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Mental Models of Pasteurized and Unpasteurized Milk Product Consumption in the United States

SUMMARY

The objective of the study was to create mental models of Americans who consume either pasteurized or unpasteurized milk products. An online survey was conducted using a modified snowball-sampling technique; 1103 responses were received, 454 of which were valid and accepted for statistical analysis. Parametric and nonparametric statistical procedures were used to detect differences among four groups based on residence (urban/rural) and milk consumption preference (pasteurized/unpasteurized). Four mental models were developed using distinguishing outcomes from ANOVA, Chi-Square tests, discriminant analysis or hierarchical linear regression. All models show that the respondents were information avoiders but differed in their sources of information on milk safety and depth of information processing. The strongest predictor of milk consumption behavior was attitude about milk healthfulness, especially that of unpasteurized milk, and the role of government and the dairy industry in regulating and advocating for responsible milk production and practice. This study demonstrates that major differences related to milk consumption choice are rooted in values, opportunities, knowledge, and the desire to seek out knowledge about the safety of milk products. The mental models of milk consumption can inform instructional efforts of educators and regulators to encourage the safe consumption of milk products by consumers.

INTRODUCTION

If pasteurization leads to food-safe consumption of milk products *(17)*, why do some Americans choose to consume unpasteurized dairy products? For some consumers, the simplest answer is that they are dairy producers and choose to consume their product rather than to pay retail prices *(15)*. If safety is a concern, home pasteurization is an option for dairy producers. For non-producers, the option to consume unpasteurized milk products is complex, depending on their resident state in the United States of America (USA), as some states restrict the legal sale of unpasteurized dairy products *(11)*. Where the sale of unpasteurized milk products is not legal, but consumption of dairy products produced by legally-owned, milk-producing animals is allowed under state law, the "ownership" of dairy animals is accomplished by farmers who sell shares in cow- or herd-sharing agreements with non-producers. These arrangements grant non-producers the right

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to a portion of the unpasteurized milk products in return for their financial investment *(8)*.

Regardless of the way in which products are obtained, unpasteurized dairy products are a low proportion of overall consumption in the USA. Only 1.6% of English-speaking pregnant women reported consuming unpasteurized milk, whereas 10.4% of Spanish-speaking women reported unpasteurized milk consumption *(10)*. The Centers for Disease Control and Prevention (CDC) report that dairy products are the second most frequent food associated with foodborne illnesses, many of which result from consumption of unpasteurized products *(17)*. From 1998 to 2011, CDC reported 2384 illnesses resulting from consuming unpasteurized milk products; 284 required hospitalization and two resulted in death *(3)*. Data from Minnesota indicated that 3.7% of all foodborne illnesses were attributed to previous consumption of unpasteurized milk products *(19)*. These estimates are complicated by the underreporting of unpasteurized milk consumption among consumers and their families *(15)*, and in states where legal sale is prohibited but consumption continues *(11)*.

An approach to better understand why Americans consume unpasteurized milk products is to develop a mental model of the behavior. Mental models are most common in social sciences, where characterizations of behavior are derived from qualitative study *(16)*. The models describe underlying assumptions and learned factors that influence behavioral action, often relying on subconscious information more often than deliberative thought *(12)*. Educating through public health messaging that essentially communicates, "Don't do that," has little effect on the targeted practice and the resulting economic impacts of the behavior. A mental models approach has the potential to explain the hidden, less public roots of behavior that could prove to be motivational to the individual who is resistant to behavior change. Combining the qualitative methods of social science with quantitative data analysis could measure the scope and depth of behavioral motivators *(4)*. Potentially, this is an approach that may reveal innovative strategies for educating people as to why consumption of unpasteurized milk products is not in the interest of human health *(5, 6)*.

With this approach in mind, the goal of this study was to research and create mental, behavioral models that give insight into why Americans consume milk products that are a known public health risk. Two models were chosen as the base theories for the construction of the Mental Models of Milk Product Consumption, The Risk Information Seeking and Processing (RISP) model *(5)* and the Theory of Planned Behavior (TPB) *(1)* *(Fig. 1)*. The objective was to create mental models of Americans who consume unpasteurized milk products, and, for comparison, models of those Americans who consume pasteurized milk products. The beneficiaries of this study are instructors of food safety information through government regulatory agencies and educational institutions, those who provide instruction to the public, and ultimately the consumers of dairy products.

MATERIALS AND METHODS

Categorical variables

The categorical variables in the experimental design were used to identify the respondent's milk preference and residency. The Milk Preference categorical variable was constructed to organize respondents into two groups based on milk product consumption: Pasteurized (the exclusive consumers of pasteurized milk) and Unpasteurized (the combination of exclusive and occasional consumers of unpasteurized milk). The Residence categorical variable was the location in which respondents resided (urban or rural), according to standard definitions from the U.S. Bureau of the Census *(21)*. Data for Milk Preference and Residence were then combined to form a single categorical variable named Milk/Residence, with four sub-groups: Pasteurized/Urban, Pasteurized/Rural, Unpasteurized/Urban, and Unpasteurized/Rural. Additionally, a behavioral outcome variable was constructed from two survey items probing the type of milk currently consumed. Data were coded to a single variable with three response choices (Exclusive pasteurized milk consumer, code = 1; Occasional unpasteurized milk consumer, code = 2; or Exclusive unpasteurized milk consumer, code = 3). The variable was used as the behavioral outcome variable for the TPB portion of the Mental Models of Milk Product Consumption.

Recruitment and sampling

A modification of snowball and chain-referral sampling of hidden populations was used to reach respondents *(20)*. These techniques were selected because the distribution of unpasteurized milk product consumers in the USA differs according to state laws *(11)*, and because of our knowledge that unpasteurized milk consumers are reluctant to openly participate in research studies *(15)*. The first phase of recruitment was to advertise the survey in markets known to appeal to or to have direct contact with consumers of unpasteurized milk/dairy products. E-mails were sent to leaders in dairy science and milk marketing, food safety professionals at educational and governmental institutions, websites for health professionals and trade associations, and email listservs. The email explained the study goals and scope, who we wanted to participate, the method by which interested persons could participate, and a live link to the online survey. Participants were compensated and told of the method to receive compensation through the online survey. In the next phase of recruitment, first and subsequent round responders were encouraged to forward the recruitment email on to individuals who might be interested or to post it in locations on social media where potential participants might see the information and the link to the study. The snowballing that occurred from multiple

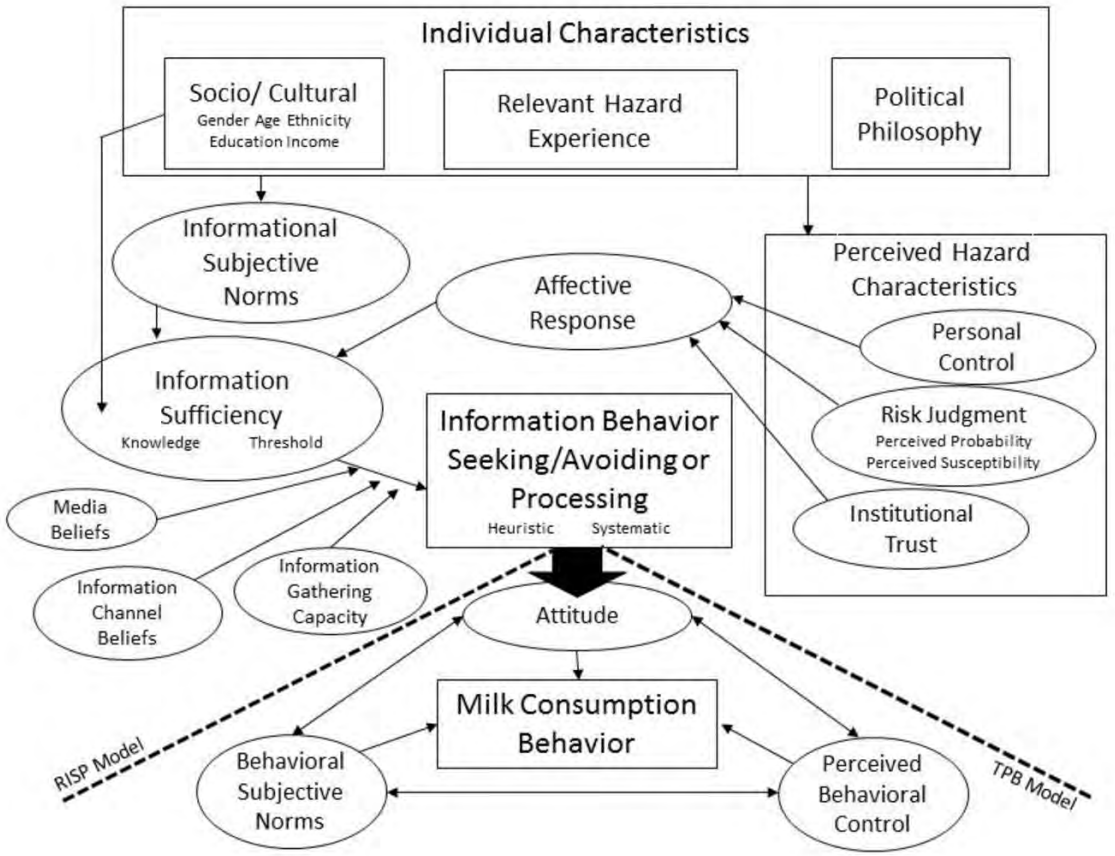

FIGURE 1. Proposed model of milk consumption behavior derived from the Risk Information Seeking and Processing model (RISP) (5) and the Theory of Planned Behavior (TPB) (1)

rounds of email distribution aimed to locate a sample of milk product consumers who were differently characterized by gender, geographical location, type of milk products they consumed, and who obtained their milk products in a variety of ways consistent with the states in which they live. Participation was limited to USA residents and those 18 years or older. Within the online survey, all participants first read an instruction page that explained the estimated amount of time required to complete the survey, the respondent's rights as a research participant in a paragraph that served as an online waiver of consent, inclusion criteria for participation, and instructions for receiving their financial compensation. The study was reviewed and approved by The Ohio State University Institutional Review Board for Social and Behavioral Sciences under Protocol number 2008B0345. To preserve the voluntary nature of the survey as required by the approved IRB protocol, all items beyond the initial screening items included an option to "choose not to answer."

Inclusion criteria and responses

The first three survey items served as the initial check for inclusion criteria: 18 years or older, milk product consumer, and resident of the USA. If the response was negative to any of these items, the participant was automatically exited from the survey to a page that explained why they were not eligible to participate. All others entered the actual survey. There were 1103 respondents by the time the online survey was closed after two weeks. Of those, 270 were deleted from the analysis because email addresses asking for financial compensation were confirmed to be of non-U.S. origin; however, these respondents were financially compensated according to IRB protocol that required payment not be a condition of voluntary participation. Another 38 respondents were deleted from analysis because of failure to complete the survey through the item requesting specific residency information, which was needed as one of two classification variables for the experimental design. Another 100 respondents chose to not answer the residency item and were deleted, again since this was a categorical variable for the experimental design. The second classification criterion for the experimental design was pasteurized/ unpasteurized milk product consumption (inclusive of dairy products). Eight respondents were deleted from analysis because of checking the "choose not to answer" response for the queries about milk product consumption. A final examination of the data showed that another 233 respon-

dents were ambiguous because of inconsistent responses that made it impossible to definitively determine the type of milk products consumed. All data analyses were completed on the remaining 454 respondents.

Online survey and data analysis

The survey contained 94 items other than the three for inclusion criteria. The questions originated from previous studies *(6, 7, 9, 13, 14, 15)* with modifications to the specific needs of the present survey. Testing and validation of items are described in these references. The survey was converted to an online format using SelectSurvey.NET (ClassApps, Release 2.0, Overland Park, KS). Data were analyzed by Chi-Square tests (non-parametric for cell counts and percentages), ANOVA (parametric variables), discriminant analysis (continuous variables only), and HLM (all variables). Data analysis was accomplished using the Software Package for the Social Sciences (SPSS, version 24, Chicago IL). Significant differences were declared if probability levels were at least 95% or greater. In some cases, principal component analysis was used to identify the set of data with the best internal consistency, defined for this study as Cronbach $\alpha > 0.600$ *(18)*.

