccination, c) intention to receive the HPV vaccine?

RQ3: For systematic processors, which message format (i.e., accessible, jargon, scientese) would be associated with a more positive a) attitude toward the message, b) attitude toward HPV vaccination, and greater c) intention to receive the HPV vaccine?

RQ4: For heuristic processors, which message format (i.e., accessible, jargon, scientese) would be associated with a more positive a) attitude toward the message, b) attitude toward HPV vaccination, and greater c) intention to receive the HPV vaccine?

Since little research examined HPV vaccination messaging targeting young adults eligible for the catch-up vaccination, more comprehensive formative research is necessary to help improve messaging and address this gap. It is crucial to investigate factors affecting attitude and intentions related to HPV vaccination among young adults in order to effectively communicate health information concerning HPV to this audience. Effective communication

could help increase vaccination rates and reduce the prevalence of HPV (Nan & Daily, 2015).

CHAPTER THREE: METHODOLOGY

The current study employed an online survey experiment to measure college students' processing route, when exposed to a message promoting HPV vaccination, with two different methods, attitude toward the message, attitude toward HPV vaccination, intention to obtain the HPV vaccine, level of scientific literacy, as well as relevant demographic information. The experiment included four conditions: the control condition (no message exposure) and the accessible message, jargon message, and scientese message conditions. A quantitative data analysis was then performed using the statistical software SPSS Statistics to obtain descriptive statistics, assess scales, and examine research questions.

Participants

College students (N = 261) were recruited at a large Southeastern university in various classes (e.g., communication, biology). Participation was voluntary, and participants received extra credit or were eligible to receive gift cards for taking part in the study. Participants were aged 17-26 years old (M = 20.47, SD = 1.86) and 55.3% were women and 44.3% were men. Of participants, 19.2% self-identified as Hispanic or Latino/a, 8.0% Black (non-Hispanic), 48.7% White (non-Hispanic), 13.8% Asian or Pacific Islander, 6.1% multiracial, and 4.2% other. Additionally, all participants were undergraduate students, including 20.8% Freshmen, 21.2% Sophomores, 36.5% Juniors, and 21.5% Seniors. Participants studied in various fields; specifically: 2.3% in the humanities (e.g., Art, English, History), 42.1% in STEM (e.g., Biology, Engineering, Medicine), 50.2% in the social sciences (e.g., Communication, Psychology, Sociology), 3.8% in Business, and 1.5% other. Participants also self-reported their current GPA: 26.1% ranged from 2.51-3.0, 34.5% in the 3.01-3.5 range, and 27.6% in the 3.51-4.0 range.

Regarding HPV and HPV vaccination, the majority of students indicated they had heard of HPV (79.3%) and a HPV vaccine (71.3%). Further, 14.9% of participants reported not having heard of HPV, and 16.5% not being aware a vaccine against HPV exists. Additionally, 5.7% of participants indicated being unsure they had heard of HPV, and 12.3% were unsure they knew about a HPV vaccine. Last, 56.3% of participants reported being unvaccinated and 43.7% were uncertain of their HPV vaccination status.

Procedure

The current study comprised two parts. First, two pretests were undertaken, and second, a survey experiment employed to measure variables of interest was distributed to college students. The two pretests, the survey, and all messages used in the study were reviewed and approved by the Institutional Review Board of the University before being distributed.

A first pretest was developed to verify participants in each of the three experimental conditions (i.e., accessible, jargon, scientese messages) would perceive the message they would examine as intended to be perceived when designed. That is, the pretest aimed to ensure participants would perceive the accessible message as presenting the information in a simple manner, the jargon message as incorporating sound claims regarding HPV vaccination, and the scientese message as being unsound. Pretest one was administered to college students at the same university where the study was conducted. After participants (N=117) completed this survey, results showed the pretest was successful only for the accessible message. Although the jargon message was viewed as more accurate and valid than the scientese message, the gap between perceived validity of information for both messages was not substantial. Furthermore, a weak scale reliability was obtained for the jargon message ($\alpha = 0.58$). Consequently, the messages and measures were revised and a second pretest was created. The second pretest was

administered to college students at the same university. Findings indicated participants (N = 95) perceived each message as intended and scale reliabilities were acceptable. All participants were exposed to the three messages in both pretest one and pretest two. Independent samples t-tests were performed for comparison between STEM and non-STEM participants for each message. All messages can be found in Appendix A, pretest one items and tests results (Table 9) in Appendix B, and pretest two items and tests results (Table 10) in Appendix C.

After analyzing pretest two to ensure the three messages could be utilized in the study, the link to the online survey experiment assessing all measures of interest was distributed to classes including students from various majors at the university. Data were collected among participants (N = 436) who were fully or partially vaccinated against HPV, unvaccinated, or unsure of their HPV vaccination status. In this sample, 30% of participants indicated they had received the full vaccination. Then, analyses were performed using the sample of unvaccinated and uncertain participants only (N = 261).

Participants completed the survey and were randomly assigned one of the four conditions (i.e., absence of message, accessible message, jargon message, scientese message). To ensure confidentiality, participants' responses were not associated to their names. Upon completion of the survey, students were redirected to a second survey that was completely unconnected to the first one where they were asked to provide their name, email address, and instructor's name to allow them to obtain extra credit and be eligible to receive gift cards. Data collection lasted ten days.

A total of 261 participants were randomly assigned one of the four conditions, with 76 participants in the control group (i.e., no message exposure), 63 participants exposed to the accessible message, 57 to the jargon message, and 65 to the scientese message. Since research

questions three and four examined systematic and heuristic processors, only participants exposed to messages (N = 185) were included in these analyses. Those who were in the control condition did not read any message, and thus were not asked to complete items pertaining to attitude toward the message and message processing.

Measures

The present study employed an online survey to randomly expose participants to a message (or lack thereof) and measure HPV and HPV vaccine awareness, attitude toward HPV vaccination, HPV vaccine uptake, intention to receive the HPV vaccine, attitude toward the message, systematic processing route, heuristic processing route, and scientific literacy. Although the Heuristic Systematic Model posits perceivers may engage in systematic, heuristic or concurrent processing when assessing information validity, the present study only included systematic and heuristic processing, as done in prior research (Griffin et al., 2002; Hitt et al., 2016; Neuwirth et al., 2002; Smith et al., 2013; Smith et al., 2017).

Additionally, participants' demographic information was obtained. All measures were self-reported, and all Likert type scales were five-point scales with 1 indicating less agreement and 5 more agreement unless otherwise noted. Participants in the control condition were not exposed to any message. Therefore, they were not asked questions pertaining to attitude toward the message and processing route (i.e., systematic, heuristic). The complete survey instrument can be found in Appendix D. The means, standard deviations, and scale reliability, assessed using Cronbach's alpha, for each scale are presented in Table 1.

Table 1

Means, Standard Deviations, and Cronbach's Alpha Coefficients for Systematic Processing, Heuristic Processing, Attitude Toward the Message, Attitude Toward the HPV Vaccination, Intention to Get Vaccinated, and Scientific Literacy

	M	*SD*	α
Systematic Processing	3.62	0.70	0.81
Heuristic Processing	2.70	0.93	0.85
Attitude Toward Message	3.82	0.76	0.89
Attitude Toward Vaccination	4.05	0.99	0.96
Intention to Get Vaccinated	3.13	0.91	0.93
Scientific Literacy	3.91	1.23	--

Demographic variables. Participants were asked to indicate their gender, age, race/ethnicity, year in school, field of study (i.e., humanities, STEM, social sciences, business, other), and college GPA.

