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Testing the Effects of the Addition of Videos to a Website Promoting Environmental Breast Cancer Risk Reduction Practices: Are Videos Worth It?

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Abstract

Searching for ways to reach wider audiences in more comprehensible ways, health promotion agencies might add videos to their current web offerings. While potentially costly and time consuming to create, the effect of these videos on websites has not received much attention. This study translated research about the potential breast cancer risk for young girls associated with the household chemical PFOA into two websites mothers with young daughters were randomly assigned to view (website with videos vs. website without videos). Results revealed participants in the video condition found the advocated risk protective behaviors easier to perform and stated they were more likely to perform them than those in the non-video condition. Approximately 15 days after exposure, those in the video condition performed on average one more protective behavior than those in the non-video condition. Results also suggest that agencies' efforts should focus on creating one quality video to place on a homepage, as video views declined the deeper people navigated into the site. Behaviors advocated should also be ones that can have lasting impacts with one-time actions, as effects wore away over time. Additional strategies are discussed for health promoters seeking to create videos to add to their current websites.

Communicating complex information for lay audiences is a challenging task. Health literacy research recommends the addition of videos to health information to potentially increase the ease of understanding current health materials (Davis et al., 2002; Gagliano, 1988; Michielutte et al., 1999). Health promotion agencies, in particular, might respond to this recommendation by adding video to their current web offerings as a strategy to make complicated health information simpler to comprehend. Videos have the advantage of showing target audiences how to specifically perform risk reducing behaviors rather than simply explaining the behaviors (Gagliano, 1988; Huang, 2009). A combination of words, pictures, and actions by similar individuals can make difficult content (e.g., highly scientific, jargon laden, breast cancer risk research) seem realistic and achievable (Albert, Buchsbaum, & Li, 2007); but do videos make a measurable impact on positive outcomes? One barrier to producing high quality videos is the time and expense necessary to create them. Will the

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added time and expense to make quality videos be worth it? Will the audience even find the additional videos useful? These questions are what the current study strives to answer through the context of environmental breast cancer risk reduction practices.

This study translated research from the laboratory about one potential carcinogen, perfluorooctanoic acid (PFOA) into a simple, seven-page website for mothers of young daughters to view. Two nearly identical versions of the website were created with one notable exception: one website included brief, informative videos with scientists and a concerned mother talking about PFOA and protective behaviors, and the other version of the website had no videos. Additional video content, alongside traditional print content, is believed to further reduce the translational and literacy barriers often present in cancer communication (Davis et al., 2002). The current paper reviews research about breast cancer related environmental exposures, specifically PFOA's potential role, as well as the need for research regarding the potential benefits the addition of video may play in helping with translation and increased behavior change.

Breast Cancer Related Environmental Exposures

While environmental factors account for an estimated 75-80% of cancer cases and deaths in the United States (ACS, 2011a), the amount of harm certain environmental exposures can cause adolescent and pre-adolescent children is still not entirely understood (President's Cancer Panel, 2010). Additionally, research identifies pre-adolescent and adolescent pubertal development as a crucial time period for breast cancer risk. This is a time of rapid cell proliferation in the breasts that may make them more susceptible to damage from chemical carcinogens (Wolff, Collmann, Barrett & Huff, 1996).

PFOA

A chemical that may increase children's cancer risk later in life is perfluorooctanoic acid (PFOA), which can be found in many products typically found around a person's home. PFOA, used in the manufacturing of non-stick and stain-resistant coatings on products such as rugs, furniture, clothes, and cookware (Rudel et al., 2007), is also found in foods prepared in packaging containing the chemical (Tittlemier et al., 2007), such as microwave popcorn bags, pizza boxes, and grease resistant fast food containers. It can be breathed-in from carpeting and flooring treatments treated with products produced with PFOA (Fromme et al., 2009). Also, PFOA is a chemical that is difficult to pronounce and to identify on product labels, which makes it an excellent selection for translation into a website and video format for the current study.

Even though the evidence connecting PFOA to future breast cancer risk may not be fully established, a precautionary approach needs to be taken toward informing the public about potential risks, particularly for children and preadolescents (President's Cancer Panel, 2010). New evidence is constantly emerging on the links between breast cancer risk and environmental exposures and the precautionary principle is guided by the general thought that it is better to take precautionary measures even in the face of uncertain findings.

Mothers as the Primary Target Audience

A first step in developing any type of message is to identify a primary audience for whom to tailor the message. Mothers of young daughters make sense as a target audience for messages about adolescent breast cancer risk reduction because they are typically the primary caretakers of children (Janicke & Finney, 2003), are key role models and sources of health information for their daughters (Austin, 1995), and can influence how adolescents interpret information (Cowan & Avants, 1988). Research also shows uncertainty among mothers regarding the causes of breast cancer, especially with regards to environmental factors (Silk et al., 2006).

