Asymmetry in food safety information – the case of the 2018 Listeriosis outbreak and low-income, urban consumers in Gauteng, South Africa

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ABSTRACT

This study considered the efficiency with which food safety information is received and retained by low-income consumers in South Africa. Primary data from 110 low-income, urban, food consumers around Gauteng were collected and analysed with a willingness to pay (WTP) experiment and a proportional odds model. The study found that initially, 47% of the respondents claimed to know what Listeriosis is. Data validation, and a WTP experiment, however, suggest that there is social acceptability response bias. The proportional odds model further showed that education level is significant in explaining the level of food safety knowledge, but income is not. These results serve as an approximation of the degree of information asymmetry between low-income, urban food consumers and the South African government.

KEYWORDS: Food safety, listeriosis, low-income consumers, information asymmetry

JEL CLASSIFICATION: D12, D82, D83, I14, I18, L15, L66

1. Introduction

As a non-rivalrous, non-excludable and non-negotiable attribute, food safety is regarded as a public good as it requires frequent public intervention as individual firms may not be able to adequately control a food safety hazard. Moreover, because food safety is also considered a credence attribute, there is a need for effective communication strategies to inform consumers on food safety to prevent consumers from unknowingly consuming food that is unsafe (Latvala 2010). The public sector is usually involved in (but are not limited to) setting minimum safety standards because consumers may not be able to judge food safety to avoid hazards (due to asymmetric information[1]) or to protect vulnerable groups such as small children or marginalised populations (Unnevehr 2007).

Increased media coverage, growth in scientific literature (see, *inter alia*, Adinolfi, Di Pasquale, and Capitanio 2016; Fontes, Giraud-Héraud, and Pinto 2015; Koç and Ceylan 2009; Valeeva, Meuwissen, and Huirne 2004; Yeung and Morris 2001) and the establishment of various national food safety authorities show the importance that consumers attach to food safety. Consumers' perceptions of food safety, however, depends on their confidence in a

government's protective regulations and their trust in the food industry's abilities to ensure safe food based on these regulations (Fotopoulos and Krystallis 2003). In South Africa, a study conducted by Vermeulen and Bienabe (2010) found that the majority of the surveyed consumers perceived food purchased at formal retailers (82%), and restaurants and take-away outlets (53%) as safe. This high level of trust in the safety of food products might be associated with the relative absence of food safety scares in the past.

In July 2017, this changed when a notable food safety issue arose when nurses in public hospitals notified the National Department of Health (DoH) of a possible Listeriosis[2] outbreak. Subsequently, it has been listed by the DoH as a notifiable disease with more than 180 fatal cases and around 1000 people receiving treatment after being infected (Nthate 2017; Spies 2018; WHO 2018). Although the progression of the outbreak was tracked and reported on by the media, there were challenges for governmental bodies to develop effective risk communication strategies for food consumers. These challenges included that the source of the outbreak was unknown and that it was difficult to pin down the sources, due to the wide variety of possible sources and long incubation period associated with the infection. Combined with this, product recall and food safety announcements are also not commonplace in South Africa (Korsten 2018). This probably added to the inefficiency of information distribution and utilisation by consumers.

On 4 March 2018 the DoH, however, identified definite products which contained Listeriosis as processed meat originating from processing facilities in Limpopo, Gauteng and the Free State provinces of South Africa. Concerned about the safety of the consumers of these products, especially vulnerable individuals (children, the elderly and individuals with a compromised immune system) the processing facilities recalled the alleged contaminated products. Consumers were also made aware of the dangers of consuming products contaminated with Listeria, and the DoH urged consumers to destroy and refrain from consuming processed meat products (Simelane 2018). On 5 March 2018, the World Health Organisation confirmed that the Listeria outbreak in South Africa was "the largest ever recorded outbreak of this severe form of listeriosis globally" (WHO 2018).

The Listeriosis outbreak, with its associated media briefings, therefore, provides the ideal case study in which to evaluate if and how low-income, urban, food consumers obtain and retain information with regards to food safety.

2. Problem statement

Previous studies such as Verbeke (2005) and Ratzan (2001) have noted that consumers with different characteristics require different types/sources of information. However, this notion has not been explored in South Africa, which is a country known for a diverse population in terms of numerous demographic aspects such as race, language and education, to name a few. South Africa, being the country with the most unequal income distribution in the world, provides an interesting case study on how income affects food safety information dynamics. The extent to which income level exacerbates/perpetuates information asymmetry related to food safety, is something currently unexplored. Knowledge on this is imperative for policymakers and food marketers to ensure effective and efficient messaging. This is contextualised in more depth below.

Food safety is a non-negotiable attribute of food. Although consumers have access to several sources of food safety information, consumers do not necessarily use the same sources, and

they do not value the sources equally (Koç and Ceylan 2009). The relevance of the source is strongly influenced by the characteristics of the foodborne risks and the asymmetric nature of food safety information (Adinolfi, Di Pasquale, and Capitanio 2016; Henson and Traill 1993). Therefore, even though studies have shown that a significant amount of consumers have changed their purchasing behaviour as a result of food safety information (see *inter ali*a Tent 1999; Wilcock et al. 2004), due to its asymmetric nature, consumers often purchase products based on incomplete information. The effect that this incomplete information has on their decision-making process is, therefore, an important aspect of consumer behaviour analysis (Tellis and Gaeth 1990). In a South African context, the efficiency of information reception and retention related to food security information is unexplored.