Model components

The first part of the mental models followed the Risk Information Seeking and Processing (RISP) model *(5)*. Constructs were: Individual Characteristics, Perceived Hazard Characteristics, Affect, Informational Subjective Norms, Information Insufficiency, information channel beliefs, Information Gathering Capacity, Information Seeking Behavior, and Information Processing Behavior. The second part of the mental models was based on constructs of the Theory of Planned Behavior (TBP) *(1)*. The constructs were: Attitude, Behavioral Subjective Norms, Perceived Behavioral Control, and Milk Consumption Behavior. Each construct was assessed with one or more survey items, some of which were modified from the literature *(6, 7, 9, 13, 14, 15)*, or modified from the results of item analysis with the current dataset. For all variables, specific survey item stems are shown in each table and response choices for each item are detailed in the tables and footnotes. Marking the "choose not to answer" response was designated as missing data.

Individual characteristics

Individual characteristics included demographic descriptors (Gender, Age, Education, Income, and Ethnicity) and were nominal-choice items, with one exception: respondents were asked to record their actual age. Continuous data for Age were then coded to four categories: 18 – 29 years, 30 – 39 years, 40 – 49 years, and 50 – 77 years, based on the distribution of responses. Primary and secondary school responses were combined for the Education variable because of low response for the primary school option. Relevant Hazard Experience queried the respondent's previous personal experience with foodborne illnesses. One item pertained to personal experience and whether the illness was resolved by medical care or was self-limiting. An additional item queried the hazard experience of close friends or relatives of the respondent and the resolution of illnesses. The Relevant Hazard Experience items were nominal choice, with responses for "don't know" and "don't remember" combined into one named "Don't know." Political Philosophy was nominally queried as the best choice describing the respondent's personal assessment; choices ranged from very liberal to very conservative. Another item asked if respondents considered themselves Libertarian.

Perceived hazard characteristics

A respondent's personal control over contracting foodborne illness from consuming unpasteurized milk products was measured in two Likert-scaled items. One item (Personal Control, self-protection) addressed the belief that the immune system will protect the respondent from foodborne illness, and the other (Personal Control, personal choice) asked about the degree to which the respondents believed they have a choice about consuming unpasteurized milk products. Responses to the two items were not summed because of low internal consistency ($\alpha = 0.58$). Risk Judgment was measured by two Likert-scaled items that queried the respondent's perceived likelihood of contracting serious foodborne illness if unpasteurized milk products were consumed and that measured perceived seriousness of illnesses caused by consuming unpasteurized milk items. Responses to the two items were summed with high internal consistency ($\alpha = 0.82$). Four Likert-scaled items measured aspects of Institutional Trust. Summed responses had an internal consistency of $\alpha = 0.93$.

Affect

The emotional response to the consumption of unpasteurized milk products was assessed in items that measured the degree of affect the respondent felt. Two items were constructed as Likert-scaled items measuring the independent concepts of Worry and Anger. A single variable was constructed and named Affect ($\alpha = 0.863$).

Informational subjective norm

The influence of family and friends on the expectation that the respondent stays informed about the safety of milk products was measured in two Likert-scaled items. One item measured the verbal and non-verbal expectations that family and friends exerted over the respondent, and the second item measured the motivation to stay informed that the respondent felt from significant others. The variable was constructed as the product of the responses to the two items and was named Informational Subjective Norm.

Current knowledge

Current Knowledge was a variable constructed from summed items that measured general food safety knowledge *(13)*. The survey asked respondents to mark "agree, disagree, or unsure" for 15 statements about the safety of various food handling practices. Items were reviewed by food safety experts for accepted practice and were designated as correct or incorrect statements, *a priori (13)*. Item responses were coded from agree/disagree to correct/incorrect responses, and not-sure responses were coded to incorrect responses. An item difficulty test was used to reduce the list of 15 knowledge items to only those deemed to be neither too easy nor too difficult *(18)*. No items were too easy; four items were too difficult. The remaining 11 items were tested for internal consistency to identify the set of items with the highest alpha value. Six items were identified for the final summed variable named Current Knowledge ($\alpha = 0.74$).

Information sufficiency

In addition to actual food safety knowledge, the respondents Knowledge Perception was the number, on a scale of 0 to 100, that the respondent felt best reflected the amount of knowledge they have about the risks associated with the consumption of unpasteurized milk products. Respondents were asked to type this number into a box on the survey. Information Sufficiency was also measured on a 0 to 100 scale, but the item asked the respondent to write the number that they believed represented the amount of information they need for their purposes to be able to make decisions regarding their consumption of unpasteurized milk products. The measure Knowledge Threshold was calculated as the difference between Knowledge Perception and Information Sufficiency.

Information gathering capacity

The summed variable Information Gathering Capacity was derived from two items that measured the ease of finding information about the safety of milk products and the usefulness of that information to the respondent. The two items had sufficient internal consistency to justify the construction of the summed variable ($\alpha = 0.74$).

Information channel beliefs

The respondent's opinion about the food safety information found through a variety of media and information channels was measured by six items. Principal component analysis was used to reduce the data into factors that best sorted the concepts. Two factors were identified and named Media Bias Beliefs (three items, $\alpha = 0.78$) and Validity Cues Beliefs (two items, $\alpha = 0.75$). The remaining item did not meet item-testing criteria and was eliminated from further analysis.

Information source beliefs

Sources of information about the food safety of milk products were queried in 14 Likert-scaled items related to the usefulness of the media. Principal component analysis was used to sort data into three factors based on eigenvalues over 0.5 and Cronbach alpha above 0.6. Items within each factor were summed and checked for internal consistency; professional Information Sources ($\alpha = 0.90$) included television, radio, news, magazines, newsletters, pamphlets, and health care professional conversations; Common Information Sources ($\alpha = 0.89$) included websites, YouTube, family/friends' conversations, and Facebook; and, Another Internet Source ($\alpha = 0.75$) included Twitter, blogs, and Pinterest.

Information seeking/avoiding behavior

Five items measured the respondent's behavior regarding the seeking or avoiding information about the safety of milk products. The items that remained after internal consistency analysis were summed to form the variable Information Seeking/Avoiding Behavior ($\alpha = 0.90$). The remaining two items were eliminated from further analysis. The variable Information Seeking/Avoiding Behavior was one of three behavioral outcome variables for the RISP model portion of the Mental Models of Milk Product Consumption.

Information processing behavior

Heuristic Processing Behavior was measured in four items, all of which had sufficient internal consistency to be included in the summed variable ($\alpha = 0.82$). Systematic Processing Behavior was also measured in four items with moderately low internal consistency ($\alpha = 0.64$). All items were retained and summed to form the variable representing the importance of the variable to the overall mental models. Heuristic and Systematic Processing Behavior were two of three behavioral outcome variables for the RISP model portion of the Mental Models of Milk Product Consumption.

Behavioral subjective norm

Two survey items measured the influence of family and friends on the respondent's choice of milk products to consume. The Likert-scaled, normative item queried the respondent about family members' and friends' expectations of the safety of their milk/dairy product choices. The Likert-scaled, motivation item asked to what degree the respondent wanted to please their referent others. The variable Behavioral Subjective Norm was computed as the product of the normative and motivation item responses.

Perceived behavioral control

External controls over the consumption of milk products were measured in two survey items. One item measured the respondent's perception of the possibility of getting the type of milk products they wanted to consume, and the

other measured the probability of getting the quantity and type of milk products desired. The two items had internal consistency ($\alpha = 0.764$) and were summed to form the variable Perceived Behavioral Control.

Attitude

The variable Attitude was calculated as the sum of the products of a group of statements measuring a respondent's beliefs and corresponding belief evaluation statements specifically associated with the consumption of milk products *(1)*. The survey item construction began with a preliminary focus group study conducted to document an array of beliefs and belief evaluations expressed by consumers of milk or dairy products *(15)*. Preliminary belief statements from the focus groups (Likert-scaled (agree/disagree), coded from 1–5, n = 39) and corresponding belief evaluation statements (Somatic-differential (likely/unlikely or important/unimportant), coded from -3 to +3, n = 39), were written based on focus group transcripts. Key informants who were either pasteurized milk/dairy product consumers (n = 8) or unpasteurized milk/dairy product consumers (n = 18) volunteered to respond to a short online survey designed to produce preliminary data. Data from belief and evaluation items were multiplied to form products that corresponded to individual attitude statements. Principal component analysis was used to sort 16 items into factors with acceptable internal consistency. Fourteen items were sorted into three factors and were named: Attitude-Concerns (items = 8, $\alpha = 0.873$); Attitude-Responsibility (items = 3, $\alpha = 0.777$); and Attitude-Benefits (items = 3; $\alpha = 0.616$). Two items that asked about attitudes toward organic foods and milk regulation failed to be included in any of the factors and were eliminated from further analysis.

Mental model data analysis

Four mental models were qualitatively constructed by triangulating quantitative outcomes of four different methods of statistical analysis: Group difference testing of nonparametric (Chi-Square) and parametric (ANOVA) variables, discriminant analysis (DM) using continuously scaled variables only, and hierarchical linear modeling (HLM) using both nominal and continuous variables. Three HLM analyses were completed for the RISP model constructs to delineate significant variables predictive of information seeking/avoiding, heuristic information processing, and systematic information processing behaviors. As with the RISP model constructs, HLM analysis was used to identify significant variables that were predictive of milk consumption behavior. Along with the variables typically included within TPB models (e.g., Subjective Norms, Perceived Behavioral Controls, and Attitude), the HLM analysis also included the behavioral outcomes variables from the RISP model but as predictive variables on milk consumption behavior. Separate analyses were completed that included the variables Information Seeking/Avoiding, Heuristic Information Processing, or Systematic Information Processing.

Data from the analyses were examined for outcomes that distinguished differences among the milk consumption/residence categories. Qualitatively distinguishing outcomes from group difference testing were defined as the statistically significant variables. For discriminant analysis, qualitatively distinguishing variables were defined as standardized canonical discriminant coefficients greater than 0.3. The significant variables from HLM were defined as distinguishing. Mental models were qualitatively constructed to highlight distinguishing features as either "high" or "low" if they were above or below the central point of the item scale and to delineate the differences among the four residence/milk consumption preference models.

RESULTS

Milk and residency groups

After the dataset was inspected for non-eligible responses, the 454 survey responses represented 30.4% consumers of pasteurized milk products (n = 138) and 69.6% consumers of unpasteurized milk products (n = 316). The milk consumption groups were further sub-divided based on residency: pasteurized group, 82 urban (59.4%) and 56 rural (40.6%); unpasteurized group, 199 urban (63.0%) and 117 rural (37.0%). There was no difference in the proportion of respondents in either the milk consumption or residence groups ($P = 0.270$).

For mental modeling, a three-level behavioral variable was constructed for milk groups: exclusive selection of pasteurized or unpasteurized milk products, or a combination of the two types. Within the urban residency group, there were 85 (30.9%) respondents in the pasteurized exclusively group, 139 (50.5%) in the milk combination group, and 51 (18.5%) in the unpasteurized exclusively group. Within the rural residency group, there were 52 (31.0%) respondents in the pasteurized exclusively group, 90 (53.6%) in the milk combination group, and 26 (15.5%) in the unpasteurized exclusively group. No statistically significant differences were found between residency groups ($P = 0.687$).

