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Efficacy of a Culturally-tailored Educational Photonovella Addressing Prevention of Meat and Poultry-related Food Poisoning for African Americans of Low Socioeconomic Status

ABSTRACT

African Americans of low socioeconomic status are often at risk of foodborne illnesses because of food preferences and exposure to a disproportionately high number of risk factors. We developed a culturally-appropriate food safety photonovella and determined its efficacy in improving food safety knowledge and behavior in low socioeconomic status African Americans in Chicago. A pre- and post-intervention food safety score was calculated based on responses to 9 weighted questions directly addressed within the photonovella. A maximum score of 12 points was possible. Among 149 participants, the overall mean baseline food safety score rose from 7.80 (SD 2.51) to 8.98 (SD 2.21) ($P < 0.01$). Ninety-seven (65%) respondents reported making at least one change in their food safety behavior since exposure to the photonovella. Thirty-five percent and 16% of the participants, respectively, said that someone they lived with and someone who doesn't live with them also read the photonovella. Among 43 who cooked or prepared chitterlings, 27 reported pre-intervention that they did not boil chitterlings for 5 minutes before cleaning, and 10 of those reported changing their behavior post-intervention. A photonovella focused on a thematic area within food safety may be an effective way to improve knowledge, influence behavior, and encourage communication of food safety information to others.

INTRODUCTION

African Americans of low socioeconomic status should be considered among the populations vulnerable to foodborne illness because of behavioral, educational, and other foodborne illness risk factors *(1)*. For example, recent FoodNet incidence data revealed that African Americans have higher rates of foodborne illness due to *Salmonella* infection in three of the four years from 2008 through 2011 *(3, 16)*. Yersiniosis, which has been associated with pork through consumption of and cross-contamination from chitterlings (intestines), has a high incidence among African Americans *(5, 10)*. In addition, disparities in educational opportunities and lower compliance with recommended behaviors of consumer food safety (especially cooking and

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chilling) have been reported in this population *(2, 11, 14)*. Food that they purchase in small neighborhood markets in low socioeconomic neighborhoods may have a relatively high likelihood of temperature abuse or contamination with fecal coliforms *(20)*. They may have limited use of cooking thermometers, and results of focus groups have raised concerns of cooking practices of turkey that may raise the risk of foodborne illness *(7, 11, 12)*. Also, African Americans are disproportionately affected by the HIV/AIDS epidemic, which heightens susceptibility to bacterial infections, including salmonellosis *(4, 6, 15)*.

The incidence of foodborne enteric infections that may be acquired from consumption of meat and poultry vary by population and therefore complicate assumptions about food safety behavior. For example, whereas FoodNet data demonstrate that the incidence of *Salmonella enterica* serovar Enteritidis infection is highest among African Americans, African Americans have the lowest incidence of *Campylobacter* infection *(13, 16, 19)*. Studies examining food safety knowledge, specifically in African Americans of low socioeconomic status, are uncommon, and the efficacy of interventions targeted to their food safety knowledge and behavior gaps have not been published.

We conducted focus groups to obtain preliminary assessment of food safety knowledge and behavior and to inform the design of educational material *(8)*. We then developed a culturally appropriate meat-and poultry-related food safety photonovella and determined its efficacy in raising food safety knowledge and eliminating behavior gaps in African Americans of low socioeconomic status. A photonovella was chosen as the educational vehicle because it allows for more dynamic learning through a combination of visual and text-based storytelling portraying culturally relevant experiences. Evidence of its use and success has been published but is scanty *(9, 18)*. The study described in this manuscript focuses on the educational intervention. The objectives were to determine food consumption characteristics among African Americans of low socioeconomic status that might be related to foodborne illness and to develop and test the efficacy of a photonovella designed to educate and influence behavior related to meat and poultry food safety.

MATERIALS AND METHODS

Focus groups

Adult African-Americans with the primary responsibility of preparing meals at home were recruited via fliers and direct intercept communication at two City of Chicago Department of Health clinics (Roseland and Englewood Health Centers) that predominantly serve people of color with gross income levels at or below 130% of the Federal poverty guidelines. Between 6 to 12 clients were invited to participate in each of 5 focus group held sessions held during July through August 2011 with an overarching theme of meat and poultry food safety. Each focus group participant received $15 compensation and each provided written informed consent involving an explanation of the study and time to read and ask questions.