Video as a Learning Tool and Retention Cue

As the most common cancer among women (ACS, 2011a), breast cancer research consumes millions of dollars each year. However, most of these findings get published in discipline-specific journals and presented at discipline-specific professional meetings (Kerner, 2006). Instead of reaching the populations who could benefit from those findings the most, much of the information is only reaching those who subscribe to specialized industry publications or members of health organizations; very little is reaching the outside world (Arkin, DeForge & Rosen, 2009). A “signal-to-noise” ratio problem exists where so much information is getting churned-out but very little is getting translated into digestible information. However, it is likely not enough to simply translate information into accessible text-only formats (Davis et al., 2002). Even with text translated to a manageable reading level, low-literate individuals may still have difficulties comprehending particular cancer prevention behaviors (Michielutte et al., 1999). Having the ability to observe and listen to video translations of complex information may be essential to promoting learning and subsequent behavior adoption. However, despite recommendations to add videos to health information to ease understanding (Davis et al., 2002; Gagliano, 1988; Michielutte et al., 1999), no study has looked to see if added videos may lead to any positive benefits. This study seeks to fill that gap in the literature.

Additionally, as more people than ever are now going to the web seeking health information, it is important to find ways to effectively communicate with all those visitors. Taking a theory based approach to incorporating videos into online health information would be wise; however, no one theory can effectively explain how the addition of videos can be used to help audiences (Liu, Liao, & Pratt, 2009). Instead, a combination of theories is the best approach to help capture the complexity inherent in an online multimedia learning environment: social cognitive theory, media richness theory, and cue summation theory.

Social cognitive theory

Social cognitive theory (Bandura, 2001), based on the premise that people learn through observation of models, helps to explain why video may be a useful addition to text-based websites advocating preventive actions. According to the theory, various conditions are necessary for modeling or observational learning; specifically, there must be retention where the individual is able to remember what the behavior was to which they were paying attention (i.e., recalling video, verbal descriptions, mental images, or both) (Bandura, 1977).

Intuitively, when it comes to learning new behaviors, it is much easier to see them done than by reading a lot of information word-by-word. Videos can also show how susceptible individuals can be to potential risks and how severe the subsequent outcomes of those risks can be. A combination of words, pictures, and actions by real people can make difficult content seem easy to perform, realistic, and achievable (Albert et al., 2007).

Media richness theory

Media richness theory (Daft & Lengel, 1984) posits that when senders wish to send complex messages, richer media (e.g., face-to-face) should be more effective for receivers than leaner media (e.g., text-only emails). Richer media, like videos, can carry much more information (e.g., ability to show visuals of how to perform a task), reduce ambiguity, and can be more useful for complicated directions and activities. On its surface the current study's website could easily be described as one that contains a plethora of complex information; receivers are given scientific information and a series of actions to reduce PFOA exposures in their homes. Prior studies have found that the incorporation of richer media, like videos, to websites can increase audience concentration/engagement levels of the users with the content (Liu et al., 2009). Richer media websites can elicit higher satisfaction and more positive attitudes toward the websites and their content than their leaner media website counterparts (Simon & Peppas, 2004), as well as increases in attractiveness and credibility (Walker et al., 2009).

Cue summation theory

Cue summation theory (Severin, 1967) also helps to explain why the additional channel of video to a website may help in increasing knowledge. An additional channel (i.e., video) to a text-only website should help to increase knowledge because it provides additional cues for the audience to draw on in the future. However, the additional channel cannot just provide redundant information (i.e., exactly the same verbatim information), or information that is unrelated, as it is likely to cause interference and lead to a decrease in learning and retention (Severin, 1967). Additional media instead must complement existing information by including some of the same information in the primary media, but also offering some add-ons (e.g., relevant pictures or modeling behaviors). These additional, relevant cues are predicted to sum with the primary media (i.e., text), and lead to increased learning as compared to the primary media alone.

Through the combination of the three theories outlined and previous findings presented, the following hypothesis is postulated:

> *H1:* The outcome measures of knowledge, severity, susceptibility, self-efficacy, response efficacy, behavioral intention, credibility of the website, satisfaction, and engagement with the website will be higher for the video website condition than the non-video condition immediately after viewing the website.

Findings from video enhanced interventions have found that video is usually more effective than just text-only information in the short run (Nielsen & Sheppard, 1988). However, there is a dearth of research looking at the longer-term effectiveness of videos on other attitudinal and behavioral components (Krouse, 2001; Michielutte et al., 1999). To meet this call, the

current study employed another measurement collection approximately two weeks after the participants originally viewed the website with the primary purpose of determining if there were actual behavioral differences between the two conditions.[1] The combination of theories outlined previously provides the same rationale for predicting that the video condition should continue to lead to more robust effects than the text-only condition weeks after the initial exposure.

> *H2:* The outcome measures of knowledge, severity, susceptibility, self-efficacy, response efficacy, behavioral intention, and behavior will be higher for the video website condition than the non-video condition approximately two weeks after the initial viewings.

While the outcome measures in the video condition might remain higher than those in the non-video condition, would they still be subject to reduced longitudinal effects that are usually seen in one-shot message campaigns? Without multiple doses and across various channels of messaging over time, the persuasive impact of campaigns will usually taper off (Atkin, 2001). However, vividness in messages, possibly produced by watching videos of people performing behaviors, can enhance the salience of issues in the minds of receivers (Murray-Johnson & Witte, 2003). Is it possible those in the video condition might not succumb to the decline in attitudes usually seen over time because the videos provide a more vivid recollection of the seriousness of the problem and the ease of prompted solutions? Therefore, we pose the following research question.

