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Social marketing campaigns can be an effective method for reaching and engaging limited-resource participants in health messages related to nutrition and physical activity. The target audience should be engaged throughout the process of message identification and creation. This study included focus groups with limited-resource caregivers to help identify information sources utilized, nutrition messages most likely to resonate, and preferred communication channels. Nine focus groups with 108 limited-resource caregivers were conducted. Most participants were between the ages of 21 and 44, with a majority receiving SNAP benefits. All participants were female with over half identifying as white. Two researchers coded focus group transcripts and identified themes. Participants expressed interest in nutrition particularly as it impacted children in their care. Nutrition information sources included family, health care professionals, and television celebrities. Participants expressed interest in practical nutrition content delivered through simple messaging. Communication channels frequently utilized included social media, posters in community agencies, and television news. Findings offer insight for nutrition professionals in creating and marketing nutrition messages that are competitive, accessible, and resonate with limited-resource caregivers.

Keywords: limited-resource caregivers, nutrition messaging, social marketing

Introduction

To prevent childhood obesity, multilevel approaches which address a variety of sectors of influence hold the greatest promise (Hoelscher, Kirk, Ritchie, & Cunningham-Sabo, 2013). A key component of multilevel, multisector programs is the use of social marketing as a means of message delivery and consistency (Hoelscher et al., 2013). Because of the influence parents have on children's dietary behaviors, childhood obesity programs need to involve parental messaging recognizing the role parents play as gatekeepers of the home food environment for children (Gracia-Marco et al., 2011; Hoelscher et al., 2013).

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Social marketing involves the strategic application of commercial marketing principles and practices to enact behavioral changes beneficial to individuals and/or society (Andreasen, 2002; Carins & Rundle-Thiele, 2013; Kotler & Zaltman, 1971). Through the use of social marketing, needs of the target population can be more fully understood, messages developed to address those needs, and communication channels germane to the target population utilized. Social marketing is more than health messaging. A fundamental component of social marketing campaigns is the use of formative research (Snyder, 2007). Formative research distinguishes social marketing from other public health approaches and grounds this approach in its commercial marketing roots (Donovan, 2011). Formative research can identify the needs, preferences, barriers, and motivations of the target audience. A detailed formative analysis of the target audience is invaluable to crafting social marketing messaging, selecting the most appropriate information delivery sources, and utilizing the best channels of communication (Atkin & Freimuth, 2001).

Communication is a critical part of all social marketing campaigns necessary for ensuring effective message development and delivery (Dresler-Hawke & Veer, 2006). A variety of theories have been proposed and studies conducted to better understand the communication process including how the communication process can best be adapted in the delivery of health and nutrition messaging to limited-resource populations (Carbone, Campbell, & Honess-Morreale, 2002; Hart, Damiano, Cornell, & Paxton, 2015; Scroggins, Lambert, & Knight, 2016; USDA, 2016). As part of this body of work, previous research has been undertaken to identify the information sources preferred by limited-resource individuals. Formal and informal information sources ranging from health care providers, nutritionists, and school systems to family, friends, and neighbors have been cited as key outlets for nutrition and health information for limited-resource populations (Gutierrez, Kindratt, Pagels, Foster, & Gimbel, 2014; Hoisington, Shultz, & Butkus, 2002; Huberty, Dinkel, Beets, & Coleman, 2012; Spink & Cole, 2001; USDA, 2016).

In regard to messaging, studies reiterate the importance of clear, concise, and consistent messaging tailored to specific population needs (Campbell, Honess-Morreale, Farrell, Carbone, & Brasure, 1999; Kessels, Ruiters, Brug, & Jansma, 2011; Noar, Christina, & Harris, 2007; Snyder, 2007; USDA, 2016). Tailored nutrition messages which are personally relevant in addressing the interest of the target population, including limited-resource populations, have been proven more effective than nontailored messages in changing dietary and physical activity behaviors (Noar et al., 2007). Communication channels, a key component of the communication process, can be classified across three continua: information versus entertainment, active versus passive, and health promoting versus health reducing (Dutta-Bergman, 2004). Individual preferences for communication channels differ based on individual demographics and the type of information being sought (Dutta-Bergman, 2004; Kratzke, Wilson, & Vilchis, 2013; Snyder, 2007; Spink & Cole, 2001; Zoellner, Connell, Bounds, Crook, & Yadrick, 2009).

