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Adolescent Females and Their Mothers:

Examining Perceptions of the Environment and Breast Cancer

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Abstract

Recent research indicates environmental factors and personal behaviors are related to breast cancer risk, but adopting a healthy lifestyle as early as adolescence can serve a protective function. To investigate perceptions of breast cancer risk and the environment, 10 focus groups ($N = 91$) were conducted with adolescent females ($n = 55$) and mothers ($n = 36$) across four counties in the Midwest, USA. The Uncertainty Management Theory provides a framework for discussing statements, and results suggest that uncertainty is maintained through ambiguity about environmental risk factors and breast cancer. Recommendations for prevention messages are presented.

Keywords

breast cancer; communication; environment; uncertainty

Introduction

Breast cancer is one of the most common types of cancers for women, with approximately 178,480 new cases estimated and nearly 40,460 deaths among American women projected for 2007 (American Cancer Society (ACS), 2007). As new evidence is presented about breast cancer and environmental risk factors (Breast Cancer and Environmental Research Centers (BCERC), 2007), there is a need to communicate these findings to the public. Adolescent females are a primary target audience because early adoption of healthy behaviors may help reduce later risk of breast cancer (BCERC, 2007). Equally important are adolescents' mothers, as they serve a vital information role for their daughters (Austin, 1995), and can also benefit personally from the current research.

Communication prevention messages rely on empirical studies to guide message strategies and content. Links between environmental carcinogens and breast cancer continue to be studied by researchers with a wide scope of factors under consideration (e.g. chemicals, personal behaviors) (BCERC, 2007). Research on lifestyle factors suggests that a healthy diet and exercise routine may play an important role in breast cancer prevention, and research on mammary gland development investigates the influence of environmental agent exposure

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(BCERC, 2007). As research continues, the need to communicate effectively to lay audiences is essential.

Communication of scientific findings is a complex process, with scientists, public health agents, and others interpreting science in inconsistent ways to audiences, resulting in both decreases and increases in uncertainty levels of audience members (Friedman, Dunwoody, & Rogers, 1999). This article uses the Uncertainty Management Theory (UMT) (Brashers, 2001) as a framework for understanding formative research related to adolescent females' and mothers' perceptions of breast cancer and environmental factors. Formative research provides insights about target audiences and can help identify appropriate message content for health campaigns (Atkin & Freimuth, 2001). The UMT provides a lens to analyze focus group data that assesses perceptions of breast cancer risk and environmental factors among adolescents and mothers (see Silk et al., 2006).

Uncertainty and the Uncertainty Management Theory

Uncertainty can be defined as the 'inability to determine the meaning of events and occurs in a situation where the decision-maker is unable to assign definite values to objects and events and/or is unable to accurately predict outcomes' (Mishel, 1990, p. 256). Uncertainty plays a large role in individuals' health experiences because they are wrought with unknowns related to potential risks, diagnoses, and prognoses. When one considers the ever changing nature of science, it is not surprising that uncertainty of varying magnitudes and saliency exists across multiple contexts (Brashers, 2001). Understanding how individuals interpret, manage, and/or reduce their uncertainty is insightful for constructing health messages that individuals will attend to, process, and ideally act on.

UMT posits that individuals appraise uncertainty as a danger or opportunity: an opportunity appraisal manages uncertainty by maintaining a sense of ambiguity and confusion through insufficient information, while a danger appraisal can yield information-seeking responses (Bradac, 2001; Brashers, 2001). Because an individual's appraisal of uncertainty stems from a variety of emotional responses, UMT encapsulates more than information seeking to manage and reduce uncertainty (Brashers, 2001). Individuals may appraise uncertainty and experience fear or anxiety, and therefore have a desire to seek information to manage or reduce their uncertainty; or, individuals may appraise uncertainty and feel hope and optimism, and consequently avoid information that would decrease this hopeful or optimistic feeling (Brashers, 2001). The UMT would predict appraising uncertainty about environmental risks of breast cancer as a danger would likely result in a communication or lifestyle activity to reduce uncertainty (e.g. exercise, discuss breast cancer). In contrast, appraising this uncertainty as an opportunity, may lead to avoiding communication or activities in order to reduce uncertainty; uncertainty is managed through ambiguity and unpredictability (e.g. unaware of relationships between the environment and cancer risks). Therefore, UMT provides a unique window for understanding how females interpret and appraise uncertainty about environmental risks for breast cancer.

