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Authors

Fleszar-Pavlović, Sara

Cameron, Linda

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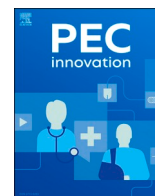
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Developing a narrative communication intervention in the context of HPV vaccination

Sara E. Fleszar-Pavlović^{a,b,*}, Linda D. Cameron^a

^a Department of Psychological Sciences, University of California, Merced, CA, United States of America

^b Sylvester Comprehensive Cancer Center, University of Miami, Miami, FL, United States of America

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ABSTRACT

Objective: We outline the development of a narrative intervention guided by the Common-Sense Model of Self-Regulation (CSM) to promote Human Papillomavirus (HPV) vaccination in a diverse college population.

Methods: We adapted the Obesity-Related Behavioral Intervention Trials (ORBIT) model to guide the development, evaluation, and refinement of a CSM-guided narrative video. First, content experts developed a video script containing information on HPV, HPV vaccines, and HPV-related cancers. The script and video contents were evaluated and refined, in succession, utilizing the think-aloud method, open-ended questions, and a brief survey during one-on-one interviews with university students.

Results: Script and video content analyses led to significant revisions that enhanced quality, informativeness, and relevance to the participants. We highlight the critical issues that were revealed and revised in the iterative process.

Conclusions: We developed and refined a CSM guided narrative video for diverse university students. This framework serves as a guide for developing health communication interventions for other populations and health behaviors.

Innovation: This project is the first to apply the ORBIT framework to HPV vaccination and describe a process to develop, evaluate, and refine comparable CSM guided narrative interventions that are tailored to specific audiences.

1. Introduction

This paper delineates a framework for developing, evaluating, and refining theoretically guided narrative interventions for health behavior change within diverse populations. Specifically, we describe the development of a narrative health communication video communicating information on the Human Papillomavirus (HPV), the HPV vaccine, and HPV-related cancers targeting university students attending a Hispanic Serving Institution with the aim of increasing HPV vaccination. We detail the steps for utilizing narrative communication concepts and the common-sense model of self-regulation (CSM) to construct an efficacious communication for promoting protective behaviors. Although this study examines this framework through the lens of HPV vaccination, it can serve as a template for theoretically guided narrative communication interventions tailored to diverse populations. We present an overview of HPV, a summary of narrative communication and the CSM, and a step-by-step guide for the development, evaluation, and refinement of

the health communication video intervention.

1.1. Overview of HPV and HPV vaccination

HPV is the most common sexually transmitted infection in the U.S., with most sexually active adults becoming infected at least once during their lifetime [1]. While most HPV infections resolve on their own, nearly 20% of adults contract high-risk infections [2]. A persistence in high-risk infections is linked with certain cancers [3]. The primary prevention is vaccination, which has the potential to prevent 90% of cancers attributed to HPV [4]. The HPV vaccine is recommended for preteens (11 to 12 years old; 2-dose series) and for those unvaccinated as preteens up to the age of 26 years (3-dose series after the age of 15; [5]). Although the vaccine has demonstrated high efficacy in preventing HPV infections, there are still low vaccination rates, leaving a high percentage of adolescents and young adults unprotected when they are most susceptible (between the ages of 15 to 25 [6]). The CDC reports that

* Corresponding author at: Sylvester Comprehensive Cancer Center, University of Miami, Florida 1120 NW 14th Street, Miami, FL 33136, United States of America.
E-mail address: sef144@med.miami.edu (S.E. Fleszar-Pavlović).

39.9% of adults have received at least one dose and only 21.5% have received the recommended doses of the vaccine [7]. Along with the low national rates, there are inconsistent rates of vaccine uptake across U.S. geographic regions, racial/ethnic groups, and gender. For instance, residents of Southern states have lower HPV vaccination rates compared to those residing in the Western states [8]. Moreover, Hispanic/Latina women in all regions of the U.S. have lower HPV vaccination rates compared with non-Hispanic White and African American/Black populations [9]. This disparity is alarming given that cervical cancer incidence and mortality are higher among Hispanic/Latina women when compared to their non-Hispanic White counterparts [10]. For all races and ethnic groups in the U.S., men have higher rates of “high risk” HPV types and are disproportionately affected by HPV-related head and neck cancers [11]. Yet, men are less likely than women to have ever received one or more doses of the HPV vaccine [7].

The COVID-19 pandemic has further exacerbated the low rates of vaccination uptake by disrupting vaccine schedules [12], heightening the inaccessibility to preventive care [13], and increasing vaccine hesitancy [14]. HPV vaccination rates declined by approximately 70% in March 2020 and remained low in August 2020 [15,16]. Recent micro-simulation models project that if HPV vaccine uptake does not rebound to the pre-pandemic rate within a three-year timeframe, there will be a significant rise in oropharyngeal cancers (e.g., approximately 6200 new cases per year; [17]). Increased efforts to recover HPV vaccine uptake to pre-pandemic rates are needed to minimize long-term consequences.