Following earlier findings related to information asymmetry in food chains, McCluskey and Swinnen (2004) introduced the *rationally ignorant consumer hypothesis*. They postulated that consumers will prefer to inform themselves only up to a point where the marginal increase in income from more information equal to the marginal cost. Stated differently, a rational consumer might be imperfectly informed due to the fact that the marginal benefit of the additional information is not worth the high cost of obtaining or processing this information. From an empirical perspective, if this hypothesis holds, information asymmetries would be even more pronounced in communities where consumers do not have the means to access, process and use the information available. This has, however not been tested. From an empirical perspective, to test this hypothesis one would require information on marginal benefits and marginal cost. Since these are not homogenous between consumers (each household is expected to have different benefits and cost), this hypothesis is implicitly tested by comparing income and knowledge level. This is based on the premise that low income serves as a proxy for low (communication) asset endowment, where acquiring additional communication assets would present a high marginal cost. Comparatively, marginal benefits associated with income would be low, based on the relatively low levels of income.

To this end, Verbeke (2005) notes the limitations of supplying food safety information to the broader public and states that " … consumer needs for information cannot be taken for granted … segmentation and targeted information provision are proposed as potential solutions to market failure and information asymmetry". Within this context, the recent listeria outbreak in South Africa provides a case study in which the effect of income and other demographic variables, on information asymmetry related to food safety can be explored. Despite the efforts to spread information about the Listeriosis outbreak among consumers, it remains unclear how information related to food safety crises are obtained and processed by, specifically low-income South African consumers.

As noted above, the Listeriosis outbreak, with its associated media briefings provides the ideal case-study in which to evaluate if and how low-income consumers obtain and retain information with regards to food safety. In a broader context, it will inform the question of how (low) income levels and certain other demographic factors affect access to food safety information or information asymmetries related to food safety.

From a policy perspective, this can inform governmental risk communication strategies in the future, which speaks to Verbeke's (2005) concern that messages should be targeted to specific consumer groups. This study is also novel in the sense that most literature pertaining to communication strategies and food safety is conducted in developed countries where consumers have the institutions, infrastructure and financial capacity to access information related to food safety. In this sense, the studies are focused on perceptions and concepts of

trust (Veflen et al. 2017) in the food safety mechanism (Latvala 2010). In the context of South Africa and other developing countries, the researchers expect that there are certain socio-economic characteristics inherent to certain consumer groups that would also impact how consumers receive and retain information related to food safety.

3. Objectives of the study

In line with the problems and research gaps identified above, the overarching objective is to empirically test for the presence of asymmetry in food safety information between low-income consumers and government. This will be achieved through three sub-objectives. The first is to determine the respondents' effective access to, and retention of food safety information in South Africa. This study, therefore, explores the speed and extent with which generic messages reached low-income consumers. This could ultimately serve as an indication of the degree of information asymmetry between government and low-income consumers and provide empirical support for the rationally ignorant consumer hypothesis as postulated by McCluskey and Swinnen (2004).

The second objective seeks to validate results from objective one, with a test on consumers' willingness to pay (WTP) for products that were identified as contaminated with Listeriosis by the DoH. The WTP for a product associated with the contaminated brands was deemed an effective way to validate the level of knowledge reported by the respondents since WTP methods are widely accepted to be demand revealing. Based on the premise that demand would be negatively affected by the knowledge of Listeria, it was deemed appropriate that WTP results could serve as a proxy for the effectiveness of information reception and retention.

The last objective seeks to explore the characteristics and demographic factors that have an impact on the level of food safety knowledge (in this case, specifically information related to Listeriosis) of low-income consumers. Information on this speaks to Verbeke (2005) in that this will help with market segmentation and focused messages to groups that are deemed at-risk such as low-income consumers.

4. Conceptual framework and research hypotheses

Study findings by Quinlan (2013), suggest that urban, low income and minority populations are at higher risk of food safety problems. In the case of the Listeriosis outbreak in South Africa, however, with the exception of periodic press releases by the DoH, and comprehensive mainstream media coverage, no record could be found of campaigns or initiatives targeting low-income consumer groups. It is therefore interesting to evaluate the impact of household income on the efficiency with which consumers obtain and retain food safety information. The logic behind the choice of household income is that it serves as a proxy for asset endowment, where it is expected that higher-income implies a larger asset endowment in communication assets such as cellular phones and televisions. In addition to this, higher incomes in the (lower) income ranges observed in this study are often associated with formal employment (as opposed to informal employment or dependence on social grants) and food procurement from formal retail establishments such as supermarkets. It is, therefore, expected that greater participation in the formal sector would greatly increase the probability of being exposed to information on Listeriosis since comprehensive information on this was available in most supermarkets.

The conceptual framework, illustrated in Figure 1, is, therefore, an interrelated and dynamic process whereby certain socioeconomic characteristics of the low-income consumers have a potential impact on their ability to access and process food safety information. In turn, the low-income consumers' knowledge of a food safety issue such as Listeriosis, in this case, is expected to influence their willingness to pay for the implicated products.