Individual characteristics *(Table 1)*

No differences were found for the demographic characteristics Gender (pasteurized $P = 0.057$, unpasteurized $P = 0.411$, variable $P = 0.081$) or Education (pasteurized $P = 0.449$, unpasteurized $P = 0.170$, variable $P = 0.188$). For the variable Age, no differences were found among consumers of pasteurized milk product milk ($P = 0.250$). For unpasteurized milk consumers, the proportion of respondents in the 30 – 39 yr. age bracket was greater than other age groups ($P = 0.041$), and the overall variable was also different ($P = 0.014$). Income was generally high among respondents, but no differences were noted among pasteurized milk con-

TABLE 1. Characteristics of participants in the milk and dairy product mental model by residence and milk preference (χ^2)

Variable	Category	Urban residence (n, % within variable)		Rural residence (n, % within variable)	
		Pasteurized milk preference	Unpasteurized milk preference	Pasteurized milk preference	Unpasteurized milk preference
Gender [a]	Male	32 (50.8)	100 (60.2)	31 (49.2)	66 (39.8)
	Female	49 (67.1)	93 (65.0)	24 (32.9)	50 (35.0)
Age [b]	18–29 years	23 (60.5)	26 (61.9)	15 (39.5)	16 (38.1)
	30–39 years	11 (39.3)	65 (56.5)	17 (60.7)	50 (43.5)
	40–49 years	10 (66.7)	42 (79.2)	5 (33.3)	11 (20.8)
	50–77 years	8 (57.1)	13 (59.1)	6 (42.9)	9 (40.9)
Education [c]	Primary/secondary school	16 (64.0)	28 (60.9)	9 (36.0)	18 (39.1)
	Technical/some college	9 (42.9)	28 (60.9)	12 (57.1)	18 (39.1)
	4-year college graduate	24 (61.5)	58 (73.4)	15 (38.5)	21 (26.6)
	Professional/post graduate	29 (60.4)	79 (58.5)	19 (39.6)	56 (41.5)
Income [d]	< $25,000	14 (56.0)	14 (63.6)	11 (44.0)	8 (36.4)
	$25,000–$49,000	10 (38.5)	13 (43.3)	16 (61.5)	17 (56.7)
	$50,000–$74,000	13 (46.4)	40 (60.6)	15 (53.6)	26 (39.4)
	$75,000–$99,000	10 (83.3)	25 (75.8)	2 (16.7)	8 (24.2)
	>$100,000	21 (65.6)	93 (65.5)	11 (34.4)	49 (34.5)
Ethnicity [e]	White/Non-Hispanic	58 (71.6)	150 (79.4)	52 (94.5)	87 (79.1)
	Hispanic/Latino	4 (4.9)	7 (3.7)	0 (0)	7 (6.4)
	Amer. Indian/Alaska Native	0 (0)	2 (1.1)	0 (0)	4 (3.6)
	Asian or Pacific Islander	13 (16.0)	7 (3.7)	2 (3.6)	7 (6.4)
	Black/African American	1 (1.2)	1 (0.5)	1 (1.8)	2 (1.8)
	Multi-racial/Multi-ethnic	5 (6.2)	22 (11.6)	0 (0)	3 (2.7)
Relevant Hazard Experience, self [f]	Don't know	9 (69.2)	8 (57.1)	4 (30.8)	6 (42.9)
	No, never	27 (57.4)	79 (69.3)	20 (42.6)	35 (30.7)
	Yes, self care	35 (53.8)	60 (48.8)	30 (46.2)	63 (51.2)
	Yes, medical care	10 (83.3)	50 (83.3)	2 (16.7)	10 (16.7)
Relevant Hazard Experience, other family or friends [g]	Don't know	7 (53.8)	17 (63.0)	6 (46.2)	10 (37.0)
	No, never	18 (62.1)	75 (75.0)	11 (37.9)	25 (25.0)
	Yes, self care	33 (50.0)	47 (42.0)	33 (50.0)	65 (58.0)
	Yes, medical care	23 (82.1)	59 (79.7)	5 (17.9)	15 (20.3)
Political Philosophy [h]	Very liberal	20 (66.7)	55 (57.9)	10 (33.3)	40 (42.1)
	Liberal	21 (67.7)	36 (69.2)	10 (32.3)	16 (30.8)
	Neutral	18 (64.3)	37 (69.8)	10 (35.7)	16 (30.2)
	Conservative	12 (40.0)	48 (76.2)	18 (60.0)	15 (23.8)
	Very Conservative	6 (85.7)	12 (42.9)	1 (14.3)	16 (57.1)
Libertarian [i]	No	49 (56.3)	79 (67.5)	38 (43.7)	38 (32.5)
	Yes	24 (68.6)	106 (60.6)	11 (31.4)	69 (39.4)

Continued on the next page.

TABLE 1. Characteristics of participants in the milk and dairy product mental model by residence and milk preference (χ^2) (cont.)

[a]Gender: Pasteurized $P = 0.057$, Unpasteurized $P = 0.411$, Variable $P = 0.081$

[b]Age: Pasteurized $P = 0.250$, Unpasteurized $P = 0.041$, Variable $P = 0.014$

[c]Education: Pasteurized $P = 0.449$, Unpasteurized $P = 0.170$, Variable $P = 0.188$

[d]Income: Pasteurized $P = 0.059$, Unpasteurized $P = 0.098$, Variable $P = 0.002$

[e]Ethnicity: Pasteurized $P = 0.012$, Unpasteurized $P = 0.033$, Variable $P = 0.0.014$

[f]Relevant hazard experience, self: Hazard experience, self – participant previous experience with foodborne illness; Pasteurized $P = 0.234$, Unpasteurized $P < 0.001$, Variable $P < 0.001$

[g]Relevant hazard experience, other family or friends: Hazard experience, other family of friends – significant others previous experience with foodborne illness; Pasteurized $P = 0.034$, Unpasteurized $P < 0.001$, Variable $P < 0.001$

[h]Political philosophy: Pasteurized $P = 0.075$, Unpasteurized $P = 0.014$, Variable $P = 0.338$

[i]Libertarian: Pasteurized $P = 0.212$, Unpasteurized $P = 0.227$, Variable $P = 0.860$

sumers ($P = 0.059$) or unpasteurized milk consumers ($P = 0.098$). However, the overall variable was significant ($P = 0.002$), principally because of differences between the pasteurized milk consumption, urban/rural groups for the $75K to $99K response option, and because of differences within the residency groups for the > $100K response option. Ethnicity, overall, differed among milk consumption groups ($P = 0.014$). More white/non-Hispanic respondents were consumers of pasteurized milk than of unpasteurized milk, and the greatest proportion of this ethnicity lived in rural areas ($P = 0.012$). Few respondents represented ethnicities other than white/Caucasian; however, it is notable that the proportion of Hispanic/Latino, American Indian/Alaska natives, and multi-racial/multi-ethnic respondents was greater among consumers of unpasteurized milk ($P = 0.033$).

Relevant Hazard Experience, Self ($P < 0.001$) differed for the unpasteurized milk groups ($P < 0.001$), but not for the pasteurized groups ($P = 0.234$). The proportion of respondents answering, "Yes, medical care" was higher among the urban group respondents than for the rural group. Relevant Hazard Experience, Other Family or Friends differed among the respondents in both milk consumption groups. Like Hazard Experience, Self, the urban groups were more likely to answer, "Yes, self-care" or "Yes, medical care" ($P = 0.034$). The unpasteurized groups were more likely to respond that they "did not know" if anyone they knew had experienced a foodborne illness, denied that no one they knew had had a foodborne illness, or if others had an illness, then the illness resolved without medical care ($P < 0.001$). The overall variable was also statistically significant ($P < 0.001$).

No differences were found for the variable Libertarian; likewise, no differences were found for political philosophy for the pasteurized milk groups ($P = 0.075$). However, political philosophy differed for the unpasteurized milk consumption group ($P = 0.014$). The unpasteurized milk group was more likely to claim to be very liberal or liberal, compared to the pasteurized milk group. The overall variable ($P = 0.338$) was not statistically significant.

Perceived hazard characteristics

Non-parametric variables from the Perceived Hazard Characteristics construct were analyzed by Chi-Square analysis *(Table 2)*. The differences in the overall Personal Control, Self-protection variable ($P = 0.007$) were accounted for by differences in Disagree and Strongly Agree response choices. Responses for those who primarily consumed unpasteurized milk products also differed ($P = 0.001$). More rural unpasteurized milk consumers disagreed that the immune system self-protects against foodborne illnesses. In contrast, urban unpasteurized milk consumers strongly agreed that self-immunity protects against foodborne illnesses. Differences were not found among consumers of pasteurized milk ($P = 0.874$). The belief that respondents have control over the type of milk products they consume was mostly positive (e.g., Agree and Strongly Agree responses) among both pasteurized ($P = 0.038$) and unpasteurized ($P < 0.001$) milk consumers from both urban and rural areas. A portion of the rural unpasteurized milk consumers disagreed that they have a choice of the type of milk they consume, which most likely contributed to the high significance level for the unpasteurized milk categorical variable ($P < 0.001$).

Parametric variables used in the mental model analysis are shown in *Table 3*. Risk judgment differed by residence ($P = 0.001$), with urban residents responding they were more likely than rural residents to believe that consuming unpasteurized milk products increases risks of serious illness.

TABLE 2. Components of the milk and dairy products consumption mental model by residence and milk preference

Variable	Response choice	Urban residence (n, % within variable)		Rural residence (n, % within variable)	
		Pasteurized milk preference	Unpasteurized milk preference	Pasteurized milk preference	Unpasteurized milk preference
Personal Control, Self-protection[a]	Strongly disagree	4 (5.1)	3 (1.6)	3 (5.6)	2 (1.8)
	Disagree	23 (29.5)	35 (18.3)	17 (31.5)	41 (36.9)
	Neutral	23 (29.5)	43 (22.5)	12 (22.2)	27 (24.3)
	Agree	21 (26.9)	63 (33.0)	18 (33.3)	29 (26.1)
	Strongly agree	7 (9.0)	47 (24.6)	4 (7.4)	12 (10.8)
Personal Control, Personal choice[b]	Strongly disagree	1 (1.3)	7 (3.6)	0 (0)	3 (2.7)
	Disagree	3 (3.9)	23 (12.0)	10 (18.2)	40 (36.0)
	Neutral	10 (12.8)	9 (4.7)	9 (16.4)	12 (10.8)
	Agree	36 (46.2)	60 (31.3)	16 (29.1)	19 (17.1)
	Strongly agree	28 (35.9)	93 (48.4)	20 (36.4)	37 (33.3)

[a]Personal Control, self-protection: Pasteurized $P = 0.874$, Unpasteurized $P = 0.001$, Variable $P = 0.007$; Item text = My body's immune system will protect me from foodborne illness caused by milk or dairy products

[b]Personal Control, personal choice: Pasteurized $P = 0.038$, Unpasteurized $P < 0.001$, Variable $P < 0.001$; Item text = I have a choice about whether I drink unpasteurized milk

Similar beliefs were found for urban consumers for the variable Institutional Trust ($P < 0.001$), showing greater trust in government efforts to protect human health in general, and specifically from hazards associated with the type of dairy products consumed.

Affect *(Table 3)*

The variable Affect differed by both residence ($P < 0.001$) and milk product consumption group ($P = 0.028$). Urban residents more strongly agreed that they felt Affect (worry/anger) about the risks associated with consuming unpasteurized milk products. The pasteurized milk groups also more strongly agreed that they felt Affect about the safety of unpasteurized milk products. There was no statistical interaction.

Informational subjective norms and knowledge *(Table 3)*

No differences were found for the variable Informational Subjective Norms. Information Sufficiency measured the difference between knowledge and the threshold of knowledge needed to decide about the consumption of milk products *(Fig. 1)*. First, the respondent's knowledge of milk and general food safety was measured as Current Knowledge, and then the perception of their knowledge was measured as Knowledge Threshold (difference between perceived knowledge and knowledge sufficiency). Rural residents scored significantly higher on Current Knowledge than did urban residents ($P < 0.001$). No other differences were found. Negative Knowledge Threshold values indicated respondents scored their perceived information sufficiency higher than their perceived knowledge. Knowledge Threshold was greater among rural than among urban residents ($P < 0.001$) and among consumers of unpasteurized rather than pasteurized products ($P < 0.001$). There was also an interaction ($P = 0.004$) between Residence and Milk Preference.

