Vomit and Diarrhea Clean Up

Vomit and diarrhea have millions of microorganisms that can cause foodborne disease. To prevent the spread of these microorganisms, all foodservice establishments must have a clean-up procedure in place.

Food workers should not clean up vomit or diarrhea.

ASSEMBLE A CLEAN-UP KIT

You can buy a kit from a supplier or assemble your own. Clean-up kits should contain personal protective equipment and cleaning supplies.

Personal Protective Equipment[a]

- 2 pairs of single-use gloves
- 1 face mask
- 1 pair of goggles
- 1 single-use gown with sleeves
- 1 single-use hair cover
- 1 pair of shoe covers

Cleaning Supplies

- 1 sealable, plastic bag with twist tie
- 1 scoop/scraper
- 1 roll of paper towels
- Absorbent powder/solidifier (such as kitty litter)
- 1-quart bottle of disinfectant[b]

[a] ***Personal Protective Equipment.*** At a minimum, your kit should have single-use gloves and a pair of goggles.

[b] ***Making Your Own Disinfectants.***

- If you use concentrated bleach (shown as 8.25% on the label) to make your own disinfectant, add 3/4 cups of bleach to 1 gallon of water.
- If you use regular bleach, (shown as 5.25% on the label), add 1 cup of bleach to 1 gallon of water.
- You can also use commercially prepared disinfectants. The U.S. Environmental Protection Agency has a list of other commercial disinfectants that you can use.

BEFORE CLEAN UP BEGINS

- Ask everyone to leave the area where the event occurred. This includes customers and workers.
- Block off this area to keep out anyone who is not cleaning up the area.
- Put on personal protective equipment. At the very least, anyone cleaning up vomit or diarrhea must wear single-use gloves and goggles.

CLEANING UP SURFACES

Many types of surfaces can become contaminated when someone throws up or experiences diarrhea in your establishment. It is important that you use the correct clean up procedure for the surface(s) that are contaminated. Three types of surfaces are common in foodservice establishments:

- Hard surfaces (floors, tables, utensils)
- Soft surfaces that cannot be laundered (carpet and upholstered furniture)
- Soft surfaces that can be laundered (linens, towels, and clothing)

HARD SURFACES

STEP 1: Cover

- Cover the vomit or diarrhea with paper towels or an absorbent powder (such as kitty litter) to soak up liquids.

STEP 2: Remove

- Remove the paper towels or hardened powder with a scoop/scraper and immediately place them in a plastic bag.

STEP 3: Wash

- Prepare a solution of soapy water.
- Wash all surfaces contaminated with vomit or diarrhea with this solution. This includes all nearby surfaces possibly splashed by vomit or diarrhea, such as chair legs, tables, walls, shelves, or counters. Wash as wide of an area surrounding the vomit or diarrhea as is possible.
- Rinse the soapy water from all surfaces with clean water.

STEP 4: Disinfect

- Using paper towels or a mop with a washable mop head, saturate all washed surfaces with a disinfectant. The disinfectant can be commercially prepared or one prepared in-house (see "Assemble a Clean-Up Kit").
- If using a disinfectant that is prepared in house, let it sit for 10 minutes. If using a commercially prepared disinfectant, follow the manufacturer instructions.
- Rinse all food-contact surfaces with clean water after they have been disinfected. Nonfood-contact surfaces do not need to be rinsed.

CARPET AND UPHOLSTERED FURNITURE

STEP 1: Cover

- Cover the vomit or diarrhea with paper towels or an absorbent powder (such as kitty litter) to soak up liquids.

STEP 2: Remove

- Scoop up the paper towels or hardened powder with the scoop/scraper and place in a sealable plastic bag.
- Never vacuum after this step.

STEP 3: Wash

- Prepare a solution of soapy water.
- Using soapy water, wash all carpet and upholstered surfaces contaminated with vomit or diarrhea. Wash as wide of an area as is possible.
- Rinse the soapy water from all surfaces.

STEP 4: Disinfect

- Steam clean the area for 5 minutes at a temperature of 170°F (76.7°C). (Not all steam cleaners can reach a temperature for 170°F (76.7°C), so check the manufacturing specifications.)
- Upholstered furniture that is soiled with vomit or diarrhea can also be disinfected with a bleach solution (described in "Assemble a Clean-Up Kit"), however, the bleach will discolor the material.

LINENS, TOWELS, AND CLOTHING

STEP 1: Contain

- Carefully place all contaminated items that can be washed in a washing machine in a plastic bag then seal the plastic bag.

STEP 2: Wash

- Machine wash soiled items in a washing machine using hot water and laundry detergent.
- For loads of all white items, add 5-25 tablespoons of bleach per gallon of water.

STEP 3: Dry

- Dry the just-washed items in a dryer on the high-heat setting.

AFTER CLEAN UP

STEP 1: Remove

- Remove all personal protective equipment and place in the plastic bag. Do not touch any of the surfaces that were just cleaned as they can be re-contaminated. All personal protective equipment must be taken off before leaving the area that has just been cleaned.
- Place all used cleaning supplies, such as paper towels and disposable mop heads, in the plastic bag. Seal the bag with a twist tie.
- Throw away all uncovered food near the vomit or diarrhea event as well as any food handled by the person who was sick.
- Remove all waste from the facility immediately following local, state, or federal rules.

