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Analyzing Consumers' Reactions to News Coverage of the 2011 *Escherichia coli* O104:H4 Outbreak, Using the Extended Parallel Processing Model

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ABSTRACT

This article describes and analyzes Flemish consumers' real-life reactions after reading online newspaper articles related to the enterohemorrhagic *Escherichia coli* (EHEC) O104:H4 outbreak associated with fresh produce in May and June 2011 in Germany. Using the Extended Parallel Processing Model (EPPM) as the theoretical framework, the present study explored the impact of Flemish (Belgian) online news coverage on consumers' perception of the risk induced by the EHEC outbreak and their behavioral intentions as consumers of fresh produce. After the consumers read a newspaper article related to the outbreak, EPPM concepts were measured, namely, perceived severity, susceptibility, self-efficacy, and affective response, combined with behavioral intentions to eat less fresh produce, to rinse fresh produce better, and to alert loved ones concerning the risk. The consumers' reactions were measured by inserting a link to an online survey below every online newspaper article on the EHEC outbreak that appeared in two substantial Flemish newspapers. The reactions of 6,312 respondents were collected within 9 days for 17 different online newspaper articles. Looking at the perceived values of the EPPM concepts, the perceived severity and the perceived susceptibility of the risk were, as expected, high. However, the consumers thought they could prevent the risk from happening, which stresses the importance of increasing consumers' knowledge of emerging food safety risks. Furthermore, analyses showed the moderating role of government trust and its influence on the way consumers perceived the risk, how worried they were, and their behavioral intentions.

The outbreak in May and June 2011 of enterohemorrhagic *Escherichia coli* (EHEC) O104:H4 was reported as one of the most severe foodborne outbreaks in Europe and the first outbreak on this scale caused by fresh produce in the European Union. The EHEC outbreak was situated mainly in Germany but affected citizens of other European countries (and some U.S. citizens) who travelled to Germany. In total, 15 European countries in addition to Germany reported cases of EHEC infection. The outbreak resulted in the loss of 50 lives and 857 cases of hemolytic uremic syndrome, which leads to acute kidney failure *(57)*. Even though this EHEC outbreak in Germany was a rare incident caused by an atypical verotoxigenic *E. coli* seropathotype (*E. coli* strain O104:H4), fresh produce as a food vehicle is a growing cause of foodborne illnesses *(21, 30, 36, 44, 49)*; in addition, the increasing international trade of fresh produce puts pressure on governing food safety. Global sourcing of fresh produce including those imported from low-cost countries with other climate conditions, other production practices, and lack of knowledge of hygiene measures and control may lead to the introduction of food safety hazards in European food products *(23, 33)*. At present, the European Union is the largest importer and exporter of fresh produce in the world *(16)*. Looking at the definition stated by the European Food Safety Authority *(19)*, "An emerging risk to human, animal and/or plant health is understood as a risk resulting from a newly identified hazard to which a significant exposure may occur or from an unexpected new or increased significant exposure and/or susceptibility to a known hazard," it becomes clear that the microbial risks related to fresh produce can be labeled an emerging food risk.

Eating contaminated fresh produce can lead in the case of biological hazards to acute diarrheal illness or in the worst case death, as exemplified in the EHEC outbreak. Thoroughly rinsing fresh produce, washing hands before and after eating, peeling fresh produce, and storing fresh produce at a cool temperature can to some extent reduce the risk, but it cannot completely be circumvented by consumers because of the absence of an adequate heat treatment or other pathogen reduction steps such as irradiation before consuming fresh produce eaten raw and sold or served as "ready-to-eat" *(20)*. Communicating these risks about raw fresh produce to consumers is necessary, since an emerging food risk, developing into a crisis similar to the *E. coli* O104:H4 outbreak, can have immediate direct economic costs due to a decrease in sales, import ban, food recalls, etc.