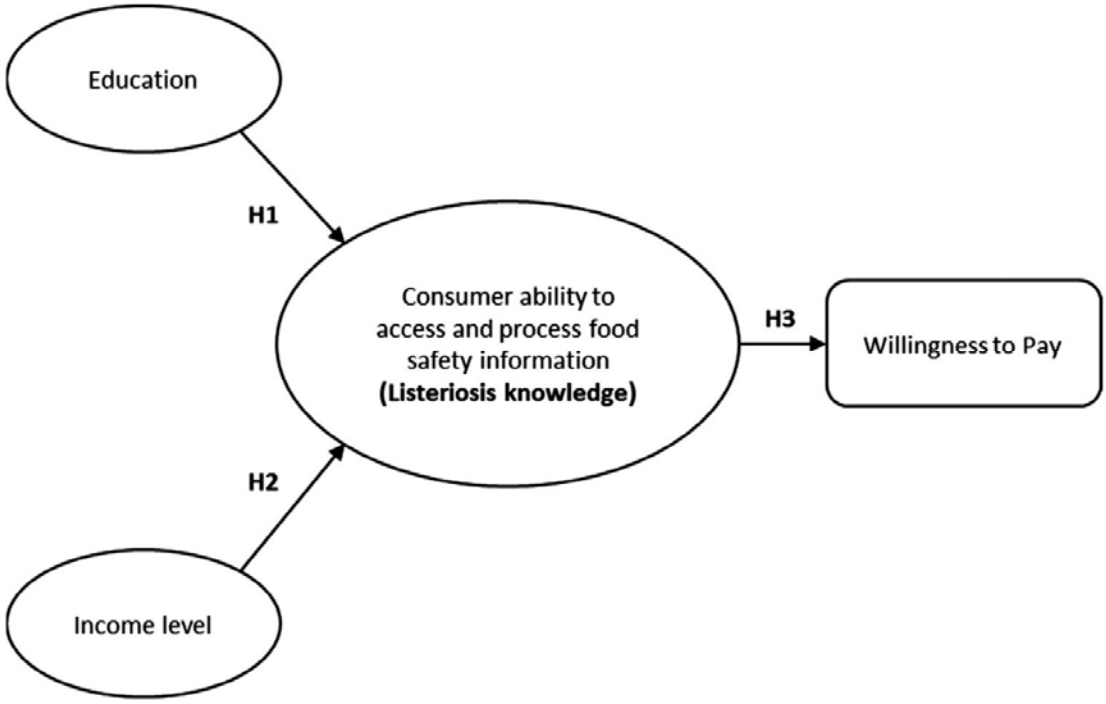

Figure 1. Conceptual framework.

5. Data sources and methods

Based on South African National Income and Expenditure data from the Living Conditions Survey (StatsSA 2017), the average expenditure on processed meat comprises around 22% of total expenditure on meat. This share is also expected to follow an increasing trend over time due to consumption trends associated with convenience and urbanisation. It, therefore, shows that lower-income consumers are comparatively more exposed to the food safety issues associated with the Listeriosis outbreak in South Africa.

It is for this reason that data from 110 low-income[3] consumers, was collected through interviews guided by a structured survey conducted by trained facilitators. In terms of vulnerable groups, 21% of the sample reported to have infants, 35% reported children under 5, and 5% reported prevalence of a chronic illness. Due to the exploratory nature of the study, and time pressures to collect the data, convenience sampling was employed. Liaukonyte, Streletskaya, and Kaiser (2015), in a study that considered how consumers retained information related to food products over time, found that the effect of negative information (such as a Listeria contamination in this case) on food demand does not persist over time. Subsequently, it was crucial to ensure that the data be collected in the shortest time possible. Additionally, the timing of the study was crucial since a key objective of the study was to evaluate the efficiency at which the respondents retained the food safety information available in the public domain. All surveys were therefore conducted between 12 March and

16 March 2018; one week after the formal press release by the DoH on the source of the contaminated products. An overview of the sample is given in Table 1.

Table 1. Descriptive statistics of the sample**.**

Gender	Education	Household Size	Household Income
Male: 29% Female: 71%	Primary school: 31% Grade 10: 34% Grade 12: 34% Diploma/certificate:1%	Min: 1 Max: 9 Mean:3.4	Min: R300 Max: R6000 Mean: R1724

The sampling area comprised of informal settlements and townships in and around Johannesburg, which included Thembisa, Soweto and Vosloorus (Figure 2).