1.2. Use narrative communication in the content of HPV vaccination

Narratives, or stories describing personal experiences with an embedded persuasive element, have been increasingly utilized in interventions to modify health-related behaviors [18]. Narratives may be well-suited for bridging the gap between health information and how it relates to oneself [19]. During a narrative an individual can be absorbed or “transported” into another person’s experiences [20,21]. A “transported” individual is more likely to believe the experiences of the narrator; thus, they are less likely to dispute information presented in the story [21]. By reducing cognitive resistance, a narrative can change attitudes and increase self-efficacy, intentions, and behaviors [22]. Further, identifying with and developing emotions for the characters in the story creates a greater influence on beliefs of the audience and enhances absorption of knowledge and changes in health-related knowledge, attitudes, beliefs, and behaviors [23]. Moreover, the greater the element of realism, or the extent to which the story is to be perceived to be like the real world, the greater the likelihood that the audience will identify with the characters and events [24].

Previous research suggests that narrative communication may be particularly effective for specific populations such as racial, ethnic, and minority groups with a strong tradition of storytelling, such as Hispanic populations [23,25]. Additionally, there is a growing body of evidence demonstrating the efficacy of narrative interventions in increasing HPV vaccine intentions [26-28] and uptake [29,30]. For instance, in a study examining the influence of the type of vaccine information (i.e., statistical, narrative, or hybrid) and the type of narrative (i.e., first-person or third-person) on college students’ intentions to obtain the HPV vaccine, Nan and colleagues [26] found that increased risk perceptions caused by both hybrid information (i.e., statistical and narrative) and narrative types (i.e., first-person and third-person) were indirectly associated with intentions to receive the vaccine, but only if the vaccine was offered at free of charge. In another study, Chan et al., [27] found that in a sample of Hispanic/Latino adults (18–26 years old), an intervention utilizing a picture storybook (*fotonovela*) delivering educational health messages that incorporate social norms, positive role models, and the importance of being vaccinated against HPV, increased intentions to get vaccinated. In a more recent study, women (> 18 years old) who were assigned to a narrative intervention titled Women’s Stories, viewed three stories (a

discussion between two women in a kitchen about the risks and consequences of HPV, a discussion between a male and female on a park bench about HPV and cancer risk for men, and a doctor discussing their support for vaccination to a young woman during a wellness visit) on an iPad in a Planned Parenthood waiting room. Compared with the control group who received written educational material, women in the Women’s Stories group had higher vaccination intentions directly after the intervention. However, intentions between the Women’s Stories and the control group did not differ at one- and six months post-intervention [28].

Several studies have examined the efficacy of narrative interventions in increasing HPV vaccination uptake in adults. Hopfer [29] evaluated an intervention comparing communication sources of a narrative message (i.e., peer only, medical expert only, or a combination of peer and expert) in motivating vaccine uptake in college women. Findings suggest that women who received a peer-and-expert narrative message compared with peer or expert-only messages were twice as likely to receive the HPV vaccine two months post-intervention. In the second study, Kim et al., [30] investigated the efficacy of a storytelling intervention delivered via a mobile, web-based platform versus information-based written material in increasing American Korean college women’s intentions and uptake of the vaccine. Both the storytelling intervention and information-based groups increased intentions to receive the HPV vaccine; however, at two months post-intervention, the storytelling intervention group was twice as likely to receive or to have scheduled an appointment to receive the HPV vaccine relative to the information-based group. Although growing evidence suggests that narrative interventions may be effective in increasing HPV vaccine intentions and uptake, more research and intervention development is needed.

1.3. The common-sense model of self-regulation

While narrative interventions have demonstrated persuasive power in improving health-related attitudes, knowledge, intentions, and behaviors, they often have little focus on the mechanisms that may be salient when processing health-related information and decisions. Using a theoretical framework of health cognitions and behavior to develop the contents of a narrative communication could potentially enhance its efficacy relative to an intervention that focuses solely on the narrative mechanisms of transportation, realism, and identification. One such framework, the CSM [31,32], conceptualizes how individuals respond to and manage future or current health threats. The CSM describes how individuals create their understanding of health, which in turn directs cognitive and emotional processes toward coping responses, health behaviors, and feedback and evaluation of the efficacy of these processes and behaviors. The CSM has predominately been used to understand how people appraise and manage an illness [33]; however, the CSM is also applied to understand how individuals evaluate the risk of illness threats [34,35]. Within the context of managing an illness threat, risk information activates illness risk representations. Illness risk representations, commonly used to assess risk-related beliefs and behaviors [34-36], develop from the process of matching self-characteristics with illness representation features [37]. For example, in the context of HPV, one’s representation of causal factors relating to HPV is based on matching self-characteristics (“*I am sexually active*”) with beliefs about the causes of HPV (“*HPV is a sexually transmitted infection*”). When self-representations correspond with elements of illness risk representations, risk beliefs will be high. However, when aspects of self-representation do not match with corresponding elements of illness risk representations, then perceptions of risk may be inaccurate.