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(9, 53). However, indirect economic costs such as loss of trust in the product or in the government can also occur *(39, 53)*. Communicating about emerging food safety hazards could avert these economic consequences. Fresh produce is generally perceived as healthy by consumers *(17, 18)*, and therefore it is not easy to communicate risks related to fresh produce. A useful model for communicating risks is the Extended Parallel Processing Model (EPPM) *(54)*. The EPPM states that risk messages need to contain a threat appeal (consisting of the perceived severity and the perceived susceptibility of the risk) to elicit a perceived threat and a reassuring appeal to elicit the perceived self- and response efficacy to obtain message acceptance, which leads to behavioral intentions *(54, 55)*. Response efficacy is the belief one has in the recommended behavior that it will prevent the threat. Perceived self-efficacy is the (feeling of) personal control to prevent the risk from happening *(54, 55)*. In the case of fresh produce eaten raw, the actual efficacy is low since consumers have only a limited impact on the microbial food safety of the fresh produce they consume due to the lack of an inactivation step for pathogens. Avoiding and cooking fresh produce are two ways to circumvent the risk. However, both interventions may not be applicable or accepted by consumers and/or cannot be maintained for the long term. Some types of fresh produce (such as lettuce, tomatoes, and cucumbers) are generally eaten raw, and fresh produce is an important part of a healthy daily diet. Consumers may select and verify the overall quality of the fresh produce they are buying, keep the produce at low temperatures to avoid multiplication of microorganisms, respect hygiene and good kitchen practices to avoid cross-contamination, and (sometimes) wash or peel the produce to reduce the microorganism populations, but for fresh produce contaminated earlier in the food chain, a residual risk may remain. Thus, consumers largely rely on the fresh produce supply chain actors (from farm to retail/catering) to provide safe food by implementing appropriate preventive measures, control measures, and testing programs and on competent authorities to regulate, control, and monitor the safety of the food chain. This stresses the role of government trust when communicating a risk to consumers. Government trust is expected to have a moderating effect on perceived risk, perceived efficacy, negative affect, and behavioral intentions. Earlier research highlighted that trust is a key principle of effective communication regarding risks and food risks in general *(6, 35, 40, 45, 50, 53)*, and especially in cases where consumers cannot control the risk: technology-related risks such as the millennium bug *(28)*, risks related to industrial chemicals *(47)*, and risks of flooding *(32, 48)*. As Ter Huurne and Gutteling *(47)* pointed out: ''Generating or maintaining trust, then, often becomes a primary goal of risk communication.''

The objective of the present study was to examine the perceived value of various EPPM concepts (i.e., perceived severity, perceived susceptibility, perceived efficacy, and negative affect) and trust in the government in Flanders (the Flemish part of Belgium) regarding food safety. The moderating influence of government trust on the EPPM concepts and behavioral intentions regarding consuming and handling fresh produce was also investigated, using real-life data from consumers collected after they read online newspaper articles about the EHEC outbreak in Germany. Newspapers are, among other media, one of the most used sources to obtain information on food safety *(29)*. Furthermore, Lee et al. *(34)* showed that, except for word of mouth, the Internet is the most used source of food safety information. Hence, analyzing consumers' reactions to online newspaper articles can provide insights into reactions to the EHEC crisis since newspapers are frequently used to obtain information on food safety. Also, most research on risk communication is measured in a research setting, using hypothetical risk messages about emerging issues. Although these studies are valuable, collecting real-life data during a crisis in a neighboring country with uncertainty about the food type and many causalities involved provided an opportunity to gain insights into consumers' first real-life reactions.

MATERIALS AND METHODS

Theoretical framework: the EPPM. The EPPM *(54)* explains people's reactions to risk messages and states that when an individual receives a risk message, it can trigger a process in which two components are appraised. The *threat appraisal* consists of the appraisal of the perceived susceptibility and the perceived severity *(54, 55)*. Belief about the seriousness of the threat (e.g., ''eating fresh produce contaminated with EHEC can lead to death'') is the *severity of the threat*. The *perceived susceptibility* is the belief that the risk could affect you (e.g., ''I eat fresh produce every day, so I can be exposed to this risk''). When the threat is perceived as severe, feelings of fear or negative affect are elicited, and people feel an urge to reduce the negative feeling. Hence, they further process the message and evaluate the efficacy of the recommended response *(54, 55)*. The perceived efficacy comprises *self-efficacy* and *response efficacy (54, 55)*. *Response efficacy* is the belief consumers have that the recommended behavior will effectively prevent the risk from happening (e.g., ''I believe that the actions necessary to prevent the risk from occurring will prevent the risk from happening'') *(54, 55)*. *Self-efficacy*, on the other hand, questions if consumers believe that they have the ability to act as the recommended behavior suggests (e.g., ''I believe I can perform the actions necessary to prevent the risk from occurring''). When both appraisals are perceived to be high, a danger control process is initiated, resulting in message acceptance, which most likely leads to adaptive behavior *(54, 55)*. Research *(15, 56)* shows that fear is not the only emotion experienced when an individual is exposed to a threat message; other negative feelings such as worry, anger, guilt, etc., can also be aroused after reading a risk message. These negative emotions are called *negative affect*. These emotions are self-directed, describing how consumers feel after reading a risk message. A feeling of guilt, for example, might arise when an individual realizes after reading the message that he or she just gave unwashed fresh produce to his or her siblings.