Personal behavior and environmental factors

Environmental risk communication strives to improve the public's understanding of risk related to environmental and health hazards, and account for individual differences of beliefs about risk (Trettin & Musham, 2000). As individuals receive environmental risk information from different sources (e.g. interpersonal, media), their understanding can often be disparate (Powell, Dunwoody, Griffen, & Neuwirth, 2007). The uncertainty of science on many health issues, which is communicated by these sources, only heightens uncertainty about personal risk factors and prevention and creates more challenges for risk communication efforts (Powell

et al., 2007). Therefore, it is important to understand differences in risk perception in order to design effective communication messages.

In the context of breast cancer, women tend to be uncertain about the causes of breast cancer, risk factors, preventative actions, and credible sources of information (Duncan, Parrott, & Silk, 2001). This confusion is compounded by a lack of concrete scientific data about the causes of the disease. As science uncovers more about breast cancer, it becomes difficult for women to assess how personal behaviors (e.g. diet and exercise) influence their risks, compared to physical environment factors and genetics (Parrott, Silk, & Condit, 2003). Adding to women's uncertainty are unknowns about the link between environmental agents and breast cancer (Mitra, Faruque, & Avis, 2004). A recent meta-analysis of studies investigating exposure to environmental agents (e.g. pesticides, herbicides) and increased breast cancer risk found inconclusive evidence about the connection between oral contraceptive use and breast cancer among young women, and whether or not smoking alone could cause breast cancer (Mitra et al., 2004). Currently, studies are examining breast development and assessment of environmental stressors (e.g. nutrition, dietary supplements, chemical and physical exposures) on future breast cancer risk (BCERC, 2007). It thus becomes necessary to communicate these results effectively in conjunction with uncertainty management methods.

Adolescents, mothers, and breast cancer

Researchers have examined the adaptability and attitudes of children whose mothers were diagnosed with breast cancer (Hoke, 2001), but perceptions among adolescents *without* a parental breast cancer experience have not been a focus. Not surprisingly, little is known about young adolescent females' perceptions of breast cancer and how they manage uncertainty about environmental risks or connect environmental exposures and habits to breast cancer as these are not routine topics discussed. Because prevention efforts can influence later breast cancer risk, it is an opportune time for an exploratory study into adolescents' beliefs about breast cancer as an initial step for tailoring messages for this audience. Also important are how adolescents' mothers interpret scientific evidence connecting the environment with breast cancer risk, as parents can influence how adolescents infer information, especially concerning serious topics (Austin, 1995). Studies show that young girls turn to their mothers for information about food and nutrition, and this relationship can affect young girls' diet and body image (Abramovitz & Birch, 2000). Regarding breast cancer and other health topics, young females may turn to their mothers for clarification and opinions. Mothers' perceptions about breast cancer and environmental risks, along with their daughters, are needed for health prevention messages.

Formative research for breast cancer prevention

Focus groups are an important method in formative research for identifying lay beliefs about breast cancer and environmental factors, as they enable discussion other methods may not capture (Stewart, Shamdasani, & Rook, 2007). As science continues to study causal risk factors for breast cancer, it is important to understand current thoughts among females about the environment's influence to help appropriately construct messages for mothers and daughters.

RQ1: How is uncertainty perceived and communicated among adolescent and adult females about breast cancer and environmental risk factors?