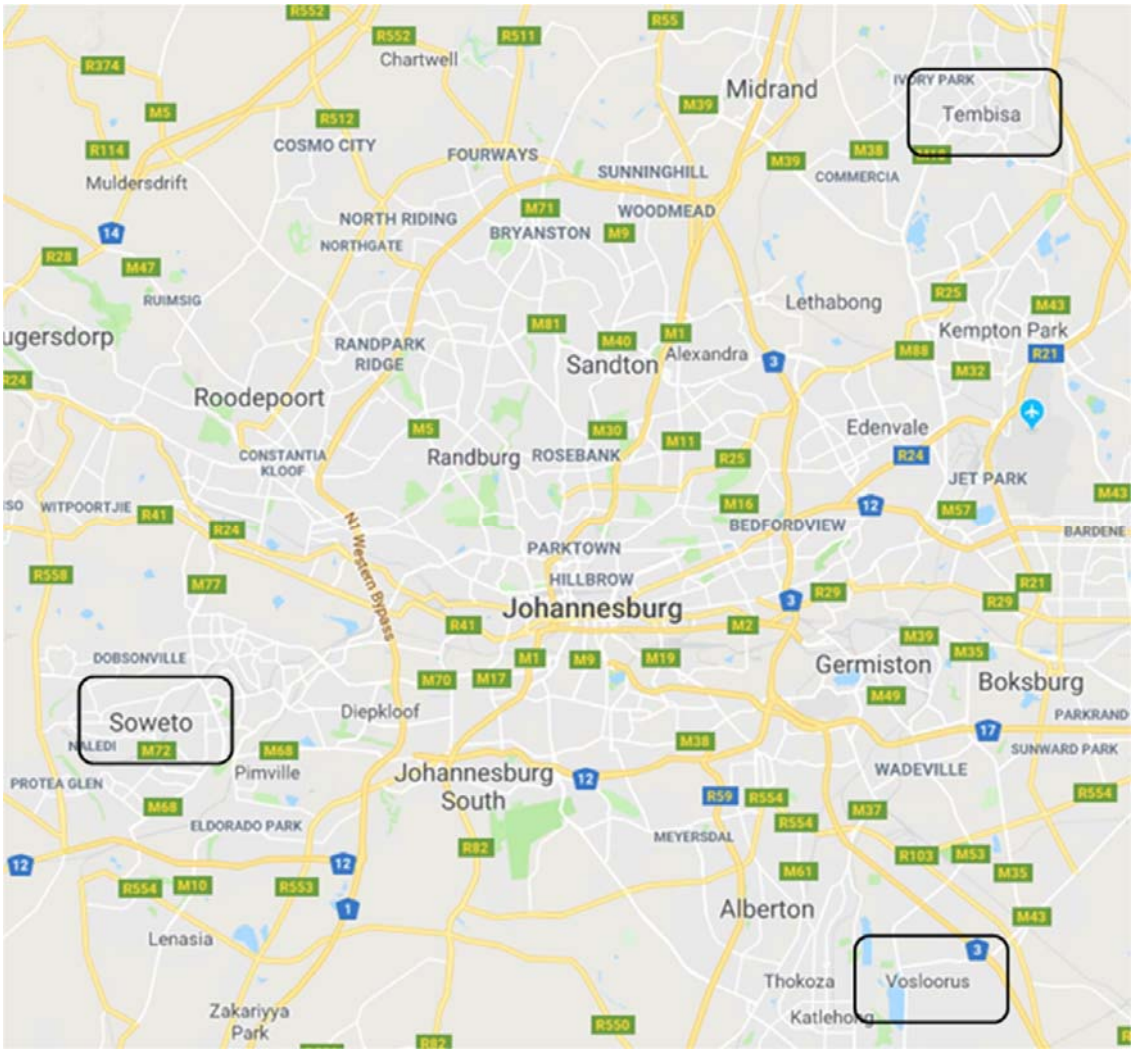

Figure 2. Location of the sampling areas. Source: Google maps, 2018.

The reasons for focusing on these geographic areas are two-fold. The first relates to convenience and timing factors, as discussed above. These areas are in close proximity to the research institution, and the researchers have an established network of enumerators in these

areas. The second reason is based on the income and unemployment dynamics associated with these urbanised or peri-urban areas. Based on 2011 census data of South Africa, the Gauteng City-Region Observatory (2016) found that the three townships included above were amongst the areas in the Gauteng province with a higher incidence of unemployment than the official national rate of 27%. In terms of household income, data from the 2011 national census showed that approximately half of residents in Vosloorus has an annual income of less than R3 200 per month. This low-income level is even more pronounced for Thembisa[4] and Soweto[5] with 76% and 85% of its residents earning less than R3200 per month, respectively (R3200 is an arbitrary classification used by StatsSA to delimit the upper-bound of the fourth lowest income category in local municipal overviews). Therefore, in addition to the time and convenience factor, the relatively lower incomes of the individuals residing in these areas, and the fact that these individuals spend about 15% of their income on processed meats, make these three areas ideal for inclusion in this case study.

In terms of the first objective, the methodological approach was simply to consider descriptive statistics, from the collected data generated. The descriptive statistics were analysed to determine the percentage of the respondents familiar with Listeriosis and to identify when these respondents first heard of this foodborne infection.

The method applied for the second objective included a basic willingness to pay experiment. There are multiple ways to elicit WTP. In the context of this study, with a significant time constraint, a basic contingent valuation study, with two rounds, was conducted. Contingent valuation is a method in which respondents explicitly state, by means of an open-ended question, their preferences in a monetary value without being provided with a market value (see Boyle 2003; Lusk and Shogren 2007) but are not obliged to pay and take ownership of the product (Maynard et al. 2004). This method of direct questioning makes it affordable and easy to implement (Romano et al. 2016). One of the main features of the contingent valuation method is that the technique can evaluate how consumers' preferences change as product attributes change (in this case, for example, from safe[6] to unsafe).