To date, no studies have used an integrated theoretical basis to examine in tandem the nutrition information sources, messages, and communication channel preferences of limited-resource caregivers through formative research across multiple focus groups. This study addresses this gap in the literature by identifying communication strategies that would engage limited-resource caregivers in promoting healthy lifestyles for their families. Shannon and Weaver's (1949) Mathematical Theory of Communication served as the theoretical basis for the study. This theory posits that effective communication is only possible when three key components are relevant and resonate with the target audience. These elements include information sources (person or entity producing the message), messages (information or concepts to be sent), and communication channels (mediums used in transmitting a communication message) (Dima, Teodorescu, & Gifu, 2014).

The Mathematical Theory of Communication, first outlined by Shannon (1948), has come to be recognized as a seminal work in the study of information processing and communication. The theory, originally designed as a means to better understand the technical aspects of communication, presents a mathematical formula depicting how communication channels impact the capacity to carry communication signals. The concepts outlined by this theory, particularly Shannon's linear communication model, have found use beyond the theory's mathematical and engineering roots with application in social sciences, psychology, and other disciplines (Krippendorff, 2009).

The following objectives guided the study:

- 1) Identify the information sources limited-resource caregivers utilized for advice on healthy eating,
- 2) Identify the messages limited-resource caregivers felt would most likely foster healthy eating, and
- 3) Determine the communication channels frequently utilized by limited-resource caregivers.

Methods

Study Design

The researchers partnered with a public relations firm to conduct focus groups to develop messages for a social marketing campaign to increase healthy behaviors for limited-resource caregivers. The concepts of the Mathematical Theory of Communication were used to guide the study design and implementation (Shannon & Weaver, 1949). Focus groups were selected because this method is widely used in marketing research and offers the ability to obtain breadth and depth of information from participants (Krueger & Casey, 2015).

Sample. Nine counties were identified for inclusion in this project—3 counties from each of the geographical regions in the state. Nine counties were determined to be the minimum needed for saturation (Krueger & Casey, 2015). In general, these regions differ in terms of race/ethnicity.

To be eligible for the project, participants had to be at least eighteen years old, a parent or guardian for at least one child between preschool and fifth grade, and responsible for providing meals and snacks to the children in their care. Additionally, participants had to reside in a household receiving or eligible for assistance programs such as free or reduced school meals; Special Supplemental Nutrition Program for Women, Infants, and Children (WIC); Supplemental Nutrition Assistance Program (SNAP); Head Start; and/or Temporary Assistance for Needy Families (TANF).

After the Institutional Review Board of the University of Tennessee approved the study in 2016, the public relations firm purchased telephone and cellular telephone lists for each of the nine counties and randomly selected and screened potential participants for eligibility. Up to 20 participants were recruited per focus group to help ensure that the actual size of each focus group was 12 to 14 participants. Focus groups included caregivers caring for at least one child between preschool and fifth grade. Many of the participants were caring for multiple children. Participants were asked to provide answers about nutrition messages for all children in their care.

Data collection and analysis. A research guide, created by the researchers and the public relations firm, provided structure for the focus groups (see Figure 1).