In the case of emerging risks regarding fresh produce eaten raw, the response efficacy that can prevent the risk from happening consists of the actions that the fresh produce supply chain actors (from farm to retail/catering) and competent authorities at the regional or national level undertake to provide safe food (e.g., intensified inspections and surveillance programs to monitor and detect the source of contamination and eliminate the contaminated product from the market, and more stringent adherence and

attention to "best practices" and hygiene in agricultural production, processing, trade, and distribution of food *(5)*). Consumers can also take action to limit food safety risks by storing and handling fresh produce appropriately at home. However, because of the absence of an adequate heat treatment or other pathogen reduction steps, the risks cannot be completely circumvented *(30)*. This implies that self-efficacy would be low in this case because consumers cannot believe in the possibility of avoiding eating contaminated fresh produce and fully control the food safety hazard. Following the EPPM *(54, 55)*, when the perceived efficacy is lower than the perceived threat, an individual's negative feelings are intensified, resulting in a "fear control" process and message avoidance. However, consumers could be unaware of the impossibility of preventing the risk from occurring (as they could believe that they can control the threat by avoiding consuming raw produce, growing their own or buying local food, thoroughly washing the produce, etc.), which could lead to a higher perceived efficacy than the actual self-efficacy. Nevertheless, the role of risk communication is to make consumers aware of the emerging food safety risks and inform consumers about the impossibility of circumventing the safety risks of fresh produce. This leads to the fact that even though the perceived self-efficacy could be high in this specific EHEC crisis (due to a lack of knowledge), the role of trust will come to the fore since the government (and food safety agencies) can undertake actions to provide safe food (e.g., increased monitoring to detect the presence of new food hazards). The belief consumers have in the competence of authority and government actions relies on the consumers' trust of these bodies. Therefore, in this study the moderating role of trust was assessed in the perceived concepts of EPPM, i.e., severity, susceptibility, efficacy, and negative affect, regarding the EHEC outbreak and on behavioral intentions.

The *E. coli* O104:H4 outbreak in May and June 2011 associated with fresh produce. In the beginning of May 2011, increased incidences of hemolytic uremic syndrome and bloody diarrhea were reported in northern Germany. The outbreak peaked on 22 May *(2)*. Three days later (25 May), the German authorities warned German consumers against eating tomatoes, lettuce, and cucumbers believed to be responsible for the outbreak. On 26 May, Spanish cucumbers were identified as the source because pathogenic *E. coli* serotypes had been found *(2)*, and the first causality outside Germany was reported. From that day on, media attention increased, and the overall sales of fresh produce, in particular of lettuce, tomatoes, and cucumbers, declined significantly in Europe. On 1 June, German authorities announced that none of the *E. coli*–positive Spanish cucumbers showed the serotype O104:H4. On 10 June, fresh sprouts produced by a German farmer were identified as the suspected food vehicle. Eighteen days later (30 June), fenugreek seeds appeared as a potential source and were removed from the market. On 5 July, the European Food Safety Authority identified fenugreek seeds imported into Germany from Egypt as the most likely source of the outbreak. 4 July was the latest onset date of illness attributed to the outbreak. Twenty-five days later, the outbreak was declared officially over by German authorities.

Procedure and newspaper coverage. For this research, the first reactions of consumers to news coverage of the EHEC outbreak in Flanders, Belgium, were collected. In Belgium, no diarrheal or hemolytic uremic syndrome–related cases occurred during the outbreak. When media coverage of the EHEC outbreak began in May 2011, a link to an online survey was inserted below every online newspaper article on this topic on two online Flemish newspapers' Web sites. In total, reactions to 17 articles focused on the EHEC outbreak were collected within a time span of 9 days, from 23 May until 31 May 2011. This period was just after the outbreak peaked (22 May), when fresh produce (lettuce, tomatoes, and cucumbers) was identified as the suspected food vehicle and before fenugreek seeds were identified as the source *(2)*. Media attention increased throughout Europe. From 19 articles that appeared in the two online newspapers during the reported period, 17 articles were used to collect consumers' reactions.

When the various articles were examined in detail, the content was clearly diverse. Some articles contained every aspect of the EPPM, i.e., severity (the consequences of the EHEC bacteria were stated clearly, e.g., hemolytic uremic syndrome and death), susceptibility (where the EHEC outbreak took place and/or whom it affected, e.g., Germany, Scandinavia, the elderly, women), and the response efficacy accomplished by the authorities (e.g., scientific research, more screening and control measures), while other articles contained only one EPPM concept. Some articles had a more reassuring tone; others were framed as more threatening. Due to the various tones of the articles, we merged the reactions to the 17 articles and did not examine the responses to individual articles.