Just before the focus group discussion began, participants completed a baseline 28 question food safety knowledge and practice survey. The survey included questions on temperature for cooking, hand hygiene, barriers to compliance with safe food handling, and knowledge of severity of foodborne illness. A focus group moderator and a community-based nutrition peer educator used a discussion guide that covered areas such as the definition of food safety, perceptions of risk, current practices, barriers to food safety practices, and access and understanding of available USDA food safety educational materials *(21, 22, 23)*. Focus group discussions were recorded and transcripts were created from the recordings.

Development of the photonovella

Data from the baseline food safety knowledge and practice survey and from the focus group discussions were used to identify key themes and clinically significant gaps in meat safety and preparation. A story was created that included mishandling of common foods served at a family dinner, followed by a visit to a physician for illness onset, during which food safety prevention was explained. African American volunteers from the community were recruited to portray all the characters in photosessions to illustrate the story. Comic Life software by plasq® was used to create a 28 page photonovella with page layouts including pictures and text. Most pages included two to four pictures. Themes and biases identified in focus groups were reflected in character dialogue and challenged with explanatory statements by the physician. The inside cover of the photonovella was information-based, alerting consumers to food safety risk related to chitterlings and an outbreak in Chicago affecting infants *(3)*. The final 6 pages reinforced additional food safety messages derived from focus group input. The focus group moderator and nutrition peer educator provided input in the development of the photonovella to ensure cultural appropriateness and accuracy of the content. The photonovella was then pilot tested among 10 adult African American clinic clients, and their feedback was used for revision.

Educational intervention

The educational intervention was conducted between February and September 2013 at the UIC Miles Square Center at Englewood, and Rush University Medical Center (outpatient clinics with similar patient populations). The goal was to recruit at least 200 African American clinic clients (via fliers and intercept communication) to participate in an in-person oral pre-intervention survey. This target number was based on an expectation of a 20% dropout rate after the baseline survey and an 80% power to detect a 15% difference

in knowledge score from baseline. The pre-intervention survey included 68 questions assessing knowledge and behavior related to some or all of the following: cooking and storage of food that can harbor pathogens, food washing, handling of raw and ready-to-eat foods, cross-contamination, hand hygiene, and eating habits. The survey also determined participants' awareness of food safety educational campaigns and their experience with meat thermometers. Demographic information concerning education, estimated annual income, care of immunocompromised patients at home, and foodborne illness history was obtained to allow exploration of factors that may be associated with knowledge and food safety behavior. Multiple choice, true-false, and open-ended question formats were utlized. At the end of the survey, each participant was given a meat thermometer, with instructions on its proper use, and a copy of the photonovella along with the instruction to read it. All consenting participants were contacted 4 to 6 weeks later to participate in a post-intervention follow-up 29-question telephone survey to assess changes in knowledge and self-reported behavior and enthusiasm for the photonovella. Questions on the pre- and post-intervention survey covered meat and poultry food safety topics specifically addressed in the photonovella. The phone follow-up was programmed for Computer-Assisted-Telephone-Interviewing (CATI). Participants received $15 and $20 compensation for their time after completing the baseline and follow-up survey, respectively.

Data analysis

Data from the pre- and post- intervention surveys were analyzed to determine whether the photonovella significantly improved food safety-related knowledge.