STEP 2: Clean mops and scoops

- Wash and disinfect mop handles and other reusable cleaning supplies, such as scoops/scrapers, using the same steps as used for hard surfaces.

STEP 3: Wash hands

- Wash hands thoroughly before performing any other duties.

TRAINING WORKERS ON CLEAN-UP PROCEDURES

- Identify who will be in charge of cleaning up after vomit and diarrhea events.
- Train selected workers in how to use personal protective equipment; wash and disinfect surfaces; and dispose of vomit and diarrhea.
- Training should take place when:
  - the vomit and diarrhea clean-up procedures are first written and put in place;
  - new workers are hired; and
  - vomit and diarrhea procedures are changed.

ACKNOWLEDGEMENTS

This work was funded through a grant from the U.S. Department of Agriculture, National Institute of Food and Agriculture, Agriculture and Food Research Initiative, "Building Capacity to Control Viral Foodborne Disease: A Translational, Multidisciplinary Approach," Grant No. 2011-68003-30395.

Provided by: [*Instructor name*]

Journal of Food Protection, Vol. 79, No. 11, 2016, Pages 1946–1952
doi:10.4315/0362-028X.JFP-16-196

Content Analysis of Vomit and Diarrhea Cleanup Procedures To Prevent Norovirus Infections in Retail and Food Service Operations

MORGAN G. CHAO,[1] ANNE-JULIE DUBÉ,[1] CORTNEY M. LEONE,[1] CHRISTINA M. MOORE,[2] AND ANGELA M. FRASER[1]*

[1]*Clemson University, Clemson, South Carolina 29634; and* [2]*North Carolina State University, Raleigh, North Carolina 27695, USA*

MS 16-196: Received 9 May 2016/Accepted 22 July 2016

ABSTRACT

Human noroviruses are the leading cause of foodborne disease in the United States, sickening 19 to 21 million Americans each year. Vomit and diarrhea are both highly concentrated sources of norovirus particles. For this reason, establishing appropriate cleanup procedures for these two substances is critical. Food service establishments in states that have adopted the 2009 or 2013 U.S. Food and Drug Administration Food Code are required to have a program detailing specific cleanup procedures. The aim of our study was to determine the alignment of existing vomit and diarrhea cleanup procedures with the 11 elements recommended in Annex 3 of the 2011 Supplement to the 2009 Food Code and to determine their readability and clarity of presentation. In July 2015, we located vomit and diarrhea cleanup procedures by asking Norovirus Collaborative for Outreach, Research, and Education stakeholders for procedures used by their constituency groups and by conducting a Google Advanced Search of the World Wide Web. We performed content analysis to determine alignment with the recommendations in Annex 3. Readability and clarity of presentation were also assessed. A total of 38 artifacts were analyzed. The mean alignment score was 7.0 ± 1.7 of 11 points; the mean clarity score was 6.7 ± 2.5 of 17 points. Only nine artifacts were classified as high clarity, high alignment. Vomit and diarrhea cleanup procedures should align with Annex 3 in the Food Code and should, as well, be clearly presented; yet, none of the artifacts completely met both conditions. To reduce the spread of norovirus infections in food service establishments, editable guidelines are needed that are aligned with Annex 3 and are clearly written, into which authors could insert their facility-specific information.

Key words: Cleaning; Food Code; Food Safety; Gastroenteritis; Restaurants

Human noroviruses are the leading cause of acute gastroenteritis and foodborne disease in the United States *(10)*. In humans, noroviruses typically spread directly via person-to-person transmission or indirectly through food, water, or the environment *(13)*. Although environmental transmission is reportedly low (0.35%) *(12, 13, 17)*, emerging evidence suggests that transmission via contaminated surfaces plays a more important role in the spread of noroviruses than previously believed *(1, 11, 13, 19)*.

Improper cleaning and disinfection of surfaces contaminated by vomit or diarrhea has played a role in norovirus outbreaks across many types of settings *(3, 7, 8, 15)*. Epidemiological investigations of two outbreaks showed positive (or presumptive-positive) surface samples after improper cleaning and disinfection procedures were used *(3, 8)*, indicating that the procedures were ineffective. In two other outbreak studies, new cases of norovirus-associated gastroenteritis emerged after cleaning or disinfection procedures were completed, also suggesting that the procedures used were insufficient to interrupt transmission via environmental contamination *(7, 15)*.