In order to address objective three, the effects of different explanatory variables on a categorical variable is evaluated with a proportional odds model. When the dependent variable has an ordinal scale, proportional odds models are usually estimated. A proportional odds model is nested in the broader class of multinomial logit models but is more parsimonious and attractive in terms of interpretations (Hosmer and Lemeshow 2000). It does, however, assume that the change in the odds between the categories is proportional and therefore a test needs to be conducted to determine which of the two models are a better fit to the data. A generic representation of a proportionate odds model is given below.

$$\text{Logit}[P(Y \leq j)] = \alpha_j - \beta\mathbf{x}\ , \qquad j = 1, \ldots, J-1 \tag{1}$$

where j is the level of the ordered category of the dependent variable, α_j is the intercept that changes depending on j, and $\mathbf{x}$ is a vector of explanatory variables.

The results associated with the various methods discussed here are presented in the next section.

6. Results

In order to address the first objective as identified above, respondents were asked a set of questions related to their knowledge of food safety. The first question in the structured survey simply asked respondents "Do you know what Listeriosis is?". Here 22% of the respondents indicated that they did not know, 31% indicated that they had an idea but were not sure (classified as respondents with partial knowledge), and 47% reported to know what it is (classified as respondents with comprehensive knowledge). The respondents classified under "partial knowledge" typically did not know the term Listeriosis but were aware of food contamination and of some of the symptoms related to consuming foods infected with the Listeria bacteria.

To determine the nature or mode with which information on Listeriosis has spread a question was posed on where respondents first heard of Listeriosis. Here respondents were allowed to select multiple sources such as radio, television, word of mouth, newspapers and others. Consequently, only the comprehensive- and partial knowledge groups within the sample were considered. Table 1 shows the results associated with the different modes in which Listeriosis information reached the respondents. It is interesting to note that the majority of the respondents received information on Listeriosis through the radio (38%), followed by TV news (17%), and word of mouth (13%). For comparative purposes, a column was included on the preferred channels for government communications by South Africans. The stronger reliance on radio in our sample could be seen as indicative of the income nuances posed by reaching different demographic groups.

In line with the first objective, it was also important to understand the speed with which food safety information reaches consumers. In terms of timing, respondents were asked when they first heard of Listeriosis. The timing results (Figure 4) should be considered in relation to the timeline presented in Figure 3. The timeline highlights the newsworthy events since the first reported Listeriosis cases in July 2017, leading up to the official announcement by the DoH (December 2017) and the identification of the source (March 2018) up to the official announcement in September 2018 that the outbreak was over.

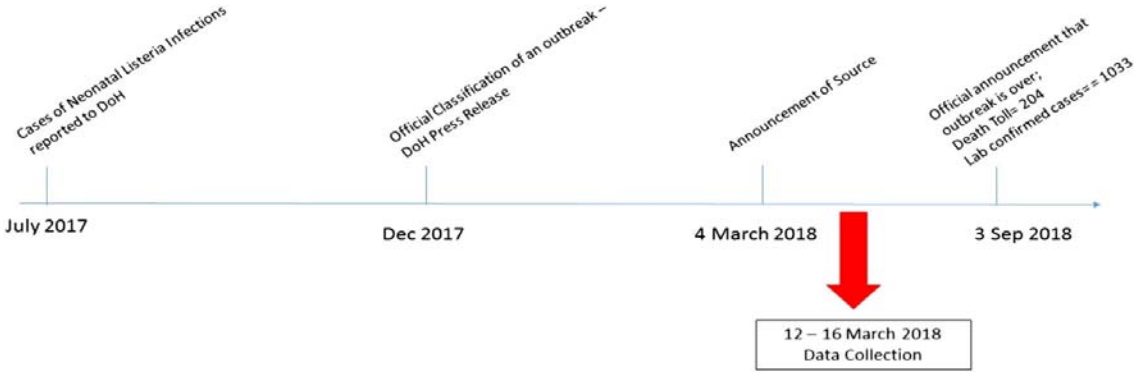

Figure 3. Timeline of South African Listeriosis outbreak.

Figure 4 depicts the responses of the respondents related to the first time they heard about the Listeriosis outbreak. Of the 110 respondents, 85 responded to the question: "When was the first time you heard about Listeriosis?". This corresponds to the number of respondents included in the "Partial Knowledge" and "Comprehensive Knowledge" categories. From

Figure 4 it is apparent that the majority of the respondents first heard about Listeriosis in the week of 4 March, which coincides with the week in which the DoH made the announcement of the infection source. This implies that, although the DoH released an official classification of a disease outbreak in December 2017,[7] less than 30% of the respondents received any information released by the DoH, and the National Institute for Disease Control, before 4 March.