Differences between the pre- and post-intervention question responses were analyzed using paired *t*-tests and McNemar tests for continuous and categorical variables, respectively. A food safety score (FSS) variable was created based on the number of knowledge, belief, and behavior questions answered correctly, out of a total of 9. This score allowed for an integrated measurement of the educational intervention's impact. A response of "Not sure" was categorized as an incorrect response. Each of these topics was covered in the photonovella. In the case of belief and behavior questions, responses that would place the patient at lower risk for foodborne disease were considered correct. We calculated a pre-intervention and a follow-up FSS. Questions included in the FSS were grouped in three categories: risky food handling behavior, risky food handling/preparation knowledge, and time and temperature knowledge. Pre- and post-intervention total FSS and scores by categories were compared using paired *t*-tests. We also compared the pre-intervention FSS between those who participated in both pre- and post-intervention interviews and those who dropped out after the pre-intervention interview, using *t*-tests. A lower score represented greater food safety risk. Questions that represented a higher risk based on their frequency of implication in the literature and biological plausibility were given a weight of 2 points (thawing meat on the counter at room temperature, relying on color to indicate doneness, and lack of knowledge of where to put a meat thermometer and how long to lather hands with soap). One point was assigned to knowing that ready-to-eat food should be discarded (not just rinsed with water) if it is splashed with raw chicken juice, that leftover meat should be reheated until steaming hot, and that cooked meat should not be left out at room temperature more than 2 hours. One-half point was given for knowing it is not acceptable to put meats next to fruits or vegetables in the grocery cart, and for knowing how to store raw meat relative to ready-to-eat foods in the home refrigerator. Therefore, a total FSS of 12 points was possible. Statistical analysis was performed using the statistical package SAS (version 9.3, SAS Institute, Cary, North Carolina).

The study and the protocol were approved by the University of Illinois at Chicago Institutional Review Board and the Chicago Department of Public Health.

RESULTS

Focus groups

Among the 34 participants, the majority (76%) were female, and their ages ranged from 21 to 62 years. Most (85%) purchased food using food stamps. In general, participants reported learning about food preparation and safety practices from family members (mother or grandmother). Most relied on traditional home practices or their own experience. One participant said "I've been cooking all of my life so I pretty much know… I know how to size my food up, when it is done and when it is not done." All group participants mentioned practices such as cooking meat for a long time on the stove, overcooking meat, and looking at the color of the meat as an indicator of its being done. One mentioned, "You can always tell by the color whether it's done or not, like with pot roast." Length of time of cooking meat was important, as one participant stated: "You put it in the oven for an hour and if it looks legit, you're done." When asked about using a thermometer to check whether cooked meat was done, participants responded with statements such as, "When I learned how to cook, I didn't learn with a meat thermometer" and "I don't know if people actually worry about the temperature itself. If it's done it is done." Approximately 30% of the participants indicated in the survey that it was okay to use the color of beef as a reliable indicator of doneness. Only two participants (6%) possessed a thermometer, which was rarely used. Over 90% of the participants did not know where to place a thermometer in the meat.

Hand washing was a recurring theme in each focus group. Participants emphasized washing their hands before cooking but not as a method of prevention of spreading germs from raw meat to cooked or ready-to-eat food. When asked the length

of time they should lather their hands with soap, 16 (47%) participants said less than 20 seconds would be sufficient, and an additional 5 (15%) participants did not know.

Lack of knowledge concerning defrosting food before cooking was an issue in all focus groups. One participant mentioned placing frozen food in a container of cold water to defrost at home for hours until they returned from work. Another said, "just leave it on the counter for a couple of hours." Only 5 participants mentioned defrosting meat in the refrigerator.

Among the 26 female participants, only 5 reported receiving any food safety materials from the WIC program, although this was described as nutrition-based information. Only 4 (12%) participants thought they may have seen the FightBac™ brochure in a health professional's office, although they had never paid attention to the symbol and weren't certain they had seen it. Five participants (15%) remembered seeing a Chicago Partnerships in Health Promotion brochure on holiday cooking. Participants across all groups said they had never seen or received the USDA materials on Thermy™, Is It Done Yet? or Be Food Safe. When asked about the USDA's online, phone, and E-mail "Ask Karen" program, one participant said "Who is Karen?..... We call and Karen answers?"

The most common preferred sources of food safety information were grocery stores (because "this is where people buy their food"), clinics (because of time spent waiting in the clinic), television advertisements, and through the mail. The idea of using a photonovella was unanimously liked by focus group participants, if the photonovella had a relevant storyline and colorful pictures that would get their attention and "show how things are done" in the African-American community.