HPV and HPV vaccine awareness. Participants were asked whether they had heard of HPV (i.e., "Have you ever heard of HPV?") and the HPV vaccine (i.e., "Have you ever heard of the HPV vaccine?") and selected "yes", "no", or "unsure" to answer these two questions.

Attitude toward HPV vaccination. To measure attitude toward HPV vaccination, a five-point semantic differential scale developed by Abhyankar, O'Connor and Lawton (2008) was utilized. The scale (M = 4.05, SD = 0.99, α = 0.96) comprised five bipolar adjectives (i.e., bad-good, harmful-beneficial, foolish-wise, threatening-assuring, risky-safe).

HPV vaccine uptake. To assess HPV vaccine uptake, participants were asked if they were

at least partially vaccinated (i.e., "Have you ever received any shot of the HPV vaccine?") (see Kim & Nan, 2015), or fully vaccinated (i.e., "Have you received the full vaccination?"). Participants answered both questions by selecting "yes", "no", or "unsure". Only participants who indicated being unvaccinated or unsure they had received the vaccine were included for analysis.

Intention to receive the HPV vaccine. Participants were asked whether they would intend to receive the HPV vaccine in the future. A five-item scale ($M = 3.13$, $SD = 0.91$, $\alpha = 0.93$) was adapted from Krieger and Sarge (2013) to measure intention to obtain the HPV vaccine. Items of this five-point Likert type scale included for example: "I plan to get the HPV vaccine."

Attitude toward the message. A Likert type scale adapted from Cho and Boster (2008) was employed to assess whether messages were positively or negatively perceived. The scale ($M = 3.82$, $SD = 0.76$, $\alpha = 0.89$) was composed of six items, for example: "I felt the message was convincing."

Systematic processing. To assess systematic processing, a Likert type scale adapted from Griffin and colleagues (2002) and Neuwirth and colleagues (2002) was utilized. The scale comprised seven items ($M = 3.62$, $SD = 0.70$, $\alpha = 0.81$) and included, for example, the item: "I am likely to think about how this HPV information relates to other things I know."

Heuristic processing. Heuristic processing was evaluated using a Likert type scale adapted from Griffin and colleagues (2002) and Neuwirth and colleagues (2002). The scale consisted of five items ($M = 2.70$, $SD = 0.93$, $\alpha = 0.85$) including "I only paid attention to the portion that seemed important."

Two methods were employed when establishing message processing route in the statistical analyses: first using the difference between scores for the systematic and heuristic

scales and second using median splits for each processing route. In the first method, for each participant, scores of the scale assessing heuristic processing was subtracted from those of the scale measuring systematic processing in order to create a new variable that reflected the difference in processing (i.e., systematic - heuristic) for each participant. In this new variable, individuals who processed the message more systematically than heuristically obtained positive values, whereas those who processed the message more heuristically than systematically obtained negative values. Participants with same scores on the five-point systematic and heuristic processing scales obtained zero in the difference in processing variable. Another variable was then developed to categorize primarily systematic and heuristic processors. That is, participants who received a positive value on the difference in processing variable were categorized as primarily systematic processors of the message to which they were exposed (N = 135), while those who obtained negative values were placed into the primarily heuristic processors category (N = 42). Those who obtained the value 0 were considered concurrent processors and were not included in the analyses.

In the second method, median splits were computed on the scales assessing systematic and heuristic processing. The median on the five point systematic processing scale was 3.71, and the median was 2.6 on the heuristic processing scale. A new variable (median systematic) was computed to categorize high and low systematic processors based on the median split. That is, values above 3.71 on the systematic processing scale were placed into "high systematic processors" in the median systematic variable, with a value of 1. Values below 3.71 on the systematic processing scale were entered into the "low systematic processors" category in the median systematic variable, with a value of 0. The same procedure was undertaken for heuristic processing, with the new variable median heuristic, with a split at 2.6 on the heuristic processing

scale. In the median heuristic variable, "high heuristic processors" were entered with a value of 1, and "low heuristic processors" with a value of 0.

Then, another variable was created where the values of median heuristic (i.e., values 0 or 1) were subtracted from those of median systematic (i.e., values 0 or 1). In this new variable, participants who obtained 1 were considered as those who processed the message more systematically than heuristically and were categorized as primarily systematic processors (N = 49), and those who obtained -1 were considered as those who processed the message more heuristically than systematically and were categorized as primarily heuristic processors (N = 60). Participants who obtained zero in the median systematic - median heuristic variable were considered perceivers who did not use one processing route more than the other and were not included in analyses.

Scientific literacy. Six items of the Test of Scientific Literacy Skills (TOSLS) questionnaire developed by Gormally, Brickman, and Lutz (2012) were included in a scale evaluating participants' scientific literacy. Items were coded as correct or incorrect, respectively 1 or 0, and summed to create a zero to six ranging scale (M = 3.91, SD = 1.23) that assessed scientific literacy, for example: "The following is a valid scientific course of action: several research studies have found a new drug to be effective for treating the symptoms of autism; however, a government agency refuses to approve the drug until long term effects are known".

CHAPTER FOUR: RESULTS

Results of the quantitative analyses performed in the current study are presented in this section. One-way ANCOVAs and independent samples t-tests were conducted to address the four research questions with message format and processing route as independent variables and attitude toward the message, attitude toward HPV vaccination and intention to obtain the HPV vaccine as dependent variables. One-way ANCOVAs were performed to account for the effect of scientific literacy as a covariate.

Influence of Message Format

Research question one asked how message format (i.e., accessible, jargon, scientese) would influence a) attitude toward the message, b) attitude toward HPV vaccination, and c) intention to receive the HPV vaccine. Three one-way ANCOVAs were performed to answer research question one. Attitude toward the message was examined with a first ANCOVA. This test did not include the control condition since participants in this group were not exposed to any message. The test failed to reach significance which indicated message format did not have a statistically significant impact on how participants perceived the message to which they were exposed. Second, another ANCOVA focused on attitude toward HPV vaccination. Results showed the test failed to reach significance as well. This signified message format did not exert a significant influence on attitude toward HPV vaccination. Last, intention to receive the HPV vaccine was explored. Findings revealed no statistically significant difference across conditions for intention to get vaccinated against HPV which indicates message format did not influence participants' willingness to receive the vaccine.

Overall, for research question one, results suggested no message format exerted an

influence on attitude toward the message, attitude toward HPV vaccination, or intention to become vaccinated against HPV. Regarding the covariate, scientific literacy was found not to exert an effect on attitude and behavioral intention. Results of all tests can be found in Table 2.