> *RQ1:* Will the outcome measures diminish over time for those in the non-video condition, while remaining stable over time for those in the video condition?

The addition of video is also believed to help low-literate audiences (Davis et al., 2002; Gagliano, 1988; Huang, 2009; Krouse, 2001). However, the assessment of literacy is usually an extremely lengthy survey. Prior studies have found a strong relationship between literacy and education level (Moon et al., 1998), therefore participants' level of education will be used as a proxy for literacy in the current study. Because of the belief that videos can be useful for low-literate populations we pose the following research question:

> *RQ2:* What is the effect of website condition (i.e., videos versus no videos) on low literate (i.e., less educated) participants on the study's outcome measures?

While the addition of video is touted to be superior to text-only material (Gagliano, 1988; Krouse, 2001), do audiences find an extra benefit of having the additional videos available? Producing and editing videos of a high quality for websites not only takes considerable effort, but also capital, which may be hard for cash-strapped agencies to obtain. Despite calls in the literature for adding videos to current health information, no study has looked at whether the audience really finds them useful additions. Furthermore, no study has asked audiences specifically what they would like to see in additional videos dealing with cancer prevention techniques. Therefore, the following research questions are posed:

[1]The time frame of two weeks was chosen because research indicates individuals consume fast food at least once a week (Pereira et al., 2005), and households make trips to the grocery store approximately twice a week (Bawa & Ghosh, 1999). This timeframe would give participants adequate time to make the changes advocated by the website (e.g., look at labels more closely, avoid fast foods in certain packaging, throw away certain items, purchase new PFOA-free items).

RQ3: What are participants' reactions to the videos?

RQ4: What do participants recommend as improvements for the videos?

Method

Participants were mothers (N=197) of young daughters up to 12-years-old. Participants' ages ranged from 21 to 51-years-old (*M* = 33.21). Additionally, 86.8% of participants classified themselves as Caucasian, 4.6% as African American, 3.6% Hispanic, 2.5% Other, and 1% each of Pacific Islander and American Indian. Numerous media were used to recruit participants (e.g., messages posted on Facebook pages of national mother organizations and news outlets, Craigslist postings in major U.S. cities, and online community newsletters). Recruitment messages asked for mothers of young daughters to look at a new website and provide their opinions. For completing two surveys (i.e., immediately after viewing the website and two weeks later) the mothers received a $10 honorarium.

At the start of the survey participants created a unique identification code used to match their responses between surveys, yet keep their identities anonymous. Participants were then randomly assigned into one of the two website conditions (i.e., video or non-video), and asked to "click-through, read, and interact with ALL of the material" on the website's seven pages. After viewing content on the website, they clicked on a large yellow button placed at the bottom of the website which brought them to the second part of the survey (Time 1). Two weeks later participants were emailed and asked to fill-out a second survey to receive their honorarium (Time 2).[2]

Website Development

The website took more than a year to conceptualize, develop, and implement. The website's text went through numerous translation stages and was ultimately reduced to about a 9th grade reading level. Crafted by a professional website designer, the website consisted of seven pages: a homepage, one describing what PFOA is, where it is found, why it is a problem, what a mother can do about PFOA, what is currently being done with PFOA, and useful links mothers could follow to learn more about PFOA. The different pages were easily navigable using links across the top of the screen.

Because the simple inclusion of scientific findings and information to increase learning seldom leads to behavior change, the creation of the text for the website was informed by key theoretical constructs. Specifically, wording was used to increase participants' perceived threat (i.e., perceived severity and susceptibility) about the possibility of their daughters developing breast cancer from PFOA in household items. The website also included clear statements emphasizing the simplicity of the actions the participants could take to decrease their daughters' risk of developing breast cancer as an attempt to build self-efficacy.

Videos—A research team member, who was also a former television reporter, produced the four brief videos placed on the website. Two interviewees, who were scientists, explained

[2]The majority of participants completed the Time 2 measures within one week of receiving the email asking them to complete Time 2. The median length of time between the Time 1 exposure and the completion of Time 2 was 15 days.

the problem of PFOA like they were speaking to elementary school children, in order to assure the content in the videos would be understood by a range of viewers. On the home page, there was a 30-second video with a mother introducing her concerns with PFOA. All of the videos contained light music to break up sound bites, as well as pictures of products and relevant imagery related to what the interviewee was discussing. On the "Where is PFOA found?" page, a video of just more than 2-minutes focused on a breast cancer prevention researcher who discussed where PFOA can be found in the home, and how it can be avoided. The page "What's the Problem with PFOA?" had a 1:30 video of a scientist discussing her lab research with PFOA, and how PFOA can potentially impact young girls' breast development. The fourth video was found on the page devoted to tips mothers can perform to reduce their daughters' PFOA exposures. This minute long video featured the same mother on the homepage who discussed specific things she is doing in her home to reduce PFOA contacts.

Informed by cue summation theory, every attempt was employed to make sure the content in the videos complemented the text on the website (e.g., showing pictures of items mentioned in the text when the interviewees discussed certain items), but the words spoken by the interviewees in the videos were not identical word-for-word to the website's text, as that would provide too much redundancy. Also, informed by social cognitive theory, the videos with the mother showed modeling behaviors. For example, shots of the mother included her reading labels more carefully, using proper pans, and looking in drawers to ensure there was no microwave popcorn around.

