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*Research Article*

# Impact of Messaging Strategy on Consumer Understanding of Food Date Labels

Catherine Turvey, MPH[1]; Meghan Moran, PhD[3]; Jennifer Sacheck, PhD[1]; Ashley Arashiro, MPH[2]; Qiushi Huang, PhD, MS, MPH[1]; Katie Heley, MPH[2]; Erica Johnston, BA[2]; Roni Neff, PhD[2]

## ABSTRACT

**Objective:** Explore consumer understanding of the food industry's 2-date labeling system and the relative effectiveness of messages in increasing understanding.

**Design:** Participant understanding of date labels assessed before and after random assignment to 1 of 7 messages explaining the meaning of the labels.

**Setting:** US online survey through Amazon Mechanical Turk collected responses from July 29, 2019, to August 5, 2019.

**Participants:** Adults aged 18 years or older who speak English (n = 2,607).

**Intervention:** Seven message variations.

**Variables Measured:** Behaviors, awareness, and understanding of date labeling, and effectiveness of messages and opportunities for improving them.

**Analysis:** Pearson's chi-square test of independence, Wald chi-square test of association, McNemar's test of marginal homogeneity, and logistic regression.

**Results:** The majority of respondents use date labels to make decisions and believe they know what the labels mean; however, only 64.0% and 44.8% knew the general meaning of the Best If Used By and Use By labels, respectively. Even fewer understood their specific meanings. Overall, education increased general understanding to 82.0% for Best If Used By and 82.4% for Use By ($P < 0.001$). The effectiveness of the educational message did not vary significantly by message variation.

**Conclusions and Implications:** Consumer education is needed to improve understanding of the 2-date labeling system, ultimately improving food safety and decreasing wasted food. This study highlights opportunities for effective educational communication.

**Key Words:** date labels, food safety, food quality, food waste, educational messaging (*J Nutr Educ Behav.* 2021;53:389−400.)

## INTRODUCTION

The US wastes an estimated 31% of the food available at retail and consumer levels or approximately 133 billion pounds of food in 2010.[1] A significant contributor to avoidable consumer food waste is confusion about food date labels (the dates and accompanying phrases on food packaging such as Sell By, Use By, and Best By).[2–4] Although comparable US data were unavailable, in the UK, an estimated 30% of household food waste may be attributable to consumer confusion about date labels. The US federal government does not have a national date labeling standard or require food product dating apart from infant formula. Across manufacturers, there is inconsistency in date determination, labeling language, and whether labels are used at all.[3] Studies show consumers are confused about the quality and safety information conveyed in date labels.[4–9]

Increasing clarity around date labels is important given that consumers and consumer-facing businesses often use date labels to make purchasing, eating, and/or discard decisions which ultimately impact both waste and food safety.[4–6,10–12] By 1 assessment by the multistakeholder group ReFED, developing a national standardized date label would be a cost-effective strategy to reduce confusion and prevent 389,000 tons of wasted food each year.[13] To address confusion around date labeling, the 2 largest American food industry trade groups, Food Marketplace Inc (FMI; formerly known as The Food Marketing Institute) and the Consumer Brands Association (CBA; formerly known as the Grocery Manufacturers Association), introduced a voluntary

[1]Department of Exercise and Nutrition Sciences, Milken Institute School of Public Health, The George Washington University, Washington, DC
[2]The Center for a Livable Future, Johns Hopkins University, Baltimore, MD
[3]Department of Health, Behavior, and Society, Johns Hopkins Bloomberg School of Public Health, Johns Hopkins University, Baltimore, MD

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Address for correspondence: Roni Neff, PhD, The Center for a Livable Future, Johns Hopkins University, 111 Market Place, Ste 840, Baltimore, MD 21202; E-mail: rneff1@jhu.edu



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labeling system in 2017. According to this Product Code Dating Initiative, products receive either a Use By or a Best If Used By label.[14] A CBA survey conducted in 2018 found that 88% of US consumers said the Use By and Best If Used By label definitions were clear.[15] Although prior research has explored consumer perceptions of date label text in general, including assessment of how consumers perceive the terms used in the voluntary standard, the authors did not identify peer-reviewed studies exploring consumer understanding of the labels in the context of their specific meanings under the voluntary standard.[3,4,6,7,9]

The 2-date labeling system reflects a bifurcation of foods into those with elevated food safety risk on the basis of date alone and those without a date. The Use By safety label is used for a small number of foods, such as deli meats, prepared foods, and soft cheeses, because of their elevated risk of *Listeria* contamination and tendency to be eaten without further cooking, which would kill microbes.[14] *Listeria monocytogenes* is the primary foodborne pathogen of concern because it multiplies even under refrigeration and because foods with elevated *Listeria* populations can become unsafe to eat over time without perceivable changes to look, taste, or smell.