Table 2
ANCOVA Between Message Format and Attitude Toward the Message, Attitude Toward the HPV Vaccination, and Intention to Get Vaccinated When Controlling For Scientific Literacy (RQ1)

		Control	Accessible	Jargon	Scientese
Attitude Toward Message	*M*	--	3.85	3.80	3.80
	SD	--	0.63	0.74	0.88
	F (2, 173) = 0.29, p = 0.75				
Attitude Toward Vaccination	M	3.83	4.00	4.20	4.23
	SD	0.99	1.04	0.96	0.89
	F (3, 249) = 2.51, p = 0.06				
Intention to Get Vaccinated	M	3.08	2.90	3.24	3.29
	SD	0.93	0.84	0.97	0.85
	F (3, 250) = 2.15, p = 0.09				

Influence of Processing Route

Research question two asked how processing route (i.e., systematic, heuristic) would influence a) attitude toward the message, b) attitude toward HPV vaccination, and c) intention to receive the HPV vaccine. This research question was examined using three independent samples t-tests.

Findings indicated tests reached significance for attitude toward the message

(t (171) = -3.38, p <0.005) and intention to obtain the vaccine (t (174) = -3.08, p <0.005), but not for attitude toward the HPV vaccination. Specifically, first, results revealed those who processed the message in a primarily systematic manner (M = 3.93, SD = 0.71) had a more positive attitude toward the message they read than primarily heuristic processors (M = 3.50, SD = 0.71). Second, primarily systematic processors (M = 3.24, SD = 0.89) had greater intention to obtain the vaccine compared to primarily heuristic processors (M = 2.75, SD = 0.88). Results of the tests for the difference between scales method are displayed in Table 3.

Table 3
Independent Samples T-Test Between Processing Route and Attitude Toward the Message, Attitude Toward the HPV Vaccination, and Intention to Get Vaccinated With the Difference Between Scales Method (RQ2, method one)

		Systematic	Heuristic
Attitude Toward Message	*M*	3.93	3.50
	SD	0.71	0.71
	t (171) = -3.38, *p*< 0.005*		
Attitude Toward Vaccination	*M*	4.13	4.15
	SD	1.04	0.81
	t (174) = 0.14, *p* = 0.89		
Intention to Get Vaccinated	*M*	3.24	2.75
	SD	0.89	0.88
	t (174) = -3.08, *p*< 0.005*		

**Significant at the p<0.005 level*

Using the median split method for processing route yielded similar results compared to method one. Indeed, with method two, statistically significant differences were found in attitude toward the message (t (105) = -5.34, p <0.001) and intention to get vaccinated (t (107) = -3.69, p

<0.001), but not in attitude toward HPV vaccination. Regarding attitude toward the message, results indicated participants who processed the message primarily systematically (M = 4.23, SD = 0.60) had a more positive attitude toward the message than primarily heuristic processors (M = 3.59, SD = 0.63). In terms of vaccination intention, findings showed primarily systematic processors (M = 3.46, SD = 0.83) had greater intention to receive the HPV vaccine compared to primarily heuristic processors (M = 2.89, SD = 0.78). Results of the median split method are presented in Table 4.

Table 4
Independent Samples T-Test Between Processing Route and Attitude Toward the Message, Attitude Toward the HPV Vaccination, and Intention to Get Vaccinated With the Median Split Method (RQ2, method two)

		Systematic	Heuristic
Attitude Toward Message	*M*	4.23	3.59
	SD	0.60	0.63
	t (105) = -5.34, p< 0.001*		
Attitude Toward Vaccination	*M*	4.24	4.22
	SD	0.88	0.78
	t (106) = -0.10, p = 0.92		
Intention to Get Vaccinated	*M*	3.46	2.89
	SD	0.83	0.78
	t (107) = -3.69, p< 0.001*		

**Significant at the p<0.001 level*

For research question two, methods one and two employed for processing route produced similar results. Specifically, findings revealed processing the message in a primarily systematic manner was associated with a more positive attitude toward the message and a greater intention

to receive the vaccine compared to primarily heuristic processing, but did not have an impact on attitude toward HPV vaccination.

Primarily Systematic Processors

Research question three asked which message format (i.e., accessible, jargon, scientese) would be associated with a more positive a) attitude toward the message, b) attitude toward HPV vaccination, and greater c) intention to receive the HPV vaccine for those who processed the message primarily systematically. Processing route was computed using the same two methods as in research questions three. To examine research question three, three ANCOVAs were performed.

First, tests were performed using the difference method when computing processing route. Findings showed there was no statistically significant difference in attitude toward the message and HPV vaccination across the conditions. However, a statistically significant difference was found in intention to become vaccinated ($F = (2,127) = 3.76$, $p < 0.05$) with: accessible message ($M = 2.98$, $SD = 0.86$), jargon message ($M = 3.29$, $SD = 0.91$), and scientese message ($M = 3.52$, $SD = 0.79$). Since a statistically significant difference was obtained, a Least Significant Difference (LSD) post-hoc test was conducted to examine pair-wise comparison of means and determine which conditions were statistically significantly different from one another. Results of the post-hoc test indicated the only significant difference between groups was between the accessible message ($M = 2.98$) and the scientese message ($M = 3.52$) with the latter being associated with significantly higher intention to receive the HPV vaccine than the former. Results of the tests for the difference between scales method are presented in Table 5.

Table 5

ANCOVA Between Message Format and Attitude Toward the Message, Attitude Toward the HPV Vaccination, and Intention to Get Vaccinated For Systematic Processors When Controlling For Scientific Literacy With the Difference Between Scales Method (RQ3, method one)

		Accessible	Jargon	Scientese
Attitude Toward Message	*M*	3.89	3.99	3.94
	SD	0.63	0.56	0.88
	F (2, 125) = 0.16, p = 0.86			
Attitude Toward Vaccination	*M*	3.94	4.18	4.34
	SD	1.09	0.99	0.90
	F (2, 127) = 1.97, p = 0.14			
Intention to Get Vaccinated	*M*	2.98	3.29	3.52
	SD	0.86	0.91	0.79
	F (2, 127) = 3.76, p = 0.03*			

**Significant at the p<0.05 level*

Second, tests were conducted employing the median split method for processing route. Interestingly, using the median split method for processing route yielded slightly different results compared to the first method. Indeed, unlike results found in the difference method, findings obtained with the median split method revealed no statistically significant difference in intention to receive the HPV vaccine across conditions among participants who processed the message primarily systematically. That is, for primarily systematic processors, message format seemed not to impact how they perceived the message and HPV vaccination, nor their intention to get vaccinated against HPV. Results of the tests for the median split method can be found in table 6.

Table 6

ANCOVA Between Message Format and Attitude Toward the Message, Attitude Toward the HPV Vaccination, and Intention to Get Vaccinated For Systematic Processors When Controlling For Scientific Literacy With the Median Split Method (RQ3, method two)

		Accessible	Jargon	Scientese
Attitude Toward Message	*M*	4.03	4.32	4.45
	SD	0.58	0.71	0.43
	F (2, 43) = 2.60, p = 0.09			
Attitude Toward Vaccination	*M*	4.06	4.28	4.40
	SD	0.77	1.17	0.65
	F (2, 43) = 2.60, p = 0.09			
Intention to Get Vaccinated	*M*	3.31	3.53	3.65
	SD	0.79	0.98	0.74
	F (2, 44) = 0.56, p = 0.58			

For research question three, methods one and two used to compute processing route produced different results. With the difference method, findings indicated, for primarily systematic processors, message format exerted an influence only on intention to obtain the HPV vaccine. The scientese message was found to be related to greater intention to become vaccinated than the accessible message. With the median split method, results suggested message format did not have any effect on attitude toward the message and HPV vaccination, nor intention to get vaccinated against HPV. These results were similar when accounting for scientific literacy as a covariate. That is, the influence of scientific literacy did not approach significance for any dependent variables (i.e., attitude toward the message, attitude toward HPV vaccination, intention to obtain the HPV vaccine).