Information channel beliefs *(Table 3)*

Media Beliefs measured beliefs about the respondent's perception of media bias and sensationalism. Differences were not found for the main effects, but an interaction was found ($P = 0.020$). Respondents in the unpasteurized urban group and in the pasteurized rural group had similar scores, which were higher than the scores of the other two groups. Higher scores on this measure meant that the respondents were less likely to perceive bias and exaggeration in media. Validity cues addressed perceptions of believability cues respondents used to evaluate media sources. No differences were found

TABLE 3. Components of the milk and dairy product consumption mental model by residence and milk preference (ANOVA[a])

Variable	Milk preference	Residence		Probability [a]
		Urban (mean ± SEM [a])	Rural (mean ± SEM [a])	
Risk judgment [b] (n = 432)	Pasteurized	6.9 ± 0.27	5.9 ± 0.32	R, $P = 0.001$ M, $P = 0.069$ R x M, $P = 0.636$
	Unpasteurized	6.3 ± 0.17	5.5 ± 0.23	
Institutional trust [c] (n = 428)	Pasteurized	12.9 ± 0.53	11.1 ± 0.63	R, $P < 0.001$ M, $P = 0.066$ R x M, $P = 0.771$
	Unpasteurized	12.1 ± 0.34	10.1 ± 0.45	
Affect [d] (n = 433)	Pasteurized	6.3 ± 0.29	5.1 ± 0.34	R, $P < 0.001$ M, $P = 0.028$ R x M, $P = 0.848$
	Unpasteurized	5.8 ± 0.18	4.5 ± 0.24	
Informational subjective norm [e] (n = 438)	Pasteurized	14.2 ± 0.79	13.1 ± 0.94	R, $P = 0.102$ M, $P = 0.127$ R x M, $P = 0.913$
	Unpasteurized	15.4 ± 0.51	14.1 ± 0.66	
Current knowledge [f] (n = 399)	Pasteurized	8.5 ± 0.20	9.5 ± 0.25	R, $P < 0.001$ M, v = 0.765 R x M, v = 0.187
	Unpasteurized	8.3 ± 0.14	9.8 ± 0.17	
Knowledge threshold [g] (n = 437)	Pasteurized	-19.0 ± 2.54	-2.29 ± 3.03	R, $P < 0.001$ M, $P < 0.001$ R x M, $P = 0.004$
	Unpasteurized	-1.49 ± 1.62	1.22 ± 2.12	
Media bias beliefs [h] (n = 427)	Pasteurized	8.6 ± 0.16	8.8 ± 0.20	R, $P = 0.181$ M, $P = 0.455$ R x M, $P = 0.020$
	Unpasteurized	8.8 ± 0.10	8.3 ± 0.14	
Validity cues beliefs [i] (n = 417)	Pasteurized	10.4 ± 0.28	10.3 ± 0.34	R, $P = 0.293$ M, $P = 0.435$ R x M, $P = 0.657$
	Unpasteurized	10.7 ± 0.18	10.3 ± 0.24	
Professional information sources [j] (n = 410)	Pasteurized	24.7 ± 0.70	24.2 ± 0.86	R, $P = 0.14$ M, $P = 0.848$ R x M, $P = 0.074$
	Unpasteurized	25.7 ± 0.45	22.9 ± 0.60	
Common information sources [k] (n = 422)	Pasteurized	14.1 ± 0.35	13.4 ± 0.43	R, $P < 0.001$ M, $P < 0.001$ R x M, $P = 0.174$
	Unpasteurized	15.7 ± 0.22	14.1 ± 0.29	
Another Internet source [l] (n = 416)	Pasteurized	8.4 ± 0.41	8.1 ± 0.51	R, $P = 0.987$ M, $P < 0.001$ R x M, $P = 0.362$
	Unpasteurized	10.5 ± 0.27	10.8 ± 0.35	
Information gathering capacity [m] (n = 430)	Pasteurized	8.1 ± 0.19	7.6 ± 0.23	R, $P = 0.001$ M, $P = 0.046$ R x M, $P = 0.354$
	Unpasteurized	7.9 ± 0.12	7.1 ± 0.16	
Information seeking/ avoiding behavior [n] (n = 423)	Pasteurized	6.8 ± 0.27	7.5 ± 0.33	R, $P = 0.026$ M, $P < 0.001$ R x M, $P = 0.541$
	Unpasteurized	5.9 ± 0.17	6.4 ± 0.23	

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TABLE 3. Components of the milk and dairy product consumption mental model by residence and milk preference (ANOVA[a]) (cont.)

Variable	Milk preference	Residence		Probability [a]
		Urban (mean ± SEM [a])	Rural (mean ± SEM [a])	
Heuristic information processing behavior [o] (n = 414)	Pasteurized	12.6 ± 0.43	11.4 ± 0.53	R, $P = 0.018$ M, $P = 0.066$ R x M, $P = 0.506$
	Unpasteurized	13.1 ± 0.27	12.4 ± 0.36	
Systematic information processing behavior [p] (n = 416)	Pasteurized	15.2 ± 0.27	15.0 ± 0.33	R, $P = 0.001$ M, $P = 0.130$ R x M, $P = 0.021$
	Unpasteurized	16.2 ± 0.17	14.8 ± 0.23	
Behavioral subjective norm [q] (n = 418)	Pasteurized	13.9 ± 0.78	12.4 ± 0.94	R, $P = 0.003$ M, $P = 0.798$ R x M, $P = 0.340$
	Unpasteurized	14.4 ± 0.49	11.5 ± 0.65	
Perceived behavioral control [r] (n = 418)	Pasteurized	8.5 ± 0.18	8.0 ± 0.22	R, $P < 0.001$ M, $P = 0.340$ R x M, $P = 0.332$
	Unpasteurized	8.5 ± 0.11	7.7 ± 0.15	
Attitude–Concerns [s] (n = 381)	Pasteurized	43.6 ± 4.12	42.5 ± 5.03	R, $P = 0.013$ M, $P < 0.001$ R x M, $P = 0.027$
	Unpasteurized	68.8 ± 2.56	50.4 ± 3.46	
Attitude–Responsibility [t] (n = 393)	Pasteurized	22.9 ± 1.83	15.7 ± 2.20	R, $P < 0.001$ M, $P = 0.011$ R x M, $P = 0.658$
	Unpasteurized	19.3 ± 1.13	10.6 ± 1.52	
Attitude–Benefits [u] (n = 391)	Pasteurized	5.0 ± 1.19	5.9 ± 1. 48	R, $P = 0.712$ M, $P < 0.001$ R x M, $P = 0.219$
	Unpasteurized	10.4 ± 0.74	8.6 ± 0.98	

[a]ANOVA = univariate analysis of variance; SEM = Standard error of mean; M = milk preference main effect; R = residence main effect; M x R = milk preference by residence interaction

[b]Item texts = (a) It is likely that drinking unpasteurized milk will make you sick; (b) I can become seriously ill from drinking unpasteurized milk; Score range = 2 – 10; α = 0.819

[c]Item texts = (a) Government officials care about the health and safety of people like me; (b) Eventually, science will find a way to solve most human health problems; (c) The government is doing a competent job of protecting people's health from risks related to the consumption of milk and dairy products; (d) I trust government to protect me from risks related to the consumption of milk and dairy products; Score range = 4 – 20; α = 0.928

[d]Item texts = (a) I am worried about the risks to my health that would come with the consumption of unpasteur-ized milk, (b) I am angry about the risks to my health that consuming unpasteurized milk would cause; Score range = 2 – 10; α = 0.863

[e]Item texts = My family and friends expect me to stay on top of information about the food safety of milk and dairy products (normative); I want to stay on top of information about the food safety of milk and dairy products that my family and friends think I should know (motivation); Score range = 1 – 25

[f]Item texts = Current Knowledge item texts shown in Table 4; Score range = 6 – 12; α = 0.737

[g]Item text = (Perceived Knowledge) Please rate your knowledge about food safety risks associated with drinking unpasteurized or raw milk. Please use a scale of zero to 100, where zero means that you know nothing and 100 means that you know everything you could possible know about this topic. Item text = (Information Sufficiency) Please estimate how much knowledge you need for your own purposes to make decisions about the food safety risks associated with drinking unpasteurized or raw milk. Using a scale of zero to 100, how much information would be sufficient for you, that is, good enough for your purposes? Knowledge Threshold = Perceived Knowledge – Information Sufficiency

[h]Item texts = (a) The media often exaggerates and sensationalizes the news, (b) News media often represent their own bias and interest; Score range = 2 – 10; α = 0.777

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TABLE 3. Components of the milk and dairy product consumption mental model by residence and milk preference (ANOVA[a]) (cont.)

[i]Item texts = (a) When the same information appears in many places, I'm more likely to believe it, (b) News stories with statistics are more believable than those without, (c) individual news stories may seem like bits and pieces, but in the long run they form a meaningful pattern; Score range = 3 – 15; α = 0.753

[j]Item texts = When it comes to the food safety of milk and dairy products, I pay attention to information from (a) television, (b) radio, (c) newspapers, (d) magazines, (e) newsletters, (f) pamphlets/factsheets, (g) health care professionals; Score range = 7 – 35; α = 0.899

[k]Item texts = When it comes to the food safety of milk and dairy products, I pay attention to information from (a) family/friends, (b) websites, (c) YouTube videos, (d) Facebook; Score range = 5 – 20; α = 887

[l]Item texts = When it comes to the food safety of milk and dairy products, I pay attention to information from (a) Twitter, (b) blogs, (c) Pinterest; Score range = 3 – 15; α = 0.750

[m]Item texts = (a) If I wanted to, I could easily get a lot of information about the food safety of milk and dairy products, (b) The information that I find about the food safety of milk and dairy products is useful to me; Score range = 3 – 10; α = 0.739

[n]Item texts = (a) When the topic of milk and dairy product food safety comes up, I'm likely to tune it out, (b) When the topic of milk and dairy product food safety comes up, I go out of my way to avoid learning more about it, (c) Gathering a lot of information on the food safety of milk and dairy products is a waste of time; Score range = 3 –15; α = 0.895

[o]Item texts = (a) When I encounter information about the food safety of milk and dairy products, I focus on only a few key points, (b) If I have to act on information about the food safety of milk and dairy products, the advice of one expert is good enough for me, (c) When I see or hear information about the food safety of milk and dairy products, I rarely spend much time thinking about it, (d) There is far more information on the food safety of milk and dairy products than I personally need; Score range = 4 – 20; α = 0.820

[p]Item texts = (a) After I encounter information about the food safety of milk and dairy products, I am likely to stop and think about it, (b) If I need to act on information about the food safety of milk and dairy products, the more viewpoints I get, the better, (c) It is important for me to interpret information about the food safety of milk and dairy products in a way that applies directly to my life, (d) When I encounter information about the food safety of milk and dairy products, I read or listen to most of it, even though I may not agree with the perspective; Score range = 8 – 20; α = 0.641

[q]Item texts = (Normative) My family and friends expect me to choose the safest types of milk or dairy products for us to drink or eat, (Motivation) I want to please my family and friends by serving the types of milk or dairy products they prefer; Score range = 1 – 25

[r]Item texts = Whether I drink raw or pasteurized milk, getting the type of milk or dairy products I want for myself and my family is...possible/definitely impossible; Score range = 2 – 10; α = 0.764

[s]Item texts for Attitude-Concerns shown in Table 5; Score range = -45 – 120, scale midpoint = 75, α = 0.873

[t]Item texts for Attitude-Responsibility shown in Table 5; Score range = -27 to 45, scale midpoint = 18, α = 0.777

[u]Item texts for Attitude-Benefits shown in Table 5; Score range = -45 to 27, scale midpoint = -18, α = 0.067

for this variable. The specific media sources used by respondents were measured and sorted into variables according to the type of source. Professional information sources did not differ among the four groups, nor were interactions found. Usefulness of Common Information Sources differed by Residence ($P < 0.001$) and Milk Preference ($P < 0.001$), but no interaction was found. Urban milk consumers reported the greatest use of Common Information Sources ($P < 0.001$), as did unpasteurized milk consumers ($P < 0.001$). Sources in the Another Internet Source category were most favored by milk preference ($P < 0.001$), with consumers of unpasteurized milk showing the most favorable agreement with the use of these sources. Other differences for the variable were not found.