The Best If Used By label is suitable for most foods and indicates potential changes in food quality over time in terms of look, taste, and smell. The food is at peak quality if used before the date on the label and may have gradual decreases in quality after that date.[14] In most cases, quality remains high for a time after the date. Food safety threats in these foods would derive from contamination and improper storage as opposed to the length of time since packaging.[16] Other than *Listeria*, microbes and molds that affect quality generally grow more quickly than those that cause foodborne illness. Accordingly, most foods, if properly handled and stored, become unappealing on the basis of changes in look, taste, or smell before they become unsafe to eat.

The FMI-CBA 2-date labeling system is consistent with the wider industry and governmental support for date label standardization, and multiple organizations have aligned on the same date labeling language.[17] The US Department of Agriculture Food Safety and Inspection Service and the US Food and Drug Administration have expressed support for a quality label and have yet to provide recommendations on a safety label.[18,19] The US Environmental Protection Agency, along with the US Department of Agriculture and US Food and Drug Administration, identified a need to clarify and communicate information on date labels as part of their Winning on Reducing Food Waste Federal Interagency Strategy to reduce food loss and waste.[20] Congressional attempts to introduce federal date labeling bills have historically failed, but at the time of writing, a bipartisan Food Date Labeling Act (HR3981) is in Congress and proposes federal standardization of a 2-date labeling system.[21] As the 2-date labeling system becomes more widely used even without the national standard, consumer understanding becomes increasingly pertinent to a consumer's ability to reduce wasted food, save money, and increase their ability to judge the safety and quality of food products.

A consumer survey was conducted to explore current knowledge and behaviors related to the labels Best If Used By and Use By and assess the relative effectiveness of 7 educational messages in increasing understanding of the meaning of the date labels. On the basis of research from the field of communications, 2 strategies were employed in the messages that were tested: values framing and narrative communication. Values framing improves message effectiveness by emphasizing aspects that resonate with the audience's existing values and beliefs,[22–24] whereas narrative communication involves weaving an educational message into a story to make the content feel more realistic, memorable, or believable than nonnarrative communication.[25]

## METHODS

### Study Design and Survey Instrument

Data were collected through an online multiple-choice survey averaging 20 minutes long. The survey had 32 questions, including 2 free-response questions. The instrument, which was reviewed by experts and tested multiple times before piloting, included questions used in prior surveys[4,26] and newly designed questions on the basis of research goals. The analyses presented in this paper were part of a larger study. Measures, detailed below, included background data on attitudes and behaviors, a pretest and posttest assessment of label understanding, and respondent assessment of the message and how it could be improved.

### Measures

*Behaviors and awareness of labeling standardization.* As outlined in Table 1, participants were asked how much attention they pay to food safety. They were asked how often and for what reasons they check date labels when deciding to buy or eat food. In addition, they were asked if the phrases on food date labels are federally regulated and whether the food industry has an agreed-upon meaning for them.

*Pre-/postunderstanding of date labels.* After answering the questions outlined in Table 1, respondents were provided the following information: In fact, until recently, food date labels had no standard meanings. The food industry has now chosen a set of phrases that should be* consistently used. We would like to know what the phrases mean to you. *NOTE: Usage is not required by law and small or local manufacturers might be less likely to use the labels.

A baseline assessment of label understanding was then performed, in which each respondent was presented with the labels "Best If Used By August 15" or "Use By August 15" in a random order. Respondents were asked, "Do you know what this label means?" with multiple-choice options to respond, yes, no, or not sure. The survey then assessed their understanding of the general meaning of the labels by asking the multiple-choice question, "Is this label telling you more about safety, quality, or both?"

**Table 1.** Respondent Behaviors and Awareness of Food Date Labeling Standardization (n = 2,607)

| Survey Question | % |
|---|---|
| In general, how much attention do you pay to food safety? | |
| Very close attention | 48.2 |
| A medium amount of attention | 43.4 |
| A little amount of attention | 7.9 |
| No attention | < 1 |
| How often do you check date labels on food, such as Use By, Sell By, and Best Before, in deciding whether to buy food? | |
| Always | 62.2 |
| Sometimes | 36.2 |
| Never | 1.3 |
| How do you typically use date labels on food, such as Use By, Sell By, and Best Before, in deciding whether to buy food? Check all that apply. | |
| Choose the item with the longest time left to go | 70.5 |
| Make sure food is not expired | 69.1 |
| Avoid buying food that is nearing the label date | 62.1 |
| Depends on the label | 23.5 |
| Ignore the label | < 1 |
| Other | < 1 |
| How often do you check date labels on food, such as Use By, Sell By, and Best Before, in deciding whether to eat food? | |
| Always | 58.2 |
| Sometimes | 40.6 |
| Never | < 1 |
| How do you typically use date labels on food, such as Use By, Sell By, and Best Before, in deciding whether to eat food? Check the best answer. | |
| Use the label date along with other information like my senses (smell, how it looks) or knowledge of how it was stored, to decide whether to eat it | 57.7 |
| Avoid eating the food on or after the label date | 32.0 |
| Avoid eating the food 1 or more days before the label date | 8.8 |
| Ignore the label | < 1 |
| Other | < 1 |
| Do you think that the phrases used on food date labels (such as Use By) are federally regulated? | |
| Only for specific foods (correct) | 22.4 |
| Yes | 34.6 |
| No | 21.1 |
| Don't know | 21.7 |
| True or false: the food industry has developed an agreed-upon meaning for the phrases used on food date labels | |
| True (correct) | 61.8 |
| False | 38.1 |

Note: Nonresponse < 1% for all questions.