The possibility that vomiting and diarrheal events could occur in retail and food service establishments, resulting in a norovirus outbreak, prompted the U.S. Food and Drug Administration (FDA) to add a new provision (2-501.11) to the 2011 Supplement to the 2009 Model Food Code *(20)*. This regulatory provision requires operations to have in place a vomit and diarrhea cleanup program. Suggested program elements are outlined in Annex 3 of the Code: (i) containment and removal of any discharges; (ii) cleaning, sanitizing, and disinfection of contaminated surfaces; (iii) evaluation and disposal of exposed food; (iv) availability of disinfectants, personal protective equipment (PPE), and equipment; (v) disposal and disinfection of cleaning tools and equipment; (vi) when PPE should be worn; (vii) employee training in cleanup procedures; (viii) segregation of contaminated areas; (ix) exclusion and restriction of ill employees; (x) removal of ill customers and others from sensitive areas; and (xi) conditions under which the plan will be implemented. The FDA based these 11 elements on the best available evidence to date.

* Author for correspondence. Tel: 864-656-3652; Fax: 864-656-0331; E-mail: afraser@clemson.edu.

Alignment with these 11 recommended elements is important but is not the only consideration for developing cleanup procedures. For a user to act on them, procedures must also be written using plain language so they are easily understood. DuBay *(6)* suggests that documents related to safety, such as these, should be written at the 5th grade level. Readability formulas, such as Flesch-Kincaid Grade Level *(6),* are one method to determine whether documents meet this standard, and educators can use readability formulas to indicate how easy or difficult the document might be to read.

However, readability indices must be interpreted with caution, as readability is not a measure of comprehension. Determining comprehension is more complex because it involves measuring the degree to which the individual who reads a sample text understands what they have read. However, given the complexity of the task, educators might not be able to directly assess reader comprehension. In this case, educators may rely upon the Clear Communication Index, a 20-item assessment instrument, developed by communication experts from the U.S. Centers for Disease Control and Prevention (CDC) *(2)*. Four topical categories make up the Index (prefaced by four open-ended introductory questions used to establish context): (i) main message and call to action, (ii) behavioral recommendations, (iii) use of numbers, and (iv) risk. Specifically, the Index was developed to identify the most important communication characteristics that enhance clarity and aid understanding of public messages and materials, as well as to provide a tool for staff to develop and assess communication products for CDC audiences, no matter the format or distribution channel *(2)*. Because of the high number of norovirus infections occurring each year, it is critical that operators in retail and food service establishments use clearly written vomit and diarrhea cleanup procedures that are aligned with established best practices. However, it is unknown whether the procedures that operators currently use meet these criteria. Thus, the aim of our study was to determine the availability of good quality vomit and diarrhea cleanup procedures. Our study was guided by three research questions: (i) Are available vomit and diarrhea cleanup procedures aligned with the 11 recommended elements outlined in Annex 3 of the 2011 Supplement? (ii) Are the procedures easy to read? and (iii) Are the procedures clearly written? Our findings can be used to direct the creation of new vomit and diarrhea cleanup procedures, as well as to guide the revision of existing procedures.

MATERIALS AND METHODS

Data collection. Vomit and/or diarrhea cleanup procedures were collected from two sources: stakeholder constituents and the World Wide Web (Web). In July 2015, stakeholders actively involved in Norovirus Collaborative for Outreach, Research, and Education, a food safety initiative funded by the U.S. Department of Agriculture, National Institute of Food and Agriculture, were sent e-mails and were asked to share any operation-specific written vomit and diarrhea cleanup guidelines currently in use. Additionally, four stakeholder groups were asked to send their procedures: Food Manufacturing Institute, Association for Food and Drug Officials, Grocery Manufacturers Association, and National Environmental Health Association. Submitted materials that did not contain vomit or diarrhea cleanup procedures were excluded. All documents were converted to Portable Document Format (PDF) files (if not yet in PDF) using the NCapture function of QSR International's NVivo 10 qualitative data analysis software (http://www.qsrinternational.com/product), and a copy of each was printed.

At the same time, a Google Advanced Search of the Web was conducted to locate additional vomit and diarrhea cleanup procedure documents. To be included, documents had to be written in the English language and designed for use in food service, food retail, or food manufacturing establishments in the United States. The following search string was used to conduct our search: *vomit AND fecal AND clean AND disinfect AND foodservice –blog*. (The minus sign before "blog" was used to exclude any results containing the word blog.) Available search results were screened to verify that they fulfilled the inclusion criteria and to exclude duplicates. Blog results were excluded because they were not considered procedural documents used in the food service, food retail, or food manufacturing industry. All included links and webpages were converted to PDF as described above for stakeholder documents.

Documents (hereafter referred to as "artifacts") from both stakeholders and the Web were compared for duplicates. Duplicates were excluded, and the remaining artifacts were each assigned a unique identifier. Only the portions of artifacts pertaining to norovirus and/or vomit or diarrhea cleanup procedures were analyzed. Portions of artifacts that pertained to other information, such as other infectious diseases or general job-related responsibilities, were excluded from our analysis.

Coding. Two coding manuals (with corresponding coding sheets) were used. The first was created to determine readability scores and alignment with the 11 recommended elements outlined in the 2011 Supplement to the FDA 2009 Food Code, Annex 3 *(20)*. The second coding manual was the CDC Clear Communication Index, which was used to assess the clarity and ease of understanding of each artifact *(2)*. Two trained coders independently coded every artifact for readability and alignment (using the first coding manual) and for clarity (using the Clear Communication Index). Subsequently, the same coders met to reconcile differing responses for each artifact. Reconciled coding responses were then entered into an Excel spreadsheet, and the resulting spreadsheet was checked for accuracy.