Primarily Heuristic Processors

Research question four asked which message format (i.e., accessible, jargon, scientese) would be associated with a more positive a) attitude toward the message, b) attitude toward HPV vaccination, and greater c) intention to receive the HPV vaccine for those who primarily processed the message heuristically. One-way ANCOVAs were employed to answer research question four. The same procedure as in research questions two and three using the two methods for processing route was utilized. For both methods, analyses showed tests failed to reach significance for the three dependent variables. Surprisingly, for research question four, results suggested no message formats were associated with a statistically significantly more positive attitude toward the message, attitude toward HPV vaccination, nor significantly greater intention to receive the vaccine for those who processed the message primarily heuristically. Similar results were obtained after controlling for scientific literacy as a covariate. Results of the tests for the difference between scales method are presented in Table 7, and those of the median split method in Table 8.

Table 7

ANCOVA Between Message Format and Attitude Toward the Message, Attitude Toward the HPV Vaccination, and Intention to Get Vaccinated For Heuristic Processors When Controlling For Scientific Literacy With the Difference Between Scales Method (RQ4, method one)

		Accessible	Jargon	Scientese
Attitude Toward Message	*M*	3.67	3.39	3.48
	SD	0.47	0.67	0.84
	F (2, 37) = 0.33, p = 0.72			
Attitude Toward Vaccination	*M*	4.54	4.20	3.93
	SD	0.59	0.88	0.82
	F (2, 38) = 1.96, p = 0.16			
Intention to Get Vaccinated	*M*	2.40	2.95	2.81
	SD	0.70	1.07	0.83
	F (2, 38) = 1.23, p = 0.30			

Table 8

ANCOVA Between Message Format and Attitude Toward the Message, Attitude Toward the HPV Vaccination, and Intention to Get Vaccinated For Heuristic Processors When Controlling For Scientific Literacy With the Median Split Method (RQ4, method two)

		Accessible	Jargon	Scientese
Attitude Toward Message	*M*	3.63	3.53	3.58
	SD	0.55	0.64	0.69
	F (2, 54) = 0.08, p = 0.92			
Attitude Toward Vaccination	*M*	4.40	4.21	4.11
	SD	0.76	0.79	0.81
	F (2, 54) = 0.66, p = 0.52			
Intention to Get Vaccinated	*M*	2.64	2.94	2.96
	SD	0.74	0.81	0.78
	F (2, 55) = 0.87, p = 0.43			

CHAPTER FIVE: DISCUSSION

The following section outlines findings obtained in the present study before presenting theoretical and practical implications of these findings, limitations of the current study, and future lines of research that could be explored.

Summary of Results

In the present study, a theory-based online experiment sought to extricate the effects of message format (i.e., accessible, jargon, scientese) and, based on the Heuristic Systematic Model, processing route (i.e., systematic, heuristic) on a) attitude toward the message, b) attitude toward HPV vaccination, and c) intention to receive the HPV vaccine among college students aged 17-26 years old. The survey instrument also assessed college students' awareness of HPV and a HPV vaccine, as well as their self-reported HPV vaccination status. Findings revealed the majority of participants indicated they knew about HPV and the vaccine. Regarding HPV vaccine uptake, only 30% of the surveyed college students reported being fully vaccinated. This finding confirms the need for HPV vaccination messaging targeting the catch-up population that is still eligible to obtain the HPV vaccine. Analyses were conducted only using the sample of unvaccinated and uncertain participants.

Overall, the data showed messages containing inappropriately employed scientific language may have a more favorable effect on behavioral intention compared to accessible messages written in plain language. This effect is stronger among individuals who more substantively engage with the content (i.e., primarily systematic processors). Additionally, regardless of processing route, findings revealed message format did not exert any influence on attitude or behavioral intention.

Theoretical Implications

Primarily systematic processors were found to hold more positive attitude toward the message and higher intention to obtain the HPV vaccine compared to primarily heuristic processors. Results pertaining to the effect of processing route were consistent with those obtained in previous research (Smith et al., 2017). These findings suggest individuals who reported carefully reading and scrutinizing message content held a more positive view of the message they read and had greater willingness to get vaccinated compared to those who indicated skimming through the message. These results shed light on the gap existing between attitude and behavioral intention since the present study found intention can be influenced even though no influence is exerted on attitude toward the health behavior. This is in direct opposition to the theory of planned behavior, one of the most frequently used health communication theories, that posits attitudes are one of the strongest influences on behavioral intention (Ajzen, 1991). In the current study, these findings may be due to the fact participants may hold conflicting opinions about HPV vaccination, and the messages did not influence these opinions in a favorable manner but did reinforce participants' belief that they should get vaccinated. For example, participants may fear detrimental health consequences of HPV vaccination, which would explain why they would negatively perceive HPV vaccination, but believe it is necessary to receive this vaccine. In this case, they would also have high intention to become vaccinated.

Primarily heuristic processors, however, appear not to hold a significantly more positive or negative attitude toward the message and HPV vaccination, nor have significantly greater intention to get vaccinated across conditions. Interestingly, it seemed there was no significant effects of messages incorporating scientific language (i.e., jargon message, scientese message) on attitude and intention among primarily heuristic processors though prior research suggested scientific terms may be used as heuristic cues among perceivers (Haard et al., 2004). Thus, the

importance of getting audiences to substantively attend to messages is high. Heuristic processing did not result in meaningful attitude or intention change in the current study. Perhaps this is because, for participants who processed messages primarily heuristically, the presence of scientific language did not necessarily reflect expertise and trustworthiness, or pre-existing negative or positive opinions pertaining to HPV vaccination were not influenced by the messages.

For primarily systematic processors, the fact that the scientese message was associated with greater intention to get vaccinated compared to the accessible message is surprising since the scientese message incorporated scientific language inappropriately employed and was designed as the most difficult message to understand. Participants who reported processing the message in a primarily systematic manner were not expected to be positively influenced by the scientese message unless they had a low level of scientific literacy which corresponds to low ability according to the HSM. The potential effect of scientific literacy on processing route was taken into account in the present study and, in an effort to increase variance in scientific literacy among participants, STEM and non-STEM students were recruited to take part in the study. Because STEM participants are familiar with scientific terminology, they were expected to have, overall, a higher level of scientific literacy than non-STEM participants and detect inappropriately used scientific terms if they were engaged in systematic processing when they examined the message to which they were exposed. However, results indicated no significant differences when controlling for scientific literacy as a covariate.