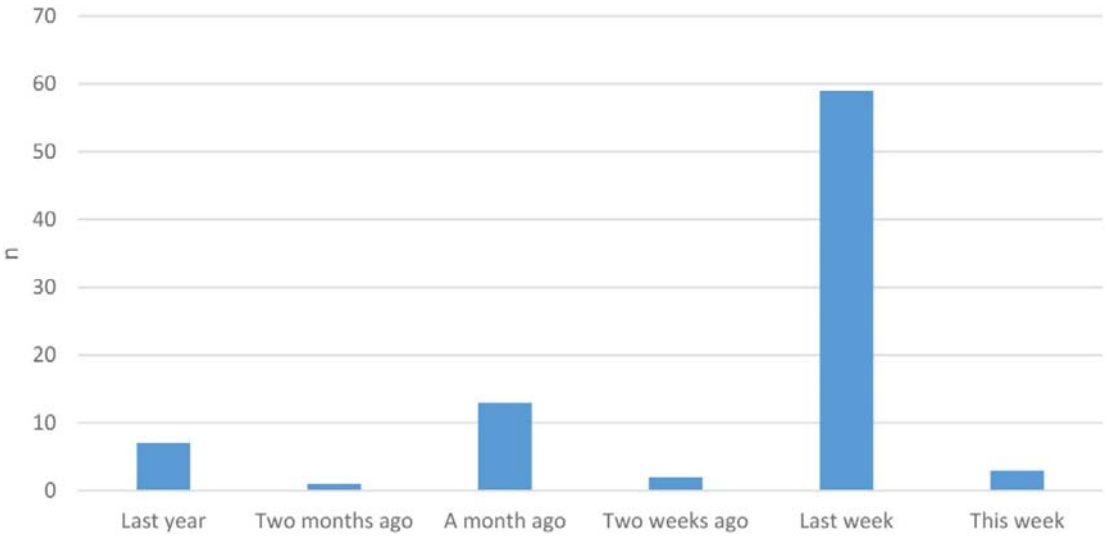

Figure 4. Timing of Listeriosis information (survey date: 12 March 2018).

In order to validate the results regarding the respondents' knowledge level about Listeriosis (objective two), a set of follow up questions were posed. These questions tested respondents' knowledge of the symptoms related to consuming products infected with the Listeria bacteria, or consuming the brands of processed meat that was, at the time of the survey, associated with the Listeriosis outbreak. Respondents were given a list of 13 possible symptoms of which 7 were listed by the DoH in their press releases and notifications as symptoms directly related to a Listeriosis infection. The other six symptoms included general flu-like symptoms. The respondents were subsequently asked to select the symptoms that they believed were associated with a Listeriosis infection. Average scores out of seven (total number of correct symptoms), were calculated by grading each correctly identified symptom with one point; incorrect selections were graded negatively. The average score for the sample was two out of seven. This suggests that the respondents' actual knowledge about the disease and the related symptoms, which becomes important for disease management strategies, might be less than what was reported in the results to the first question; "Do you know what Listeriosis is?".

The remainder of the questionnaire comprised of additional validation questions on affected products and brands. These questions started with a general question on whether the respondents were aware of the products and brands that were identified as contaminated with the Listeria bacteria (by the DoH) with a "Yes" or "No" option. Subsequently "Yes" and "No" questions were confirmed by open-ended questions where they were requested to name the products and brands. The results associated with this is presented in Table 2. These results seem to support the notion that the DoH messages, press releases, and general media coverage, did not effectively reach low-income consumers. Out of the 51 respondents that indicated a comprehensive knowledge of the outbreak, 64% had (correct) knowledge of products and brands mentioned in the DoH press release of 4 March 2018. These results

could serve as further supporting evidence that the level of knowledge regarding the outbreak might have been over-stated by respondents, and responses to the initial question "Do you know what Listeriosis is?", suffered from social acceptance bias.

Table 2. Mode of transfer of Listeriosis information to respondents.

Mode	% of knowledgeable respondents that were reached through listed mode	South Africans mode of preference for government communication
TV news	17%	35%
Newspapers	4%	20%
Social media	9%	12%
School correspondence	2%	NA
Local clinic	4%	NA
Radio	38%	12%
Word of mouth	13%	NA

Source: HSRC, 2013 – South African Social Attitudes Survey.

Some additional concerns related to the implicated brands were also identified. The questions aimed at determining whether or not the respondents could link particular brands to the outbreak revealed that 7% of respondents that claimed to be familiar with products and brands listed "Tiger Brands" as a contaminated brand in the validation section. This points to a degree of imperfect knowledge as Tiger Brands[8] is the larger food manufacturing company, but the processed meat products are actually marketed under one of their subsidiary companies namely "Enterprise Foods".

The results also showed degrees of brand confusion. Of the respondents, 4% listed brands such as "Goldi" and "Eskort" as being infected with the Listeria bacteria. These brands were, however not mentioned as infected brands by the DoH, although they produce similar processed meat products to those of the brand connected to the infection.

The initial question "Do you know what listeriosis is?" were used to categorise respondents into three groups, namely "No knowledge", "Partial knowledge" and "Comprehensive knowledge". This was subsequently broken down further based on the validation questions asked on product and brands. This is presented in Table 2. If one compares the initial categorisation (denoted by *n* in column 2) with the respondents with adequate product and brand knowledge it suggests that the initial knowledge response might have been inflated.

In order to address the second objective of the study, to confirm the results of objective one, a two-round WTP experiment was included in the survey. Before any reference was made to Listeriosis in the survey, a question was posed to the respondents, on how much they would be willing to pay for a packet of Vienna sausages as displayed in Figure 5. After the set of Listeriosis questions, as discussed above, the same question was posed again. This time the question contained additional information that the packet of Vienna sausages originated from a processing facility where Listeriosis was identified. A summary of the WTP results, for the two distinctive rounds, is presented in Table 3.

Figure 5. Product display for WTP experiments with branding removed. Source: Product photo downloaded from pnp.co.za and edited to remove branding.

Table 3. Summary of knowledge level pertaining to contaminated products and brands.