Readability and alignment were evaluated using 30 items divided into three areas: Identifying Information (four items; e.g., title, date of publication or latest revision), Readability (three items: Flesch Reading Ease score, Flesch-Kincaid Grade Level, and number of passive sentences), and 11 Elements Recommended in Annex 3 of the 2011 Supplement to the 2009 Food Code (11 items; hereafter referred to as topic areas).

Flesch Reading Ease and Flesch-Kincaid Grade Level formulas were used to calculate readability scores. Flesch Reading Ease is calculated on a scale of 0 to 100; the lower the score, the more difficult the document is to read. Generally, scores lower than 60 indicate difficulty; 60 to 70, "standard" level; and 70 or higher, "easy to read" *(4)*. The Flesch-Kincaid Grade Level determines reading levels from grades 3 to 12 based on mean sentence length and word length *(4)*. Our analysis required that artifacts be available in a .docx format; one artifact could not be converted into .docx format and, thus, was not included in our readability formula calculations.

Artifacts were assessed for clarity using the CDC Clear Communication Index *(2)*. The Index is composed of 20 items (prefaced by four open-ended introductory questions used to

establish context) that are divided into four domain areas; three of these are optional, based upon relevance. Part A, core, assesses the main message and the call to action (five items), language (two items), information design (three items), and the state of the science (one item). Parts B (behavioral recommendations), C (numbers), and D (risk) are optional, and each contains three items. We determined that part D (risk) was not relevant to the goals of a procedural document and omitted it from our analysis. Thus, in all, we assessed the artifacts using parts A, B, and C. For every artifact, each coder entered their responses to the included Index items on a copy of the Index Score Sheet.

Data analysis. To determine alignment with the 11 topic areas from Annex 3 of the Food Code, a scoring system was created in which an artifact could receive up to 11 points, each point corresponding to one of the 11 topic areas. Frequencies were calculated for the number of artifacts that addressed each topic area, using Microsoft Excel (Microsoft Corp., Redmond, WA). Based on the existing Clear Communication Index scoring system, we calculated frequencies and mean clarity scores using Microsoft Excel. Because, as previously explained, we omitted part D (risk) from our analysis, the total number of Index items evaluated was 17. Two scatterplots of our data were also created to show the relationship between (i) artifacts' alignment and clarity scores and (ii) artifacts' alignment scores and date of publication or last revision.

RESULTS

A total of 38 artifacts, from stakeholders and the Web, were analyzed. We received 43 artifacts from stakeholders; of these, we excluded 13 that were duplicates, 3 that were fact sheets that our team had produced (a potential conflict of interest), 1 that was designed for use outside the United States, and 13 that were not procedures (blogs, training materials, fact sheets, etc.), yielding 13 artifacts. Our Google search of the Web yielded 440 results. Of the 440, 10 were duplicates and 405 did not meet our eligibility criteria, so 25 were included in our sample.

The average number of pages coded per artifact was 3.3 ± 2 (1 to 9) [mean ± SD (range)]. Across all artifacts, authors were affiliated with health departments (24), for-profit companies (6), national governments (3), nonprofit organizations (3), and schools (2). Some (12) artifacts did not include a publication date or latest revision date. Of those that did (26), the publication or revision dates ranged from 2005 to 2015. Only 17 artifacts listed a revision date of 2011 or later. Twenty-one authors cited references or materials from which the information was adapted. Among those, only three artifacts referenced the latest updates to the Food Code, the 2011 Supplement (2) or the 2013 Food Code (1).

Alignment with Food Code. The mean alignment score was 7.0 ± 1.7 (2.7 to 10) [mean ± SD (range)] (Table 1). All stakeholder artifacts scored >50% alignment, and three-quarters of Web-related artifacts scored similarly. Of the 11 topic areas, those addressed in nearly all artifacts were cleaning, sanitizing, disinfection (37); disinfectants, PPE, equipment (35); when PPE should be worn (37); and cleanup situations (38). Five topic areas were addressed in fewer than half of the artifacts: containment of spill (12), disposal or disinfection of tools or equipment (13), employee training (4), segregation of contaminated areas (12), and removal of ill persons (16). However, even though an element may have been addressed, we noticed an absence of detail in some instances. For example, the disinfectants, PPE, and equipment topic area was addressed by most, but the types of PPE and equipment that might be helpful in vomit and diarrhea cleanup, such as shoe covers and scoops and scrapers, were not explicitly mentioned.