Questionnaire. The online questionnaire was developed using adaptations of existing 7-point Likert scales, with 1 referring to "totally disagree" or "not at all," 4 to "neutral," and 7 to "totally agree" or "very much." Every concept was measured by using one item instead of using the complete scale consisting of multiple items. This has been encouraged by several researchers (for examples, see Alexandrov *(1)* and Rossiter *(42)*) and was necessary to prevent dropout in this unique real-life data collection.

First, the respondents indicated which online newspaper they had read (*De Morgen* or *Het Laatste Nieuws*), and they were asked to specify which article(s) they had read. Next, eight negative emotions were measured, namely, anger, sadness, fear, frustration, helplessness, distrust, worry, and guilt, by asking the consumers to indicate, on a 7-point Likert scale, how they felt after reading the article. After summation of the mean values, the emotions were conceptualized into *negative affect* ($\alpha = 0.870$) as suggested by Dickinson and Holmes *(15)*. The EPPM concepts were measured using an adaptation of Witte's model *(54)*. *Perceived severity* was measured with the item, "I see EHEC bacteria as a risk to the safety of fresh produce," and *perceived susceptibility* with the item, "It is possible that I have come in contact with fresh produce that contains EHEC bacteria." *Self-efficacy* was measured with the item, "I can avoid eating fresh produce contaminated by the EHEC bacteria." *Response efficacy* was not measured, since consumers could not circumvent the risk due to the EHEC outbreak; therefore, they could not believe in the recommended preventing behavior. *Government trust* was measured based on the scale of De Jonge et al. *(11)* using one item, "I trust the government that safety of fresh produce will be guaranteed." The scale of De Wit et al. *(14)* was used to measure *behavioral intentions*. More precisely, the following aspects were measured: the intention to eat less fresh produce in general, the intention to rinse fresh produce better, and the intention to alert loved ones about the potential risks of fresh produce due to the EHEC outbreak.

Analyses. The online data set was collected using the questionnaire tool SurveyMonkey (Portland, OR). The data were analyzed using the statistical program SPSS Statistic Viewer 20 for Windows (IBM, Armonk, NY). Various statistical analyses were used: independent-sample *t* tests, analyses of variance between groups (one-way analysis of variance), and univariate analyses. The significance level was <0.05, as posited by Fisher *(22)*.

RESULTS

Sample description. A total of 6,312 respondents filled out the questionnaire; 47.6% were male, and 52.4% were female. The average age was 40.70 years (standard deviation [SD] = 13.72), with a minimum age of 13 years and a maximum age of 88 years. Based on the Internet Protocol addresses and the sociodemographic data, no multiple responses were given by a single respondent.

The EPPM concepts. Tables 1 and 2 show the results of the measured concepts. Table 1 provides an overview of gender differences, and Table 2 distinguishes differences per age group. Looking at the perceived values of the EPPM concepts, the perceived severity (M = 5.40) and the perceived susceptibility of the risk (M = 4.64) were above the neutral value of 4 as measured on a 7-point Likert scale, which is relatively high. For perceived severity, gender differences were observed. Severity was perceived to be lower by men than by women (M_{men} = 5.26 versus M_{women} = 5.53). Severity and susceptibility increased with age, with perceived susceptibility the lowest in the youngest age category (Table 2).

Perceived self-efficacy was also above the neutral value of 4 (M = 4.25) (Table 1). This feeling of efficacy was higher for men than for women (M_{men} = 4.26 versus M_{women} = 4.07) (Table 1). Furthermore, the older the respondent, the more self-efficacy he or she perceived (Table 2).

Negative affect was measured using anger (M = 3.07, SD = 1.86), sadness (M = 3.07, SD = 1.78), fear (M = 3.47, SD = 1.84), frustration (M = 3.08, SD = 1.84), helplessness (M = 3.17, SD = 1.86), worry (M = 4.72, SD = 1.73), guilt (M = 1.88, SD = 1.21), and distrust (M = 4.41, SD = 1.81). In general, the mean value for negative affect is 3.33. This is rather low (i.e., below the neutral value of 4 on the 7-point Likert scale). As observed in Table 1, men had a lower negative affect than women (M_{men} = 3.20 versus M_{women} = 3.45). When the four age categories were compared regarding negative affect, it increased with age. However, the increases are not significant between the two youngest age groups (Table 2).

Government trust. A mean value of 3.86, which is just below the middle value, was found for government trust. No differences between men and women were found for trust (Table 1). Young adults (25 to 35 years) and adults (35 to 54 years) had the highest value for government trust and differed significantly with all age groups (Table 2).