Educational intervention

Two hundred persons were interviewed in the baseline survey, and 149 (75%) received the educational intervention and had a follow-up interview. The overall mean baseline food safety score was 7.80 (standard deviation [SD] 2.51) out of 12. The mean baseline food safety score was not significantly different between those included in the study and those dropping out before the intervention (n = 51, score 7.64, SD 2.37, $P = 0.69$).

Among the 149 African American consumers who participated in the baseline survey, intervention, and follow-up survey, 100 (67%) were female *(Table 1)*, 28 (19%) cared for immunocompromised persons at home, and 41 (28%) believed either themselves or other family members had previously experienced a foodborne illness. Their overall mean baseline food safety score rose from 7.80 (SD 2.51) to 8.98 (SD 2.21) ($P < 0.01$). Substantial improvements were noted especially with regard to thawing of ground meat *(Table 2)*. The proportion of all participants who said it was okay to thaw ground meat on the counter declined from 27% to 9% ($P < 0.01$). The proportion who knew how long to lather their hands with soap increased from 58% to 69% ($P = 0.01$). Significant improvement was also observed for separation of meat in the grocery cart, not using color of beef to indicate doneness, and reheating leftover meat to steaming hot.

When categories were considered, more substantial improvements were seen in food safety knowledge and behavior concerning food handling/preparation knowledge (6 points) and time and temperature knowledge (4.5 points) than in risky food consumption and handling behavior (1.5 points) (improvement 15% ($P = < 0.001$, 17%, $P < 0.001$, and 16%, $P = 0.02$, respectively).

In a sub-analysis of 43 consumers who cooked or prepared chitterlings, 27 reported not boiling chitterlings for 5 minutes before cleaning (pre-intervention). Of these, 10 (37%) reported that they had changed their behavior since receiving the photonovella; they now either boil chitterlings *(7)* or do not prepare them at all *(3)*($P < 0.01$). The proportion of those reporting thawing meat on the counter decreased from 13 (30%) to 3 (7%) (< 0.01), and handwashing had improved from 24 (56%) to 29 (67%) participants post-intervention ($P = 0.2$).

Ninety-seven (65%) of the respondents reported making at least one change in their food safety behavior since receiving the photonovella. Using a meat thermometer was the most common behavior change (31 [32%]), followed by keeping raw meat and produce separate (22 [23%]) and not thawing meat on the countertop (21 [22%]). Thirty-five percent and 16%, of the consumers, respectively, said that someone else they lived with and someone else who doesn't live with them also read it. Eighty-two percent of the consumers said they had not previously heard a chitterlings-related food safety educational message. Also, concerning their awareness of available educational material, 75 (50%), 19 (13%), 5 (3%) were aware of Be Food Safe, FightBac™, and Thermy™, respectively.

DISCUSSION

Our study demonstrates the efficacy of an educational photonovella focused on meat and poultry food safety for low socioeconomic status African Americans who often handle chicken, beef, and pork, often eat at home, and often prepare their own meals. Notably, a substantial minority of these consumers reported that they cared for an immunocompromised person, were the primary caretaker of an infant, lived in a household where someone had been pregnant in the past year, and/or knew someone who they believed had experienced a foodborne illness.

The improvement in the FSS revealed several topics that the photonovella was especially successful at improving and topics for which it did not demonstrate significant effect. For example, a relatively large reduction was seen as a result of the intervention in persons who found it acceptable to thaw ground meat on the counter. However, nearly one-third, both before and after the intervention, would not discard

Table 1. Characteristics of low socioeconomic African Americans participating in the educational intervention (n = 149)