Interestingly, findings pertaining to the scientese message were consistent with previous studies. Haard and colleagues (2004) found the use of scientese in messages increased persuasiveness and the current research confirms this. Further, van Mulken and Hornikx (2011)

explored the effect of scientese on perceived credibility and found a message containing scientese was viewed as more credible than a message without scientese in the context of beauty products advertisements. In the present study, although scientific literacy did not appear to have a strong and consistent effect as a covariate, participants who self-reported as primarily systematic processors may have scrutinized the scientese message without detecting the inaccurate use of scientific terms because of a lack of knowledge pertaining to scientific terminology. An alternate explanation may be the fact that the processing route measurement that relied on self-reported measures. Participants who self-reported processing in a primarily systematic manner may have not engaged in an in-depth analysis of the message, but rather primarily in heuristic processing and utilized scientific language in the scientese message as a heuristic cue indicating high expertise. In this case, participants may have held a level of desired confidence in their judgment (i.e., sufficiency threshold) that did not outweigh their level of actual confidence. This would have led to engaging in heuristic processing. Alternatively, perhaps participants who self-reported having processed primarily systematically partially did, but also employed scientific terms as a heuristic cue (i.e., concurrent processing).

Surprisingly, message format did not seem to exert an effect on attitude and behavioral intention. Although it was expected the accessible message would be most favorably perceived since it incorporated clear and simple-worded content supposed to facilitate comprehensibility and adherence to the content of the message, this message format was not related to significantly positive attitude toward HPV vaccination. An explanation may lie in the fact that many participants perhaps processed the information primarily heuristically, and the clear and simply-worded message did not have the effect of facilitating comprehensibility and persuasiveness.

The two methods employed to compute systematic processing (i.e., difference method,

median split method) yielded slightly different results concerning vaccination intention. Indeed, unlike the difference method, the median split method revealed no effects of message format on intention to become vaccinated for primarily systematic processors. This result may suggest individuals who were categorized as primarily systematic processors in the difference method were mixed with concurrent processors in this category, while those identified as primarily systematic processors in the median split method did engage in systematic processing, or vice versa. That is, the difference in results between the difference method and the median split method may stem from categorization based on employed processing route, in either method, that do not mostly comprise primarily systematic processors but perhaps concurrent processors. Additionally, another factor that may have contributed to this difference in results between the two methods is unequal sample sizes for systematic and heuristic processors. Indeed, 135 participants were categorized as primarily systematic processors and 42 as primarily heuristic processors in the difference method, whereas 49 were identified as primarily systematic and 60 as primarily heuristic processors in the median split method.

Practical Implications

Findings obtained in the present study may provide useful information to inform future health messages aimed to promote HPV vaccination, as well as other health behaviors. First, awareness messaging pertaining to HPV and the HPV vaccine is still needed as some college students are unaware of this health issue or uncertain whether they had heard of it.

Second, results suggested health messages may positively impact young adults' intention to obtain the HPV vaccine without necessarily having an effect on attitude toward the message or HPV vaccination. Messages could hence focus on factors influencing willingness to become

vaccinated against HPV. Third, although the extant literature recommends the use of plain language and the creation of accessible messages, the presence of technical information (e.g., scientific jargon) may help increase message persuasiveness. This result is consistent with studies that compared messages using scientese with the absence of scientese (Haard et al., 2004; van Mulken & Hornikx, 2011). In future messages, it may be beneficial to use some scientific language and provide brief explanations for clarity of the message. Additionally, findings in the current study supported previous research that reported being engaged with message content in a systematic manner was associated with greater intention to adhere to the recommended behavior. It would be thus beneficial to identify strategies to enhance systematic processing. This may involve, for example, increasing perceived personal relevance (i.e., motivation) and enhancing scientific literacy (i.e., ability).

Limitations

Several limitations pertaining to the sample and measurements need to be noted. First, the sample consisted of college students only, and external validity may have been increased if young adults who do not attend college had been recruited to participate in the study. There would have perhaps been a greater variance in scientific literacy. Furthermore, the sample comprised both women and men. Since the HPV vaccine for women has been available for a longer period of time than the vaccine for men, and the former has been more advertised than the latter, women may have had a greater knowledge of HPV and the vaccine compared to men participating in the current study. Because of this, men and women may overall hold different views on the HPV vaccination.

Second, in terms of measurement, processing route was self-reported; hence the categorization of participants based on their processing route when exposed to the message may

not accurately reflect how they processed the message they read in the experiment. Furthermore, the unequal sample sizes for the two methods used to compute processing route may explain differences in results yielded by these two methods. The comparison between both methods would have been more accurate with similar sample sizes. Additionally, this present study did not employ a pretest - posttest methodology, and attitude toward HPV vaccination was only assessed after message exposure and not both prior and subsequently to message exposure. Another limitation lies in the fact that findings refer only print messages in a certain format and not other message types.

Further, motivation and ability were not measured in the present study. Measuring these variables would have helped identifying systematic processors. For example, motivation could have been assessed by measuring personal involvement (Smith et al., 2013). Indeed, individuals who view the HPV vaccination topic as personally relevant would be more likely to scrutinize HPV vaccination messages compared to those who do not find it relevant. Further, some items measuring processing route asked participants what they did when reading the message, and what they would be likely to do after reading the message. It may have been difficult for participants to accurately report whether they would be likely, for example, to think about the message after reading it. Therefore, this type of items may not accurately assess processing route.

Additionally, six items were utilized to assess scientific literacy. The latter would probably have been more accurately measured with more items. In the present study, a longer measurement for scientific literacy was not employed to avoid a lengthy survey. Last, another limitation lies in the fact that intention to receive the HPV vaccine was assessed without exploring factors that can highly influence behavioral intention such as perceived severity and

susceptibility, stigmatization of the HPV infection, vaccine cost, and health insurance status or concerns.

Future Research

Future research could focus on various avenues to further explore strategies aimed to increase health message persuasiveness in the context of vaccination. First, future research could examine the two approaches employed in the present study to measure processing route (i.e., difference method, median split method) and seek to determine which method most accurately assess processing route and the reasons explaining why. It would also be beneficial to measure processing route with a more controlled exposure. That is, ensuring participants truly engage with the message. In the present study, the only element providing an indication of whether participants truly scrutinized the message or rather skimmed through it was the time it took for them to complete the survey. However, this is not an accurate indicator as participants could leave the survey open without engaging with its content. Monitoring the time spent by participants on pages displaying messages would help address this issue. Further, it would also be helpful to measure level of attention when participants are exposed to messages. For example, attention can be measured using thought listing or questions about the content of messages to which participants exposed (i.e., true or false).

Second, researchers could further delve into factors that motivate individuals to systematically engage with message content as when they do, results suggest they may have greater intention to adopt the recommended behavior. That is, how to facilitate the use of systematic processing. Third, the use of jargon and scientese in health messages could be further explored to better understand the effects these two message formats exert on attitude toward the recommended behavior and behavioral intention. A measure of message credibility should also

be incorporated into studies to assess whether the level of perceived credibility differs between the jargon and scientese messages. Fourth, when measuring attitude toward vaccination, it would be advantageous to include an item to determine whether participants deem the vaccination to be necessary or unnecessary. This could help identify participants who hold a favorable view of vaccination while not highly intending to obtain the vaccine. This may uncover low perceived severity of HPV and/or low susceptibility to contract the virus. Additionally, in terms of sample, men and women could be studied separately and results could be compared to explore the differences in attitude and behavioral intention according to gender. Last, regarding the methodology, qualitative research should be undertaken, especially using focus groups where participants would be asked their opinions concerning message features. This investigation would enable the development of stronger and more effective health messages.