Figure 1. Focus Group Questions

<p>Introductory questions:</p> <ol style="list-style-type: none"> 1. Thinking about your family as you were growing up, were there any family traditions or practices that encouraged healthy eating and active lifestyles? 2. If so, what are they? <p>Sources of Information:</p> <ol style="list-style-type: none"> 1. Who are the people outside your home that you trust for advice on healthy eating? 2. Where do you get the best meal planning ideas, recipes, and information regarding healthy meals and snacks? <p>Messages:</p> <ol style="list-style-type: none"> 1. Thinking about these influential outside sources, what could someone say to you that would encourage healthy eating? <p>Communication Channels:</p> <ol style="list-style-type: none"> 1. Where do you currently get information about healthy eating and active lifestyles? 2. Is this information from a source dedicated to healthy foods and active lifestyles, or is it from a source that also includes other information? 3. By show of hands for each, please let me know if you currently pay attention to messages of any kind from these media and advertising resources. TV news, radio news, newspaper stories, in-store displays, vendor booths at fairs and shows, posters in government offices, TV ads, newspaper ads, billboards, bus signs, Facebook posts, Twitter posts, Instagram posts 4. Did I miss any information resources that are valuable to you? If so, what are they?
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Focus group questions were framed and structured using three elements from Shannon and Weaver's (1949) Mathematical Theory of Communication—information sources, messages, and communication channels. Questions explored the information sources utilized by participants, messages most likely to foster healthy eating, and the communication channels typically used. Subject matter experts working with limited-resource caregivers reviewed the guide for clarity.

Moderators from the public relations firm facilitated the nine focus groups in community locations. The public relations firm possessed an understanding of focus group and marketing research as it has provided marketing services for 25 years to government, nonprofit, and corporate entities. Additionally, the public relations firm was familiar with conducting market research and focus groups for limited-resource audiences. The research team worked closely with the firm providing training and input needed to ensure the objectives of the study were fully obtained. Three different moderators led the focus groups. To ensure consistency across the moderators, each moderator received training by the research team on questioning style, probes to be utilized, and the format to be followed for each focus group.

Prior to the start of each focus group, participants were provided a copy of the informed consent form, and consent was obtained. All subjects were reimbursed \$20 for their participation. Each group lasted one and a half hours. Research team members were present but not in the same room during the focus groups. After each focus group, team members and the moderators debriefed the discussion and made notes about each group.

Each focus group was videotaped. The videos were transcribed verbatim by professional transcriptionists and reviewed by the focus group moderator for accuracy. The public relations firm prepared reports after each focus group was completed. Using the transcripts and the focus group reports, two researchers identified trends and patterns across the focus groups. These data were coded, sorted, and organized using the focus group discussion guide and the Mathematical Theory of Communication (Creswell, 1998). An open coding approach was used to analyze each focus group separately, and then the categories were aggregated across the groups (Creswell, 1998; Krueger & Casey, 2015). Discrepancies in codes and themes between the two researchers were discussed and resolved. Trustworthiness included the triangulation of findings with the public relations firm reports and team member notes, debrief sessions after each focus group, and the Mathematical Theory of Communication that guided focus group discussion and analysis.

Results

Nine focus groups, three groups from each of the geographical regions in the state, were conducted with 108 participants. Data saturation was achieved after the ninth focus group when research team members who had observed all of the groups determined that no new information was being shared by participants. Team members also reviewed the public relation firm reports, which also demonstrated no new themes or information were being shared. Participant characteristics are described in Table 1.

Table 1. Demographic Variables for Sample (N = 108)

Variable	Number (%)
Age	
21 - 29	41 (38.1)
30 - 44	55 (50.9)
45- 54	6 (5.6)
55+	6 (5.6)
Children per grade level	
Preschool	65 (33.0)
First	34 (17.3)
Second	32 (16.2)
Third	29 (14.7)
Fourth	20 (10.2)
Fifth	17 (8.6)
Educational obtainment	
Some high school	14 (13.0)
High school graduate	35 (32.4)
Some college	34 (31.5)
College graduate	15 (13.9)
Technical school	5 (4.6)
Graduate school	5 (4.6)
Family income	
< \$20,000	56 (51.2)
\$20,000 - \$29,999	30 (27.8)
\$30,000 - \$39,999	12 (11.1)
\$40,000 - \$49,999	10 (9.3)
\$50,000+	0
Gender	
Female	108 (100)
Marital status	
Cohabiting	12 (11.1)
Divorced	9 (8.3)
Married	48 (44.4)
Single	39 (36.1)
Program participation ^a	
Free or reduced school meals	88 (81.5)
Head Start	21 (19.4)
SNAP	79 (73.1)
TANF	14 (13.1)
WIC	54 (50)
Race/ethnicity	
African American	32 (29.6)
Asian	1 (.9)
Hispanic	5 (4.6)
White	64 (59.2)
Other	6 (5.5)

^aParticipants can enroll in multiple programs. Therefore, percentage does not equal 100.