TABLE 1. *Number of artifacts that addressed each of the 11 elements recommended for inclusion in a cleanup program*[a]

Item	No. (%) of artifacts that addressed item
1. Containment of spill	12 (31.6)
2. Cleaning, sanitizing, disinfection	37 (97.4)
3. Disposal of exposed food	18 (47.4)
4. Availability of disinfectants, PPE, equipment	35 (92.1)
5. Disposal/disinfection of tools, equipment	13 (34.2)
6. When PPE should be worn	37 (97.4)
7. Employee training	4 (10.5)
8. Segregation of contaminated areas	12 (31.6)
9. Exclusion of ill employees	22 (57.9)
10. Removal of ill customers and others	16 (42.1)
11. Situations for cleanup	38 (100)
Mean score ± SD (range)[b]	7.0 ± 1.7 (2.7–10)

[a] $n = 38$. PPE, personal protective equipment.
[b] The maximum possible score for all items combined was 11.

Readability. For the 37 documents that could be converted to .docx format and analyzed, the mean Flesch Reading Ease score was 39.4 (a score <60 indicates that the document is considered "difficult to read") *(4)*. The mean Flesch-Kincaid Grade Level was 11.5, which is higher than the recommended 5th grade level for safety-related documents *(6)*.

Clarity of communication. The maximum score possible for clarity was 17 points. The mean clarity score was 6.7 ± 2.5 (3 to 13) [mean ± SD (range)] ($n = 38$) (Table 2). Of the 17 items we assessed from the Clear Communication Index, only the following five items were addressed in more than half of the artifacts: call to action (32), one or more behavioral recommendations (38), how to perform recommendation(s) (29), meaning of numbers explained (21), and no calculations required (38).

Data analysis. When plotted on a graph with clarity scores represented on the *x* axis and alignment scores represented on the *y* axis (Fig. 1), nine artifacts scored well (>50%) in both clarity and alignment (upper right quadrant), 23 artifacts scored poorly (<50%) in clarity but well in alignment (upper left quadrant), and six scored poorly in clarity and alignment (lower left quadrant). When the alignment scores of each artifact were plotted against

TABLE 2. *Number of artifacts that addressed each of the items contained in Parts A, B, and C of the CDC Clear Communication Index*[a]

Item	No. (%) of artifacts that addressed item
Part A: Core	
Main message	13 (34.2)
Main message location	13 (34.2)
Main message emphasized with visual cues (e.g., font size, color, bold typeface)	3 (7.9)
Main message supported by image(s) (e.g., photographs, infographics)	1 (2.6)
Call to action	32 (84.2)
Active voice	4 (10.5)
Words used by primary audience	4 (10.5)
Use of lists	12 (31.6)
Organization	18 (47.4)
Placement of important information	9 (23.7)
Known/unknown information	3 (7.9)
Part B: Behavioral recommendations	
One or more behavioral recommendations	38 (100)
Why recommendation is important	9 (23.7)
How to perform recommendation(s)	29 (76.3)
Part C: Numbers	
Numbers appropriate for primary audience	9 (23.7)
Meaning of numbers explained	21 (55.3)
No calculations required	38 (100)
Mean score ± SD (range)[b]	6.7 ± 2.5 (3–13)

[a] $n = 38$.
[b] The maximum possible score for all items combined was 17.

their respective publication or revision dates (Fig. 2), alignment scores were higher for artifacts published or revised since 2011, when the 11 elements were added to Annex 3 in the Food Code.

DISCUSSION

Alignment. Our analysis of vomit and diarrhea cleanup procedures revealed that no single artifact was perfectly aligned with the 11 recommended elements listed in Annex 3 of the Food Code. One possible reason why scores were low is that authors did not know about the 11 elements in Annex 3 because the U.S. state in which they were based had adopted an older version of the Food Code. Notably, only three authors cited either the 2011 Supplement or the 2013 Food Code (in which the elements are listed), suggesting that the other 35 authors might have found information from other, perhaps outdated, sources. However, despite the fact that many (20) states have not yet adopted the 2009 Food Code (to which the 2011 Supplement was added) or the 2013 Food Code *(21),* this does not limit authors' ability to develop cleanup procedures using the most current version of the Food Code. For example, although two of the three authors who cited the most current versions were based in U.S. states that have adopted the 2009 and 2013 Food Codes, respectively, one of the three authors was based in a state that has only adopted the 1999 Food Code *(21)*.

Another possible reason that scores were low is that authors might have viewed some of the 11 elements as impractical. The 11 elements listed in Annex 3 of the FDA Food Code are based on recommendations used within health care for the prevention and control of noroviruses; however, these precautions are specifically applicable to health care settings and might not be practical to implement in a food service setting. For example, many authors did not address segregation of contaminated areas (26) or removal of ill customers and others (22). Authors might have viewed these two elements as impractical because they could cause an immediate decrease in sales if, for example, restaurant employees cordoned off sections of the dining room where an incident took place or asked customers to move or leave the restaurant. Furthermore, such disruptions in the dining environment could negatively influence the customers' experience at that facility and their desire to return. Authors