Depending on their response, subsequent questions asked them to specify, "What does this label mean about the [safety/quality] of a product?" For instance, if a respondent correctly answered that the Use By label is mainly about safety, they were then asked to specify what it means about the safety of the product (for example, "after this date, the product is not safe to eat"). If a respondent incorrectly answered that the Use By label was mostly about quality, they were asked to specify what they think it means about quality and were not asked to specify what it means about safety. Respondents correctly identified the general and then the specific meaning of the Use By label if they said the label was telling more about safety, and "after this date the product is not safe to eat." Respondents correctly identified the general and then the specific meaning of the Best If Used By label if they said the label was telling more about quality and "after this date, the product's quality might still be good for eating," or "after this date the product's quality is likely still good for eating."

Respondents then each received 1 of 7 randomly assigned messages (M1–M7) that explained the meaning of the labels. Messages 1 through 6 contained the same information

**Table 2.** Association Between Responses to Prior Behavioral Questions and Understanding of General Meaning of Date Labels Among Respondents At Baseline (n = 2,607)

| Response to Question | Understood "Best If Used By" Label | Misunderstood "Best If Used By" Label | *P* | Understood "Use By" Label | Misunderstood "Use By" Label | *P* |
|---|---|---|---|---|---|---|
| Reported knowing meaning of the label | | | 0.63 | | | 0.15 |
| Yes | 1538 (64.2) | 857 (35.8) | | 1049 (45.1) | 1278 (54.9) | |
| No | 34 (58.6) | 24 (41.4) | | 16 (31.4) | 35 (68.6) | |
| Not sure/unsure | 93 (62.4) | 56 (37.6) | | 100 (44.6) | 124 (55.4) | |
| Reported amount of attention paid to food safety | | | < 0.001[a] | | | 0.14 |
| Very close attention | 734 (58.6) | 519 (41.4) | | 538 (42.9) | 715 (57.1) | |
| A medium amount of attention | 783 (69.4) | 346 (30.7) | | 526 (46.5) | 605 (53.5) | |
| A little amount of attention | 141 (68.1) | 66 (31.9) | | 93 (45.2) | 113 (54.9) | |
| No attention | 7 (58.3) | 5 (41.7) | | 8 (66.7) | 4 (33.3) | |
| Reported frequency of checking date labels when buying food | | | < 0.001[a] | | | 0.007[a] |
| Always | 981 (60.6) | 639 (39.4) | | 699 (43.2) | 920 (56.8) | |
| Sometimes | 654 (69.5) | 287 (30.5) | | 438 (46.5) | 505 (53.6) | |
| Never | 27 (79.4) | 7 (20.6) | | 23 (67.7) | 11 (32.4) | |
| Reported frequency of checking date labels when eating food | | | < 0.001[a] | | | 0.45 |
| Always | 893 (58.9) | 623 (41.1) | | 663 (43.8) | 852 (56.2) | |
| Sometimes | 752 (71.4) | 301 (28.6) | | 484 (45.8) | 572 (54.2) | |
| Never | 15 (62.5) | 9 (37.5) | | 12 (52.2) | 11 (47.8) | |

[a] $P < 0.05$ was considered statistically significant.

Note: Values are n (%). Sample size for each question varied by missing values with missing values being < 1% for each. Pearson's chi-square tests of independence examined the association between responses to behavioral questions and understanding of the general meaning of the date labels among participants at baseline.

preceded by a different value frame (Figure 1).

The following value frames began the respective messages:

1. Neutral: "The new food date labels can help you" (shown in Figure 1).
2. Food quality: "The new date labels can help you enjoy good quality food and avoid throwing out food that still tastes great."
3. Food safety: "The new date labels can help you feel confident in your food safety decisions, and avoid throwing out food that's still safe to eat."
4. Financial benefit: "The new food date labels can help you save money and avoid throwing out food that's still good."
5. Food waste: "The new food date labels can help you reduce waste and avoid throwing out food that's still good."

Messages 6 and 7 presented the information using narrative communication.

6. Narrative describing a person interpreting and using food date labels (Figure 2).
7. Narrative presenting this story via illustration (Figure 3).

After reviewing their messages, respondents were again asked the same questions to identify the general and specific meanings of the labels. Their answers were compared with baseline responses to assess the effectiveness of the different messages in increasing understanding.