Method

Participants and procedures

This study analyzes a subset of focus group data collected from 91 females across 10 focus groups (Silk et al., 2006) (six adolescent focus groups (n = 55) and four adult focus groups

(n = 36)) (see Table 1). Adults (ages 21–55 years) were mothers of adolescent focus group participants (aged 9–15 years); only two adolescent focus groups did not have mothers participate. Participants were recruited through a sampling of local community, middle-school and youth organizations in urban and rural areas in the Midwest, and advised that separate daughter and mother focus groups would occur simultaneously. It was therefore possible to address the inherent ethical issue of discussing complex information with adolescents because mothers would have knowledge of topics discussed and be immediately available to discuss any concerns. Informed consent was obtained at the beginning of the focus group session and all discussions were tape recorded. After focus groups were completed, each participant was debriefed and received an honorarium. Debriefing materials included pamphlets from the American Cancer Society, and a list of six credible Internet websites (e.g. Centers for Disease Control and Prevention).

Moderator training and guide

Moderators, females between the ages of 23–33 years, participated in 14 hours of focus group training, including a graduate seminar about focus groups in the social sciences, with an added two hours discussing the study's goals and review of the moderator guide. The moderator guide was designed to facilitate discussion and elicit information, knowledge, perceptions, and beliefs about breast cancer risks. Previous literature of adolescent perceptions to prevent breast cancer was incorporated into moderator guide questions (Spira & Kenemore, 2000), and researchers also met with community advocates for their comments. This study analyzes data relevant only to questions on environment and health (e.g. 'Does your environment affect your health?'), as well as probes into perceptions about specific environmental factors and breast cancer (e.g. 'What role does pollution play in causing breast cancer?' and 'What role do cleaning products and/or lawn care products have in causing breast cancer?').

Unitization and coding

Unitization—Each one-and-a-half-hour focus group was transcribed verbatim, and participant numbers were assigned to ensure confidentiality. Thought units were selected as the unit of analysis to accurately account for uniqueness of thoughts, and provide the greatest utility for understanding interpersonal interaction (Hatfield & Weider-Hatfield, 1978). A thought unit was characterized by a subject/verb pairing or a simple sentence (e.g. 'They do have lung cancer'). Three research assistants (RAs) were trained for three hours to unitize data. After resolving disagreements through discussion, RAs unitized approximately 10 percent of data and obtained 95 percent agreement. The remaining data were then unitized independently by the RAs.

Two RAs coded units, and Cohen's kappa was used to calculate intercoder reliability as it compensates for agreements by chance (Cohen, 1960). Initial reliability from 5 percent of the data was moderate (Cohen's Kappa = .73). The coding scheme was improved by clarifying coding rules, and coders were retrained for approximately three more hours. Another 5 percent of the data were coded and once strong reliability was established (Cohen's Kappa = .97), coders divided the remaining data and coded it independently.[1]

Environmental units—Environmental units were defined as response statements to the environment question and probes pertaining to living conditions, pollution, and lifestyle habits in relation to environmental exposures (e.g. 'I think that preservatives and everything that they put on the lands to grow the vegetables'/'washing the fruits and vegetables and everything

[1]The data set resulted in 5174 thought units. The six adolescent groups account for 47 percent of the data (Range = 239 to 682 units per group), and the four adult groups account for 53 percent of the data (Range = 594 to 794 units per group).

[because of pesticides]'). Environmental units represented 5.6 percent of the overall data set, the fifth largest category out of a total of 15 possible categories.

UMT coding scheme—After the environmental thought units were compiled, the UMT was used to code into the primary themes of *danger* and *opportunity* to reflect the broad categories of appraisal that orient individuals toward uncertainty. Secondary themes of *physical environment, interpersonal communication*, and *personal behavior* represent specific examples of how individuals experience and manage uncertainty about cancer risk. *Danger* was defined as statements acknowledging environmental risks and acts to reduce uncertainty about these risks. *Opportunity* was defined as statements stressing ambiguity about environmental risks. In addition to the primary UMT themes, secondary themes of *physical environment* (references to physical environmental risks such as chemicals), and *interpersonal communication* (references to communication interactions with friends or families) were coded as ways of managing uncertainty. A final secondary theme of *personal behavior* (references to exercise or lifestyle) emerged from the data within the primary UMT themes of danger and opportunity. Given the important role of personal behavior in breast cancer prevention and the ambiguity many women report in assessing its preventative impact (Duncan et al., 2001), *personal behavior* was included as a theme within the analyses.