Measures

At Time 1, participants completed measures of perceived severity and susceptibility; self efficacy; response efficacy; behavioral intention; credibility; and satisfaction. At Time 2 participants again completed these measures, excluding satisfaction. Confirmatory factor analyses were run on scales with more than four items, which led to the removal of an item for both behavioral intention and severity. The final scales had reliabilities of .864 or higher.

Time 1 and 2 participants responded to knowledge items, demographic items (e.g., level of education), and those in the video condition provided feedback (open and closed-ended) to items about the quality and usefulness of the videos. Also, at Time 2 participants indicated what recommended behaviors, if any, they performed since visiting the website weeks prior.

Knowledge—Knowledge was assessed three different ways. Five questions asked factual questions about PFOA determined from the content of the website (e.g., PFOA exists naturally in the environment, PFOA is in the blood of most people). The answer responses consisted of: true, false, and unsure. All answers could be determined just by reading the text; that is, no question asked about anything that was solely mentioned in the videos. Additionally, participants were asked to check boxes next to products with PFOA (e.g., non-stick cookware, pizza boxes, fast food wrappers) they remembered from the website as well as to check boxes next to behaviors the website mentioned to reduce PFOA exposure (e.g., look more closely at labels, avoid fast foods in grease/oil resistant packaging). The number of correct responses was summed for each participant in its respective knowledge category

(i.e., knowledge about PFOA, products, and actions to take), meaning each participant received three knowledge scores.

Severity and susceptibility—Severity and susceptibility were assessed by items adapted from the risk behavior diagnosis (RBD) scale (Witte, Cameron, McKeon, & Berkowitz, 1996). Participants rated their level of agreement on a seven point scale (i.e., strongly agree to strongly disagree) for three statements (e.g., consequences of using PFOA products are severe, using PFOA products is dangerous to a person's health) (T1α=.933, T2α=.908). Susceptibility items asked for agreement on four statements (e.g., it is likely the cancer risks associated with using PFOA products will impact my daughter, my daughter is at-risk for negative consequences if exposed to PFOA) (T1α=.903, T2α=.915).

Efficacy—Self-efficacy and response efficacy were also assessed by items adapted from the risk behavior diagnosis (RBD) scale (Witte et al., 1996). Self-efficacy items asked for level of agreement on four statements (e.g., I have the ability to engage in the risk reduction practices recommended on the website, it is easy for me to engage in the risk reduction practices recommended on the website) (T1α=.902, T2α=.864). Response efficacy also asked for agreement on four statements (e.g., checking product labels for harmful chemicals is an effective way to protect people from getting breast cancer later in life) (T1α=.941, T2α=.950).

Behavioral intention and behavior—A general measure of behavioral intention was assessed with four items (T1α=.942, T2α=.945) asking participants whether they planned to perform future actions because of their new knowledge of PFOA (e.g., I intend to reduce the number of products with PFOA in my home, I intend to seek more information about PFOA). At Time 2, actual behaviors were measured by asking participants to select the PFOA reduction techniques advocated by the website that they performed over the past two weeks from a list that was provided (e.g., I looked more closely at the labels of products I bought, I avoided using non-stick cookware that may be made with PFOA).

Credibility—Website credibility was measured along three dimensions (i.e., competence, caring, and trustworthiness) adapted from McCroskey and Teven (1999). Three items asked about competence credibility (e.g., the website provided expert knowledge) (α=.903), three items asked about caring credibility (e.g., the website content communicated strong concern for people) (α=.900), and three items asked about trust credibility (e.g., I feel like I can trust the information included on the website) (α=.956).

Satisfaction—Satisfaction with the website was assessed using a scale with items adapted from Scott and Craig-Lees (2010). Five items were used and asked agreement level on statements such as: I found the website pleasing; I found the website satisfying (α=.876).

Engagement—An objective measurement of website engagement was determined by using Google Analytics to track the average amount of time users spent on the websites (and each of the seven pages) during the course of the study.

Education—Education was determined by asking one item about the highest level of education completed (i.e., less than high school; high school/GED; some college; 2-year, 4-year, or Graduate degree).

Feedback—Opinions about the videos were obtained from a series of single-item questions about their length (very good, good, okay, poor, very poor), the amount of information presented (too much, just right, not enough), usefulness ("I thought the videos were a useful addition to the website," 1=SD to 7=SA), ratings of the interviewees ("I found the: mother easy to relate to, experts in the videos credible"), and an overall rating of all the videos presented (very good, good, okay, poor, very poor). These items were adapted from Murphy et al. (2000). Participants in the video condition were also allowed to give open-ended opinions about what they would change regarding the videos.

Results

Time 1 - Hypothesis 1

There were 197 participants who completed the study at Time 1 (95 in the video condition and 102 in the non-video condition). A manipulation check asked participants in the video condition how many of the videos (i.e., 0 to 4) they watched; 13 stated they watched zero. Because the study is concerned with the effect of viewing the videos on the various outcome measures, these participants were placed in the non-video condition, with the final samples for Time 1 being 82 in the video condition and 115 in the non-video condition.[3] A look at demographic characteristics between the conditions showed no significant differences between the conditions in age, numbers of children, marital status, household incomes, levels of education, or family history of cancer.