*Assessment of messages and how they could be improved.* Participants were asked to write their thoughts as they viewed their messages and provide suggestions for what could make the message more effective or persuasive. Respondents' evaluation of the characteristics of the message (persuasive, effective, convincing, compelling, reasonable, logical, rational, appropriate, informative) were assessed using a 7-point Likert scale adapted from Dillard and Ye.[27]

## Participants and Recruitment

The Johns Hopkins Bloomberg School of Public Health Institutional Review Board deemed the project exempt on February 22, 2019 (no. 00008460). The survey was piloted in March 2019 through distribution on a student activities listserv at the Johns Hopkins Bloomberg School of Public Health and made modifications to enhance participant understanding of questions on the basis of the resulting feedback. For the final survey, Amazon Mechanical Turk (MTurk) was used to collect 2,799 responses between July 29, 2019, and August 5, 2019. MTurk is an online platform in which individuals complete tasks, such as participating in a research survey, for financial compensation. Researchers created an MTurk notification that gave users a description of the online survey and told them they would receive $2.75 for participation in a 20-minute survey. Given the 7 message conditions, a sample size of 2,639 provides 95% power to detect an effect size of 0.1 at $P < 0.05$. Additional responses were collected in case some responses were incomplete or low quality.

Respondents came from a sample of adults aged 18 or older who speak English and live in the US. Prior research has found that MTurk users from the US slightly skew toward females, younger, higher education, and lower-income vs the typical US population distribution. Nonetheless,