Conclusion

The HPV vaccine has been found to be safe and effective to prevent serious HPV-related health conditions such as cancer and genital warts (CDC 2017; Fu et al., 2014). The HPV vaccine can be administered up to 26 years old although this vaccine is substantially advertised toward parents with children to prompt them having children vaccinated at ages 11-12 years old. Vaccination rates of young adults are still low, and health messages may be utilized to help bridge this gap. Results of the present study indicate messages including scientific terminology may be viewed as more persuasive than plain language messages to prompt young adults to receive the HPV vaccine. These findings may aid informing future message development targeting the catch-up population eligible to receive the HPV vaccine, but also audiences that can obtain other vaccinations to decrease the prevalence of various diseases.

APPENDIX A
HPV HEALTH MESSAGES

Original message from the CDC

What is HPV?

HPV is the most common sexually transmitted infection (STI). HPV is a different virus than HIV and HSV (herpes). HPV is so common that nearly all sexually active men and women get it at some point in their lives. There are many different types of HPV. Some types can cause health problems including genital warts and cancers. But there are vaccines that can stop these health problems from happening.

How is HPV spread?

You can get HPV by having oral, vaginal, or anal sex with someone who has the virus. It is most commonly spread during vaginal or anal sex. HPV can be passed even when an infected person has no signs or symptoms. Anyone who is sexually active can get HPV, even if you have had sex with only one person. You also can develop symptoms years after you have sex with someone who is infected making it hard to know when you first became infected.

Does HPV cause health problems?

In most cases, HPV goes away on its own and does not cause any health problems. But when HPV does not go away, it can cause health problems like genital warts and cancer. Genital warts usually appear as a small bump or group of bumps in the genital area. They can be small or large, raised or flat, or shaped like a cauliflower. A healthcare provider can usually diagnose warts by looking at the genital area.

Does HPV cause cancer?

HPV can cause cervical and other cancers including cancer of the vulva, vagina, penis, or anus. It can also cause cancer in the back of the throat, including the base of the tongue and tonsils (called oropharyngeal cancer). Cancer often takes years, even decades, to develop after a person gets HPV. The types of HPV that can cause genital warts are not the same as the types of HPV that can cause cancers. There is no way to know which people who have HPV will develop cancer or other health problems. People with weak immune systems may be less able to fight off HPV and more likely to develop health problems from it, this includes people with HIV/AIDS.

How can I avoid HPV and the health problems it can cause?

You can do several things to lower your chances of getting HPV. Get vaccinated. HPV vaccines are safe and effective. They can protect males and females against diseases (including cancers) caused by HPV when given in the recommended age groups (see “Who should get vaccinated?” below). HPV vaccines are given in three shots over six months; it is important to get all three doses.

Get screened for cervical cancer. Routine screening for women aged 21 to 65 years old can prevent cervical cancer.

If you are sexually active:

• Use latex condoms the right way every time you have sex. This can lower your chances of getting HPV. But HPV can infect areas that are not covered by a condom - so condoms may not give full protection against getting HPV.

• Be in a mutually monogamous relationship – or have sex only with someone who only has sex with you.

Who should get vaccinated?

All boys and girls ages 11 or 12 years should get vaccinated. Catch-up vaccines are recommended for males through age 21 and for females through age 26, if they did not get vaccinated when they were younger. The vaccine is also recommended for gay and bisexual men (or any man who has sex with a man) through age 26. It is also recommended for men and women with compromised immune systems (including people living with HIV/AIDS) through age 26, if they did not get fully vaccinated when they were younger.

How do I know if I have HPV?

There is no test to find out a person's "HPV status." Also, there is no approved HPV test to find HPV in the mouth or throat. There are HPV tests that can be used to screen for cervical cancer. These tests are recommended for screening only in women aged 30 years and older. They are not recommended to screen men, adolescents, or women under the age of 30 years. Most people with HPV do not know they are infected and never develop symptoms or health problems from it. Some people find out they have HPV when they get genital warts. Women may find out they have HPV when they get an abnormal Pap test result (during cervical cancer screening). Others may only find out once they've developed more serious problems from HPV, such as cancers.

How common is HPV and the health problems caused by HPV?

HPV (the virus): About 79 million Americans are currently infected with HPV. About 14 million people become newly infected each year. HPV is so common that most sexuallyactive men and women will get at least one type of HPV at some point in their lives. Health problems related to HPV include genital warts and cervical cancer. Genital warts: About 360,000 people in the United States get genital warts each year. Cervical cancer: More than 11,000 women in the United States get cervical cancer each year. There are other conditions and cancers caused by HPV that occur in persons living in the United States.

I'm pregnant. Will having HPV affect my pregnancy?

If you are pregnant and have HPV, you can get genital warts or develop abnormal cell changes on your cervix. Abnormal cell changes can be found with routine cervical cancer screening. You should get routine cervical cancer screening even when you are pregnant.

Can I be treated for HPV or health problems caused by HPV? There is no treatment for the virus itself. However, there are treatments for the health problems that HPV can cause:

1. Genital warts can be treated by you or your physician. If left untreated, genital warts may go away, stay the same, or grow in size or number.

2. Cervical precancer can be treated. Women who get routine Pap tests and follow up as needed can identify problems before cancer develops. Prevention is always better than treatment. For more information visit www.cancer.org.

3. Other HPV-related cancers are also more treatable when diagnosed and treated early. For more information visit www.cancer.org.

Messages Employed in Prestest 1

Accessible Message

HPV (Human Papillomavirus) is a virus people can get from sexual contact. HPV causes the most common sexually transmitted infection. There are different types of HPV. Some types can lead to health problems like genital warts and cancer. It often takes years for the cancer to appear. People with HPV do not have any signs or symptoms, so most people do not know they have HPV. Once someone has HPV, there is no treatment against the infection. Health problems that some types of HPV can cause can be avoided before getting the virus. The HPV vaccine can prevent genital warts and cancer that HPV could cause. The HPV vaccine works and is safe. Women can get the HPV vaccine through age 26. Men can get the HPV vaccine through age 21, or age 26 for those who have sex with men or a weak immune system. If you have not gotten the HPV vaccine, contact a doctor or public health office to get the vaccine today.

Jargon Message

Human Papillomavirus (HPV) is a virus spread through genital tract, and causes the most common sexually transmitted infection. There are different viral strains of Human Papillomavirus. Non-oncogenic HPV strains have been identified as infective agents that can induce genital warts, and oncogenic HPV strains are carcinogenic agents. Carcinogenesis often takes years to develop. Human Papillomavirus infections are asymptomatic, so most infected people do not know they are carriers of the virus. There is no treatment to cure Human

Papillomavirus infection. Human Papillomavirus-induced warts and carcinogenesis can be avoided prior to exposure to the virus. The Human Papillomavirus vaccine can reduce the incidence of Human Papillomavirus-induced warts and cancerous cells. The vaccine is highly immunogenic and generally well tolerated. Females can get doses of the vaccine through age 26. Males can get doses of the vaccine through age 21, or age 26 for those who have intercourse with males, or are immunocompromised. If you have not gotten the Human Papillomavirus vaccine, contact a physician or public health office to get the vaccine today.