Results

Results are organized using the aforementioned primary themes of *danger* and *opportunity*, and the secondary themes of *physical environment*, *interpersonal communication*, and *personal behavior*. Representative qualitative comments are selected to illustrate the themes.

Uncertainty reduction as a response to danger

Participants identified some environmental factors as dangerous and discussed strategies that may help to reduce uncertainty. Pollution, pesticides, and secondhand smoke were acknowledged as perceived risks where females could take action to reduce their exposure.

Physical environment—Learning more about one's environment as a way to reduce environmental risks and improve health was noted as a key strategy to reduce uncertainty associated with the physical environment. Increased knowledge was particularly important in relation to manufacturing (e.g. 'Certain areas, around a lot of manufacturing areas that, where there is high pollution/So that's one thing you want to consider when you're looking for where you want to live'), or in relationship to risk to family members (e.g. 'Yeah, I pay attention to all that kind of stuff/If it's a possibility it may affect my family, yeah/').

Personal behavior—Both adolescents and adults recognized that some behaviors are potentially preventative when it comes to reduction of cancer risk. Washing produce, physical activity, and exposure to secondhand smoke were identified as factors that can increase or decrease risk associated with the environment. For some adults, washing fruit was a way to relieve anxiety about environmental affects health and cancer (e.g. 'Now I get kind of paranoid about everything/the washing of the fruits and vegetables and everything'). Other adults stated that cancer occurs with secondhand smoke (e.g. 'All different cancer is where secondhand smoke is, everything you know it's all tied together'). Adolescents expressed that the environment can have a negative or positive influence on physical activity, a behavior that can reduce cancer risks and improve overall health (e.g. 'Like if you want to get outside and exercise/and if it's raining or something you can't do it'; and 'Exercising and breast cancer are the same because if you don't [*sic*] keep yourself healthy you will sometimes get breast cancer or some kind of cancer').

Interpersonal communication—Communication about environmental factors as a strategy to reduce uncertainty was stated twice as many times by adult participants compared to adolescent participants. Analysis showed few adolescents communicating about environment risks to family and friends, with communication depending on the perceived severity of the information (e.g. 'Sometimes, it depends on if it [the news story] really bothers me or not') and on the topic being addressed by educators or adults (e.g. 'I mean, they tell [about the environment] at school'). Communication in the adult focus groups centered on novel information presented in the news media. For example, adults mentioned they pay attention to the news about the environment and then discuss it with family members, especially if the information was perceived as a threat with avoidable consequences if one took recommended actions (e.g. '[My mom] she'll say, [*sic*], watch the strawberries/or there is something going on/so wash your food really good/Or she'll hear environment issues').

Uncertainty as a maintenance opportunity

Participants revealed confusion about the relationship between environmental risk factors and breast cancer. Adolescents and adults named several specific physical environment agents they perceived as negative to overall health, but were unclear to the specific connection with breast cancer.

Physical environment—In response to questions about the environment's link with breast cancer, not all adolescents could express a relationship, and adults were equally unsure about the relationship between the two. For instance, some adults doubted a connection between the environment and breast cancer risks (e.g. 'I don't see how [the environment and breast cancer are connected]/I don't see'). Other adults stated more confidence in links between environmental factors and breast cancer (e.g. 'It just seems that it runs in a kind of grouping as to the kind of cancer/which leads me to believe that it must be something environmental also' and 'It's a big deal/I think there's a big relationship').