Information gathering capacity *(Table 3)*

There were differences by Residence ($P = 0.001$) and Milk Preference ($P = 0.046$) for the variable Information Gathering Capacity, but no interaction was found. Urban respondents expressed greater agreement than rural respondents that they have the capacity to find milk-related information and regarded the information as useful. The effect was somewhat greater for consumers of pasteurized milk than for the consumers of unpasteurized milk ($P = 0.046$).

Information behavioral outcome variables *(Table 3)*

The behavioral outcome variables of the RISP portion of the survey were Information Seeking/Avoiding Behavior, Heuristic Information Processing Behavior, and Systematic Information Processing Behavior *(Fig. 1)*. Pasteurized milk consumers somewhat agreed they were seekers of milk safety information, compared with unpasteurized milk consumers ($P < 0.001$), especially among those living in rural areas ($P = 0.026$). Higher scores indicated information seeking behavior; whereas low respondent scores showed information avoiding behavior (score range 3–15, 9 = neutral). Mean scores primarily below neutral showed this sample of responders were, overall, information avoiders.

The depth at which information is processed was measured as Heuristic Information Processing Behavior (superficial) and Systematic Information Processing Behavior (in depth).

TABLE 4. Items used in the construction of the variable, Current Knowledge[a]

Item text	Correct/Incorrect Concept [b]	Status for inclusion in final variable [c]
Cooking eggs until both the yolk and white are firm will kill harmful germs.	Agree	Failed, low alpha
There is less risk for bacterial contamination in whole tomatoes in the store compared to pre-cut tomatoes you buy.	Agree	Failed, low alpha
It is okay to eat eggs with runny yolks.	Disagree	Failed, item too difficult
It is okay to eat raw fish or seafood like sushi, sashimi, ceviche, or raw oysters.	Disagree	Failed, item too difficult
It is okay to eat alfalfa or other raw sprouts.	Disagree	Failed, item too difficult
It is okay to eat cold (straight out of the package) hot dogs.	Disagree	Failed, low alpha
It is okay to eat soft cheese you buy that is made from unpasteurized milk, like Brie or Camembert.	Agree	Failed, low alpha
It is okay to eat cut cantaloupe without washing the rind first.	Disagree	Included, passed item discrimination test
It is okay to drink raw unpasteurized milk.	Disagree	Included, passed item discrimination test
If you have diarrhea, it's okay to prepare food for others in the family if you wash your hands.	Disagree	Included, passed item discrimination test
When you can't see any pink color inside a cooked hamburger patty you know all the harmful germs have been killed and the hamburger is safe to eat.	Disagree	Included, passed item discrimination test
Using the same cutting board to cut up raw chicken and then cut raw vegetables for a salad is safe if you wipe the board off with a clean cloth between the different foods.	Disagree	Included, passed item discrimination test
Head lettuce is more likely to have higher microbial counts than pre-washed (bagged) lettuce.	Disagree	Included, passed item discrimination test
It is okay to drink juices and smoothies made with raw fruit and vegetables.	Disagree	Failed, item too difficult
It is okay to eat a banana without washing the skin first.	Agree	Failed, low alpha

[a]Final scale: Score range = 6 – 12 points; $\alpha = 0.737$; n = 399

[b]Correct/incorrect concept = participant choosing conceptually correct discriminator (agree, disagree, not sure, choose not to answer). "Not sure" choices recoded to incorrect response; "choose not to answer" recoded as missing data

[c]Status for inclusion required acceptable outcomes on item testing: Item difficulty (correct scores > 20% and < 80% accuracy acceptable), Internal reliability (Item combination with $\alpha > 0.70$), Item discrimination ($r > 0.2$ between total score and item)

Heuristic Information Processing Behavior was somewhat greater among urban respondents ($P = 0.018$); however, mean scores indicated that agreement with items measuring heuristic processing was average (score range 4–20, 12 = neutral). No other group or interaction differences were found. In contrast, urban respondents also scored slightly above the mean on Systematic Information Processing Behavior ($P = 0.001$) and there was an interaction with Milk Preference ($P = 0.021$). Urban unpasteurized and rural pasteurized milk consumers had higher scores within their respective residence groups. For Systematic Information Processing Behavior, scores ranged from 8–20, with 14 = neutral.

Three constructs were used to predict the behavioral outcome of the TPB portion of the Mental Models of Milk Product Consumption: Behavioral Subjective Norm, Perceived Behavioral Control and Attitude *(Fig. 1)*. Behavioral Subjective Norm differed by Residence ($P = 0.003$), with no other differences noted. As was the case for the Informational Subjective Norm, the type of milk products consumed was influenced by family members and friends, and the effect was significantly higher for those in the urban residence group ($P < 0.001$). The indication is that those in the urban group perceived that they had the support of significant others to obtain and consume the type and amount of milk they preferred. Other differences were not found.

Attitude toward milk consumption was measured by respondents' beliefs and evaluation toward Attitude-Concerns, Attitude-Responsibility, and Attitude-Benefits *(Table 5)*. Attitude-Concerns differed by Residence ($P = 0.013$) and by Milk Preference ($P < 0.001$), and there was an interaction ($P = 0.027$). Unpasteurized milk consumers felt more concern about issues that lead the public to be cautious of an unpasteurized food. In general, residents in urban areas shared the concern. There was no interaction for Attitude-Responsibility, but differences were found for Residence ($P < 0.001$) and Milk Preference ($P = 0.011$). Urban residence and pasteurized milk consumers were more likely to share attitudes related to responsible practices related to unpasteurized milk consumption. Attitude-Benefits differed only by Milk Preference ($P < 0.001$), with unpasteurized milk consumers agreeing to the benefits of their choice of milk, in contrast to pasteurized milk consumers.

Discriminant analysis *(Tables 6 and 7)*

All continuous-scaled variables from the RISP and TPB models were included in the Discriminant Analysis. Key distinguishing variables, defined as standardized canonical discriminant function coefficients greater than 0.6, were Attitude-Responsibility and Attitude-Concerns. Distinguishing variables (e.g., those with values between 0.3 and 0.6) were Affect, Current Knowledge, Knowledge Threshold, Another Internet Sources, Information Seeking/Avoiding, Heuristic Information Processing, Attitude-Concerns, Attitude-Responsibility, and Attitude-Benefits. Coefficients for other continuous-scaled variables were not considered in the construction of the Mental Models of Milk Product Consumption.

Hierarchical linear modeling for the RISP model *(Table 6)*

Three HLM models were computed with each one ending with a RISP model behavioral outcome variable. All models were significant (Information Seeking/Avoiding, $P < 0.001$, $R^2 = 0.841$; Heuristic Information Processing, $P < 0.001$, $R^2 = 0.771$; and Systematic Information Processing, $P < 0.001$, $R^2 = 0.559$). Variables in the Individual Characteristics construct of the RISP model *(Fig. 1)* were the first to be entered into the HLM models. Hispanic/Latino ethnicity differed for the Information Seeking/Avoiding Behavior model ($P = 0.003$). Female gender ($P = 0.021$) and Age 18–29 years were significant for the Heuristic Information Processing Behavior model, and Age 18–29 years was also different for the Systematic Information Processing Behavior model ($P = 0.029$). The "don't know" response option for the variable, Relevant Hazard Experience, Self, was different for the two information processing models (Heuristic, $P = 0.001$; Systematic, $P = 0.016$). Urban respondents were more likely to respond that they don't know whether they have ever had a foodborne illness. However, if they did know about their hazard experience, urban respondents reported that they had resolved the illness with self-care in the Information Seeking/Avoiding Behavior model ($P = 0.037$). Other than the "very liberal" response option, which was excluded from model analyses, other response options for Political Philosophy differed, especially for the Information Seeking/Avoiding Behavior model and less so for the Heuristic Information Processing Behavior model *(Table 6)*. Urban respondents tended to be more liberal and rural respondents to be more conservative.

In the RISP construct, Perceived Hazard Characteristics *(Fig. 1)*, Institutional Trust differed in the Information Seeking/Avoiding Behavior model ($P < 0.001$), whereas in the Heuristic Information Processing Behavior model, both Risk Judgment ($P = 0.015$) and Institutional Trust differed ($P = 0.005$). For both models, urban respondents scored higher on the scale than did Rural respondents, indicating greater trust in governmental institutions and better judgment about the risks associated with consuming unpasteurized milk products. When asked about their choice to consume unpasteurized milk products, both pasteurized and unpasteurized milk consumers differed for the response choice "Strongly Disagree" for the Systematic Information Processing Behavior model. However, consumers of unpasteurized milk products were more likely to mark the "strongly disagree" option, whereas the pasteurized milk product consumers were the least likely to choose this option.

TABLE 5. Items and factor analysis used to construct the variables Attitude-Concerns, Attitude-Responsibility, and Attitude-Benefits[a]

Attitude belief statements [b]	Attitude evaluation statements [c]	Rotated component matrix [d]		
		Attitude-Concerns	Attitude-Responsibility	Attitude-Benefits
Even if I wanted to buy it, specialty milks like raw milk or organic milk are too expensive for me.	How likely are you willing to pay more for raw or organic mil when other types of milk may be less expensive?	0.482	---	---
Supporting local farmers by buying the food they produce is a balance between the economic health of my community and my pocketbook.	How important is it to support both your personal and local economy by buying foods grown in your area?	0.700	---	---
I worry about the hormones in my milk or dairy products, especially for children.	How likely do hormones in milk or dairy products make them unsafe for you or your children?	0.789	---	---
I worry about the pesticides in my milk or dairy products, especially for children.	How likely do pesticides in milk or dairy products make them unsafe for you or your children?	0.817	---	---
Animal diseases like tuberculosis and brucellosis are passed to humans who drink raw milk.	How likely is raw milk safe to drink if it came from cows or goats that are tested to be sure they are free of disease?	0.486	---	---
Cows or goats that eat a natural or grass diet free of added chemicals, or grains that may or may not be genetically modified, produce safer milk. (reverse coded)	How important is it for your safety to drink milk from cows or goats that eat a natural or grass diet that is free of added chemicals or grain that may or may not be genetically modified?	---	---	0.675
Raw milk is healthier and more nutritious than pasteurized milk. (reverse coded)	How likely is raw milk to be healthier and more nutritious than pasteurized milk?	---	---	0.725
Grass- or pasture-fed cows or goats produce milk that is richer in beneficial fats.	How important is it to drink milk that has the beneficial fat that only comes from grass- or pasture-fed cows or goats?	0.795	---	---
If you think you have something like lactose intolerance or a milk allergy, raw milk is better for you because it is easier to digest than pasteurized milk. (reverse coded)	Because of something like lactose intolerance or allergies, how important is it to consume raw milk if you have trouble digesting pasteurized milk?	---	---	0.725
The fat in milk is nutritious and healthy if you drink in moderation and as part of your whole daily diet.	How important is the fat in milk to the overall health and nutritional quality of your daily diet?	0.718	---	---
People who have chronic diseases that affect their immune system should not drink raw milk.	How important is it to only drink pasteurized milk for people who have chronic diseases that affect their immune systems?	---	0.800	---

Continued on the next page.

TABLE 5. Items and factor analysis used to construct the variables Attitude-Concerns, Attitude-Responsibility, and Attitude-Benefits[a] (cont.)