Variable	Number (%)
Race	
Black/African-American	147 (98.66)
Multi-racial	2 (1.34)
Gender	
Female	100 (67.11)
Male	49 (32.89)
Age groups	
18–30 years	13 (8.72)
31–49 years	45 (30.20)
50–64 years	73 (48.99)
65 or more years	18 (12.08)
Yearly household income	
Less than $10,000	6 (11.76)
At least $10,000 but less than $15,000	5 (9.8)
At least $15,000 but less than $25,000	9 (17.65)
At least $25,000 but less than $30,000	6 (11.76)
At least $30,000 but less than $35,000	1 (1.96)
At least $35,000 but less than $40,000	5 (9.8)
At least $40,000 but less than $45,000	5 (9.8)
At least $45,000 but less than $75,000	9 (17.65)
At least $75,000 or more	3 (5.88)
Refused or Missing	100
Education	
8th grade or less	2 (1.34)
Some high school	19 (12.75)
High school graduate	39 (26.17)
Associate's degree	19 (12.75)
Some college	43 (28.86)

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Table 1. Characteristics of low socioeconomic African Americans participating in the educational intervention (n = 149) (cont.)

Variable	Number (%)
Education (cont.)	
GED	4 (2.68)
Bachelor's degree	14 (9.4)
Master's degree	3 (2.01)
Other	5 (3.36)
Refused or missing	1 (0.67)
Living situation	
Apartment	79 (53.02)
House	70 (46.98)
Employment status	
Currently employed	51 (34.23)
Receive SNAP benefits	76 (51.01)
Ever worked as a food handler	51 (34.23)
Has access to a computer with internet access	107 (71.81)
Anyone pregnant within the household in previous 12 months	16 (10.74)
Primary caregiver of infant or child in household	36 (24.16)
Do you cook or prepare chitlins (or chitterlings) yourself?	
Yes	43 (28.86)

vegetables intended to be eaten raw that had been splashed with raw chicken juice. The rationale for this behavior might be related to food insecurity due to their low-income status or it may be that the way such information was presented in the photonovella was ineffective. In the photonovella, the presentation of this information occurred indirectly as a statement of one of the characters when shopping for vegetables and meat at a grocery store. The character explained, "We can get sick if the raw meat juices get on the other food," in the context of keeping them separate in the grocery cart. However, the photonovella did not explicitly direct consumers to either cook or throw away raw vegetables if they became contaminated with raw meat juice, regardless of where this occurs. In contrast, the photonovella directly addressed thawing ground meat in four places, including directly stating not to thaw meat on the counter in two places and indirectly indicating this in another. The difference in efficacy of these two food safety topics suggests the importance of direct statements and intentional redundancy within such educational materials.

Proper handling and cooking of chitterlings was another important food safety topic in which efficacy was demonstrated. More than one-third of the consumers who cooked or prepared chitterlings but did not follow the USDA recommendation to boil them for 5 minutes before cleaning stated that they had changed to a safe behavior after the intervention *(24)*. Few of these consumers had previously heard food safety directions concerning this food. The photonovella directly addressed chitterlings cooking and handling in two places, and the public health importance and relevance to the African-American community was presented on the inside cover, where an outbreak in infants of yersiniosis associated with consuming chitterlings was summarized. Although our study did not examine reasons why behavior did not change, we suspect that some persons are reluctant to make changes

Table 2. Percent distribution of correct responses to food safety questions that determined the food safety score and comparison of changes between the pre-intervention and follow-up phases (correct responses in italics)

Variable and Points Assigned	% Correct Response Pre-intervention n = 149	% Correct Response Post-intervention n = 149	Test statistic (McNemar's test)	*P*-value
Risky food-handling behavior				
Ok to put meats next to fruits/ vegetables in grocery cart 0.5 *(Not okay)*	115 (77)	132 (89)	8.8	0.003
Do what if chicken juice splashed vegetables 1 *(Throw away)*	46 (31)	53 (36)	1.6	0.21
Risky food handling/preparation knowledge				
Ok to thaw ground meat on the counter 2 *(Not okay)*	109 (73)	135 (91)	21.1	<0.0001
Ok to use color of beef to indicate doneness 2 *(Not okay)*	102 (69)	117 (76)	7.3	0.007
How should ready-to-eat foods be stored with raw meat 0.5 *(Stored separately)*	136 (91)	136 (91)	0.00	1.00
Time and temperature knowledge				
How hot should leftover meat be reheated 1 *(Steaming hot)*	65 (44)	84 (56)	7.1	0.008
In order to check if the meat is done, where would you put the meat thermometer 2 *(In the thickest part of the meat)*	131 (88)	138 (93)	2.6	0.1
How long can cooked meat be left at room temperature 1 *(Less than 2 hours)*	80 (54)	89 (60)	1.6	0.21
Number of seconds should lather hands with soap 2 *(15 seconds or more)*	68 (46)	90 (60)	10.1	0.0015