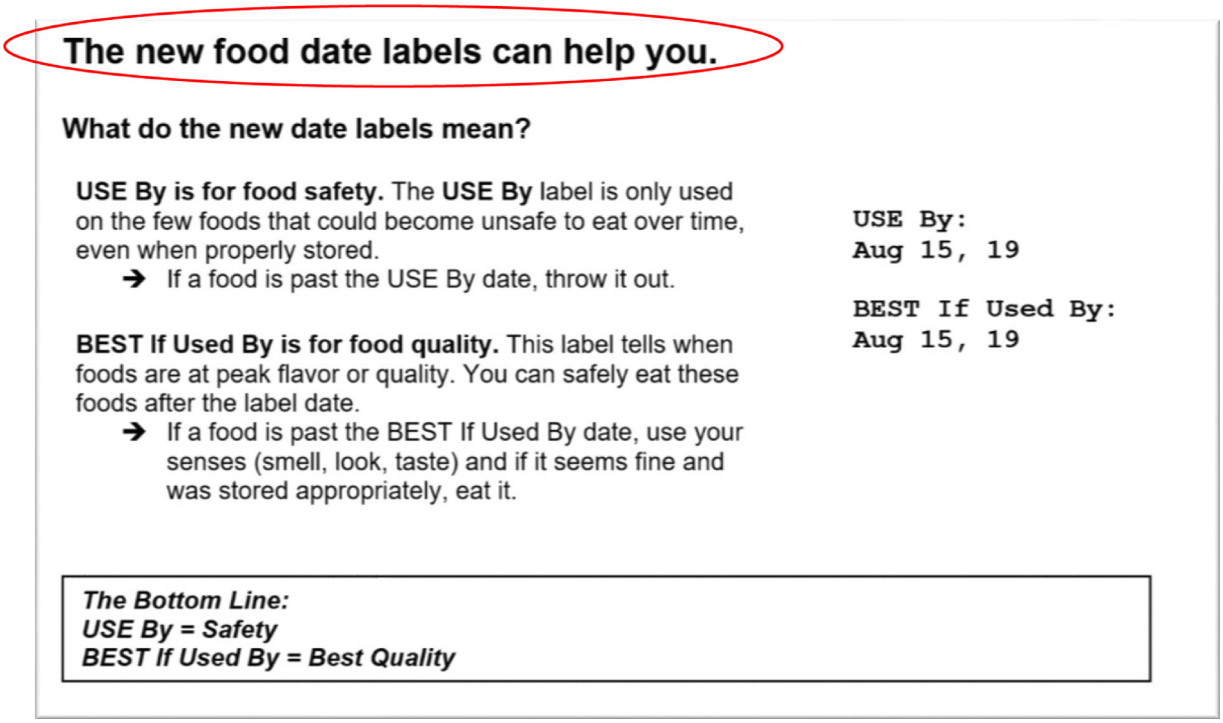


**Figure 1.** Example educational message (message 1 neutral frame message circled).

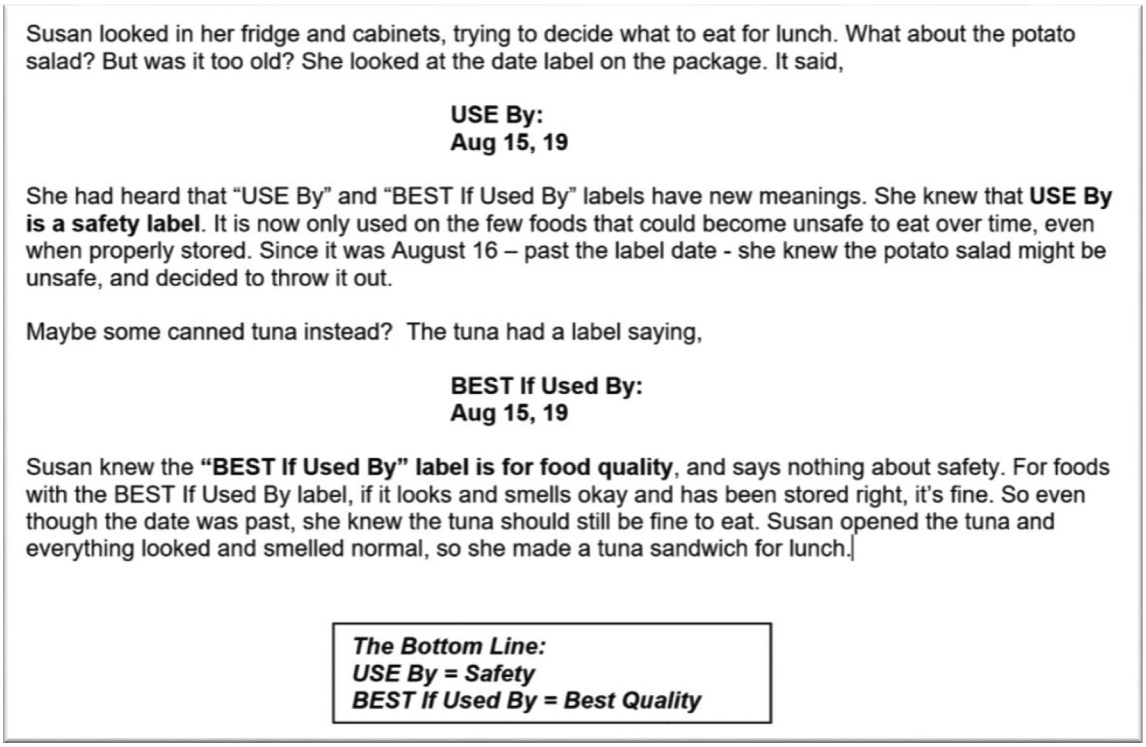


**Figure 2.** Example of narrative message (message 6).

studies suggest MTurk provides a much more representative sample of the general population than university subject pools.[28,29]

### Data Analysis

A Pearson chi-square test of independence was performed to examine differences in participants' food date label knowledge across educational messages at baseline. Pearson's chi-square tests of independence were used to examine the association between responses to other behavioral questions and understanding of the general meaning of the date labels among participants at baseline. McNemar's test of marginal homogeneity was used to determine if there was a significant change in the percentage of people who correctly identified the general meaning of the date labels before and after the intervention for each educational message and in aggregate. For each type of date label, a logistic regression adjusting for baseline knowledge was performed to assess if the effectiveness at increasing general understanding of label meaning varied across messages participants received, and *P* from the Wald chi-square test was reported and interpreted. The dependent variable was correctly or incorrectly identifying the general meaning of the labels, and the independent variable of interest was the message received. How the survey asked respondents about the specific meaning of the label depended on their response to the general knowledge question; therefore, statistical significance tests were not conducted on changes in the understanding of the specific meaning of the labels. Statistical significance was considered at an alpha level of 0.05 for all tests. SAS (version 9.4, SAS Institute Inc, 2013) was used to perform statistical analyses.

Answers to the 2 free-response questions (n = 2,555 and n = 2,532) were coded by a single coder (C.T.) using a grounded theory approach[30] in which the open-ended responses were reviewed and an initial list of themes was created for each question. After reviewing themes with a senior researcher (R.N.), a list of fewer than 15 codes were finalized for each of the 2-open-ended questions. An open-ended response was then coded as 1 if it received each code and 0 if it did not. The most salient codes relevant to core research questions are included in the results. Data for each question were analyzed independently and not pooled.

## RESULTS

The final sample included 2,607 respondents, after removing responses not meeting inclusion criteria (n = 3), duplicates (n = 35), incomplete surveys (n = 119), and seemingly computer-generated qualitative responses (n = 32) from the original 2,799 respondents.

### Behaviors and Awareness

Table 1 provides an overview of baseline behaviors and awareness related to date labeling. Of note, half (48.2%) of the respondents report paying very close attention to food safety, and nearly all (98% to 99%) reported checking date labels at least sometimes before deciding whether to buy or eat food. In survey responses and free text, respondents noted using


**Figure 3.** Example of an illustrated message (message 7).

date labels differently depending on the situation and factors like the type of food, its cost, or the type of label. Only 22.4% of respondents were aware that phrases on food date labels are federally regulated only on specific foods. Respectively, 34.6%, 21.1%, and 21.7% mistakenly believed they were federally regulated for all foods or none or were unsure, whereas 61.8% said they were aware that the food industry had developed an agreed-upon meaning for food date label language.