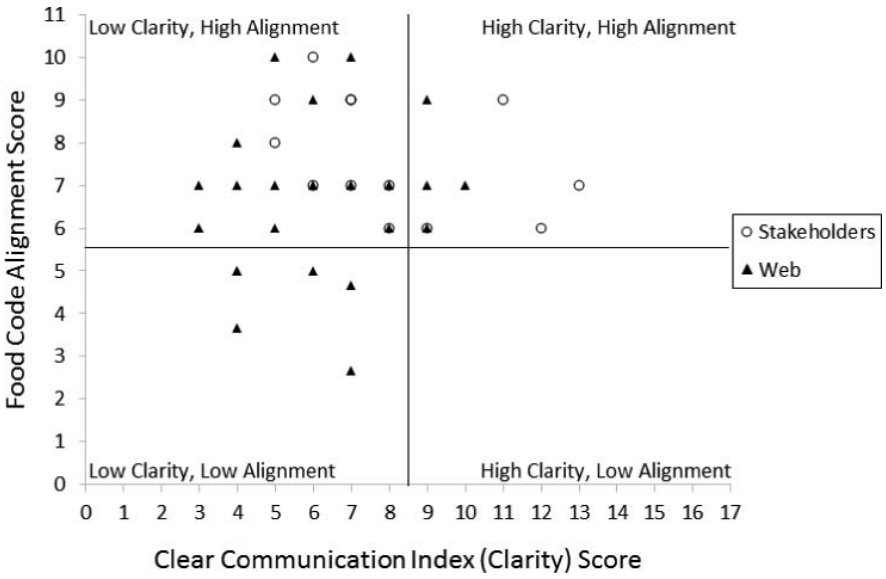

FIGURE 1. *Clear Communication (clarity) score versus Food Code alignment score (*n = *38). The following coordinates have two overlapping data points: (3,6), (4,5), (6,7), (7,7), (7,9), (8,6), (8,7), (9,6), and (9,9).*

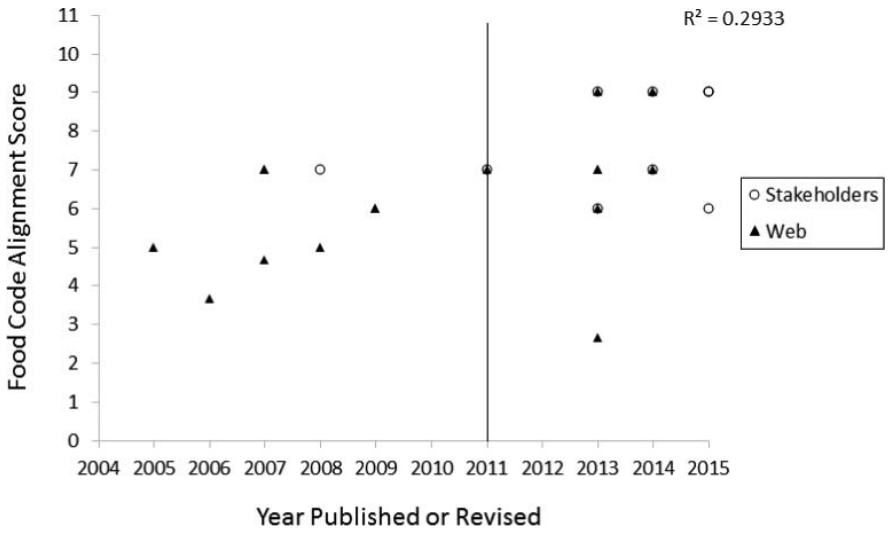

FIGURE 2. *Year of publication versus Food Code alignment score (*n = *26). The following coordinates have two overlapping data points: (2007, 7), (2009, 6), (2011, 7), (2013, 6), (2013, 7), (2013, 9), (2014, 7), (2015, 9). The following coordinate has three overlapping data points (2 Stakeholders and 1 Web): (2014, 9).*

of procedures for cleanup in food service must consider such limitations of infection control when applied in food service settings. These settings differ greatly from health care settings, where infectious disease control practices are part of the general procedures and are easier to implement *(16)*. For this reason, it would be helpful if the FDA provided guidance on the level of importance of implementing each of the 11 elements as well as guidance on how to implement each element.

Readability and clarity. In addition to lacking alignment, most artifacts were not easy to read and understand. Both readability scores indicated difficulty, and an overall low clarity score (6.7 of 17) indicated that there were more items requiring improvement. Furthermore, the wide range of scores (3 to 13), with half of the documents scoring below 7 (median) in clarity, demonstrates that some artifacts required a great deal of improvement. In particular, visual support for the main message (images) was notably lacking in most artifacts (37). Published studies suggest that text accompanied by images could improve comprehension and recall compared with text alone, particularly among people with limited literacy *(5, 14, 22)*. Thus, the presence of meaningful images that support the main message of a procedural document could increase the likelihood that the instructions therein would be understood and followed, particularly by food service workers for whom English is a second language.

One possible explanation for the low clarity scores is that most (25) authors were affiliated with state or local health departments, where training in the art of clear communication is often not required. Rather, the majority of their training is focused on compliance with general and food safety standards. A common source of food safety training and registration or certification for food safety specialists in the United States is the National Environmental Health Association *(9)*; for this certification, an individual must pass one of several credential exams, three of which specifically pertain to food safety: (i) Registered Environmental Health Specialist or Registered Sanitarian, (ii) Certified in Comprehensive Food Safety, and (iii) Certified Professional–Food Safety *(18)*. However, none of the exam content areas for food safety professionals are devoted to assessing their understanding of clear communication strategies. This demonstrates that those who are certified to create food safety education, and who will likely develop vomit and diarrhea cleanup procedures for use in food service establishments, might still be without training in how to communicate messages clearly.