despite educational messaging if they have not personally experienced illness, essentially feeling reassured by their unremarkable past experiences. Alternatively, some may also not have read this specific information closely. Regardless, considering that this was a relatively passive educational intervention, the results are encouraging.

Focus group and survey results indicated that awareness of food safety educational material was poor. The most well recognized program, Be Food Safe *(25)*, was familiar to approximately half of these consumers, suggesting some success in its penetration to the community. However, we are not aware of studies that have examined efficacy of this important program in raising food safety knowledge. Results of such studies could be important to compare with ours to determine optimal formats and language to communicate food safety information to those lacking in knowledge or acknowledging risky behavior. Dissemination of material such as Be Food Safe and our photonovella might reach African American consumers of low socioeconomic status efficiently through grocery stores in their communities, local health department programs (such as immunization clinics) and WIC programs.

Strengths of this photonovella as an educational intervention include the fact that it was culturally appropriate, utilizing characters recruited from the local community. Similarly, the information prioritized for presentation and language used to communicate information was informed by community focus groups. The story format was appealing to many participants and, encouragingly, many readers acknowledged making at least one behavior change and sharing information with others. In addition, the post-intervention survey was administered at least a month after providing the participants with the photonovella. Therefore, the results likely indicate more than short-term knowledge change. The photonovella may also be adapted to dissemination on the Internet as well.

As an educational intervention tool, the photonovella has not been well studied, especially when applied to food safety education. However, in a study of knowledge, attitudes, communication and behavioral intentions with respect to sexually transmitted infections, performed in South Africa *(9)*, which targeted secondary school students and included a pre and post-test follow-up design, the investigators reported successfully increasing knowledge on the spread of sexually transmitted infections, a change in attitude to condom use and toward people with such infections, and greater intention to practice safe sex. In a study of Cuban and Puerto Rican women of childbearing age in southern Florida, a photonovella (available on paper and video format) was used to educate about and promote the use of folic acid to prevent neural tube defects *(17)*. The investigators reported that 93% of these women stated that they would begin to take a multivitamin. These two studies, along with ours, support further educational research utilizing the photonovella as an intervention.

Limitations of our study include generalizability, since the results were derived from only two health clinic populations in one city. Our study also did not include a control population, so we cannot rule out the possibility that some knowledge change could have occurred from a source other than our photonovella, although we are unaware of any such community campaigns at the time of our study. Behaviors were self-reported, and observation to confirm them was not included. Finally, there was a lack of scientific literature evaluating photonovella development and assessment and on guidance of development of the FSS. We encourage future study in these areas to develop best practices and guidance.

A photonovella focused on a thematic area within food safety may be an effective way to improve knowledge, influence behavior, and encourage communication of food safety information to others. Given that a photonovella may inform and entertain, it may hold a reader's attention longer than traditional didactic material, and, through the dominant use of photography, may illustrate in realistic ways information and behavior through use of characters that a reader might identify with. We encourage further study of photonovellas, culturally adapted to subpopulations, to augment existing food safety educational campaigns.

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The photonovella created for this project is available by Internet at the following address (http://www.uic.edu/sph/downloads/cms-downloads/eohs/AA-photnovella-Draft_091112.pdf) and information on copies may be requested by contacting the lead author (mdworkin@uic.edu). We gratefully acknowledge Dr. Stephanie Wang from Rush Medical Center, Anastasia McGee and Natoya Sain from the UIC Chicago Partnerships for Health Promotion, the City of Chicago and UIC clinics, community participants and the participating clinics in Englewood and Roseland neighborhoods for their assistance with this project. Funding for this project was granted from the USDA National Institute for Agriculture (NIFA), NIFSI grant award 2010-01289.

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