Attitude belief statements [b]	Attitude evaluation statements [c]	Rotated component matrix [d]		
		Attitude-Concerns	Attitude-Responsibility	Attitude-Benefits
It is the responsibility of the dairy industry to educate the public about the health benefits of milk and dairy products.	How important is it that the dairy industry takes the responsibility to educate the public about the health benefits of milk and dairy products?	---	0.757	---
Government regulators have made getting "certified organic producer" status too expensive for most farmers.	How important is it that government regulators make it more affordable for farmers to obtain "certified organic producer" status?	0.622	---	---
For safety, it is as important for raw milk to be government regulated as it is for pasteurized milk to be regulated.	For safety, how important is government regulation of raw milk?	---	0.815	---
Factor internal consistency		$\alpha = 0.873$	$\alpha = 0.777$	$\alpha = 0.666$

[a]Factor analysis statistics: $R^2 = 0.607$, KMO = 0.828, Bartlett's test of Sphericity, $P < 0.001$.
Note: Two sets of attitude statements failed inclusion in factor analysis

[b]Scale: Strongly agree = 5, Strongly disagree = 1

[c]Scale: Very important/Very likely = 3, Very unimportant/Very unlikely = -3

[d]Extraction method, principal component analysis; rotation method, Varimax with Kaiser Normalization

Informational Subjective Norm differed in the Information Seeking/Avoiding Behavior ($P = 0.003$) and Heuristic Information Processing Behavior models ($P < 0.001$); however, mean differences were not found *(Table 3)*. Current Knowledge was highly significant for the Heuristic Information Processing Behavior model ($P < 0.001$). Mean differences were found for Residence ($P < 0.001$). Rural residents were more knowledgeable about general food safety concepts compared to the urban respondents.

For the Heuristic Information Processing Behavior model, Media Bias Beliefs differed ($P = 0.002$). The significant interaction between residency and milk preference groups accounted for the model significance *(Table 3)*. Urban consumers of unpasteurized milk products scored higher means than did their rural counterpart product consumers, scoring lowest on the belief that the media exaggerate, sensationalize and report their bias when reporting on the safety of milk products. Differences were also found for both this model ($P = 0.011$) and the Information Seeking/Avoiding Behavior model ($P < 0.001$) for the variable Another Internet Source. The unpasteurized milk consumption group scored higher than the pasteurized milk consumers on their use of Internet information sources (Twitter, blogs, Pinterest) to learn about milk product safety. The capacity to seek and find information about the safety of milk products was highest for the urban, pasteurized milk consumption group and lowest for the rural, unpasteurized milk consumption group *(Table 3)*. The variable was significant for the Information Seeking/Avoiding Behavior model ($P = 0.009$).

Hierarchical linear modeling for the TPB model *(Table 7)*

When the prediction variable Information Seeking/Avoiding was included as a predictor variable in the HLM analysis of the TPB model *(Fig. 1)*, differences were found for Information Seeking/Avoiding ($P = 0.008$), Perceived Behavioral Control ($P = 0.022$), Attitude-Concerns ($P < 0.001$), and Attitude-Responsibility ($P < 0.001$). The model was significant ($P < 0.001$), with 32.7% of the overall variation explained by the set of included predictor variables. Likewise, both of the Milk Consumption Behavior models with Heuristic and Systematic Information Processing predictor variables were significant (Heuristic, $P < 0.001$, $R^2 = 0.319$; System-

TABLE 6. Components of the risk information and seeking model *(5)* included in the mental models of milk product consumption

Variable	Category	Discriminant analysis[a] Standardized canonical coefficients		Information seeking/ avoiding behavior[c]		Hierarchal linear modeling[b] Heuristic information processing behavior[d]		Systematic information processing behavior[e]	
		Function 1 (X axis)[f]	Function 2 (Y axis)[g]	Standardized coefficient (β)	Probability	Standardized coefficient (β)	Probability	Standardized coefficient (β)	Probability
	Constant			---	< 0.001	---	0.046	---	0.021
Gender	Male	---	---	Excluded	---	Excluded		---	Excluded
	Female	---	---	0.008	0.816	-0.100	0.021	-0.086	0.152
Age	18 – 29 years	---	---	0.001	0.981	0.131	0.007	0.147	0.029
	30 – 39 years	---	---	Excluded	---	Excluded	---	Excluded	
	40 – 49 years	---	---	-0.051	0.139	0.049	0.233	-0.106	0.063
	50 – 77 years	---	---	0.013	0.697	0.008	0.842	0.040	0.480
Education	Primary/ secondary school	---	---	-0.063	0.057	0.031	0.434	-0.045	0.416
	Technical/ some college	---	---	-0.007	0.843	-0.048	0.266	0.066	0.271
	4–year College graduate	---	---	-0.070	0.063	0.016	0.726	-0.017	0.793
	Professional/ post-graduate	---	---	Excluded	---	Excluded	---	Excluded	---
Income	< $25,000	---	---	0.014	0.712	-0.026	0.558	-0.096	0.127
	$25,000 – $49,000	---	---	0.024	0.540	-0.032	0.482	-0.038	0.549
	$50,000 – $74,000	---	---	0.018	0.634	-0.013	0.776	-0.106	0.095
	$75,000 – $99,000	---	---	-0.020	0.544	-0.010	0.809	0.025	0.657
	> $100,000	---	---	Excluded	---	Excluded	---	Excluded	---
Ethnicity	White/ Non-Hispanic	---	---	Excluded	---	Excluded	---	Excluded	---
	Hispanic/ Latino	---	---	0.093	0.003	-0.56	0.130	-0.081	0.111
	American Indian/ Alaska Native	---	---	Excluded	---	Excluded	---	Excluded	---
	Asian or Pacific Islander	---	---	-0.064	0.072	0.007	0.870	-0.040	0.492
	Black/ African American	---	---	-0.031	0.334	-0.060	0.121	0.037	0.493
	Multi-racial/ Multi-ethnic	---	---	-0.002	0.954	-0.071	0.072	0.058	0.283
Relevant hazard experience, self	Don't know	---	---	0.062	0.096	-0.153	0.001	0.151	0.016
	No, never	---	---	Excluded	---	Excluded	---	Excluded	---
	Yes, self care	---	---	0.102	0.037	-0.081	0.169	0.147	0.069
	Yes, medical care	---	---	-0.111	0.076	0.128	0.089	0.119	0.249
Relevant hazard experience, other family/ friends	Don't know	---	---	0.076	0.044	0.021	0.638	0.032	0.605
	No, never	---	---	0.033	0.449	-0.033	0.522	0.113	0.123
	Yes, self care	---	---	Excluded	---	Excluded	---	Excluded	---
	Yes, medical care	---	---	0.094	0.066	0.016	0.792	0.078	0.355
Political philosophy	Very liberal	---	---	Excluded	---	Excluded	---	Excluded	---
	Liberal	---	---	0.104	0.018	-0.091	0.083	-0.071	0.327
	Neutral	---	---	0.102	0.026	-0.154	0.005	0.015	0.841
	Conservative	---	---	0.101	0.039	-0.154	0.008	0.064	0.430
	Very Conservative	---	---	0.079	0.022	-0.051	0.220	-0.054	0.348

Continued on the next page.

TABLE 6. Components of the risk information and seeking model *(5)* included in the mental models of milk product consumption (cont.)

Variable	Category	Discriminant analysis [a] Standardized canonical coefficients		Information seeking/ avoiding behavior [c]		Hierarchal linear modeling[b] Heuristic information processing behavior[d]		Systematic information processing behavior [e]	
		Function 1 (X axis) [f]	Function 2 (Y axis) [g]	Standardized coefficient (β)	Probability	Standardized coefficient (β)	Probability	Standardized coefficient (β)	Probability
Libertarian	Yes	---	---	-0.372	< 0.001	0.304	< 0.001	0.220	0.004
Personal control, self-protection	Strongly disagree	---	---	-0.009	0.784	0.022	0.589	-0.036	0.513
	Disagree	---	---	Excluded	---	Excluded	---	Excluded	---
	Neutral	---	---	0.059	0.155	-0.052	0.294	0.074	0.281
	Agree	---	---	-0.037	0.412	0.027	0.609	0.110	0.141
	Strongly agree	---	---	-0.022	0.681	-0.081	0.217	0.037	0.680
Personal control, personal choice	Strongly disagree	---	---	0.009	0.779	-0.018	0.655	0.164	0.004
	Disagree	---	---	0.042	0.515	-0.115	0.140	-0.239	0.027
	Neutral	---	---	0.021	0.568	0.028	0.531	-0.061	0.332
	Agree	---	---	0.005	0.897	-0.046	0.295	-0.068	0.266
	Strongly agree	---	---	Excluded	---	Excluded	---	Excluded	---
Risk judgment	-.055	.232	0.019	0.798	0.215	0.015	0.075	0.539	
Institutional trust	-.132	-.252	-0.232	< 0.001	0.221	0.005	-0.065	0.539	
Affect	.330	-.274	-0.138	0.053	0.027	0.754	-0.039	0.740	
Informational subjective norm	.094	.269	0.143	0.003	-0.297	< 0.001	0.118	0.137	
Current knowledge	-.470	.208	0.200	< 0.001	-0.028	0.654	0.052	0.548	
Knowledge threshold	-.244	-.213	-0.001	0.967	-0.057	0.197	-0.002	0.972	
Media bias beliefs	.167	.101	-0.021	0.617	0.163	0.002	0.178	0.012	
Validity cues beliefs	-.143	.204	-0.034	0.469	0.078	0.178	0.176	0.029	
Professional information sources	.187	.173	0.042	0.428	-0.040	0.532	0.225	0.012	
Common information sources	-.050	-.262	0.067	0.239	-0.078	0.253	0.230	0.016	
Another Internet source	-.373	-.186	-0.333	< 0.001	0.211	0.011	-0.259	0.023	
Information gathering capacity	.246	-.008	0.106	0.009	-0.012	0.794	0.063	0.346	

[a]Data for all continuous variables included in analysis, 57% of cases correctly classified
[b]Data for continuous and dummy variables included in analysis
[c]Model, $R^2 = 0.841$, $P < 0.001$
[d]Model, $R^2 = 0.771$, $P < 0.001$
[e]Model, $R^2 = 0.559$, $P < 0.001$
[f]Function 1, $P < 0.001$
[g]Function 2, $P < 0.001$

TABLE 7. Components of the theory of planned behavior model *(1)* included in the mental models of milk product consumption

Variable	Category	Discriminant analysis[a]		Hierarchal linear modeling[b]					
		Standardized canonical coefficients		Milk consumption behavior with Information seeking/avoiding behavior[c]		Milk consumption behavior with Heuristic information processing behavior[d]		Milk consumption behavior with Systematic information processing behavior[e]	
		Function 1 (X axis)[f]	Function 2 (Y axis)[g]	Standardized coefficient (β)	Probability	Standardized coefficient (β)	Probability	Standardized coefficient (β)	Probability
Constant				---	< 0.001	---	< 0.001	---	< 0.001
Information seeking/ avoiding		.569	.580	-0.145	0.008	---	---	---	---
Heuristic information processing		.191	.436	---	---	0.039	0.481	---	---
Systematic information processing		-.058	-.189	---	---	---	---	0.071	0.241
Behavioral subjective norm		.008	.237	-0.026	0.662	-0.006	0.918	-0.031	0.622
Perceived behavioral control		.126	-.288	0.121	0.022	0.090	0.083	0.078	0.133
Attitude-Concerns		-.382	-.645	0.404	< 0.001	0.413	< 0.001	0.394	< 0.001
Attitude-Responsibility		.659	.209	-0.508	< 0.001	-0.463	< 0.001	-0.450	< 0.001
Attitude-Benefits		.327	-.078	0.092	0.079	0.112	0.032	0.112	0.031