Illness risk representations span five key domains: (1) identity-illness label and symptoms; (2) cause-beliefs about the illness’ contributable factors; (3) timeline-beliefs about the illness’ onset, duration, and decline; (4) consequences-anticipated physical/psychosocial outcomes; and (5) control-beliefs about protective behaviors, treatments, or illness controllability [34]. Risk representations mediate the relationship

between the perception of risk information and decisions to engage in protective behaviors [34]. Protective behaviors are also motivated by a clear and coherent understanding of how the representational attributes are linked with recommended protective behaviors, termed risk-action-link coherence. Having a clear understanding of how a behavior reduces a health threat can promote behavior initiation and maintenance [38-40].

Evidence indicates that illness risk representations and coherence regarding vaccine-preventable diseases are key predictors of vaccination intentions and uptake behavior [41,42]. In a study of adults aged 65 and older, illness representations of pneumonia and the pneumococcal vaccine were associated with vaccine intentions and uptake. Specifically, those that perceived pneumonia to be chronic (timeline) and believed that vaccines can prevent pneumonia (control) were associated with intentions to receive the vaccine. Further, those who perceived more severe consequences of pneumonia (consequences) and believed that treatment can control pneumonia (control) had higher vaccine uptake [43]. Likewise, in a 2021 study on COVID-19 vaccination willingness conducted in the Netherlands, all illness representation dimensions except for timeline were related to willingness to receive the COVID-19 vaccination [44].

2. Methods

2.1. Design

The current study utilizes an adapted Obesity-Related Behavioral Intervention Trials (ORBIT; [45]) model for the development, evaluation, and refinement of the CSM-guided narrative video. The ORBIT framework, which defines an iterative process for behavioral intervention development, focuses on the early developmental phases and is not specified for one disease, health risk or behavior. The ORBIT model includes four phases: (a) Phase 1, which encompasses defining and refining the design and elements of the intervention, (b) Phase 2, which includes preliminary testing of the intervention to examine efficacy, and (c) Phases 3 and 4 which comprise efficacy and effectiveness trials of the

newly developed intervention. The current study focuses on Phase 1. Specifically, the development of the narrative video was conducted in three stages: (1) Stage 1: Script Content Development, (2) Stage 2: Script Content Evaluation and Refinement, and (3) Stage 3: Video Evaluation and Refinement as detailed below (See Fig. 1).

2.2. Stage 1: Script content development

Table 1 presents a structure of the script content. Guided by CSM constructs, we developed script content to induce coherent HPV risk representations to motivate HPV vaccination. Specifically, relevant information about HPV and the HPV vaccine were categorized and paired with each CSM construct. For example, regarding the construct of *identity*, the content presented was a description of the HPV infection and the risks associated with contracting the infection. As another example, information about how the HPV vaccine protects against the HPV infection was presented for the construct *control*. Once these components were identified for each CSM construct, the techniques (e.g., communication between friends, action planning) for delivering the information were developed. These techniques were based on inducing the key aspects of narrative communication.

Next, we created a video script with input from undergraduate research assistants. A primary objective was to develop a video targeted toward undergraduate students; accordingly, incorporating their perspectives was vital to the development of the script and video. The university is a Hispanic-Serving Institution with 54.3% of the students identifying as Hispanic/Latino; 20.6% as Asian/Pacific Islander, and with lower percentages identifying as non-Hispanic White (9.5%) and African American/Black (4.2%). The video was created to be relevant to the primary audience (i.e., Hispanic/Latinos) while ensuring that the information was relevant to other represented races/ethnicities at the university. We included advisors of five races/ethnicities in each evaluation phase.

The script incorporated the concepts of narrative communication by including a direct testimonial of a student, Sofia, describing to her roommate, Elena, and roommate's boyfriend, Luis, her mom's recent