All participants were female. Recruitment was not limited to females, but no males participated in this study. As expected, there were some demographic differences between the groups based on the region and type of county (urban versus rural), with counties in the western part of the state and urban counties more likely to include African American participants compared to counties in the central and eastern part of the state.

The results of the focus group discussion are presented by the three key constructs of the Mathematical Theory of Communication (information sources, messages, and communication channels) to demonstrate relevant and important ideas for healthy eating for limited-resource families.

Information Sources Used by Participants

Participants identified a variety of sources that they trusted for advice and information, such as recipes and meal planning tips about healthy eating. Relatives and friends were identified most frequently as being the most trusted source of advice about healthy eating. Mothers, mothers-in-law, and grandmothers were mentioned most often, but sisters, aunts, husbands, and grandfathers were also identified. Participants described valuing these relatives' experience and knowledge. Participants also described actively seeking advice from friends and relatives:

- “My grandmother was kind of like my mother, and she was the cook for our family. So, I kind of go to her for when I want to know how to cook something. She just tells me what to do.”
- I ask friends, ‘How do you get three servings of vegetables in a meal? What are you serving?’”

Participants also identified doctors, WIC, and school teachers as providing helpful information about healthy eating. In contrast to their active solicitation of advice from friends and relatives, participants described more passively receiving information from these professionals. Participants also commented that these doctor and WIC appointments also provided opportunities to be exposed to different types of information.

Participants also frequently identified celebrities, especially celebrities with cooking shows and doctors. Top celebrities included Rachel Ray and Dr. Oz. Also mentioned were the *Chopped* and *Pioneer Woman* television shows, and the *Food Network* television channel. Moderators probed the participants to ascertain the extent to which participants trusted the information provided by celebrities. All participants offered positive impressions of the information offered by celebrities indicating they trusted the information provided.

Messages Resonating with Participants

Many participants described either their own or family members' experiences dealing with poor health and chronic conditions, and they often related these conditions to poor food and nutrition choices:

- “I don’t want my kids to grow up and look like me. I want them to grow up and be healthy and active. I want them to make better choices than I did.”
- “[My daughter] is learning from my chronic illness that she’s got to eat healthier because they’re all at risk.”

When asked about messages to increase healthy behaviors, many participants identified health messages related to avoiding these diseases. One participant identified this as a type of “reality check.” These ideas included comments like:

- “You’re going to be on these pills for the rest of your life if you don’t lose weight.”
- “Your blood sugar is high. You need to put down the soda.”

Other participants identified positive health messages as an effective method to encourage healthy behaviors. Energy was identified as an important part of the message. Energy was also described as something that parents needed to take care of children and children needed to grow strong and be active:

- “You’ve definitely got to have an energy level when you have kids.”
- “A kid sitting on a couch eating a bag of potato chips very sluggish and then a kid eating an apple or a yogurt running around. What you eat makes you sluggish.”

Participants also wanted messages that related simple changes to encourage healthy behaviors as described by one mother, “The simpler you can make it, the better.” Participants suggested simple messages related to food facts, mom-friendly recipes, recipe substitutions, and easy meal plans. In addition, they identified the importance of visual aids to help demonstrate healthy behaviors. One person used the example of seeing how much sugar is in a can of soda as a method for engaging people and teaching them at the same time. Finally, participants desired messages that they could relate to: “[If] they’re similar to your own [family], you’re gonna be more likely to try it.”

Communication Channels Preferred by Participants

For participants, the communication channels most frequently used for obtaining information related to nutrition included the internet, social media, and information at the doctor’s office. Specifically, participants identified Facebook, posters in community agencies, television news, and in-store displays as being used most frequently for obtaining nutrition information.

Participants appreciated the visual content of Facebook and other social media sites, especially when they wanted to learn a recipe or a cooking technique. Participants described social media outlets as important for new and interesting ideas for recipes and meal planning:

- “I use [Pinterest] for inspiration. It’s not always great, but at least it’s something different. My family doesn’t want to eat the same meals over and over again, and I don’t either. It really helps to have inspiration, because sometimes I can’t even think of anything different.”