Hypothesis 1 tested whether the outcome measures of knowledge, severity, susceptibility, self-efficacy, response efficacy, behavioral intention, credibility of the website, satisfaction, and engagement of the website would be greater for the video condition than the non-video condition at Time 1 (i.e., immediately after viewing the website). An analysis of variance was used to examine the differences between conditions, and the hypothesis was partially supported. The dimensions of susceptibility, self-efficacy, behavioral intention, and the competence dimension of credibility were significant ($p < .05$). We explain these results below and in Table 1.

Knowledge—Three different survey responses measured knowledge. Five items asked factual questions about PFOA. Another question asked participants to check the boxes of 14 products they remembered the website mentioning had PFOA. Four products were incorrect, so leaving those boxes unchecked also counted as a correct response. Similarly, the final knowledge items asked participants to select which of 13 behaviors they remembered the website mentioning to reduce PFOA exposure. Four of these behaviors were incorrect, so leaving those boxes unchecked also counted as correct responses. The results showed a non-significant difference between the conditions on all three measures of knowledge.

[3]The data were also analyzed excluding the participants who were in the video condition but indicated they did not watch any videos. All significance test results for Time 1 remained the same with these participants excluded.

Susceptibility—The mean difference for perceived susceptibility between the video condition (*M*=5.43, *SD* = 1.10) and the non-video condition (*M*=5.08, *SD* = 1.09) was found to be significant $F(1, 195) = 4.97$, $p = .027$, $\eta^2 = .025$. Participants in the video condition perceived their daughters to be more susceptible to the harmful effects of PFOA than those in the non-video condition.

Self-efficacy—The mean difference for perceived self-efficacy between the video condition (*M*=6.16, *SD* = 0.86) and the non-video condition (*M*=5.67, *SD* = 0.97) was also found to be significant $F(1, 195) = 13.81$, $p < .001$, $\eta^2 = .066$. Participants in the video condition felt stronger they could perform the recommended actions to reduce PFOA in their daughters' lives than those in the non-video condition.

Severity & response efficacy—There were no significant differences between the two websites on either of these two dimensions.

Behavioral intention—The mean difference between conditions for behavioral intention was found to be significant $F(1, 195) = 7.22$, $p = .008$, $\eta^2 = .036$. Participants in the video condition (*M*=5.88, *SD* = 1.14) stated more strongly they intended to take actions pertaining to PFOA in the future than those in the non-video condition (*M*=5.38, *SD* = 1.36).

Credibility—Credibility was measured on three dimensions: trust, caring, and competence. Only the competence dimension was found to be significant $F(1, 195) = 4.04$, $p = .046$, $\eta^2 = .020$, meaning participants in the video condition (*M*=6.30, *SD* = 0.95) rated the website and its information as coming from a more expert source than those in the non-video condition (*M*=6.02, *SD* = 0.98).

Satisfaction & engagement—The mean difference for satisfaction between the conditions was found to be non-significant. However, for our measure of engagement, using Google Analytics, we could see that participants in the video condition spent approximately three more minutes on the video website (*M*=17:43) compared to those in the non-video condition (*M*=14:42).

Time 2 - Hypothesis 2 & Research Question 1

Of the 197 participants who completed the survey at Time 1, 131 completed the survey at Time 2, and were successfully matched to their Time 1 data (video N=52; non-video N=79).[4] Hypothesis 2 predicted the primary outcome measures from Time 1 would be higher for the video condition than the non-video condition weeks after the initial viewings. To test this hypothesis, a one-way ANOVA was used to examine differences between conditions at Time 2. Additionally, research question 1 asked whether the outcome measures would diminish over time for those in the non-video condition, but would remain stable for those in the video condition. A repeated measures mixed ANOVA was used to answer this question by looking for interaction effects. Tables 2 and 3 have complete results for all measures.

[4]The data were also run excluding the participants who were in the video condition but indicated they did not watch any videos. Significance test results were the same for all variables at Time 2 except for self-efficacy which was now barely non-significant *p*=.057. All significant results for the repeated measures ANOVA remained the same.

Knowledge—There were no significant differences between the two conditions on any of the three measures of knowledge at Time 2. However, the repeated measures mixed ANOVA did reveal a significant decrease in PFOA knowledge over time $F(1, 129) = 5.32$, $p = .023$, partial $\eta^2 = .040$ between Time 1 (M=3.44, SD=1.16) and Time 2 (M=3.21, SD=1.12) and between the numbers of products remembered correctly $F(1, 129) = 80.97$, $p < .001$, partial $\eta^2 = .386$ between Time 1 (M=10.97, SD=1.16) and Time 2 (M=9.69, SD=1.53).

Self Efficacy—There was also a significant effect of perceived self-efficacy at Time 2, $F(1, 129) = 4.72$, $p = .032$, $\eta^2 = .035$, where those in the video condition (M=6.01, SD=0.84) felt stronger that they could perform recommended actions than those in the non-video condition (M=5.67, SD=0.92). There was no significant main effect for time; however, the interaction between time and condition was significant, $F(1, 129) = 5.78$, $p = .018$, partial $\eta^2 = .043$. Multivariate simple effects analyses showed that the perceived self-efficacy of participants in the non-video condition did not change across time, $F(1, 129) = 0.36$, $p = .550$, Wilks' $\Lambda = .997$. However, participants' self-efficacy in the video condition did change across time, significantly decreasing from Time 1 to Time 2, $F(1, 129) = 6.81$, $p = .01$, Wilks' $\Lambda = .950$.