Statements also revealed commonalities across all focus groups about what constitutes an environmental risk factor. Factories, geographic areas of residence (e.g. urban vs rural daily living), pollution, and climate were each frequently mentioned as physical environment risks. Factory comments from adolescents emphasized harms such as, 'and the factories pollute your air', and 'because of the chemicals', but comments were tempered with 'it depends'. Ambiguity was also present when participants were asked about the relative risk contribution that different physical agents make to overall breast cancer risk. For example, adults expressed vagueness in their statements about factories' influence on health and breast cancer (e.g. 'It depends on what kind of factory it was/and what kind of um, pollution the factory has'; and 'If it's near one of those plants I think so'), indicating a sustaining level of uncertainty.

Statements also showed that participants found geographic areas of residence to be a physical environment risk, but were unclear as to its relationship with breast cancer. Some participants felt that residential climate could affect risk of breast cancer (e.g. 'Yes, I think so/Just because of the nature of areas, things that go on/like climate, colder in some areas warmer in others', and 'It's different because in one place it might be hot and one place might be cold'). In addition, adolescents stated that living in rural areas creates less of a risk of getting breast cancer compared to other areas (e.g. 'I think the country won't have pollution in it'). Adults echoed these statements when disclosing that living in the city is detrimental to one's health and can consequently increase one's risk of breast cancer (e.g. 'Well, the city, we do have more pollution and stuff here/not in the country, it's not like that/it's more clarity in the air', and 'and all of the horrible things that come from cities'). Other adults found that city living can affect risk of cancer, but were unsure as to its connection *specifically* with breast cancer (e.g. 'I think the larger cities probably have a higher percentage of people with cancer/But like she

said I don't know if [living in the city is] necessarily linked to breast cancer'). A further emphasis by adults highlighted that living near power lines and radioactive components can increase one's risks of breast cancer (e.g. 'And we've all heard that radiation, whether it's a power line or living near a power plant').

Adolescents and adults expanded on physical environment agents through naming specific pollutants that may impact overall health as well as risk of breast cancer. Adolescents mentioned carbon monoxide as increasing risks of breast cancer, but reflected uncertainty for other environmental pollutants. For example, when adolescents were asked whether smog related to breast cancer risks, they responded, 'I think it could/Don't know/It could/It could/maybe.' Adults mentioned asbestos and DEET (chemical name, N,N-diethyl-meta-tolu-amide) as risk factors, although not directly linked to breast cancer (e.g. 'There's asbestos in the plants, there's all different types of skin cancer/I don't think it's necessarily breast cancer from the plants'). Adults further demonstrated uncertainty about pollutants and breast cancer with most participants unsure of the status of secondhand smoke as an environment risk for breast cancer; only one adult participant was certain that secondhand smoke is a proven environment risk factor for breast cancer.

Personal behavior—Participants' responses related to personal behavior revealed expansive definitions about personal behavior and lifestyle risks, and highlighted a state of uncertainty. Some adolescents and adults considered lifestyle and personal behaviors related to the environment of people, rather than specific activities to perform and reduce breast cancer risks (e.g. 'Sometimes in your environment people don't have a good lifestyle/and you might end up following them/so you end up not having a good lifestyle', and 'I was thinking a different way, like you know, with all the kids with this parent and that parent, and stepfamilies, that's the lifestyle I thought'). Comparatively, other adults thought an environment lifestyle and personal behavior implied stress levels and mental health (e.g. 'Stress has large amounts of repercussions on people').

Interpersonal communication—Responses showed that some adolescents and adults may choose to sustain a level of uncertainty by not seeking information or communicating about environmental risk factors with family or friends. After noting that many of them do see and read stories about the environment, participants responded that they do not tend to communicate about it unless it is related to a food safety issue (e.g. 'Nope, nope, nope' and 'No/We just look at it [the information in the media]'). Adults specifically stated a perception of little information available to them about the environment and breast cancer, and little desire to obtain clarification through communication outlets (e.g. 'I don't think there's that much information about it'). A few participants indicated that they avoid the news media (e.g. 'I don't watch the news or stuff like that'), which is a decision that can lead to untimely or a lack of information related to emergent science associated with breast cancer. Lack of effort on the part of participants to clarify or gain more information about the environment and breast cancer provides some evidence for participants' comfort with ambiguity and uncertainty about breast cancer risk.