Behavioral intentions. The intention to rinse fresh produce better (M = 5.72) and the intention to alert loved ones (M = 5.46) were clearly expressed by the respondents. Both intentions were higher for women than for men (M_{women} = 6.03 versus M_{men} = 5.39 and M_{women} = 5.66 versus M_{men} = 5.23) (Table 1). All four age categories differed; the older the respondent, the higher his or her behavioral intentions to rinse fresh produce better and to alert loved ones (Table 2). The mean value for the intention to eat less fresh produce is below the middle value of 4 (M = 3.28) and is significantly higher for women than men (M_{women} = 3.37 versus M_{men} = 3.19) (Table 1). No age differences were found regarding the intention to eat less fresh produce (Table 2).

The moderating role of government trust. In the case of emerging food safety risks, government trust was expected to have a moderating role since the risks cannot be circumvented by consumers but predominantly by actions to be taken by the fresh produce supply chain actors and authorities to guarantee food safety. Therefore, the present study also looked into the moderating impact of government trust on the perceived EPPM concepts. First, the main effect of trust on the intention to eat less fresh produce was analyzed. This is the most important behavioral intention because during an outbreak consumers need to continue eating fresh produce that is not linked to the outbreak or when the outbreak in one country does not influence food safety in another (neighboring) country. For example, during the *E. coli* outbreak in May and June 2011 involving fresh produce in Germany, throughout Europe lettuce, tomatoes, and cucumbers sales decreased. However, this decrease was based on a panic reaction, not rational arguments. The analysis of the main effect of trust was followed by analyzing interaction effects of trust and the various EPPM concepts on the intention to eat less fresh produce. Respondents were divided into two groups based on the median split for trust and every EPPM concept: perceived severity, perceived susceptibility, perceived self-efficacy, and negative affect.

A main effect of trust on the behavioral intention to eat less fresh produce was found. Respondents with high government trust had a lower intention to eat less fresh produce (M = 2.92, SD = 1.85) than respondents with low trust (M = 3.56, SD = 2.01) (t = 13.15, df = 6,090.29, $P < 0.001$). Furthermore, an interaction effect was found for perceived severity and trust on the intention to eat less fresh produce [$F(1,4290)$ = 5.025, P = 0.025], as shown in Figure 1a. An interaction effect appeared for perceived susceptibility and trust on behavioral intention to eat less fresh produce [$F(1,4338)$ = 4.455, P = 0.035] (Fig. 1b). The highest intention to eat less fresh produce emerged when the perceived susceptibility and severity were high and trust was low. The lowest intention to eat less fresh produce was found with low susceptibility and severity and when trust was high. However, when the threat was perceived to be high (which was the case for emerging food risks as shown by the mean values for severity and susceptibility), high trust in the government led to lower intention to eat less fresh produce than when the government trust was low. Hence, high trust in the government can reassure consumers and make them continue to eat fresh produce.

In Figure 1c, an interaction effect for trust and self-efficacy on the intention to eat less fresh produce is shown [$F(1,6268)$ = 10.883, P = 0.001]. The highest behavioral intention to eat less fresh produce was found when perceived self-efficacy and trust were low. The lowest intention to eat less fresh produce emerged when perceived self-efficacy and trust were high. However, when self-efficacy was low, the

TABLE 1. *Mean differences between men and women for the measured EPPM concepts, trust, and behavioral intentions*[a]

Concept	Women (n = 3,305)		Men (n = 3,007)		Total (n = 6,312)		Statistics for difference between genders
	M	SD	M	SD	M	SD	
Perceived severity	5.53	1.52	5.26	1.70	5.40	1.61	$t = -6.50$, df = 6,049.80, $P < 0.001$
Perceived susceptibility	4.66 A	1.29	4.61 A	1.34	4.64	1.31	$t = -1.65$, df = 6,150.73, $P = 0.100$
Perceived efficacy	4.07	1.68	4.26	1.72	4.16	1.70	$t = 4.42$, df = 6,273, $P < 0.001$
Negative affect	3.45	1.75	3.20	1.28	3.33	1.26	$t = -7.43$, df = 5,796.02, $P < 0.001$
Trust	3.87 A	1.66	3.86 A	1.71	3.86	1.75	$t = -0.090$, df = 6,067.63, $P = 0.928$
Intention to rinse better	6.03	1.31	5.39	1.62	5.72	1.50	$t = -16.98$, df = 5,774.28, $P < 0.001$
Intention to alert loved ones	5.66	1.47	5.23	1.67	5.46	1.58	$t = -10.83$, df = 6,012.52, $P < 0.001$
Intention to eat less fresh produce	3.37	1.98	3.19	1.95	3.28	1.97	$t = -3.49$, df = 6,270.57, $P < 0.001$

[a] Means followed by the same letter in the same row indicate that there is no difference for gender. All other values differ at P values of <0.001. Equal variance was expected only for perceived efficacy; all other concepts had a Levene test P value of <0.001, so no equal variance is assumed. M, mean value; SD, standard deviation. Values used: 1 = totally disagree; 2 = disagree a lot; 3 = disagree; 4 = neutral; 5 = agree; 6 = agree a lot; 7 = totally agree.

lowest intention to eat less fresh produce appeared when trust was high.