Severity, susceptibility, & response efficacy—There were no significant differences between conditions at Time 2 on any of these three dimensions. Similarly, no significant differences were found for time, or the time by condition interactions.

Behavioral intention—Behavioral intention also continued to be significantly different at Time 2 between conditions $F(1, 129) = 7.72$, $p = .006$, $\eta^2 = .056$, where participants in the video condition (M=5.65, SD = 0.95) stated more strongly they intended to take actions pertaining to PFOA in the future than those in the non-video condition(M=5.09, SD = 1.23). However, there was also a main effect for time, as behavioral intention decreased from Time 1 to Time 2, $F(1, 129) = 12.39$, $p = .001$, partial $\eta^2 = .088$. There was no significant interaction effect between time and condition.

Behaviors performed—A one-way ANOVA analyzed if there were differences between conditions for actual behaviors participants performed since looking at the website and taking the survey at Time 2. Participants checked boxes next to 9 behaviors recommended on the website they had performed since viewing the website. A total number of behaviors performed was calculated for each participant. The analysis found a significant mean difference between conditions $F(1, 129) = 8.61$, $p = .004$, $\eta^2 = .063$, where participants in the video condition (M=2.98, SD = 1.84) performed about one more recommended behavior than those in the non-video condition (M=2.04, SD = 1.77).

Research Question 2

Research Question 2 asked if the website condition (i.e., video versus non-video) might have an effect on less literate individuals (measured by education level) on the various outcome measures. This became a difficult question to precisely answer due to the low numbers of less-educated participants in our sample. Approximately 40% of our sample at Time 1 had at

least a 4-year degree and 21% had a graduate degree (N=121, higher-educated). That left only about 39% of our sample with a 2-year degree, some college, a high school diploma, or less than high school education (N=76, lower-educated).

A one-way ANOVA was carried out on the 76 less educated participants (33 in the video condition and 43 in the non-video condition) from Time 1 and found a significant effect for self-efficacy $F(1, 74) = 13.38$, $p < .001$, $\eta^2 = .153$, where those in the video condition (M=6.50, SD=0.69) felt stronger that they could perform the recommended actions to reduce PFOA in their daughters' lives than those in the non-video condition (M=5.74, SD=1.01).

Self-efficacy continued to be significant weeks later at the Time 2 collection $F(1, 37) = 4.65$, $p = .038$, $\eta^2 = .112$. At Time 2 the numbers of less educated respondents were fewer (N=39, 16 in the video condition and 23 in the non-video condition). However, the analysis still revealed that less educated participants in the video condition (M=6.31, SD=0.85) felt stronger that they could perform the recommended behaviors than those in the non-video condition (M=5.61, SD=1.09).

Research Question 3

Research Question 3 asked participants' reactions to the videos. Overall, reactions were positive; 84% of respondents rated the length of the videos as good or very good, with no one rating them poor or very poor. Similarly, on a seven-point semantic differential scale about the words used in the videos (7=easy to understand to 1=difficult to understand) the mean was 6.46, showing that the majority of people believed the language used in the videos was fairly easy to comprehend.

Eighty-percent of respondents said the amount of information used in the videos was "just right," while 18% responded that there was "not enough information" in the videos. Sixty-seven-percent of participants agreed or strongly agreed that the mother shown in the videos was relatable. The experts in the videos received more favorable reviews, with 79% agreeing or strongly agreeing that the experts were credible. Overall, about 84% of participants rated the videos as "good" or "very good." Also, more than 80% agreed, or strongly agreed, that the videos were a useful addition to the website.

Research Question 4

Research Question 4 asked what improvements participants would like to see to the videos. Of the 94 participants originally randomly assigned to the video condition, 57 wrote comments in an open-ended response. The researcher initially open-coded the responses, and using the constant comparative method created 8 thematic categories that could encompass all responses (e.g., an explicit statement that nothing should be changed, that someone else should be featured in the videos, that the videos could use more information, comments regarding the length of the videos). The researcher and an undergraduate research assistant then independently coded the comments using these categories with 98.4% overall agreement. The instances of disagreement were then subsequently discussed and resolved. Only themes and key illustrative accounts for possible improvements to the videos are discussed here.

Forty-percent of respondents explicitly stated they would change nothing about the videos. Four participants made comments stating that different people should be included in the videos. For example, one participant stated that it would have been nice to have other experts from outside of the academic setting. Another participant believed there could have been more diversity by stating, “It would be good to have a couple of mothers from different cultural backgrounds.” Two participants stated that the mother did not seem real enough. “Get a more ‘real’ mom in there – she was obviously acting even though she probably really did all of those things – she seemed very unnatural,” stated one participant.

Only two participants stated that the videos were not useful, with one stating, “To me videos like that add nothing to the website. If I can read it, I don’t need to watch it on a video.” A large percentage (23%) stated they wished there was even more information included in the videos, specifically more about the science. Other participants said they would have liked to see specific brands of products to avoid.