### Pre-/Postunderstanding of Date Labels

A Pearson chi-squared test of independence showed there was no significant difference in baseline knowledge of date labels across the

**Table 3.** Percentage of Respondents Correctly Identifying "Best If Used By" as Quality Label Before and After Education

| Message Received | % Correct | % Incorrect | *P* |
|---|---|---|---|
| Total (n = 2,601) | | | < 0.001[a] |
| Before | 64.0 | 36.0 | |
| After | 82.0 | 18.0 | |
| Neutral (n = 379) | | | < 0.001[a] |
| Before | 63.6 | 36.4 | |
| After | 81.5 | 18.5 | |
| Quality (n = 370) | | | < 0.001[a] |
| Before | 61.1 | 38.9 | |
| After | 82.7 | 17.3 | |
| Safety (n = 369) | | | < 0.001[a] |
| Before | 63.1 | 36.9 | |
| After | 82.7 | 17.3 | |
| Financial (n = 372) | | | < 0.001[a] |
| Before | 65.3 | 34.7 | |
| After | 82.5 | 17.5 | |
| Waste (n = 365) | | | < 0.001[a] |
| Before | 65.5 | 34.5 | |
| After | 80.3 | 19.7 | |
| Story (n = 369) | | | < 0.001[a] |
| Before | 65.0 | 35.0 | |
| After | 82.4 | 17.6 | |
| Illustration (n = 377) | | | < 0.001[a] |
| Before | 64.2 | 35.8 | |
| After | 82.0 | 18.0 | |

[a] $P < 0.05$ was considered statistically significant.

Note: Respondents were randomly assigned 1 of 7 educational messages that explained the meaning of date labels. Nonresponse was removed and was < 1% for each condition. McNemar's tests determined if there was a significant change in the percentage of people who correctly identified the general meaning of the date labels before and after the intervention for each educational message and in aggregate.

7 message groups. At baseline, 92.1% of respondents reported they knew what the Best If Used By label meant. However, only 64.0% and 46.2% of all respondents, respectively, correctly identified the general and specific meanings of the label. Similarly, although 89.4% said they knew what the Use By label means, only 44.8% and 24.3% correctly identified the general and then specific meanings.

A Pearson chi-square test of independence showed that reporting knowing the meanings of the labels was not significantly associated with identifying their meanings at baseline (Tables 2). The reported amount of attention paid to food safety and frequency of checking date labels when buying or eating food was significantly associated with identifying the meaning of the Best If Used By label ($P < 0.001$). A lower percentage of those paying very close attention and always checking date labels when buying or eating food correctly identified the general meaning of the Best If Used By label than those who reported paying less attention or checking labels less frequently. Checking date labels when buying food was also significantly associated with identifying the meaning of the Use By label ($P = 0.007$). A lower percentage of those who always checked the Use By label knew the label's meaning than those who reported checking less frequently.

McNemar's test of marginal homogeneity showed that each of the 7 messages was associated with a significantly increased general understanding of date label meaning (Tables 3 and 4). Messages resulted in a significant absolute increase of 18.0% and 37.6%, respectively, in correctly identifying the general meaning of Best If Used By and Use By labels ($P < 0.001$ for both). The Wald chi-square test of association from the logistic regressions found no statistically significant differences in the effectiveness of increasing understanding across 7 messages ($P = 0.91$ for Best If Used By and $P = 0.06$ for Use By labels). Given that the $P$ value for Use By was close to the significance level used to determine statistical significance ($P = 0.05$), researchers conducted pairwise comparisons and confirmed that no message was significantly more effective than the others.

Similarly, the percentage of respondents correctly identifying the specific meaning of the Best If Used By label increased from 46.2% to 63.0% after education across messages. The percentage of respondents correctly identifying the specific meaning of the Use By label increased from 24.3% to 52.3% after viewing messaging. Little variation in the effectiveness at increasing understanding of the specific

**Table 4.** Percentage of Respondents Correctly Identifying "Use By" as Safety Label Before and After Education

| Message Received | % Correct | % Incorrect | *P* |
|---|---|---|---|
| Total (n = 2,605) | | | < 0.001[a] |
| Before | 44.8 | 55.2 | |
| After | 82.4 | 17.6 | |
| Neutral (n = 379) | | | < 0.001[a] |
| Before | 44.1 | 55.9 | |
| After | 81.3 | 18.7 | |
| Quality (n = 369) | | | < 0.001[a] |
| Before | 43.4 | 56.6 | |
| After | 84.3 | 15.7 | |
| Safety (n = 371) | | | < 0.001[a] |
| Before | 45.0 | 55.0 | |
| After | 83.8 | 16.2 | |
| Financial (n = 371) | | | < 0.001[a] |
| Before | 45.6 | 54.5 | |
| After | 85.4 | 14.6 | |
| Waste (n = 364) | | | < 0.001[a] |
| Before | 46.7 | 53.3 | |
| After | 82.7 | 17.3 | |
| Story (n = 370) | | | < 0.001[a] |
| Before | 46.0 | 54.1 | |
| After | 82.4 | 17.6 | |
| Illustration (n = 378) | | | < 0.001[a] |
| Before | 42.9 | 57.1 | |
| After | 76.7 | 23.3 | |

[a] $P < 0.05$ was considered statistically significant.

Note: Respondents were randomly assigned 1 of 7 educational messages that explained the meaning of date labels. Nonresponse was removed and was < 1% for each condition. McNemar's tests of marginal homogeneity determined if there was a significant change in the percentage of people who correctly identified the general meaning of the date labels before and after the intervention for each educational message and in aggregate.

meaning of the date labels was seen across messages.