No significant interaction effect of trust and negative affect was found on the intention to eat less fresh produce [$F(1,5884) = 0.565$, $P = 0.452$] (Fig. 1d). However, a main effect was found for trust on negative affect, which is visualized in Figure 1d. Respondents with high trust had lower negative feelings ($M = 3.13$, $SD = 1.22$) than respondents who had low government trust (M = 3.58, SD = 1.26) ($t = 13.93$, df = 5,877, $P < 0.001$).

DISCUSSION

Since the food risk communication field is expanding, as well as policy attention on emerging food risks *(53)*, insight into consumers' reactions to food safety risk communication based on real-life collected data is important when developing a risk communication strategy and preparing future crisis communication. The empirical findings showed that the perceived severity and the perceived susceptibility of the EHEC risk of fresh produce with consumers in Flanders, a region in Belgium close to the outbreak region in Germany, were relatively high. The perceived self-efficacy was high as well. Consumers could have been unaware of the limited possibilities they had to prevent the risk from occurring in the case of fresh produce eaten raw. Because of the absence of an adequate heat treatment or other pathogen reduction steps, the risks cannot completely be circumvented *(30)*. Individuals might think that they can fully prevent the risk from happening by rinsing fresh produce more thoroughly, for example. However, storing and handling fresh produce appropriately at home helps reduce the number of pathogens, but for fresh produce contaminated earlier in the food chain, a residual risk may remain. Thus, consumers largely rely on the fresh produce supply chain actors (from farm to retail/catering) and competent authorities to provide safe food. This stresses the important role of risk communication to increase awareness and knowledge of emerging food risks. The average value for negative affect was the lowest of all measured concepts, which is in line with the EPPM, since the perceived threat and the perceived efficacy were high. This means that the respondents do perceive a threat but feel efficacious enough to prevent the risk from happening. Therefore, they go into "danger control," instead of "fear control," which leads to fewer negative feelings and higher behavioral intentions such as rinsing fresh produce better and alerting loved ones. The values for negative affect and the behavioral intentions to rinse fresh produce and to alert loved ones after reading the news on the EHEC outbreak were higher for women and older respondents. The differences based on gender and age are similar to those found in previous research on risk perception *(13, 17, 18, 24, 29, 38, 45, 49, 51)*. A possible explanation for the gender differences might be that women do most of the cooking and have a caretaking role in the household *(7, 8, 10)*; this could lead to higher perceived risk, higher negative affect, and higher behavioral intentions.

The results showed that the behavioral intention to rinse fresh produce better and the intention to alert loved ones was high. The Eurobarometer results *(17, 18)* showed similar results when consumers were asked what they did after hearing about food safety problems: 16% in 2005 and 11% in 2010 stated that they permanently changed eating habits, and 37% in 2005 and 35% in 2010 said that they avoided the food mentioned in the story for a while. The latter can be clearly seen in the decline in sales of cucumbers, salad, and tomatoes all over Europe, especially in Germany and Spain, during the EHEC outbreak. However,

TABLE 2. *Mean values per age category for the measured EPPM concepts, trust, and behavioral intentions*[a]

Concept	<25 yr (n = 819)		25–35 yr (n = 1,695)		36–54 yr (n = 2,574)		≥55 yr (n = 1,144)		ANOVA outcome
	M	SD	M	SD	M	SD	M	SD	
Perceived severity	5.24A	1.62	5.36 A	1.52	5.38 A	1.65	5.60	1.65	$F(3,6228) = 8.80$, $P < 0.001$
Perceived susceptibility	4.44	1.31	4.69 A	1.25	4.67 A	1.28	4.64 A	1.45	$F(3,6175) = 7.79$, $P < 0.001$
Perceived efficacy	4.10 A	1.61	4.03 A	1.63	4.20	1.71	4.32	1.84	$F(3,6192) = 7.32$ $P < 0.001$
Negative affect	3.15 A	1.24	3.28 A	1.21	3.36	1.27	3.46	1.32	$F(3,5820) = 10.54$, $P < 0.001$
Trust	4.08 A	1.52	3.68	1.54	3.84	1.55	3.95 A	1.70	$F(3,6225) = 21.06$, $P < 0.001$
Intention to rinse better	5.24	1.61	5.58	1.52	5.80	1.44	6.10	1.42	$F(3,6214) = 61.40$, $P < 0.001$
Intention to alert loved ones	4.98	1.64	5.24	1.58	5.54	1.55	5.91	1.44	$F(3,6228) = 70.98$, $P < 0.001$
Intention to eat less fresh produce	3.24 A	1.94	3.32 A	1.91	3.29 A	1.97	3.24 A	2.07	$F(3,6228) = 0.548$, $P = 0.650$

[a] Means followed by the same letter in the same row do not differ from one another according to the post hoc test Dunett's C. Dunnett's C was used because unequal variance is assumed (Levene's tests, $P < 0.001$). M, mean value; SD, standard deviation. Values used: 1 = totally disagree; 2 = disagree a lot; 3 = disagree; 4 = neutral; 5 = agree; 6 = agree a lot; 7 = totally agree. ANOVA, analysis of variance.