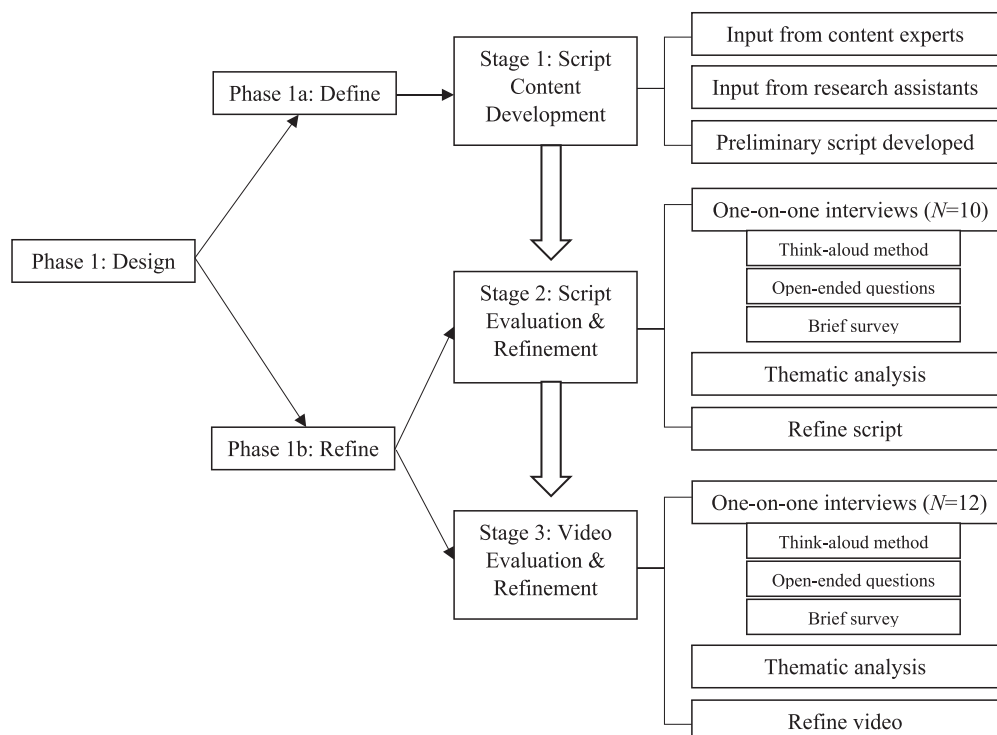


Fig. 1. Adapted ORBIT Methodological Framework for the Development of the Common-Sense Model-Guided Narrative Video.

Table 1
Common-sense model constructs, delivery techniques, and video content.

Illness Representations- CSM Constructs	Delivery Technique	Message/Task Presented in the Script/Video
Identity	Communication between friends to change risk representations	Description of HPV infection: <ul style="list-style-type: none"> the most common sexually transmitted infection Risks Associated w/ Contracting HPV: <ul style="list-style-type: none"> Early-onset of sexual behavior Having many sexual partners Weakened immune system Being a man who has sex with men Having an uncircumcised penis (or partner w/ an uncircumcised penis) Unprotected vaginal, anal, or oral sex Damaged or punctured skin on genitals Tobacco smoke or heavy alcohol use
Cause		<ul style="list-style-type: none"> Infection caused by the Human Papillomavirus Spread through skin-to-skin contact
Consequences		Most HPV infections resolve on their own; Some strains cause genital warts; High-risk strains cause cervical, vaginal, penile, anal, & head and neck cancers
Control		There is no cure for HPV. High-risk strains can be prevented with the HPV vaccine. Information about the Vaccine: <ul style="list-style-type: none"> Safe, effective, and long-lasting protection against most HPV related cancers; Does not protect against HPV strains that cause genital warts The HPV vaccine was FDA approved in 2006. >135 million doses of HPV vaccines have been given and vaccines continue to be safe and effective. >12 years of safety monitoring show that the HPV vaccine has caused no serious side effects. The vaccine is a series of 3 doses (for those >15 years old). The second dose should be given 1–2 months after the first, and the third dose should be given 6 months after the first dose. Even if you suspect that you currently have or that you had an HPV

Table 1 (continued)

Illness Representations- CSM Constructs	Delivery Technique	Message/Task Presented in the Script/Video
		infection you should still get the HPV vaccine. <ul style="list-style-type: none"> The most common side effects of the vaccine are mild and get better within 24–48 h. These include: <ul style="list-style-type: none"> Pain, redness, or swelling where the shot was given Fever Dizziness or fainting Nausea Headache Muscle or joint pain The HPV vaccine is available at your primary care provider and drug stores (e.g., Walgreens, CVS). Most insurances cover the HPV vaccine. Appointments can be made online at participating drug stores.
Timeline		Most sexually active people will be infected with HPV at some point in their lives and can be repeatedly infected. The peak time for contracting HPV is shortly after becoming sexually active. It takes 15 to 20 years for cervical cancer to develop in women. Head and neck cancer is more prevalent in men and develops at around the age of 40–55 years old. Between 59 and 69 years old is when vaginal, penile, and anal cancers develop.
Coherence		Discussion of the link between HPV and cancer. High-risk strains of the HPV virus can survive for several years in your body. Eventually, the virus can lead to normal cells transforming into cancerous cells.
Risk-Action Link Coherence	Communication to encourage understanding of the relationship between specific actions and risk	Explanation of how the HPV vaccine stimulates the body to produce antibodies (e.g., “Just like a tetanus vaccine works to enable to the immune system to recognize and destroy tetanus bacteria before it takes over the body, the HPV vaccine stimulates the body to produce antibodies that, in future encounters with an HPV infection, bind to the virus and prevent it from infecting cells”)
Coping for Threat Control	Action Planning	Please call the university student health center to schedule an appointment with one of the providers to discuss HPV vaccination.

cervical cancer diagnosis and how it motivated her to get the HPV vaccine followed by conversation about the HPV infection, vaccine, and HPV-related cancers. Trained research assistants reviewed the script and provided language, tone, and scene recommendations. These recommendations guided the revision and refinement of the script.