Discussion

The current research used social cognitive, media richness, and cue summation theories as frameworks to inform the addition of videos as a strategy for making breast cancer information more accessible and understandable for lay audiences. This research attempted to determine the effectiveness of adding four short videos to a website promoting the reduction of PFOA in people’s homes. The videos attempted to translate the sometimes complicated science of breast cancer research, and PFOA, into information the majority of mothers could easily comprehend.

The research supported the use of the aforementioned theories by demonstrating that individuals exposed to the video condition reported engaging in one additional risk reduction behavior than the control condition. Following the logic of social cognitive theory, instead of only using text that just tells, videos can show people how to take actions, as well as show them how easy the actions can be. Videos add an element of “realness” and “richness” to a potentially bland topic. For example, the videos showed a real mom taking steps to reduce PFOA exposures in her home. Cue summation theory also lends a theoretical basis to the possible effectiveness of the addition of videos to websites. Videos, if complementary to the text offered on the website, should provide additional helpful cues to mothers, making the information more salient in the mothers’ minds in the future than just the presence of text alone.

Videos as an Effective Tool

Results from the current study did not fully support our hypotheses, but many of the components essential in changing behavior did appear to be affected in the video condition versus the non-video condition. Those in the video condition, immediately after viewing the website, felt as though their families were more susceptible to the effects of PFOA, and also stated more strongly they intended to take future actions regarding PFOA than those in the non-video condition. Additionally, those in the video condition believed they could more effectively and easily perform the recommended behaviors than those in the non-video condition. These effects are not surprising given the rationale from social cognitive theory

that people can learn behaviors more effectively by seeing actions done by other people. Two of the videos showed a mother actually doing some of the recommended actions, helping to show mothers just how easy the actions can be.

The effects between conditions that were significant at Time 1 and were subsequently measured again at Time 2 remained significant, except for perceived susceptibility. Additionally, those in the video condition, since viewing the website at Time 1, performed about one more recommended action than those in the non-video condition. With the participants in the video condition stating they found the recommended actions easier to perform than those in the non-video condition, it is not surprising that those in the video condition did more real behavior changes than those in the non-video condition.

Longitudinal Effects

To answer our first research question, there was only one time by condition interaction, and it was in the opposite direction of what was predicted. Self-efficacy for those in the video condition decreased, while for those in the non-video condition it remained stable. However, self-efficacy still remained higher for those in the video condition than those in the non-video condition. This finding shows that videos can be useful in the short-run, but are not panaceas to keeping self-efficacy high across the long-term. Possibly multiple exposures to videos, similar to what is the norm for viewing commercials on television over days and weeks, may help to keep self-efficacy from deteriorating over time.

These deteriorating effects over time also show us that the effects of video can be strong and useful right away, but are susceptible to the same over-time decrease in effects as other experimental stimuli. To maximize the effectiveness of videos, perhaps behaviors that can be quickly acted upon should be prioritized in website content, potentially neutralizing threats with just one action. For example, some actions moms could take to reduce PFOA exposure in their homes for a long-time could be done swiftly and with one action (e.g., disposing deteriorating non-stick pans, purchasing PFOA-free cookware).

Advice for Practitioners

For practitioners contemplating the pros and cons of expending resources to place videos on their websites, it appears the payoff may be worth it, but many considerations need to be examined. Our website had seven pages and four videos. According to website tracking statistics, the video placed on the homepage received the most views, whereas videos placed on the pages deeper in the website were viewed much less. For practitioners to maximize their investment, time and energy would probably be best spent on making one really effective video to place on a homepage. Despite the diminishing number of views the videos received as participants navigated the site, the majority of those in the video condition who viewed the videos either agreed or strongly agreed that the videos were a useful addition to the website.

The open-ended comments from participants gave some useful insight into how the content of the videos could be improved. Similar to what (Silk et al., in press) found with information in magazine advertisements, a large percentage of mothers would like even more scientific information placed in the videos. However, this finding may be an artifact of

the highly educated sample. Also, one participant stated that the "researchers' messages would come across as more authoritative if they weren't doing what appears to be basic office tasks that could be done by anyone. Their environment should reinforce their messages, like the mom's does (home/kitchen)." This comment highlights an ongoing problem for creating engaging videos. When filming the videos, one scientist would not allow the camera into her lab, fearing the video footage may unintentionally reveal research results. With the growing call to translate science from the laboratory to lay audiences, it would be advantageous for scientists to go through media training to help them understand the pieces necessary to make their data more engaging to the general public.

Limitations – Opportunities for Future Research

One limitation to the study was in truly determining how a person's literacy level affected the usefulness of the videos on the various outcome measures. Our sample was highly educated, with only about 7% of the sample having a high school education or less. Our sampling technique was effective at getting large numbers of participants, but it would be fruitful for future studies to specifically recruit more participants with less education to effectively test video's impact on low-literate audiences. However, the finding that the lower educated participants in the video condition found the risk reduction behaviors easier to perform (i.e., more self-efficacious) than those in the non-video condition, even across time, shows promise that the addition of videos to websites can have a significant impact.