Editable model guidelines. Our results indicate the considerable challenges authors must overcome when developing procedures. Can we reasonably expect authors to follow guidelines of which they are not aware or that they believe to be impractical? Further, can we expect all authors of procedures to have been trained in the art of clear communication? Indeed, it is unrealistic to expect such things. Rather, we should provide authors with editable model guidelines upon which they can base their facility-specific procedures, thereby alleviating the burden placed on them to create effective procedures. Such guidelines could address each of the 11 elements and provide specific step-by-step instructions for how to cleanup vomit and diarrhea (including what PPE and equipment to use) in a food service establishment, based on the most current evidence. Moreover, each step could be assessed by food service and food safety experts to ensure that all steps could be easily applied in a food service setting. Such editable guidelines could also be structured to meet each of the criteria outlined in the Clear Communication Index, including the use of visuals to support the main message (as this was most notably lacking in the artifacts studied). Providing authors with clearly written materials, into which they could simply insert their facility-specific information, would compensate for any lack of training in clear communication techniques.

However, one challenge remains: Annex 3 of the Food Code is not prescriptive (e.g., specific types of PPE that must be worn are not stated; types of equipment that must be used are not stated); rather, the recommended elements are broad, such that authors can tailor individual steps in the procedure to suit their facility. Note, however, that there are no universal, evidence-based guidelines for cleaning up vomit

or diarrhea in food service settings. Further research is needed to establish the minimum standard cleanup steps that must be taken to disrupt the transmission of pathogens. Guidelines for use in a food service establishment must be practical, accounting for what tools are typically available in that setting, as well as for the atmosphere within a dining environment; thus, they will inevitably be different from those found in health care settings. Thus, it is necessary to determine whether wearing certain types of PPE (e.g., gowns, shoe covers) and using certain pieces of equipment (e.g., biohazard bags) are necessary and practical during all instances of vomit or diarrhea cleanup. Also, although segregation of a contaminated area is recommended, evidence is needed to establish the geographic area that must be cleaned and disinfected when in a food service setting. As this new information becomes available, it will be increasingly important that food service operations be notified and be able to implement the most effective procedures. Providing them with editable model guidelines will facilitate updates consistent with current scientific understanding and will help to effectively prevent the spread of illness.

Limitations. Because of the proprietary nature of some procedures used in-house at food service establishments, our sample was limited to the procedures that stakeholders were willing to share with us for our analysis and the procedures that are posted publicly on the Web. We recognize that not all procedures in existence were shared with us or posted to the Web; thus, although procedures may exist that are aligned with the 11 recommended elements in Annex 3 in the Food Code and that are easy to read and understand, we had no way to access them. Also, because the Web is constantly being updated, new procedures might have been posted online since we performed our search of the Web. Similarly, the evidence base for the proper cleanup of vomit and diarrhea is constantly growing and evolving, such that the standards we used to measure alignment might change over time. However, we are not aware of any such changes at this time.

Overall, the vomit and diarrhea cleanup procedures in our sample were neither easy to read nor clearly presented. Although most (32) scored well (>50%) in alignment, all require some improvement in that area. The area needing the most improvement was clarity, in which only nine artifacts scored well. Our findings can be used to improve existing procedures as well as to inform the creation of new procedures via editable model guidelines so that they align with the 11 elements in Annex 3 and meet the criteria outlined in the Clear Communication Index. Such procedures, when followed, can help reduce the likelihood that food might become contaminated and that others might become ill as a result of vomiting or diarrheal episodes in food service settings.

ACKNOWLEDGMENT

This work was funded through a grant from the U.S. Department of Agriculture, National Institute of Food and Agriculture, Agriculture and Food Research Initiative, "Building Capacity to Control Viral Foodborne Disease: A Translational, Multidisciplinary Approach," grant no. 2011-68003-30395.