Scientese Message

Human Papillomavirus (HPV) is a virus spread through abiogenic tract, and causes the most common sexually transmitted infection. There are different phylogenetic strains of Human Papillomavirus. Non-dihybrid HPV strains have been identified as microvesicles that can induce genital warts, and phenotypic HPV strains can cause cancer. Phagocytosis often takes years to develop. Human Papillomavirus infections are asymptomatic, so most people do not know they are carriers of epithelial precursors. There is no treatment to induce antibody responses and cure Human Papillomavirus infection. Human Papillomavirus-induced warts and cancer can be avoided prior to exposure to the virus. The Human Papillomavirus vaccine can reduce the incidence of Human Papillomavirus -induced warts and centromere tumors. Because the vaccine contains a notochord-based load, it works and it is safe. Females can get doses of the vaccine through age 26. Males can get doses of the vaccine through age 21, or age 26 for those who have intercourse with males, or are cytolysis resistant. If you have not gotten the Human Papillomavirus vaccine, contact a physician or public health office to get the vaccine today.

Messages Employed in Prestest 2 and the Survey

Accessible Message

HPV (Human Papillomavirus) is a virus people can get from sexual contact. HPV causes the most common sexually transmitted infection. There are different types of HPV. Some types can cause health problems like genital warts and cancer. It often takes years for the cancer to appear. People with HPV do not have any signs or symptoms, so most people do not know they have HPV. Once someone has HPV, there is no medication to clear the infection. Health problems caused by HPV can be avoided before getting the virus. The HPV vaccine can keep you from getting genital warts and cancer caused by HPV. The HPV vaccine works and is safe. Women can get the HPV vaccine through age 26. Men can get the HPV vaccine through age 21, or age 26 for those who have sex with men or a weak immune system. If you have not gotten the HPV vaccine, contact a doctor or public health office to get the vaccine today.

Jargon Message

Human Papillomavirus (HPV) is a virus spread through genital tract, and causes the most common sexually transmitted infection. There are different viral strains of Human Papillomavirus. Non-oncogenic HPV strains have been identified as infective agents that can induce genital warts, and oncogenic HPV strains are carcinogenic agents. Carcinogenesis often takes years to develop. Human Papillomavirus infections are asymptomatic, so most infected people do not know they are carriers of the virus. There is no treatment to cure Human Papillomavirus infection. Human Papillomavirus-induced warts and carcinogenesis can be avoided prior to exposure to the virus. The Human Papillomavirus vaccine can reduce the incidence of Human Papillomavirus-induced warts and cancerous cells. The vaccine is highly immunogenic and generally well tolerated. Females can get doses of the vaccine through age 26. Males can get doses of the vaccine through age 21, or age 26 for those who have intercourse with males, or are immunocompromised. If you have not gotten the Human Papillomavirus vaccine, contact a physician or public health office to get the vaccine today.

Scientese Message

Human Papillomavirus (HPV) is a triploblastic virus spread through the chromosomal tract, and causes the most common sexually transmitted infection. There are different hydrophobic strains of Human Papillomavirus. Polysaccharide HPV strains have been identified as nucleotides that can induce genital warts, and mitochondrial HPV strains can cause cancer. Apoptosis often takes years to develop, and HPV infections are asymptomatic, so most people do not know they are carriers of acetylcholine precursors. There is no treatment to induce enantiomers and cure HPV infection. HPV-induced warts and cancer can be avoided prior to exposure to the virus. The HPV vaccine can reduce the incidence of HPV-induced warts and polymerase tumors. Because the vaccine contains an acrylamide-based load, it works and it is safe. Females can get doses of the vaccine through age 26. Males can get doses of the vaccine through age 21, or age 26 for those who have intercourse with males, or are nucleus resistant. If you have not gotten the HPV vaccine, contact a physician or public health office to get the vaccine today.

APPENDIX B
PRETEST ONE

The following questions concern the message you just read. Please indicate your level of agreement for the following: (on a five-point scale, 1 = strongly disagree, 5 = strongly agree).

I think this message:

was easy to read (accessible)

did not make sense (scientese)

was valid (jargon)

was unsound (scientese)

was clear (accessible)

included accurate claims (jargon)

was easy to understand (accessible)

used sounds claims (jargon)

had invalid claims (scientese)

Table 9

Means, Standard Deviations, Cronbach's Alpha Coefficients, and Independent Samples T-Tests Between STEM and non-STEM Participants for the Accessible, Jargon, and Scientese Messages (Pretest One)

		All Participants (N = 117)	Non STEM (N = 56)	STEM (N = 61)
Accessible Message	*M*	4.36	4.35	4.38
	SD	0.54	0.57	0.52
	$\alpha = 0.79$			
	$t\ (115) = -0.26,\ p = 0.80$			
Jargon Message	M	3.85	3.89	3.81
	SD	0.53	0.51	0.56
	$\alpha = 0.58$			
	$t\ (115) = 0.79,\ p = 0.43$			
Scientese Message	M	2.41	2.43	2.38
	SD	0.77	0.81	0.73
	$\alpha = 0.78$			
	$t\ (115) = 0.32,\ p = 0.75$			

APPENDIX C
PRETEST TWO

The following questions concern the message you just read. Please indicate your level of agreement for the following: (on a five-point scale, 1 = strongly disagree, 5 = strongly agree).

I think this message:

was easy to read (accessible)

included scientific jargon inappropriately (scientese)

included scientific words in a sound way (jargon)

used scientific words out of context (scientese)

was clear (accessible)

had accurate scientific language (jargon)

was easy to understand (accessible)

accurately used scientific jargon (jargon)

used scientific language in a way that did not make sense (scientese)

had simply worded information (accessible)

used technical scientific terms appropriately (jargon)

had incorrect information with technical scientific terms (scientese)

Table 10

Means, Standard Deviations, Cronbach's Alpha Coefficients, and Independent Samples T-Tests Between STEM and non-STEM Participants for the Accessible, Jargon, and Scientese Messages (Pretest Two)

		All Participants (N = 95)	Non STEM (N = 43)	STEM (N = 52)
Accessible Message	*M*	4.47	4.57	4.39
	SD	0.54	0.56	0.51
	α = 0.84			
	t (93) = 1.64, *p* = 0.10			
Jargon Message	M	3.86	3.95	3.77
	SD	0.79	0.66	0.88
	α = 0.89			
	t (93) = 1.10, *p* = 0.27			
Scientese Message	M	2.83	2.99	2.69
	SD	0.97	0.93	0.99
	α = 0.84			
	t (92) = 1.51, *p* = 0.14			

APPENDIX D
SURVEY

Demographics

What is your gender?

- Male
- Female
- Other
- Prefer not to answer

How old are you? Enter raw number

Please select the option that best describes your race/ethnicity. Check all that apply:

- Hispanic or Latino/a
- Black (non-Hispanic)
- White (non-Hispanic)
- Asian or Pacific Islander
- American Indian, Alaskan Native, or Native Hawaiian
- Other, please specify

What year in school are you?