Discussion

Prior to creating messages for adolescents and adult females, formative research is necessary to understand perceptions about the environment and breast cancer. This study demonstrates that both groups perceive breast cancer to be a relevant health issue to females. Data indicate that participants are uncertain about the relationship between the environment and breast cancer, and this uncertainty frames how participants behave, communicate and attend to messages about the environment and breast cancer. These high levels of uncertainty are

consistent with UMT constructs (Brashers, 2001), with both age groups reporting uncertainty in terms of a danger or opportunity.

Uncertainty as a danger

Uncertainty perceived as a danger prompted some uncertainty reducing actions (Brashers, 2001), but resulted in the fewest responses among participants. Results suggest that participants generally do not seek to reduce uncertainty about the environment's role in breast cancer risks, perhaps perceiving that it is not a relevant risk factor or less critical than other risk factors such as age or family history. Adults discussed uncertainty reducing responses about the physical environment, personal behaviours, and communication tactics, while few adolescents reported communication efforts to reduce uncertainty about the role of the environment and breast cancer risk.

Statements show that although few adolescents and adults seek information about the physical environment and its relation to breast cancer risk, some adults felt empowered to reduce their harms and acknowledged the importance of a healthy lifestyle (e.g. fresh produce and exercise) to improve overall health. Some adult women mentioned specific risk reducing behaviors in which they engage as a protective action for their family. For example, washing produce to reduce exposure to pesticides and steering clear of smokers to reduce exposure to secondhand smoke are deliberate actions that demonstrate a high level of perceived risk as well as self-efficacy in being able to decrease some environmental risk factors. Some participants, however, noted that personal behavior such as washing fruit is 'paranoid', suggesting that societal, familial, or cultural values may pose barriers for the promotion of some risk reducing behaviors. Prevention messages should attempt to appeal to the priority of familial safety as it is a potential motivator for action among primary family caretakers and frame specific behaviors that can reduce uncertainty.

Mothers' communication statements reinforce research on the ability of friends and family members to help individuals seek information as a way of managing uncertainty (Brashers, Neidig, & Goldsmith, 2004). Family and friends can serve as collaborators in information gathering (Brashers et al., 2004) and assist individuals in reducing uncertainty. It again highlights the need for future messages to address the involvement of family in order to reduce uncertainty.

Adolescents may not realize the capacity of others in assisting them to manage uncertainty, and do not think about breast cancer or its environmental links, leading to less communication statements. Health issues that are distal in nature are an unlikely source of concern for most adolescents (and most adults too); thus, messages are challenged in how to promote early prevention behaviors for a health threat that is rightfully perceived as a low threat for this age group. It is possible that development of messages where uncertainty needs to be reduced may not be appropriate for the adolescent audience. Health communicators may be better served creating prevention messages linked with other more salient health concerns to be effective. For example, adolescents discussed the importance of physical activity, especially those that can be done indoors on days when the weather is poor. Creating messages that link increased physical activity as beneficial to how adolescents' look and feel as well as to risk reduction for breast cancer later in life might be one effective strategy. Future messages to adolescents may need to evoke components of self-efficacy and build skills to perform prevention behaviors like physical activity (Austin, 1995).