Participants also discussed the ability to save information on their phone or computer so they can reference it easily. Furthermore, participants discussed the social groups that Facebook and other social media platforms provide.

Discussion

The Mathematical Theory of Communication outlines three key components of effective communication – information sources, messages, and communication channels (Shannon & Weaver, 1949). Using the Mathematical Theory of Communication as a lens, this study sought to better understand the information sources utilized, the nutrition messages most likely to resonate, and the communication channels preferred by limited-resource caregivers in order to inform social marketing campaigns designed to encourage healthy eating. This study extends the literature by examining these three components of communication in tandem across multiple focus groups. Findings from this study advance the knowledge base of nutrition education while informing the work of practitioners in the field. In particular, these findings expand the field of knowledge by focusing on information needs of limited-resource parents and caregivers of younger children (infants through 5th grade)—an important audience for nutrition messages especially to prevent obesity.

Consistent with previous research, participants expressed enthusiastic interest in healthy eating and nutrition, particularly as these topics impacted children in their care (Fulkerson et al., 2011). Participants were active consumers of nutrition content, seeking out this content from what Spink and Cole (2001) conceptualize as informal and formal information sources. Informal information sources, including extended family members and friends, were the most frequently trusted. Participants in the focus groups looked to friends and relatives for advice on food preparation, meal planning, and child feeding due in part to their life experiences raising children/grandchildren. These findings reinforce previous research identifying family members and friends as important informal information sources for health and nutrition information (Hoisington et al., 2002; Huberty et al., 2012; Spink & Cole, 2001).

Celebrity health professionals and hosts of cooking television shows were viewed as resources for practical information on food preparation, recipes, meal planning, and general health. Interestingly, participants did not question or critique the credibility of the information presented

by television celebrities. Participant's' general acceptance of the information offered reiterates what Klos et al. (2015) identified as the precarious reality of education nestled in the context of television entertainment.

In terms of formal information sources, participants were more likely to utilize physicians for nutrition information than WIC nutritionists or social service professionals. These findings parallel previous research in which parents identified physicians as a frequent source of nutrition information (Duncanson, Burrows, Holman, & Collins, 2013). Focus group participants reported their conversations with doctors to be brief yet helpful. Previous research has shown that even short interpersonal connections with health care professionals can serve as important sources of health information that leads to behavioral change (Lazarus, 1997). Participants' use of sources curated online and through social media is consistent with the pervasive use of the internet and social media as a tool for health information (Lohse, 2013).

Aligning with previous research, participants expressed a clear desire for practical nutrition content delivered through simple messaging (Hart et al., 2015). Participants discussed healthy eating in everyday terms – easy recipes appealing to children, simple meal plans, and inspiration for feeding the family. Their focus on practical aspects of food consumption stands in contrast to technical nutrition messages which center on what to eat but not how (Jabs et al., 2007). Such technical messages can be perceived as impractical and difficult to implement particularly for limited-resource households (Crossley, 2011). Congruent with focus group outcomes obtained from USDA's Maximizing the Message focus group project, participants were most interested in information that could easily dovetail with their hectic lifestyles (USDA, 2016).

When asked what messages would motivate them to focus on healthy eating, participants offered two distinct message themes. In discussing themselves, participants' messages focused on the negative health consequence of poor dietary quality. These messages were supported with personal stories demonstrating the effects of poor diet quality on health. Such pessimistic messaging could be a manifestation of the impact that low socioeconomic status has on physical health (Braveman, Cubbin, Egerter, Williams, & Pamuk, 2010). However, the emphasis of such negative messaging stands in contrast to previous research demonstrating positive messaging as effective in promoting health behavior (Quagliani & Hermann, 2012). When discussing their children, participants adopted a more positive tone. Messages focused on the importance of fueling children's bodies to help them grow and the importance of a healthy diet for children's cognitive development. Such positive messaging reiterates and reflects the hopes and dreams caregivers have for their children and their future (Mohr, Zygmunt, & Clark, 2012).