2.3. Stage 2: Script content evaluation and refinement

We conducted 10 one-on-one interviews with university students utilizing a mixed-methods approach [46] that incorporated three components: (1) a think-aloud task; (2) open-ended questions; and (3) a brief survey. Qualitative methods (i.e., think-aloud method, open-ended questions) enabled students to aid in the development of the script content and provide advice for refinements. The think-aloud method involves the verbalization of thoughts, feelings, or reactions while performing or immediately after performing a task, such as reading a script or watching a video [47]. The interviews were designed to examine script language, information comprehension, informativeness, storyline realism, identification/transportation, script improvements, and character likability. Open-ended questions assessed needed improvements, language appropriateness, information comprehension, and likability of the storyline, characters, and setting. The brief survey assessed the script's quality and informativeness. A mix-methods approach was employed to optimize intervention engagement and outcomes by identifying and incorporating the perspectives of the target audience [48,49].

2.3.1. Participants

In Fall 2021, we recruited undergraduate research assistants at the university ($N = 10$) to complete a one-on-one interview. Participants were eligible if they were between the ages of 18 and 26 years old and had working video and audio on their computer. Participants were on average 21.6 ($SD = 1.2$) years old and included seven men, three women, five identified as Hispanic/Latino and four identified as White, four as Asian, one as multi-ethnic, and one respondent listed race/ethnicity as other.

2.3.2. Procedure

After completing consent, participants met with the interviewer via Zoom for an interview. The interviewer informed the participant that she would be transcribing the interview during the session but that the interview would not be recorded. Participants in preliminary pilot tests had voiced that they would feel more at ease discussing this sensitive topic if the interviews were not recorded. Thus, interviews were not recorded, enabling participants to be candid about sensitive topics.

Participants first completed the think-aloud task, for which the video script was divided into six sections. Participants were asked to stop at the end of each section to vocalize their thoughts, feelings, and reactions. If participants found anything confusing, the interviewer recorded the areas of confusion and probed further about what the participant found confusing. After participants finished the six sections, the interviewer asked several open-ended questions. After the interview had been completed, participants received a link to an online survey. Interview length averaged 31.4 min ($SD = 6.6$; range 22–41 min). The University's Institutional Review Board approved all study procedures (Protocol ID UCM2021-142).

2.3.3. Measures

Open-ended questions assessed improvement suggestions (e.g., "What do you think can be improved?"), language appropriateness (e.g., "Do you think the language is appropriate for undergraduates at the university?"), information comprehension (e.g., "Was there anything you found confusing about the information in the script?"), and script likability (e.g., "What did you like about the script?").

An 8-item quality measure, adapted from Lee et al. [50], assessed script quality (e.g., "The script was appealing.", "The script was

believable.", "The script was relevant to me.") with ratings ranging from *strongly disagree* = 0 to *strongly agree* = 4. Informativeness was assessed with 3 items (e.g., "I gained a lot of information from this script.", "The script was logical and rational.") with ratings ranging from *strongly disagree* = 0 to *strongly agree* = 4.

Participants age, gender, and race/ethnicity were assessed.

2.3.4. Statistical analysis

Qualitative data from the think-aloud task and open-ended questions were entered into excel and analyzed using deductive and inductive thematic analysis [e.g., 51-53]. The first author and two trained research assistants in qualitative analyses coded the interviews for the following themes identified a priori based on narrative communication concepts: (1) language appropriateness, (2) information and storyline comprehension, (3) informativeness, (4) realism, (5) identification/transportation, and (6) likability. We also adopted a realist approach in identifying any new themes at semantic and interpretive levels based on the procedures detailed by Braun and Clarke [54]. The realist approach focuses on the context in which events or behaviors occur and seeks to uncover the underlying mechanisms that explain why certain outcomes happen in specific contexts. This approach is particularly interested in how the interaction of various factors generates the observed results. The script evaluations (i.e., quality, informativeness) and demographics were assessed with descriptive statistics. The script evaluation ratings of *Agree* to *Strongly Agree* by 60% or more participants were considered acceptable for all survey questions, except for the statement, "The script did not teach me anything new" which was deemed acceptable if 60% or more participants rated this question *Disagree* to *Strongly Disagree*.

2.4. Stage 3: Video evaluation and refinement

The refined script from Stage 2 was utilized for video filming. We recruited undergraduate students with acting experience to audition for the video roles. Staff met with the chosen actors twice prior to filming to provide instructions relating to the delivery of the script in line with narrative communication theory and to practice lines. During these sessions, stage direction was added, and language was further refined to match the dialect of the undergraduate population.