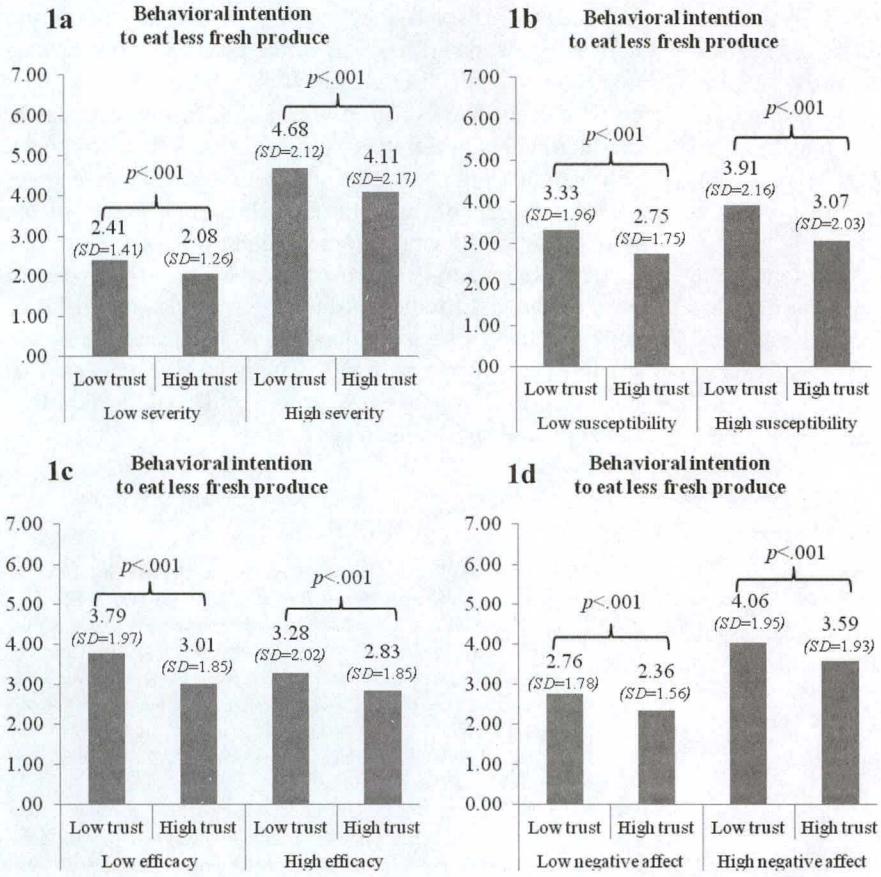

FIGURE 1. *Interaction effects of perceived severity (a), perceived susceptibility (b), perceived efficacy (c), negative affect (d), and trust on intention to eat less fresh produce. Values used: 1 = totally disagree; 2 = disagree a lot; 3 = disagree; 4 = neutral; 5 = agree; 6 = agree a lot; 7 = totally agree.*

in the current study there was no clear behavioral intention to eat less fresh produce for men or women. During the EHEC outbreak, no clinical cases of *E. coli* O104:H4 were identified in Belgium, and there were no indications that any fresh produce sent to the market in Belgium was contaminated with EHEC in general or the *E. coli* O104:H4 outbreak strain in particular. Therefore, there was no need to avoid eating fresh produce in Belgium, so the Belgian government did not warn against eating different types of fresh produce such as lettuce, tomatoes, or cucumbers during the outbreak, in contrast to the German government *(2)*. A low intention to eat less fresh produce is a positive outcome, bearing in mind the increase in economic losses if people stop eating fresh produce. Hence, the intention to eat less fresh produce is the behavioral intention one wants to avoid. Risk communication could help avoid the indirect and direct economic losses of a foodborne outbreak crisis by raising awareness about and knowledge of emerging food risks. A high awareness of potential food safety risks entails that people perceive a lower risk because it is not novel anymore *(12)*, avoiding a scare, which will lead to a higher intention to keep on eating fresh produce that is not related to the outbreak.