Another limitation is the cultural diversity of the participants. Only about 5% of participants classified themselves as African American. African American women have the highest death rates from breast cancer than any other racial or ethnic group in the United States (ACS, 2011b). Due to their usually lower socioeconomic status than Caucasian women, their increased risks from environmental exposures because of a sheer lack of monetary resources to enact change (e.g., purchasing new cookware) would make them an important population to target in future studies. Additionally, the ethnic makeup of the interviewees in the videos would also be an important variable to manipulate with this population as the two researchers were Caucasian females, and the mother was of Hispanic heritage. Future studies should vary the race of video interviewees and hold constant the information content to examine different outcomes for different ethnic groups.

Future research should also seek to determine if the addition of videos to websites could potentially be related to an increase of web-related behaviors, not just behaviors the website's content may advocate. For example, would participants in the video condition be more likely to forward the website link to family and friends, post or share the website on their Facebook pages, or link to the website on their blogs?

Finally, cue summation theory guided us to not create videos that were exact transcripts of the website's text. However, because the videos were not verbatim transcripts it is possible some additional content present in the videos, and not in the text, influenced the effectiveness of the video condition. Future studies may want to test the effectiveness of video-enhanced websites containing identical content with what is present on the corresponding text of the website.

Conclusion

The results show a video-enhanced website can help to change attitudes and impact behaviors in positive ways. The study also supported tenets of theories created well before the invention of the Internet (i.e., social cognitive, media richness, and cue summation). While the added videos did not lead to knowledge gain as cue summation predicted, these additional add-ons of richer media to the text-only website were related to increased self-efficacy, and most importantly greater actual behavior change, weeks after initial exposure.

However, before simply placing videos on websites practitioners need to go through a careful assessment of priority outcomes. The positive effects of video can fade over time, so any desired behaviors advocated should be ones that are simple to perform, and provide a lasting impact through just a one-time action.

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Table 1

Time 1 Only - One-way ANOVAs for outcome measures on the video and non-video conditions.

	Condition				
	Video n = 82 *M (SD)*	**Non-Video n = 115 *M (SD)***	***F df*=(1,195)**	***p***	**η^2**
Knowledge					
About PFOA	3.39 (1.31)	3.30 (1.24)	.266	.606	.001
Products	10.63 (2.26)	10.94 (2.22)	.809	.347	.005
Actions to Take	11.45 (2.22)	11.31 (2.30)	.177	.647	.001
Severity	5.58 (1.23)	5.37 (0.96)	1.74	.189	.009
Susceptibility	5.43 (1.10)	5.08 (1.09)	4.97	.027*	.025
Self-Efficacy	6.16 (0.86)	5.67 (0.97)	13.81	<.001*	.066
Response Efficacy	5.49 (1.25)	5.30 (1.13)	1.21	.272	.006
Behavioral Intention	5.88 (1.14)	5.38 (1.36)	7.22	.008*	.036
Credibility					
Competence	6.30 (0.95)	6.02 (0.98)	4.04	.046*	.020
Trust	5.79 (1.23)	5.60 (0.94)	1.42	.234	.007
Caring	6.13 (1.02)	6.05 (0.88)	0.391	.533	.002
Satisfaction	5.33 (1.40)	5.14 (1.08)	1.17	.280	.006

(*) *Note:* An asterisk signifies significance of at-least $p < .05$.

Table 2

Time 2 Only - One-way ANOVAs for outcome measures on the video and non-video conditions.

	Condition				
	Video n = 52 ***M (SD)***	**Non-Video n = 75** ***M (SD)***	***F*** ***df*****=(1,129)**	***p***	η^2
Knowledge					
About PFOA	3.37 (1.10)	3.11 (1.13)	1.58	.211	0.12
Products	9.77 (1.70)	9.63 (1.42)	0.25	.620	.002
Actions to Take	11.75 (2.04)	11.47 (1.68)	0.74	.390	.006
Severity	5.55 (0.99)	5.21 (0.95)	3.77	.054	.028
Susceptibility	5.38 (0.92)	5.11 (1.00)	2.35	.128	.018
Self-Efficacy	6.01 (0.84)	5.67 (0.92)	4.72	.032*	.035
Response Efficacy	5.42 (1.21)	5.35 (1.02)	0.136	.713	.001
Behavioral Intention	5.65 (0.95)	5.09 (1.23)	7.72	.006*	.056
Actual Behaviors Performed	2.98 (1.84)	2.04 (1.77)	8.61	.004*	.063

(*)*Note:* An asterisk signifies significance of at-least $p < .05$.

Table 3

Time 1 to Time 2 – Repeated Measures Mixed ANOVAs for outcome measures on the video and non-video conditions (N=131).

	Time *df* = (1,129)			Time × Condition Interaction *df* = (1,129)		
	F	***p***	**partial η^2**	***F***	***p***	**partial η^2**
Knowledge						
About PFOA	5.32	.023*	.040	0.066	.80	.001
Products	80.97	<.001*	.386	1.51	.22	.012
Actions to Take	0.28	.598	.002	1.10	.297	.008
Severity	2.60	.109	.020	0.842	.361	.006
Susceptibility	0.022	.882	<.001	1.06	.305	.008
Self-Efficacy	2.72	.102	.021	5.78	.018*	.043
Response Efficacy	0.35	.555	.003	0.398	.529	.003
Behavioral Intention	12.39	.001*	.088	1.85	.176	.014

(*) *Note:* An asterisk signifies significance of at-least $p < .05$.