The pervasive use of the internet and social media were clearly evident. Participants noted Facebook as a preferred channel for messages related to healthy eating and feeding their family. This preference is consistent with research identifying Facebook as an effective channel for engaging limited-resource audiences with nutrition messaging (Duncanson et al., 2013).

Additionally, participants' proclivity for content delivered online is reflective of the high percentage of US adults who use the internet, including a growing number of low-income adults who access online content through mobile devices (Horrigan & Duggan, 2015). These preferences reinforce the internet's legacy as a frequently utilized source of health information (Li, Theng, & Foo, 2016).

In addition to online channels, participants indicated they pay attention to posters and health promotion literature in community agencies. Posters and literature have long been used as information channels for health promotion (Appleton, 2016). Individuals have utilized these channels obtaining health information on topics ranging from cancer prevention to fruit and vegetable consumption (Hagues et al., 2016; Kratzke et al., 2013). However, the effectiveness of these communication channels for facilitating long-term behavior change remains uncertain (Appleton, 2016).

This study is not without limitations. Given that all focus groups for this study were conducted in one Southern state, the extent to which the data can be generalized to limited-resource audiences in other states is limited. Additionally, this study focused on one segment of the limited-resource population – caregivers of children. The findings, therefore, may not resonate with other limited-resource segments such as senior adults or adults without caregiving responsibilities. Furthermore, only women participated in this study, so these results cannot be generalized to male caregivers.

Implications for Research and Practice

As the findings from this study indicate, limited-resource consumers use a variety of media channels and sources for information on nutrition and healthy eating. The challenge for nutrition educators is how to create and market messages that are competitive, accessible, and meet the needs of these consumers. To remain relevant, nutrition educators need to be willing to move beyond the traditional printed materials and low-key social media posts to create media content that is interactive, dynamic, and user-focused. It is important that educators create content and messages for internet and social media channels that are competitive and attract the attention of the target audience. A variety of information sources and messages are prevalent on internet and social media sites. As a result, nutrition educators wishing to use these channels must compete for the attention of the end-user working to ensure that attention is given to their messages. In order to be competitive in such information-saturated environments, nutrition educators must give attention to creating messaging that relies not simply on static text but instead works to attract and engage the end-user in a dynamic fashion. Engagement could occur through a variety of methods including the use of videos, interactive advertisements, animated Graphic Interchange Formats (GIFs), and contests.

An additional means of capturing the end-user's attention include purchasing ads to ensure prominent displays of content. Ad purchasing is used frequently in business and industry as a

means of engaging consumers through social media platforms. Through the use of internet browsing history, ad purchases can be targeted to specific groups such as those with expressed interests in nutrition and food preparation. Additionally, ad purchasing helps to ensure messaging is prominently displayed in social media feeds of the intended users. In order to optimize the use of social media engagement, nutrition education programs should consider employing nutrition educators and professionals who focus exclusively on message development and dissemination. These individuals could leverage skills in internet and social media messaging to develop content that is engaging, meets the information needs of the targeted users, and is rooted in research-based dietary guidance. Furthermore, nutrition educators will want to use and engage popular opinion leaders to be messengers for nutrition content including family members, doctors, and celebrities.

Future research needs to focus on the assessment of nutrition social marketing campaigns that include effective messages and the role of these campaigns in comprehensive nutrition education interventions. While focus group methodology is often used as a tool in formative research, future studies may seek to employ other research methodologies such as cognitive interviewing. The extent to which similar of different findings would arise from such techniques could be of great value to the field of nutrition messaging.

Celebrities were found to be a trusted source of information for participants in the study. Additional research on the importance of celebrities in nutrition messaging is warranted. Such research could explore the types of celebrities which best resonate with different groups as well as the celebrity messages of greatest value.

Finally, the role of health care professionals in the dissemination of nutrition content deserves deeper exploration. Strategies for engaging health care professionals, particularly doctors, should be examined. The impact of social marketing strategies utilizing health care professionals would be beneficial in advancing multilevel, multisector nutrition education approaches.

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