Reported level of knowledge	*n*	Product knowledge	Brand knowledge	Brand and product knowledge
No knowledge	25	2	0	0
Partial knowledge	34	26	21	17
Comprehensive knowledge	51	47	35	33

Table 3 shows that prior to any information or questions on Listeriosis were given to the respondents, their average willingness to pay for the packet of 500 g Vienna sausages was R32.75 with two respondents having an initial willingness to pay of R0 due to lack of cold storage facilities and the small size of their households. The average WTP is also quite close to pre-outbreak price ranges associated with this product of between R26.99 and R31.99. The average WTP value, however, showed slight variations between the sub-groups categorised in terms of knowledge level. What is interesting from the results presented in Table 3 is that the "partial knowledge" group was willing to pay the highest price for the packet of sausages, followed by the group with "comprehensive knowledge". Further testing, however, revealed that the WTP price difference between the sub-groups is not statistically significant.

In terms of the second round of willingness to pay questions (after providing information and asking questions on Listeriosis, and stating that the product originated from an implicated factory), the average price that respondents were willing to pay for the 500 g packet of sausages was R1.79. Although 93% of the total sample indicated a zero-rand willingness to pay, eight respondents were still willing to pay positive amounts with an average of R31; this reflects only a marginal difference from their WTP results in round one. It is also noteworthy that these respondents (the ones with a positive willingness to pay) fell within the "partial knowledge" and "comprehensive knowledge" categories, which supports the notion of social acceptance bias. Other possible explanations for the "miss-alignment" of knowledge with a positive willingness to pay could be due to consumers' assuming the low probability of infection, a lack of understanding or low involvement in the consumers purchasing decision. Typically, a low priced routine purchase product with a prominent brand (such as Enterprise Viennas) is associated with low levels of decision involvement from a consumer. This implicitly contributes to consumer's lack of (updated) knowledge on the product.

In order to speak to objective three, a proportional odds model was estimated in order to gauge how income and demographic factors (such as education level) impact on the respondents' level of food safety information knowledge. The model was estimated with data on knowledge level, with slight adjustments made based on information contained in the validation questions on brands and symptoms that followed.[9]

The dependent variable, therefore, consists of three categories, namely "no knowledge", "partial knowledge" and "comprehensive knowledge". The explanatory variables that were considered are household income and education. As mentioned earlier, household income and education are expected to lead to a greater probability of being exposed to food safety information. This is confirmed by a significance test between the income levels of employed *versus* the unemployed categories in the sample, which found the difference in average income between the two groups to be significant at a 5% level of significance. Household income is therefore included as a continuous variable in the proportional odds model presented in Table 4.

Table 4. Summary results of willingness to pay experiments.

Reported level of knowledge	*N*	Average WTP 1	Average WTP 2
No knowledge	25	R31.30	R0.00
Partial knowledge	24	R33.35	R2.94
Comprehensive knowledge	51	R33.00	R1.84

Education, in turn, is included as a proxy variable for respondents aptitude to receive and retain information and is included as an ordinal categorical variable (1 = Primary School Completion, 2 = Grade 10 Completion and 3 = Grade 12 Completion). Since the initial press releases and media coverage regarding the outbreak includes medical jargon and are not in one's mother tongue, it is expected that education will play a key role in the efficiency with which food safety messages are received and retained. The results of the estimated model are presented in Table 4.

The results above show that education plays a key role in the level of knowledge pertaining to Listeriosis that the respondents had. In contrast to this, the insignificance of the income variable shows that the level of income within the sample had no impact on the level of knowledge. If the specific odds-ratios are regarded, it shows that the probability of a higher

knowledge level on Listeriosis increases by 61% when the level of education increase from primary school completion to Grade 10 completion and by 159% when education increase from primary school completion to Grade 12 completion. Although statistically insignificant, it is still worthwhile to interpret the income coefficient as well. In this regard, the odds of having an increased knowledge level on Listeriosis increased by 0.32% for a 1% increase in income (Table 5).

Table 5. Proportional Odds Model for the level of Food Safety Knowledge of Low-Income Consumers.

Dependent variable – knowledge status Base outcome – no knowledge	Coefficient	*t*-Stat	Odds ratio
Intercept α_2 (no knowledge | partial knowledge)	1.31	0.69	
Intercept α_3 (partial knowledge | comprehensive knowledge)	2.85	1.5	
Edu – completed Gr10	0.48	1.07	1.61
Edu – completed Gr12	0.95	2.06	2.59
Income	0.28	1.08	1.32

7. Discussion and conclusion

The aim of this study was to explore the nature and efficiency with which food safety information is disseminated and received by low-income, urban, food consumers in Gauteng, South-Africa. Results suggest that there are inefficiencies in this process. This ultimately supports the notion of information asymmetry between low-income consumers and government, and implicitly provides empirical evidence for the rationally ignorant consumer hypothesis as postulated by McCluskey and Swinnen (2004). This hypothesis states that if the marginal benefit of additional product information does not outweigh the costs, consumers will not attempt to gather additional information. In the case of this study, the relative cost to the information of consumers would be disproportionately high due to the low levels of income associated with the sample. Further anecdotal evidence of this is that this group of respondents relied heavily on radio and word of mouth to obtain information on the Listeriosis outbreak. A radio is a relatively low-cost communication asset compared to televisions and smartphones. Whilst word of mouth information has little to no cost.