- Freshman
- Sophomore
- Junior
- Senior
- Graduate Student
- Non-degree seeking
- Other

Which of the following best describes your field of study?

- Humanities (e.g., art, English, history)
- STEM (e.g., biology, chemistry, mathematics, physics, engineering)
- Social Sciences (e.g., communication, psychology, sociology)
- Business
- Other, please specify

What is your specific major?

Please check your approximate UCF GPA:

- 0 – 1.5
- 1.51 - 2
- 2.01 – 2.5
- 2.51 - 3
- 3.01 – 3.5
- 3.51 – 4

HPV and vaccine awareness

Have you ever heard of HPV?

- Yes
- No
- Unsure

Have you ever heard of a HPV vaccine?

- Yes
- No
- Unsure

Exposure to one of the three messages (randomly assigned)

Attitude toward HPV vaccination

I think getting the HPV vaccine is: (on a five-point scale)

1 = Bad	5 = Good
1 = Harmful	5 = Beneficial
1 = Foolish	5 = Wise
1 = Threatening	5 = Assuring
1 = Risky	5 = Safe

HPV vaccination

Have you ever received any shot of the HPV vaccine?

- Yes
- No
- Unsure

If yes, have you received the full vaccination?

- Yes
- No
- Unsure

Intention to receive the vaccine (if unvaccinated, partially vaccinated, or unsure)

Please indicate your level of agreement for the following: (on a five-point scale, 1 = strongly disagree, 5 = strongly agree).

I plan to get the HPV vaccine.
I decided to receive the vaccine against HPV.
I intend to get vaccinated against HPV.
I am willing to get the HPV vaccine.
I will get vaccinated against HPV.

Attitude toward the message

I think the message I just read was: (on a five-point scale)

Persuasive
Effective
Convincing
Good
Compelling
Clear

Processing route

Please indicate your level of agreement for the following: (on a five-point scale, 1 = strongly disagree, 5 = strongly agree).

When I read this message:

I paid attention to all the details.

I only paid attention to the portion that seems interesting.
I mostly skimmed for important information.
I was focused on the meaning of the content.
I focused only on a few key points.
I only paid attention to the portion that seemed important.
There was far more information than I personally need.

After reading this message:

I am likely to stop and think about HPV vaccination.
I have a broader understanding of HPV or HPV vaccination.
I am likely to think about how this HPV information relates to other things I know.
I probably will NOT spend much time thinking about HPV vaccination.
I will try to relate the ideas in this message to my own life.
I am likely to make connections between this information and HPV information I got elsewhere.

Scientific literacy

True or false: the following is a valid scientific argument:

A strain of mice was genetically engineered to lack a certain gene, and the mice were unable to reproduce. Introduction of the gene back into the mutant mice restored their ability to reproduce. These facts indicate that the gene is essential for mouse reproduction.

- False (incorrect)
- True (correct)

True or false: the following is a valid scientific argument:

This winter, the northeastern US received record amounts of snowfall, and the average monthly temperatures were more than 2°F lower than normal in some areas. These facts indicate that climate change is occurring.

- False (correct)
- True (incorrect)

True or false: the following research study is not likely to contain a confounding factor (variable that provides an alternative explanation for results) in its design:

Researchers randomly assign participants to experimental and control groups. Females make up 35% of the experimental group and 75% of the control group.

- False (correct)
- True (incorrect)

True or false: the following research study is not likely to contain a confounding factor (variable that provides an alternative explanation for results) in its design:

To evaluate the effect of a new diet program, researchers compare weight loss between participants randomly assigned to treatment (diet) and control (no diet) groups, while controlling for average daily exercise and pre-diet weight.

- False (incorrect)
- True (correct)

True or false: the following is a valid scientific course of action:

Journalists give equal credibility to both sides of a scientific story, even though one side has been disproven by many experiments.

- False (correct)
- True (incorrect)

True or false: the following is a valid scientific course of action:

Several research studies have found a new drug to be effective for treating the symptoms of autism; however, a government agency refuses to approve the drug until long term effects are known.

- False (incorrect)
- True (correct)

APPENDIX E
IRB APPROVAL LETTER 1

University of Central Florida Institutional Review Board
Office of Research & Commercialization
12201 Research Parkway, Suite 501
Orlando, Florida 32826-3246
Telephone: 407-823-2901 or 407-882-2276
www.research.ucf.edu/compliance/irb.html

Approval of Exempt Human Research

From: **UCF Institutional Review Board #1**
FWA00000351, IRB00001138

To: **Laura Boutemen** and Co-PI **Lindsay B Neuberger**

Date: **October 27, 2017**

Dear Researcher:

On 10/27/2017, the IRB reviewed the following activity as human participant research that is exempt from regulation:

Type of Review:	Exempt Determination, Category 2
Project Title:	How message format and processing route influence perceived persuasiveness of messages promoting HPV vaccination
Investigator:	Laura Boutemen
IRB Number:	SBE-17-13453
Funding Agency:	
Grant Title:	
Research ID:	N/A

This determination applies only to the activities described in the IRB submission and does not apply should any changes be made. If changes are made and there are questions about whether these changes affect the exempt status of the human research, please contact the IRB. When you have completed your research, please submit a Study Closure request in iRIS so that IRB records will be accurate.

In the conduct of this research, you are responsible to follow the requirements of the Investigator Manual.

On behalf of Sophia Dziegielewski, Ph.D., L.C.S.W., UCF IRB Chair, this letter is signed by:

Signature applied by Renea C Carver on 10/27/2017 03:23:38 PM EDT

Designated Reviewer

APPENDIX F
IRB APPROVAL LETTER 2

University of Central Florida Institutional Review Board
Office of Research & Commercialization
12201 Research Parkway, Suite 501
Orlando, Florida 32826-3246
Telephone: 407-823-2901 or 407-882-2276
www.research.ucf.edu/compliance/irb.html

Determination of Exempt Human Research

From: **UCF Institutional Review Board #1**
FWA00000351, IRB00001138

To: **Laura Boutemen** and Co-PI **Lindsay B Neuberger**

Date: **February 27, 2018**

Dear Researcher:

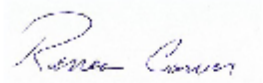
On 02/27/2018, the IRB reviewed the following activity as human participant research that is exempt from regulation:

Type of Review:	Exempt Determination, Category 2
Modification Type:	Modification of a few words in the third message to show participants.
Project Title:	How message format and processing route influence perceived persuasiveness of messages promoting HPV vaccination
Investigator:	Laura Boutemen
IRB Number:	SBE-17-13453
Funding Agency:	
Grant Title:	
Research ID:	N/A

This determination applies only to the activities described in the IRB submission and does not apply should any changes be made. If changes are made and there are questions about whether these changes affect the exempt status of the human research, please contact the IRB. When you have completed your research, please submit a Study Closure request in iRIS so that IRB records will be accurate.

In the conduct of this research, you are responsible to follow the requirements of the Investigator Manual.

This letter is signed by:



Signature applied by Renea C Carver on 02/27/2018 08:15:54 AM EST

Designated Reviewer

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