We contracted a professional videographer to film and create the video. The 7:39-min video was filmed in Spring 2022 on the university's campus. On the day of filming each actor signed a photo/video release form and tested negative for COVID-19. Filming took approximately four hours, and the actors received a \$50 gift card for their time. The video was then evaluated.

2.4.1. Participants

In Spring 2022, we recruited undergraduate students ($N = 12$) via SONA, the university's research participant pool to complete one-on-one interviews to evaluate the newly developed video. Participants were eligible if they were between the ages of 18 and 26 years old and had working video and audio on their computer. Participants were on average 20.8 ($SD = 2.1$) years old, and included ten females and two males, six identified as Hispanic/Latino, and three identified as White, two as Asian, one as African American/Black, one as multi-race, and five identified as a race/ethnicity not listed.

2.4.2. Procedure

After completing consent, participants met with the interviewer via Zoom for an interview. Participants were informed that the interview would be transcribed, and that the interview consisted of three tasks (1) a think-aloud task, (2) open-ended questions, and (3) a brief survey. Participants first completed the think-aloud task, for which the video was divided into three segments that were between 2.00 and 2.30 min in duration. At the end of each segment, participants were asked to vocalize their thoughts, feelings, and reactions. After the think-aloud task, the interviewer asked several open-ended questions. Once the

interview was completed, participants were sent a link to an online survey and were granted course credit. The interviews lasted an average of 32.9 min (*SD* = 6.1; range 24–47 min).

2.4.3. Measures

Open-ended questions were identical to Stage 2 with the addition of assessments on character likability and realism (e.g., “What do you think about the characters in the story?”; “Do you feel like the scenario could happen in real life?”).

The quality and informativeness subscales were identical to Stage 2 except for referencing the video rather than script.

Demographic measures were identical to Stage 2.

2.4.4. Statistical analyses

Statistical procedures were identical to those in Stage 2. Themes were chosen a priori based on narrative communication concepts and participant perspectives for video refinement. A realist approach was used to identify any new themes at semantic and interpretive levels based on Braun and Clarke’s [54] detailed procedures. Video evaluations and demographics were assessed with descriptive statistics. Video evaluation ratings of *Agree to Strongly Agree* by 60% or more participants were considered acceptable for survey questions, except for the statement, “The video did not teach me anything new”, which was deemed acceptable if 60% or more participants rated this question *Disagree to Strongly Disagree*.

3. Results

3.1. Stage 2: Script content evaluation results

3.1.1. Script content evaluation qualitative findings

Table 2 presents the thematic findings. Thematic analysis revealed that the key aspects of narrative communication were present, participants were able to comprehend the information delivered, and they liked the presentation of the information. Thematic analysis not only revealed important findings that fit within the a priori themes and had direct implications for script revisions, it also uncovered a new theme—the need for additional information. First, participants felt that the language was often too formal. For example, participants expressed that the way in which the characters greeted each other was too formal; thus, they suggested greetings that were commonly used in their everyday vernacular. Second, participants voiced their concerns about terms that seemed inappropriate for the situation such as the word, ‘honor’. In the script, the character Sofia says, “I already got my first dose. I did it in honor of my mom.” Some participants felt that the word ‘honor’ in their culture usually indicates that the person you are honoring has died. The use of this word created confusion and some participants questioned if Sofia’s mom had died. The line was edited by participants and revised to read, “Yes, I got my first dose already because this situation with my mom has really freaked me out!” To further clear up any confusion about Sofia’s mom being alive, we added a line at the end stating, “I know my mom would be happy to know you are both protecting yourselves.” Third, participants had questions about topics that were not covered in the script, such as the use of condoms to prevent HPV and the anatomical location that cervical cancer affects. We added dialogue between the characters, Luis and Sofia, to help clarify the anatomical location of the cervix and information on condoms not being 100 % effective in HPV prevention. Fourth, participants recommended that the script make more comparisons to other vaccines such as the flu vaccine—a vaccine students may be familiar with and potentially receive every year. Lastly, participants indicated wanting details about where to get additional HPV vaccine information. All participant suggestions and refinements were incorporated into the final script (See Supplementary Table 1).

3.1.2. Script evaluation quantitative findings

Descriptive results indicate that all participants *strongly agreed/*

Table 2

Summary of script one-on-one interview thematic findings with sample responses.