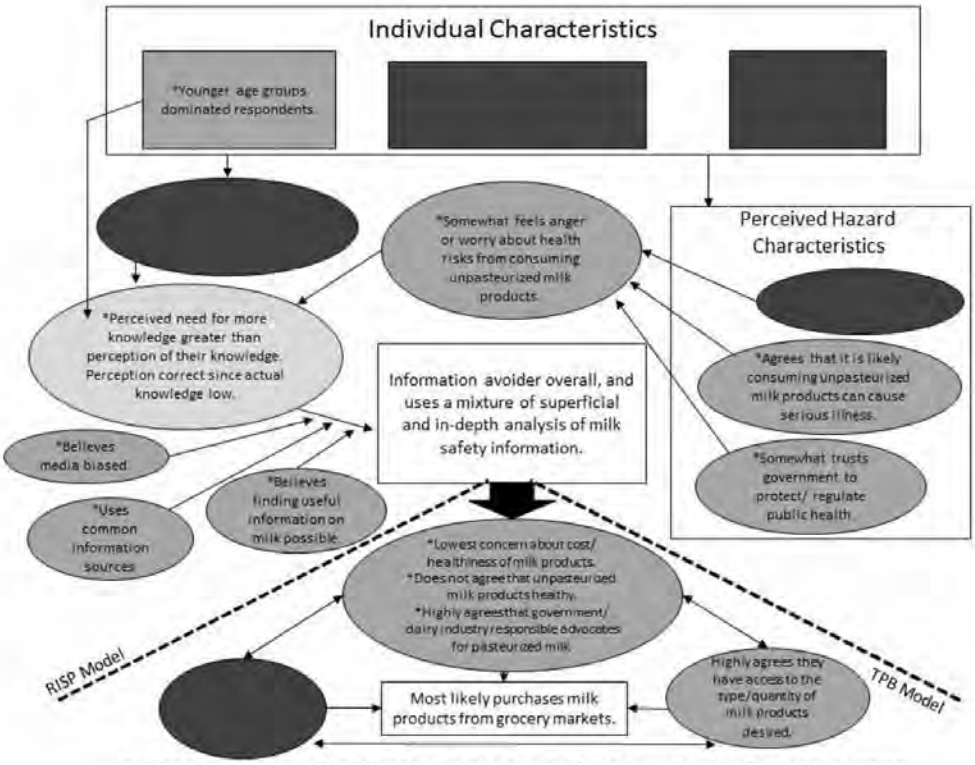
[a]Data for all continuous variables included in analysis, 57% of cases correctly classified
[b]Data for continuous variables included in analysis
[c]Model, $R^2 = 0.327$, $P < 0.001$
[d]Model, $R^2 = 0.319$, $P < 0.001$
[e]Model, $R^2 = 0.319$, $P < 0.001$
[f]Function 1, $P < 0.001$
[g]Function 2, $P < 0.001$

atic, $P < 0.001$, $R^2 = 0.319$). The only individual variables that differed were Perceived Behavioral Control for the Information Seeking/Avoiding model ($P = 0.022$) and for the three Attitude variables for all the models *(Table 7)*.

The Mental Models of Milk Product Consumption *(Fig. 2–5)*

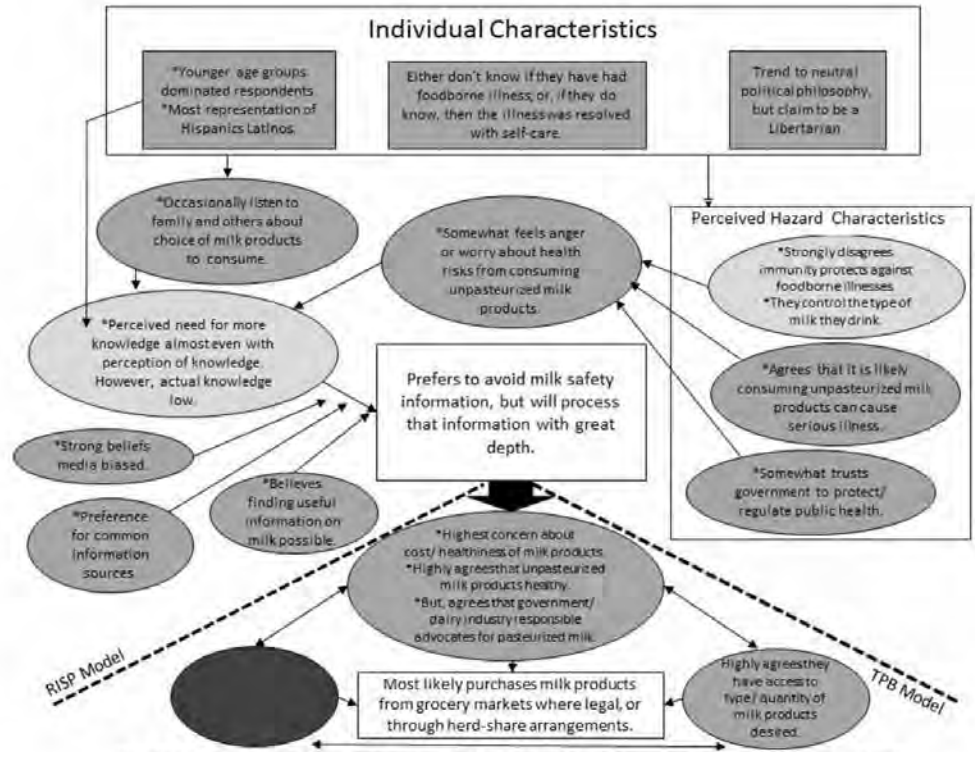
Graphic figures for the Mental Models of Milk Consumption were based on the model structure of *Fig. 1*. Construct names were substituted for interpretive phrases that describe the statistical outcomes.

Respondents categorized as urban, pasteurized milk consumers *(Fig. 2)* most likely purchased their milk products from grocery markets. The only notable individual characteristic was the clustering of respondents in the younger age groups. The Personal Control variable was not distinguishing for the construct Perceived Hazard Characteristics. For Risk Judgment, urban pasteurized milk consumers agreed that unpasteurized milk can lead to serious foodborne illness. Scores were low, but positive, for Institutional Trust, meaning they have some trust in the government to protect and regulate public health. They



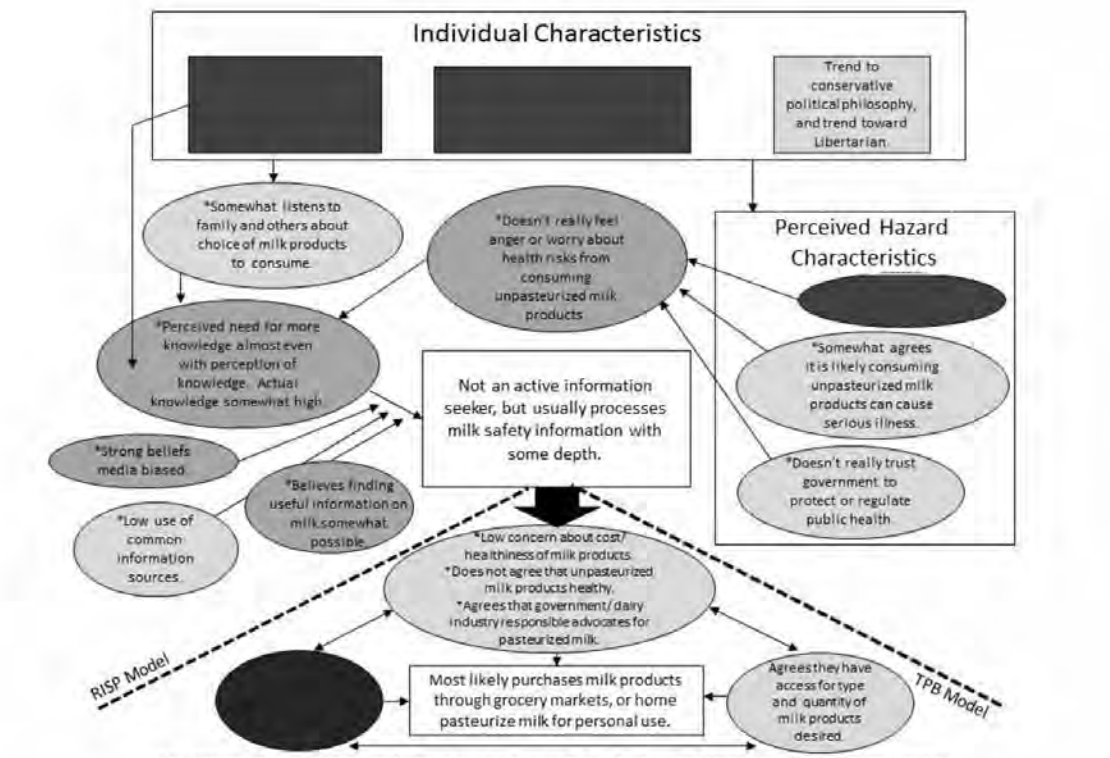
Key: Light shading = low scaled distinguishing, Medium shading = high scale distinguishing, Dark shading = not distinguishing, Black shading = model interface

FIGURE 2. The mental model of milk product consumption for urban, pasteurized milk consumers



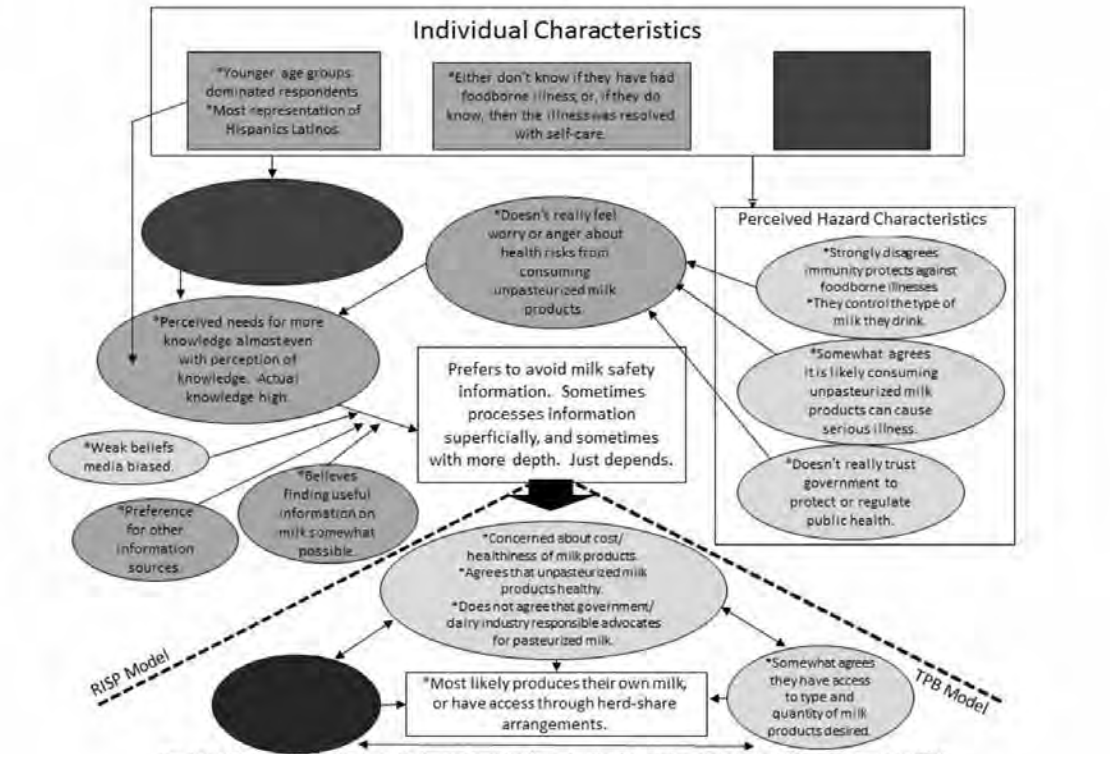
Key: Light shading = low scaled distinguishing, Medium shading = high scale distinguishing, Dark shading = not distinguishing, Black shading = model interface

FIGURE 3. The mental model of milk product consumption for urban, unpasteurized milk consumers



Key: Light shading = low scaled distinguishing, Medium shading = high scale distinguishing, Dark shading = not distinguishing, Black shading = model interface

FIGURE 4. The mental model of milk product consumption for rural, pasteurized milk consumers



Key: Light shading = low scaled distinguishing, Medium shading = high scale distinguishing, Dark shading = not distinguishing, Black shading = model interface

FIGURE 5. The mental model of milk product consumption for rural, unpasteurized milk consumers

also felt a lesser emotional response, or Affect, toward the consumption of unpasteurized milk. Their relatively low Current Knowledge scores are consistent with these findings *(Table 3)*. They believed that the media is biased. They primarily used Common Information Sources and believed they have the means and capacity to find and interpret information as needed. Attitudes toward the consumption of unpasteurized milk included concern about the cost of milk products in general, that unpasteurized milk products were not a healthy choice, and that the government is the appropriate and responsible advocate for the regulation and monitoring of milk safety. They made their own decisions about milk choice and were not influenced by significant others. Most of all, they agreed that they have access to both the type and quantity of milk products that they prefer to consume.