With regards to food safety information retention, the results suggest that the propensity of low-income consumers to efficiently absorb information related to food safety is limited. Although 47% of the surveyed sample indicated that they have comprehensive knowledge of the Listeriosis outbreak, this number seems to be inflated. Subsequent questioning revealed disparities in terms of notable symptoms associated with Listeriosis, with respondents scoring poorly in the identification of these symptoms. In terms of product and brand awareness, results also suggest that consumers received and retained incomplete information with only 30% of the total sample showing confirmed comprehensive knowledge in terms of infected products *and* brands. This again seems to support the hypothesis as discussed above since it is likely less costly (in terms of shopping time and information gathering and processing) to avoid all implicated products instead of certain implicated brands. Most studies of recall events in developed countries also show that consumers avoid the whole implicated category all together (see *inter alia* Tilston et al. 1992) Further brand issues that were identified were related to possible confusion between the company and product brand and a small proportion of the sample identified the incorrect brands as the ones that are affected.

The WTP results seem to provide further evidence of possible social desirability response bias in initial answers relating to the knowledge level of Listeriosis. This corresponds to pre-outbreak price levels of processed sausages reported for the first round of the WTP experiment. This suggests that consumers were unable to relate their reported level of knowledge/information to their actual purchasing decision. In the second round of WTP, where the presence of Listeriosis in the product processing facility were explicitly noted, 93% of respondents indicated that they would not buy the product. The presence of selected respondents with a positive price for the second round, however, serves as an indication that a degree of confusion persisted even after information was explicitly shared and highlighted.

In terms of understanding characteristics that explain knowledge level, two overarching explanatory variables were considered in the reported level of knowledge in the sample. Not surprisingly, results from the proportional odds model shows that education level is significant in explaining the level of knowledge, with the odds of an increased knowledge level increasing by 61% if the respondent completed grade 10 instead of just primary school completion (grade 7) and by a 159% if the respondent completed high school (grade 12). Similarly, the odds of having an increased knowledge level on Listeriosis increased by 0.32% for a 1% increase in income, although statistically insignificant.

These results support the notion by Ratzan (2001); you reach no-one when you try to reach everyone, and this statement reinforces the argument that generic food safety announcements are not sufficient to reach low-income consumers. The results presented here seem to confirm this. In terms of key factors to consider for food safety knowledge level of low-income consumers, the prominence of education in comparison to income suggest that it might not be an issue of access to information but rather an issue of understanding and retaining information related to food safety. This also reinforces Verbeke's (2005) plight that food safety messages need to be focused on a specific audience. Although consumer characteristics and demographics are important to take into account in these messages, the level of involvement required by consumers in the purchasing decision could also be an important factor to consider. The effect of this, however, needs further research.

Although the results presented here makes a strong case for further research regarding social marketing (related to food safety issues) from a public health perspective, the importance of further research on economic factors should not be neglected. The study does, however, underscore that very little is known about social networks and informal institutions in low-income communities and how this impacts information sharing and ultimately information asymmetry. Understanding these factors and the economics thereof are key to recommend and implement effective policies and mitigation strategies and addressing market failures associated with information asymmetries.

As a final thought: The Listeriosis outbreak in South Africa, and the high associated death toll, should serve as a learning experience on how low-income consumers can be better and timeously reached with accurate and targeted food safety messages. The exploratory results presented here seem to support the view that this will require tailor-made messages with actionable information, specifically aimed at vulnerable groups in terms of income level and education level. This study could serve as a point of departure for more in-depth research into this. If targeted food safety messaging is not perused, protection against foodborne diseases is selective. Within a South African context, this is ultimately adding to the stark inequalities already prevalent within our society.[10]

Disclosure statement

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Notes

[1] Information asymmetry characterizes the market for products with credence attributes, meaning that the seller has more information about true product quality than the buyer (Sanderson and Hobbs 2006).

[2] Listeriosis is a food-borne infection caused by the Listeria monocytogenes pathogenic bacteria that can be present in soil, water, vegetation and animal faeces which can contaminate fresh food, notably meat. Listeriosis can cause serious harm to pregnant women, the elderly, new-borns, and those with a weakened immune system. The fact that the incubation period is up to 70 days makes it difficult to track the infection (Medical News Today 2017).

[3] In this context, low income consumers are understood to be marginalised and lower income consumers as defined in BFAP (2018) with monthly incomes below ZAR 5124. If converted with March 2018 exchange rates this amounts to a monthly income below USD 433. Comparatively, the mean income of the sample was ZAR 1827 per month, which amounts to USD 154.

[4] This is for the Winnie Mandela Ext7 ward which is the ward in Thembisa were the survey was conducted.

[5] This is for the Thulani ward which is the ward in Soweto were the survey was conducted.

[6] Food that is regarded free from the food borne infection, Listeriosis.

[7] On 5 December 2017 the DoH and National Institute of Communicable Diseases released messages that as of the beginning of December Listeriosis prevalence are classified as an outbreak. These messages included prevention strategies, best practices in food preparation and key symptoms.

[8] More information about Tiger Brands can be found on their website (http://www.tigerbrands.com/) including links to their subsidiary companies such as Enterprise Foods (https://www.enterprisefoods.co.za/).

[9] The amount of respondents in the “Comprehensive knowledge” category decreased from 47% to 43%, “Partial knowledge” increased from 31% to 34% and “No Knowledge” increased from 23% to 24%.

[10] Out of 149 countries monitored by the World Bank, South Africa was estimated to be the most unequal country with a Gini-coefficient of 0.63.

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