Theme	Sample Responses
1. Appropriateness of the script language	Participants voiced when they felt that the language was not appropriate or accessible for understanding the information. Further, participants offered revisions to make the language colloquial. “There were several instances where the language is too formal.” (Women) “It’s all simple vocabulary, but I would change the word ‘honor’ to something else.” (Man)
2. Comprehension	Participants voiced when they felt that the information was clear as well as when the information presented, or scenario was unclear or confusing. “The whole section makes sense, and I got all the information I needed.” (Man) “Did Elena’s mom die? This sentence seems to indicate that the mom has died. I don’t think [getting a vaccine] is a nice way to honor your mom. It’s a little confusing.” (Man)
3. Informativeness	Participants expressed when new information was learned. “I did not know that HPV was an STI.” (Man) “Oh, guys can get it [HPV] too?” (Women)
4. Realism	Participants expressed when the storyline seem like it could happen in real-life. “[It] sounds like a real scenario. Elena looking up HPV [on the computer] seems like it was something I would do.” (Women) “I like that it sounded like it could be a true story. It doesn’t seem too scripted or dramatic.” (Women)
5. Identification/ Transportation	There were several instances where participants voiced that the storyline was relevant or relatable to their own lives and that they were absorbed in the storyline. “In my mind, I was being Elena and if my roommate came in, I would ask her the same questions.” (Woman) “The mom having cancer makes people more empathetic.” (Man)
6. Likability	Participants expressed if they liked or did not like how the information was presented, the storyline, or the characters. “I liked the informational part. Learning about HPV. What we can do to prevent it. I enjoyed seeing Sofia’s friends acknowledge the situation and affirm.” (Man) “I liked that it kind of acted like a FAQ. Elena or Luis would ask about the vaccine and there would be clear information about it” (Woman)
Need for Additional Information	Participants expressed when there were areas that needed more information or that comparisons should be made to make the information more relatable. “Overall, make more comparisons, like make comparisons with the flu shot. It’s just like getting the flu shot.” (Man) “Someone who has anxiety might need to know exactly what they are calling for. Add more details about who to call and where to go.” (Woman)

Note. Themes 1–6 represent a priori themes. New themes captured in thematic analysis are listed below a priori themes.

agreed that the script was persuasive, interesting, believable, of high quality, and logical and rational. Further, all participants *strongly disagreed/disagreed* that the script was boring. Most participants ($\geq 80\%$) *strongly agreed/agreed* that the script was an appropriate length, relevant to them, appealing, and that they gained new information. Only 40% of participants *strongly agreed/agreed* that the script did not teach them anything new (See Supplementary Table 2).

3.2. Stage 3: Video evaluation results

3.2.1. Video evaluation qualitative findings

Table 3 presents the thematic findings. Thematic analysis revealed that the key aspects of narrative communication were present while viewing the video, and participants agreed that the information presented was clear and concise and, although participants had varying degrees of knowledge about HPV and the vaccine, most indicated that they gained new information. Thematic analysis also revealed a new

Table 3
Summary of video one-on-one interview thematic findings with sample responses.

Theme	Sample Responses
1. Appropriateness of the video language	<p>“The guy said, ‘we have your support’ that’s not something you would generally hear them say but I get what they were trying to portray with giving support for their friend.” (Woman)</p> <p>“It was like a conversation that you would have with your friends.” (Woman)</p>
2. Comprehension	<p>“I think when they were reading off the google searches it was a little difficult to keep up and there was medical information that can be confusing.” (Woman)</p> <p>“It’s very understandable. It’s easy to follow along.” (Woman)</p>
3. Informativeness	<p>“I thought it was informative. There were definitely parts I was like I didn’t know that.” (Woman)</p> <p>“I think this is completely new to me. I did not know what HPV was. I was aware of other STDs like AIDS/HIV.” (Man)</p>
4. Realism	<p>“I think at first it seemed very dramatic but considering the topic, I think it’s good and it’s helpful.” (Woman)</p> <p>“I thought it was also interesting and having it staged on campus and it will help students think it’s actually being portrayed on campus.” (Woman)</p>
5. Identification/Transportation	<p>“I can totally feel her pain because a year ago I lost my mother to lung cancer. She had cancer the first time which was in the breast area, and it metastasized to the lung area. Seeing her suffer through the pain of cancer was really hard to live.” (Man)</p> <p>“My mom went through something like that I just didn’t tell anyone. The fact that she vocalizing it shows that there is a lot of support at the school.” (Woman)</p>
6. Likability	<p>“I thought it was cool how you guys took real students. I’ve seen them before. I think it’s cool because they look our age and look like us. You are more likely to listen because they are just like us. They know what life is like at this age and at this school. It was nice that they look our age and I’ve seen them around campus.” (Woman)</p> <p>“I like the amount of info and how it was a conversation throughout, and she wasn’t just lecturing them. She didn’t shut her friends down when they were asking questions. The girl on the laptop was looking it up as they were talking about it, and it shows that you can do reach on it.” (Woman)</p>
Video Enhancements	<p>“I thought the introduction was long. The intro was long so if you can condense it...” (Man)</p> <p>“The sound could be clearer. Maybe turn the music down.” (Woman)</p> <p>“There is a lot of information at once so if there are visuals or graphics/bullet points it would be helpful. They talked about specifically for UC Merced at the end so if there is a link at the end that would be good.” (Man)</p>

Note. Themes 1–6 represent a priori themes. New themes captured in thematic analysis are listed below a priori themes.

theme—video enhancements, and several critical issues which were addressed in the final video. First, participants indicated that the introduction scenes of the video were too long. As such, the introduction scenes were reduced by 14 s reducing the video from 7:39 min to 7:25 min. The introduction scenes included the character named “Sofia” walking through the campus, to her dorm, and into her dorm room. Because there was no vital information presented during the introduction, we felt it was acceptable to reduce the opening scenes. It is possible that a video longer than 7 min is still too long; thus, further considerations should be given to the video length and future intervention implementation. Second, the analysis revealed that participants were not aware of where the health center’s location is or how to contact them. Information was included at the end of the video about the location and contact information for the health center. Third, participants who process information visually may benefit from a brief written synopsis of the information presented in the video. Thus, “HPV Fast Facts” slides were created and presented at the end of the video.