The only non-distinguishing construct for the Mental Model of Milk Consumption, Urban Unpasteurized milk consumers, was Behavioral Subjective Norms *(Fig. 3)*. Those in this group were characterized by younger age, greater representation of Hispanics/Latinos, being unaware they had ever had a foodborne illness or practiced self care if they had, and being libertarian and politically neutral. They strongly disagreed that foodborne illness could be controlled solely by the immune system and believed that illness from consuming unpasteurized milk was likely to be serious. They had a low but positive level of trust in the government to regulate public health, and they felt some emotion (e.g., Affect) regarding the consumption of unpasteurized milk. They occasionally listen to family members about seeking more information about milk safety, but not when they make the choice about what type of milk to consume. The perception of their milk safety knowledge and the perception of their need for additional knowledge were similar, but when quizzed on their actual food safety knowledge they scored poorly. This group strongly felt that the media reports biased information. Their preference of sources of information about milk safety consisted of other common information sources used by the public, such as social media on the Internet. If they need additional information about milk safety, they felt confident they could locate it and would be able to understand and use the information they found.

Attitudes toward milk safety were expressed as concern about the economics and healthfulness of some forms of milk products. As unpasteurized milk consumers, they believed that unpasteurized milk is a healthy choice, but they continued to believe in the need for government and the dairy industry to monitor and regulate the safety of milk sold and consumed. They agreed that they have access to the type and quantity of milk products they desire to consume, and they most likely obtained their unpasteurized milk from grocery markets where sale is legal, or through herd-share arrangements.

Consumers of pasteurized milk who lived in rural areas purchased their milk from grocery markets, or if they were dairy producers, consumed their product and home pasteurized the milk for safety *(Fig. 4)*. As farmers or residents of areas where milk is produced, they agreed that they have sufficient access to milk products for their needs. The only distinguishing characteristic of this group was their trend to conservatism and libertarianism. They agreed that unpasteurized milk can lead to serious illness, but they doubted the ability of the government to protect or regulate public health. They were worried or angry about potential health risks from consuming unpasteurized milk products, even though they do not consume this type of milk personally. Occasionally, they listen to the opinions of significant others about their knowledge of milk safety, have a balanced perception of their knowledge and need for additional information, and scored well on their knowledge of food safety measures. They, nevertheless, strongly believed that the media are biased, did not express a firm preference for any of the information sources queried on the survey, and had confidence in their ability to find and understand milk safety information, should they need it. Attitude beliefs and evaluations for this milk consumption group were low concern about the cost and healthfulness of milk products, and they had a tolerance for the practice of consuming unpasteurized milk. They believed in the government and industry's abilities to advocate and regulate for a safe milk supply.

The rural consumers of unpasteurized milk in this study most likely produced their milk or obtained it from a herd-share arrangement *(Fig. 5)*. Legal sales in rural areas could also have been a source in some states. Regardless, the respondents agreed they have access to the type and quantity of milk products they desired to consume. They, like the urban respondents, were younger and like the urban, unpasteurized milk group, had notable Hispanic/Latino representation among the respondents. They either did not know if they have experienced foodborne illness or if they did know, then the illness was resolved with self care. They strongly disagreed that immunity protects from contracting a foodborne illness and they somewhat agreed that such illnesses can be serious. They did not trust the government to protect public health. This attitude was also evident in the TPB portion of the model, when respondents were asked if the government or the dairy industry were responsible advocates for regulation. They did not express Affect about health risks from consuming unpasteurized milk products. This group had a balanced perception of their milk safety knowledge and their need for additional information. When they seek information, they find it on the Internet or from family members and friends, and they did not perceive media to be biased. They expressed belief that the information they needed would be available and they would be able to understand the information if located. As consumers of unpasteurized milk, they believed in the healthfulness of milk products in general and of consuming unpasteurized milk.

DISCUSSION

Limitations of this study

Data on fluid milk consumption was obtained separately from data on dairy product consumption in the online survey. In a preliminary inspection, the data for dairy product consumption was mostly incomplete. Because unpasteurized milk is more widely available than are dairy products made from such milk, and because unpublished data from the survey indicated that few survey respondents home-prepared dairy products from their unpasteurized milk, it was decided that the primary outcome behavior for the mental models would be best represented by a variable designated Milk Product Consumption. This variable considered the available data for both fluid milk and dairy products. Another limitation of the study is that consumption of pasteurized dairy products is a function of state laws; thus statistical sampling across the USA is not possible.

A third limitation of the study is the use of a modified snowball-sampling technique for recruiting respondents. The choice was made to use the technique to sample a "hidden" population *(20)*, which means consumers of unpasteurized milk vary from state to state because of local laws and regulations, and because of previous work that revealed the reluctance of such consumers to participate in funded research *(15)*. The primary interest was to recruit and characterize the largely understudied unpasteurized-milk consuming consumers who obtain their products as it is locally. Pasteurized milk consumers were recruited as a comparison sample. The intention was not to recruit a statistically representative sample, especially since the size of the unpasteurized milk consuming population is not known. Not unexpectedly, a large portion of the collected data was deleted from the analysis because of the type of sampling and recruiting methods used. This loss was due to failure to meet inclusion criteria, missing data, and inconsistent data that was uninterpretable because of what appeared to be respondents motivated to participate for the financial compensation. However, all who entered the actual survey were offered financial compensation as per IRB protocol.

Pasteurized and unpasteurized milk consumption, urban groups

It was surprising that urban respondents in both the pasteurized and unpasteurized milk consumption groups were not strongly characterized by their political beliefs, even though the unpasteurized group did make a claim of libertarianism. The passion felt for unpasteurized milk consumption in the urban group was most likely born from their libertarian views, but not to the point of activism for the cause. There were inconsistencies evident in their agreement with and support of government protection and regulation of public health, their relatively low level of Affect, and evidence that they avoid searching for milk safety information. They may use depth to process information they do read, but the sources of information were common Internet sources. However, the urban, unpasteurized milk consumption group showed the strongest preference for professional information sources, as compared with the pasteurized milk group *(Table 3)*. The depth of information processing would be tempered by their relative belief in media bias in milk safety information. It is notable that neither of these groups were highly knowledgeable of food safety information.

Consistent with findings in this study, unpasteurized milk consumers strongly believe in the healthful aspects of consuming milk in its "natural state" *(15)*. A major contrast between these two groups was the relative lack of concern (pasteurized milk consumers) and concern (unpasteurized milk consumers) about the healtfulness of milk products. We have previously learned that issues related to hormones, pesticides, and manipulation of the nutritional quality of animal feed as related to milk quality were major issues for consumers of unpasteurized milk. We had also found, and there is evidence in the present study, that urban consumers of pasteurized milk were overall unconcerned about milk safety, basically trusting that the products on the grocery shelf were safe and nutritious *(15)*. The unpasteurized milk consumers were committed to their beliefs about the healthfulness of unpasteurized milk, enough to seek out a source of unpasteurized milk either through legal sales or through a herd-share, supplementing products with grocery purchases. Overall, urban milk consumers were satisfied with the type and quantity of milk they preferred and with the efforts required to obtain that milk.

Pasteurized and unpasteurized milk consumption, rural groups

Dairy producers were among the respondents to this study. In areas of the country where fresh-produced milk is available for purchase, as gifts or for personal use, rural residents may have more opportunities to obtain unpasteurized milk more conveniently than urban residents do. However, we have found that rural residents are more skeptical about participation in research studies *(15)*; thus, we chose to use an online survey with trusted sources of referral to gain access to the rural participants.

The tendency toward conservative political philosophy, libertarianism, and a belief in government oversight of public health were notable and defining characteristics of the rural, pasteurized milk product consumers. Conversely, the lack of trust among rural, unpasteurized milk product consumers was also defining.

Of the four groups studied, the two rural groups demonstrated the most opposing views regarding their views on consumption of unpasteurized milk products, trust, and regulation. Both rural groups differed from the urban groups from their lack of Affect and especially in their knowledge of food safety. Both rural groups demonstrated statistically greater knowledge of food safety than the urban

groups, with the rural, unpasteurized milk consumption group having the highest score. They are not information seekers, but they process information with depth and have adequate information gathering capacity. Access to information is limited by distance and infrastructure, but Internet sources are available and used. Overall, the pasteurized milk consumers communicated in this study that they believed that pasteurization is the safest and healthiest choice for milk products, even though rural opportunities and philosophies were shared by the two rural groups. As expected, those in the rural, unpasteurized milk consumption groups communicated strong support for their choice of milk products.

CONCLUSIONS AND RECOMMENDATIONS

This study demonstrated that major differences in milk consumption choices are rooted in values, opportunities, knowledge, and the desire to seek out knowledge about the safety of milk products. Ajzen *(1)* believed that human behavior is rooted in beliefs and a person's evaluation of those beliefs, specifically their attitudes. Information seeking and processing styles, normative modifiers on behavior and perceived behavioral controls are tangibles that are modifiable through education, regulation, and the respondents' willingness to modify their behavior. Attitudes are learned over a lifetime of experience and are less malleable through external requests to change. The challenge for educators and regulators is to find ways to go beyond the teaching of information. The use and application of information are difficult to teach to another person who shares different values, and the consumption of unpasteurized milk products is value based. The opportunity to influence another person's behavior is best done by showing the learner a different outcome – perhaps one that is more consistent with their philosophies related to residence, economics, health, or regulation and oversight. These are the defining values expressed by the respondents to this study.

An example of successful food safety behavior change was found in the Abuela Project in Washington State *(2)*. Grandmothers – the Abuelas – are respected members of the Hispanic community and have influence over others. A locally produced and popular queso fresco was made from unpasteurized milk. Its popularity was rooted in the sensory qualities of the product, a personal but learned value. Serious outbreaks of disease caused by *Salmonella* Typhimurium DT 104 occurred in Washington State, with attribution to this cheese. Educators, food scientists, and regulators worked together to find an acceptable product made from pasteurized milk that had similar flavor and texture. After they taught the Abuelas how to make the product and asked them to teach the method to others in their community, the incidence of foodborne illnesses dropped dramatically. This demonstrated that working within the value system of learners to show a different method with a different outcome is difficult, but possible with innovative approaches to education, industry methods, and regulation.

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Is Your Program Crumbine Material? Put it to the Test!

The Samuel J. Crumbine Consumer Protection Award for Excellence in Food Protection at the Local Level is seeking submissions for its 2018 program.

All local environmental health jurisdictions in the U.S. and Canada are encouraged to apply, if they meet the following basic criteria:

- Sustained excellence over the preceding four to six years, as documented by specific outcomes and achievements, and evidenced by continual improvements in the basic components of a comprehensive program;
- Demonstrated improvements in planning, managing and evaluating a comprehensive program;
- Innovative and effective use of program methods and problem solving to identify and reduce risk factors that are known to cause foodborne illness; and
- Providing targeted outreach; forming partnerships; and participating in forums that foster communication and information exchange among the regulators, industry and consumer representatives.

The award is sponsored by the Conference for Food Protection, in cooperation with the American Academy of Sanitarians, American Public Health Association, Association of Food and Drug Officials, Food Marketing Institute, Foodservice Packaging Institute, International Association for Food Protection, National Association of County & City Health Officials, National Environmental Health Association and NSF International.

For more information on the Crumbine Award program and to download the 2018 entry guidelines, please go to www.crumbineaward.com. **Deadline for entries is March 15, 2018**