## Assessment of Message

More than 70% of all respondents indicated that they agree or strongly agree that the message they received was reasonable, logical, rational, appropriate, and informative. A total of 61.3% of the respondents indicated they agree or strongly agree it was effective. A lower percentage of respondents reported they agree or strongly agree that the message they received was convincing (56.3%), persuasive (45.1%), or compelling (43.9%).

As compared with assessments of other messages, the quality message had the highest percentages of respondents agreeing or strongly agreeing to 8 positive attributes of the message, whereas the narrative message had the lowest percentages of agreement. Comparing the quality message vs the narrative message using a Pearson chi-square test of independence, respondents agreed or strongly agreed the messages were: effective (68.2% vs 53.8%; $P < 0.001$), convincing (62.3% vs 50.8%; $P = 0.002$), compelling (51.8% vs 38.9%; $P = 0.001$), reasonable (75.2% vs 70.3%; $P = 0.13$), logical (78.2% vs 67.3%; $P = 0.001$), rational (74.9% vs 69.2%; $P = 0.08$), appropriate (76.5% vs 70.0%; $P = 0.04$), and informative (75.5% vs 65.4%; $P = 0.003$). The quality message had the highest percentage of respondents agreeing or strongly agreeing that it was persuasive, whereas the waste message had the lowest percentage agreement (49.3 vs 42.5%; $P = 0.06$).

## Free-Response Reaction to Messages

A total of 2,555 respondents provided reactions to the prompt, "Please write down the thoughts that entered your head as you viewed the message about the labels." The most salient codes relevant to the core research questions included comments that the message was useful, familiar, good, new, or had issues. In addition, 15.7% mentioned that the message was useful or contained information that could help them avoid waste, save money, or stay safe.

In 16.4% of responses, participants said the information seemed intuitive, familiar, or confirmed what they already believed. Some described the information as "common sense" or "self-explanatory." Some said they "basically" knew the information already, or it looked like the "same old terms." Of those respondents mentioning the information was in some way familiar, only 26.1% had correctly identified the general and specific meanings of the date labels before receiving an educational message, and 48.9% correctly identified the meanings after education.

Of the responses, 14.5% mentioned something positive or good, such as that the message was clear,

interesting, or compelling, and in 14.3% of responses, participants noted that they learned new information from the message. In contrast, 13.5% mentioned critiques or issues regarding either the message or food date labeling. A recurring sentiment was discomfort with the Best If Used By label, which participants often described as ambiguous and confusing. Some participants said they were uncomfortable relying on their senses and did not want to guess whether the food is safe. They preferred a hard date telling them when food is unsafe.

Responses to the narrative and narrative with illustration revealed that some participants did not realize the story was intended to be didactic. Respondents commented on the character's discarding behavior and how it compares with their own.

### Free-Response Suggestions for Improving Messages

When asked, "What would make the message more persuasive or effective for other consumers or viewers?," several themes emerged (n = 2,532). The most salient codes relevant to core research questions included suggestions related to visuals, wording, using examples, adding more information, changing the wording of the educational message, changing the wording of the label itself, or leaving the message as is. Of responses, 21.1% of responses recommended improving the visual message presentation. Participants recommended using visual cues like bolded letters and color to grab attention, connote safety warnings, or emphasize parts of the message. Reactions to the illustration visuals were mixed. Some felt the cartoon helped illustrate the message, and others felt the cartoon was cluttered, distracting, or hard to follow. Thirteen percent of responses made a recommendation or critique of the wording of the educational message. Reactions to receiving the information through a story were mixed.

In 17.3% of responses, participants recommended leaving the message as is or said they did not know how to improve the messages. Some were surprised anyone could be confused by the labels. 16.2% recommended using examples of how the labels would be used on specific foods or adding more information on food safety and how to use date labels.

Though participants were asked for feedback on the messaging, 12.2% of responses critiqued the wording of the date labels themselves (Use By or Best If Used By). This phrasing is fairly solidified, and there is little flexibility to change this wording. Some participants expressed their dislike for the Best If Used By label and its subjectivity. Some said the labels would be more effective if there were federal regulations or consistent usage.

## DISCUSSION

As the industry-supported food date labeling system becomes increasingly widespread in the US, this research indicates that not only do consumers frequently misinterpret the new labels (as has been previously shown[4–9]) but that they often do so with confidence. Although 92.1% and 89.4% of respondents believed they knew the meaning of Best If Used By and Use By label, respectively, only 46.2% and 24.3% correctly identified the specific meanings of these labels at baseline. Misunderstanding of date labels was common even among those who reported paying very close attention to food safety or always checking date labels or who commented that the labels are familiar. In addition, misinterpretations frequently persisted even after directly viewing explanations of the change.

Thus, a challenge for future educational messaging is capturing the attention of consumers who believe they already know the information, find it so familiar as to be boring, or are satisfied with a rough understanding of how to use the labels.

Although overall correct responses regarding even the general meaning of the labels remained at only 82% after the intervention, the 7 educational messages tested can still be considered somewhat successful in increasing understanding. Messaging resulted in an absolute increase of 18.0% for participants correctly identifying the general meaning of Best If Used By and a 37.6% increase correctly identifying the general meaning of Use By. Understanding of the specific meaning of the labels also increased after the intervention but remained at only 63.0% for the Best If Used By label and 52.3% for the Use By label.