3.2.2. Video evaluation quantitative findings

Descriptive results indicate that participants (≥75%) *strongly agreed/agreed* that the video was appealing, persuasive, interesting, believable, logical and rational, and they gained new information. Most participants (≥66.7%) *strongly agreed/agreed* that the video was an appropriate length, high quality, and was relevant. Over half of the participants (58.4%) *strongly disagreed/disagreed* that the video was boring and that it did not teach them anything new (See Supplementary Table 2).

4. Discussion and conclusion

4.1. Discussion

This project developed and evaluated a theoretically guided health communication video for college students containing information on HPV, the HPV vaccine, and HPV-related cancers. Analysis revealed that participants felt that the newly developed video was appealing, persuasive, interesting, believable, and of high quality. Participants also reported that they gained new information about HPV and the HPV vaccine from the video. This project describes a process which can be utilized to develop comparable narrative CSM videos that are tailored to specific audiences to maximize identification with the characters, coherence, and motivation for specific audiences. The framework is uniquely suited for developing narrative communications. First, it utilizes a theoretical framework of health cognitions and health behavior decisions to develop the contents and messages of the narrative video. We suggest that utilizing the CSM can enhance the narrative intervention’s efficacy relative to a health communication that focuses solely on the narrative mechanisms. As the CSM was developed to capture how people encode, process, and develop schema for health threats such as illness risks and has accumulated substantial empirical support [36], it serves as an efficacious guide for health persuasion messages [55,56]. Furthermore, the CSM constructs, specifically illness risk representations, influence protective behaviors. Therefore, using risk representations as a guide for the video content highlights the relationship between the perception of risk information and the decision to engage in protective actions. Having a clear understanding of a health threat can reduce distress and increase protective behaviors (e.g., HPV vaccination). Second, the implementation of the think-aloud method enabled undergraduate students to aid in the development of the script and video content and to provide their perspectives. This method was also beneficial in identifying unanticipated responses, which resulted in important modifications to the script and video contents. Third, we employed deductive and inductive thematic analysis to examine the qualitative interviews which proved an effective methodological approach. By selecting themes a priori, we were able to refine the script and video based on narrative communication concepts and participant perspectives. Including a realist approach enabled the identification of

new themes (i.e., new information, video enhancements), and thus, necessary refinements to the script and video. This approach proved essential for achieving key refinements.

4.2. Innovation

There are several ways in which this project was innovative. Firstly, it applies the ORBIT framework [45] for creating a CSM-guided narrative intervention to boost HPV vaccination. The ORBIT model's strength lies in its focus on early intervention development stages, offering a non-disease-specific, iterative, and rigorously tested approach, unlike many traditional health outcome-focused models. Secondly, the project's methodological approach involved undergraduate students in both the development and evaluation of the narrative video intervention, ensuring content relevance and refinement based on their feedback. This inclusive strategy also extended to utilizing university students as video actors and filming on campus, enhancing the intervention's relatability. Finally, the project delineates a replicable process for crafting population specific CSM guided narrative videos, aiming to enhance identification, coherence, and motivation among young adult university students.

4.3. Conclusion

This project developed, evaluated, and refined a theoretically guided health communication video for diverse university students. This research represents essential preliminary steps before advancing to the subsequent phase, which involves executing a pilot randomized controlled trial to assess the video's influence on perceptions of HPV risk, intentions to receive the HPV vaccine, and actual HPV vaccination rates. We provide a step-by-step guide for utilizing narrative communication key concepts and the CSM to encourage protective behaviors, which serves as a model for developing future behavior change interventions tailored to diverse populations.

CRediT authorship contribution statement

Sara E. Fleszar-Pavlović: Writing – review & editing, Writing – original draft, Visualization, Resources, Project administration, Methodology, Investigation, Funding acquisition, Formal analysis, Data curation, Conceptualization. **Linda D. Cameron:** Writing – review & editing, Writing – original draft, Validation, Supervision, Software, Resources, Project administration, Methodology, Investigation, Conceptualization.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper. S.F.P. is funded by The Ruth L. Kirschstein NRSA Institution Research Training Grant (T32; 5T32CA251064-03) in Cancer Training in Disparities and Equity (C-TIDE).

Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.pecinn.2024.100272>.

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