REFERENCES

1. Atmar, R. L., A. R. Opekun, M. A. Gilger, M. K. Estes, S. E. Crawford, F. H. Neill, S. Ramani, H. Hill, J. Ferreira, and D. Y. Graham. 2014. Determination of the 50% human infectious dose for Norwalk virus. *J. Infect. Dis.* 209:1016–1022.
2. Centers for Disease Control and Prevention (CDC). 2014. The CDC Clear Communication Index: a tool for developing and assessing CDC public communication products: user guide. Available at: http://www.cdc.gov/ccindex/pdf/clear-communication-user-guide.pdf. Accessed 3 May 2016.
3. Cheesbrough, J. S., J. Green, C. I. Gallimore, P. A. Wright, and D. W. G. Brown. 2000. Widespread environmental contamination with Norwalk-like viruses (NLV) detected in a prolonged hotel outbreak of gastroenteritis. *Epidemiol. Infect.* 125:93–98.
4. D'Alessandro, D. M., P. Kingsley, and J. Johnson-West. 2001. The readability of pediatric patient education materials on the World Wide Web. *Arch. Pediatr. Adolesc. Med.* 155:807–812.
5. Delp, C., and J. Jones. 1996. Communicating information to patients: the use of cartoon illustrations to improve comprehension of instructions. *Acad. Emerg. Med.* 3:264–270.
6. DuBay, W. H. 2004. The principles of readability. Impact Information, Costa Mesa, CA.
7. Evans, M. R., R. Meldrum, W. Lane, D. Gardner, C. D. Ribeiro, C. I. Gallimore, and D. Westmoreland. 2002. An outbreak of viral gastroenteritis following environmental contamination at a concert hall. *Epidemiol. Infect.* 129:355–360.
8. Fankem, S. L. M., S. A. Boone, M. Gaither, and C. P. Gerba. 2014. Outbreak of norovirus illness in a college summer camp: impact of cleaning on occurrence of norovirus on fomites. *J. Environ. Health* 76:20–26.
9. Fraser, A. M., and B. A. Nummer. 2010. Surveying the food safety training needs of environmental health specialists in the U.S. *J. Environ. Health* 72:18–23.
10. Hall, A. J., B. A. Lopman, D. C. Payne, M. M. Patel, P. A. Gastañaduy, J. Vinjé, and U. D. Parashar. 2013. Norovirus disease in the United States. *Emerg. Infect. Dis.* 19:1198–1205.
11. Hall, A. J., J. Vinjé, B. Lopman, G. W. Park, C. Yen, N. Gregoricus, and U. Parashar. 2011. Updated norovirus outbreak management and disease prevention guidelines. *Morb. Mortal. Wkly. Rep.* 60:1–18.
12. Hall, A. J., M. E. Wikswo, K. Manikonda, V. A. Roberts, J. S. Yoder, and L. H. Gould. 2013. Acute gastroenteritis surveillance through the National Outbreak Reporting System, United States. *Emerg. Infect. Dis.* 19:1–5.
13. Hall, A. J., M. E. Wikswo, K. Pringle, L. H. Gould, and U. D. Parashar. 2014. Vital signs: foodborne norovirus outbreaks—United States, 2009–2012. *Morb. Mortal. Wkly. Rep.* 63:491–495.
14. Houts, P. S., C. C. Doak, L. G. Doak, and M. J. Loscalzo. 2006. The role of pictures in improving health communication: a review of research on attention, comprehension, recall, and adherence. *Patient Educ. Couns.* 61:173–190.
15. Isakbaeva, E. T., M. A. Widdowson, R. S. Beard, S. N. Bulens, J. Mullins, S. S. Monroe, J. Bresee, P. Sassano, E. H. Cramer, and R. I. Glass. 2005. Norovirus transmission on a cruise ship. *Emerg. Infect. Dis.* 11:154–157.
16. MacCannell, T., C. A. Umscheid, R. K. Agarwal, I. Lee, G. Kuntz, K. B. Stevenson, and the Healthcare Infection Control Practices Advisory Committee (HICPAC). 2011. Guideline for the prevention and control of norovirus gastroenteritis outbreaks in healthcare settings. *Infect. Control Hosp. Epidemiol.* 32:939–969.
17. Matthews, J. E., B. W. Dickey, R. D. Miller, J. R. Felzer, B. P. Dawson, A. S. Lee, J. J. Rocks, J. Kiel, J. S. Montes, C. L. Moe, J. N. S. Eisenberg, and J. S. Leon. 2012. The epidemiology of published norovirus outbreaks: a review of risk factors associated with attack rate and genogroup. *Epidemiol. Infect.* 140:1161–1172.
18. National Environmental Health Association (NEHA). n.d. Credentials: advance your career with a NEHA credential. Available at:

http://neha.org/professional-development/credentials. Accessed 29 March 2016.
19. Teunis, P. F. M., C. L. Moe, P. Liu, S. E. Miller, L. Lindesmith, R. S. Baric, J. Le Pendu, and R. L. Calderon. 2008. Norwalk virus: how infectious is it? *J. Med. Virol.* 80:1468–1476.
20. U.S. Food and Drug Administration (FDA). 2011. FDA Food Code 2009: supplement. Available at: http://www.fda.gov/Food/GuidanceRegulation/RetailFoodProtection/FoodCode/ucm272584.htm. Accessed 30 March 2016.
21. U.S. Food and Drug Administration (FDA). 2016. Real progress in Food Code adoption. Available at: http://www.fda.gov/downloads/Food/GuidanceRegulation/RetailFoodProtection/FoodCode/UCM476819.pdf. Accessed 2 March 2016.
22. Yin, H. S., B. P. Dreyer, L. van Schaick, G. L. Foltin, C. Dinglas, and A. L. Mendelsohn. 2008. Randomized controlled trial of a pictogram-based intervention to reduce liquid medication dosing errors and improve adherence among caregivers of young children. *Arch. Pediatr. Adolesc. Med.* 162:814–822.