In risk communication about food safety hazards that cannot completely be circumvented by consumers when communicating about fresh produce eaten raw, trust plays a vital role. The results show that the level of government trust was beneath the neutral middle value of 4, with the youngest and oldest age groups having the highest level of trust. Furthermore, a moderating role for government trust was found. Looking at the significant interaction effects between government trust and every EPPM concept measured, besides negative affect, trust played a moderating role in explaining the impact of the EPPM concepts on behavioral intention. When the perceived susceptibility was high, the intention to eat less fresh produce was much higher when trust was low than when it was high. The same effect was found for perceived severity. When the perceived self-efficacy was low (which will be the case once awareness and knowledge of emerging food safety risks increase), the lowest intention to eat less fresh produce emerged when trust was high. No significant interaction effect appeared for trust and negative affect on the intention to eat less fresh produce. However, when trust was low, a higher negative affect was found than when trust was high. These results are in line with previous research on risk communication *(26, 37, 43, 45, 47)* and stress the important, moderating role of trust. When trust was high, it mitigated the way the message was being perceived, leading to better message acceptance and the resulting behavioral intentions.

From these results, managerial implications can be drawn. Since consumers cannot completely avoid these fresh produce risks, increasing knowledge of emerging food safety hazards is important. To increase this knowledge, communication should explain in an honest, understandable, and accessible way the emerging hazard (the threat), what the government and food safety authorities are doing to provide safe food (the relief), and what consumers can do (e.g., keep on eating fresh produce, rinse items thoroughly) and cannot do (e.g., they cannot completely circumvent the

risk when fresh produce is eaten raw). However, increasing knowledge of consumers' inability to circumvent the risk could lead to the perception that they are not in control, i.e., low self-efficacy, which could lead to more feelings of worry and fear *(54, 55)*. Nevertheless, due to ethical reasons and the right to know about emerging hazards, risk communication should take place, but the role of trust comes to the fore since it has an important, moderating role in cases where consumers cannot control the risk, for example, in risks of flooding *(32, 48)*. Hence, the primary goals of future risk communication about emerging food safety issues need to be building and maintaining trust and increasing knowledge.

Trust is fragile. Once it is lost, it cannot easily be rebuilt *(45)*. Openness, transparency, competency, and efficiency are important components of communication for building and maintaining trust *(25, 35, 41)*. During a foodborne outbreak, there is a lot of uncertainty because the source cannot be found immediately (e.g., in the EHEC outbreak it took almost 2 months before the fenugreek seeds were identified as the source) and false accusations can spread (e.g., Spanish cucumbers were cited as a potential source). These factors decrease trust, because of the constantly changing, sometimes contradictory, messages being disseminated. However, when communication is transparent and open, uncertainty can be communicated, which is better than not communicating. Not communicating leads to more doubts, and people believe any other (not credible) information source they find. As Kahlor's *(31)* Planned Risk Information Seeking Model (PRISM) shows, people who cannot prevent a risk from happening counteract by looking for information. Furthermore, people do not always trust news media coverage, but a motivation for following the (distrusted) news is to fulfill the need for cognition *(52)*. Therefore, consumers must find an independent source of information that gives more clarification and insights. Breakwell *(6)* stated that an information source that is believed to be expert, unbiased, and not sensationalizing will be most trusted. Research shows that respondents get confused when there are many different sources, and they need to have one information point providing easily accessible information *(3, 4, 27, 47)*.

The unique situation of collecting data during a real-life crisis has limitations. Various contextual factors cannot be ruled out. Moreover, whether respondents heard more via other broad media channels (e.g., television or radio) or personal communication with family, friends, colleagues, etc., is unclear. Another limitation is in the methodology, since by inserting a link below every online newspaper article, self-selection of the respondents was induced. Only persons who read one of the EHEC articles, noticed the link, and voluntarily wanted to participate clicked on the link to fill out the survey. The fact that response efficacy was not measured is an additional limitation. Since respondents can only to a limited extent prevent the risk of foodborne infection regarding consumption of raw fresh produce, no response efficacy was measured because no recommended behavior could be inserted in the item to measure response efficacy. However, looking at the results for self-efficacy, respondents believed they could prevent the risk from happening. It would have been interesting to gain insights into the behaviors through which respondents thought they could prevent the risk from happening. In future research, existing beliefs in different behaviors could be investigated with various communication strategies necessary to counter these misperceptions. Future research could also investigate in more detail the vital and moderating role of trust in risk communication, especially in cases where consumers cannot prevent the risk from happening (e.g., industrial risks or natural disasters such as flooding or hurricanes). Finally, examining further which information source, authority, or organization is perceived as trusted and credible during a food crisis would be interesting.

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