Message effectiveness did not vary significantly on the basis of message strategy. Narrative messages were not more successful at increasing understanding compared with other messages, and respondent assessment of the narrative message was relatively low. Lack of clarity that the story was intended to be didactic and characters were modeling good behavior may have impeded the effectiveness of the narrative messages. Adding or improving the visual presentation of the messages may improve the effectiveness of these messages, as suggested by 21.0% of respondents.

Prior research indicates that a subset of consumers rely on food date labels and not their senses when making food-related decisions.[12] This survey found that participants were particularly uncomfortable with the Best If Used By label because many did not feel equipped to determine if food is safe without a hard expiration date. Food safety was a significant concern of participants, and those who reported paying very close attention to food safety were more likely to misunderstand the Best If Used By label. Consumer desire for a concrete expiration date on all foods indicates a need for education that most food safety threats do not come from the length of time since packaging.

These results are comparable to other survey research. For example, the baseline finding that less than half (44.8%) of respondents knew that the Use By label generally conveys safety information, and 64.0% were aware the Best If Used By label generally conveys quality information, is comparable to an earlier survey in which these percentages were 42% and 70%.[4] The finding that 92.1% and 89.4% believed they knew the meaning of the industry's new Best If Used By and the Use By labels is also consistent with the 88% reported in an industry survey.[15]

A strength of this research is the mixed-methods analysis of a large

national sample of adults. A limitation is this research did not include reliability or stability tests, and this survey did not collect respondent demographic information. As noted in methods, MTurk users as a group differ slightly from the US population, including by demographics and internet use. As prior research supports that food labeling behavior and understanding can vary by demographic factors, future research should explore how such factors (eg, age, gender, income, education) impact responsiveness to messaging about the new date labels.[4,12] In addition, participants could report attitudes and behaviors they believe are socially desirable or correct instead of reflecting their usual or true attitudes and behaviors. Finally, MTurk users who are interested in food safety or date labeling may have been more likely to respond to recruitment notifications and may be more informed about date labeling than the general population.

## IMPLICATIONS FOR RESEARCH AND PRACTICE

Food date labels can play an important role in helping consumers make informed decisions about food purchasing and consumption, preventing unnecessary discards, and avoiding unsafe consumption. Increasing public understanding of food date labeling has important implications for food waste and safety because more than 98% of respondents at least sometimes use these labels when deciding to buy or eat food.

This research supports the findings of a 2020 National Academies of Science and Medicine consensus panel, which emphasized the importance of educational messaging in adaptation to the evolving date labeling regulation environment, including the potential passage of a federal date labeling standard.[31]

In the absence of federal regulation, some manufacturers chose to use nonstandard date labels that differ from the FMI-CBA voluntary standard. Some states even have laws that conflict with the voluntary standard, which inhibits the adoption of the FMI-CBA system. For example, Pennsylvania law requires milk to contain a date after which the product cannot be sold preceded by the words "Sell by," "Not to be sold after," or "Not to be sold after the date stamped above."[32]

Though the CBA reported that 87% of the consumers of products had adopted the labels in 2018 and anticipated that the entire consumer packaged goods industry would adopt the voluntary labels by January, 2020, a recent assessment found that less than 50% of products had an FMI-CBA standard label.[15,33] Consumers who receive educational messaging about the new date labels may become confused if they continue to see nonstandard labeling or labels with the same language but varied capitalization. Although the nationally standardized policy is necessary to assure consistent label usage, the adoption of the industry-voluntary labels is sufficiently widespread to create a need for clear understanding.

Though all the messages that were tested increased understanding, this survey did not find evidence that 1 frame was significantly more successful than another. Future research could focus on testing the effectiveness of various message content and visual presentation. These results suggest that an effective consumer education campaign would:

1. Emphasize that the FMI-CBA 2-date labeling system is relatively new and that misunderstanding is common, so it is important to attend to the information being presented.
2. Explain that there are 2 different labels for 2 different classes of food: those with elevated food safety risk on the basis of date alone and those without a date.
3. Convey that changes in safety and quality usually do not occur simultaneously. For most foods, changes in quality occur before food becomes unsafe.
4. Convey that most food safety threats do not come from the time since packaging and food date labels provide just 1 piece of information for making decisions about food.
5. Be clear that the message is didactic or demonstrate the consequences of date label decisions if using narrative communication.
6. Explore using visuals or images to capture attention and decrease wordiness.
7. Clarify that the labels are not federally regulated and not universally adopted.

Future studies could explore how to balance providing additional information with retaining attention and avoiding overwhelming consumers. Researchers could also investigate how a person's general food safety knowledge impacts their ability to absorb food date labeling education. Finally, researchers could explore how food safety confidence and self-efficacy impact the use of date labels and waste. As the 2-date labeling system becomes widely adopted, developing effective consumer educational messaging is crucial to enabling consumers to meet their goals in preventing waste, saving money, and promoting food safety.

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