Uncertainty as an opportunity

Uncertainty seen as an opportunity where ambiguity and confusion are maintained presented the greatest amount of qualitative data. Statements related to the physical environment were

characterized with frequent ambiguity as well as definitional confusion about personal behaviors. The lack of communication and intent to seek information about environmental factors for breast cancer highlights females consciously and unconsciously sustain a level of ambiguity. Statements suggest that both adolescents and adults realize the environment likely plays some role in breast cancer, but have not made defined connections about how and why the environment may be significant. Adolescent and adult females may prefer inconclusive messages about environmental risk factors and breast cancer to maintain a level of uncertainty. Participants managed their uncertainty about factory and pollution risk factors by clarifying that it depends on the type of factory and its pollution. It suggests participants are hopeful the factories near them are not the ones to cause the most harm, and prefer to maintain this unpredictability, rather than acknowledge that a factory near them could contribute to cases of breast cancer. In other words, sustaining a state of uncertainty is a more desirable strategy than decreasing uncertainty for individuals with minimal resources who are unable to remove themselves from a hazardous environmental influence. The desire to maintain an uncertainty state poses a unique challenge for health communicators as they try to create messages based on emerging science about the environment and breast cancer to an audience that may be comfortable with the current state of their knowledge.

Uncertainty is further evidenced as participants suggest pollutants such as carbon monoxide, smog, DEET, and geographic residences as having potential environmental links to breast cancer. ACS (2007) currently lists environmental pollution (e.g. chemicals and pollution) as those ‘factors with uncertain, controversial or unproven effect on breast cancer’. This again demonstrates sustained scientific uncertainty and a willingness among audiences to continue this uncertainty. Even though science has not suggested a causal link between climate and breast cancer, participants made an association between hot/cold climates and risk for breast cancer. It seems participants are maintaining uncertain beliefs until science can define a causal link between specific environmental factors and breast cancer. Consequently, health messages need to not only convey the state of the science, but strive to correct misled beliefs among lay audiences. Although correct knowledge is not sufficient for behavior change, it is an important factor for influencing individuals to engage in recommended behaviors.

The discrepancy between lifestyle and personal behavior definitions expresses a level of uncertainty being maintained about personal behaviors to reduced risks. The ACS lists personal behaviors such as alcohol consumption, obesity, and high-fat diets as part of potential environmental risk factors for breast cancer, but remains unclear about the role of smoking (ACS, 2007). Participants mentioned none of these factors. Perhaps some women are fearful of knowing what behaviors can help reduce risk because they do not want to acknowledge their lack of performance of recommended behaviors. Message content that targets self-efficacy may be needed to help some women process their uncertainty and slowly adopt prevention behaviors. Invoking a precautionary principle might be another strategy for health messages because new science is constantly emerging about potential risk factors. As statements reveal adolescents and adults do not communicate about the environment and how it may impact breast cancer risk, it indicates that future health messages may need to acknowledge the level of ambiguity being maintained.

Limitations

The lack of emotional statements (e.g. statements of anxiety, worry) in relation to uncertainty is a limitation of the coding scheme. Also, focus groups cannot be considered representative of the larger female population, but should be considered within the context of formative research.

Conclusion

Using the UMT, this study reveals that future messages should raise awareness and provide concrete evidence, as well as incorporate self-efficacy and family appeals to increase message effectiveness about breast cancer and environmental risk factors. Results indicate that adolescents have little desire to reduce their uncertainty about breast cancer at this stage, while adult females seek to both reduce and maintain their uncertainty. More investigation is warranted to further improve communication to these audiences.

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Table 1

Descriptive statistics for focus groups

Focus group	Size (N)	Age (years)	County	Race/Ethnicity
1	7 Adults	31–46	Oceana	6 Whites, 1 Latino
2	7 Girls	10–15	Lenawee	1 African American, 5 Whites, 1 Latino
3	10 Adults	21–46	Lenawee	2 African Americans, 5 Whites, 3 Latino
4	14 Girls	9–13	Saginaw	7 African Americans, 5 Whites, 2 Unknown
5	11 Adults	27–55	Saginaw	2 African Americans, 2 Whites, 7 Latino
6	8 Adults	32–50	Genesee	2 African Americans, 6 Whites
7	8 Girls	11–13	Genesee	8 African Americans
8	6 Girls	13–14	Genesee	5 African Americans, 1 Other
9	14 Girls	10–12	Genesee	3 African Americans, 9 Whites, 2 Other
10	6 Girls	9–13	Oceana	5 Whites, 1 Latino