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Annual Scientific Meeting
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Introduction

Risk analysis, including risk perception, risk assessment, risk management, and risk communication, represents an interdisciplinary field that is the foundation of decision making across a myriad of disciplines. The annual meeting of the Society for Risk Analysis (SRA) in December 2009 brought together nearly 1,000 international scientists and practitioners from a wide range of disciplines who share an interest in risk analysis. A full list of meeting materials, including presentations and abstracts, can be found on the SRA website at [Society For Risk Analysis Annual Meeting 2009](#).

A number of presentations and abstracts at the meeting may be of some interest to environmental health staff in Ontario public health units. The Ontario Agency for Health Protection and Promotion has compiled a listing of these abstracts and presentations for information purposes only. Any opinions, findings, and conclusions or recommendations in these abstracts and presentations are those of the authors and do not necessarily reflect the views of any other organization or agency, including the Ontario Agency for Health Protection and Promotion.

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Food

The Animal Human Interface in Food Animal Production

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Abstract: With increasing concern over pandemic influenzas of animal origin, there is an urgent need to develop evidence-based programs to reduce the evolution of viral strains that are transmissible to humans and capable of causing severe illness. Workers in food animal production are at the front line of exposures to these zoonoses and the population at greatest risk of primary exposures and infections. Although most attention has been given to smallholder animal husbandry, risks of viral evolution and transmission to workers are heightened in industrial scale food animal production (IFAP) for these reasons: IFAP involves dense confinement of animals under stressful and nonhygienic conditions; animals are exposed to subtherapeutic doses of antibiotics as feed additives; most workers are not provided cleanup facilities or personal protection; and waste management is largely unregulated. We are developing a model to evaluate factors contributing to spread of influenzas among farms in regions with high IFAP densities. These factors include: farm size,

existence of producer networks, frequency of vehicle and social contacts. We will use spatial statistics and geographic information systems to develop risk maps useful in guiding monitoring programs and developing interventions to protect workers. A major area of uncertainty in understanding occupational risks of influenza exposure concerns workers in meat and poultry processing plants. Because of the size of this workforce and its lack of access to medical and other social services in the US (due to immigration status as well as the use of incarcerated persons who are at additional risk of infection in prisons), this question is of high priority. Research supported by NIOSH, Center for a Livable Future, Winslow and Clayton Baker Foundations, and the Pew Charitable Trusts.

Development of tools for vulnerability assessment in the food supply

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Abstract: The food supply chain is a complex and dynamic system-of-systems that stretches around the globe. In recent years, the threat from intentional food contamination has been a topic of concern. Some have argued that the terrorist threat is overstated and that adulteration for economic gain (e.g. melamine) and disgruntled employees are more significant threats. Security upgrades to address these issues cost money. A better understanding of vulnerabilities is thought to provide more targeted and cost effective mitigation measures. Existing vulnerability assessment approaches have focused on facilities and are based upon the use of scoring systems. These subjective scores make comparison of results for the purposes of cost effective risk management problematic. Focusing on facilities may also overlook other more vulnerable points in the system. We are working to develop a vulnerability assessment tool that will i) provide quantitative estimates that directly measure risk using quantitative measures of risk; ii) make use of readily available information about food production systems; iii) clearly identify information requirements; and iv) be generic in nature, enabling application to multiple food-hazard combinations. Case studies will be used to examine production pathways to generate insight into the most important attributes of a food system with respect to characterizing vulnerability and determine how the pathways can generically be described. The definition of a finite set of generic processes that can be pieced together to describe a food production pathway will provide a known structure for future assessments and will allow for them to be done at the appropriate level of detail. This presentation will describe this initiative, including challenges, successes and a case study.

Handling

Observational study of food handling practices in retail deli departments

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Abstract: Food prepared outside of the home in foodservice establishments such as retail stores, restaurants, and delicatessens has been associated with an increased risk for specific foodborne illnesses. Deli meat sliced at retail, for example, has been associated with an increased risk for listeriosis illnesses compared to deli meat sliced and packaged at federally-inspected processing establishments. Specific reasons for the association between foodborne illnesses and food prepared at foodservice establishments are not well known. In order to reduce foodborne illnesses cases, there is a need to identify the practices which pose the greatest potential for contamination in these settings. Quantitative microbial risk assessment (QMRA) is one means for systematically identifying these practices. A key need of QMRA, however, is data appropriate to the system under study. Therefore, the purpose of this study is to provide a set of data regarding practices in deli departments for use within an interagency retail *Listeria monocytogenes* risk assessment currently in progress. Food employees (n=45) in deli departments at nine retail facilities were observed using a notational analysis method as they prepared food for sale. The notational analysis method allowed for the recording of the frequency and sequence of (1) contact between objects and the deli products before sale; (2) hand washing and glove changing during preparation; and (3) equipment, utensil and surface cleaning and sanitizing. This presentation will review the available methods to assess food handling practices and will provide the preliminary results of our observations.

Listeria

A discrete event model to track *Listeria monocytogenes* in the retail environment

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Abstract: A recent USDA/FSIS comparative *Listeria monocytogenes* (Lm) risk assessment predicts that of the listeriosis cases attributed to deli meat, a vast majority are associated with deli meat sliced and packaged at retail. In order to develop efficient risk management options, there is a need to: i) identify potential sources and practices that contribute to Lm contamination of food at the retail; and ii) identify retail practices that would reduce or eliminate Lm contamination of ready-to-eat foods prepared and sold to consumers. Within the scope of an interagency risk assessment of Lm at retail, a discrete-event model that tracks Lm cells at various locations over time in a retail setting is under development. This model considers i) the transfer of bacteria from some defined compartment to others (unsliced products, sliced products, food contact surfaces, non food contact surfaces, slicer, gloves, hands, etc.); ii) the bacterial inactivation through cleaning and disinfection; and iii) the bacterial growth according to the physical and chemical environment (temperature, pH, aw, presence of growth inhibitors). Sequences of events are derived using specifically acquired data from an observational study of food handling practices in retail deli departments. Moreover, this risk assessment is designed to evaluate the relative effectiveness of retail Lm control measures along with

other risk management scenarios. This presentation will describe this model, provide an illustration using current data and highlight the data gaps that mainly influence the outputs.

Considering the duration of *Listeria monocytogenes* growth challenge studies

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Abstract: Domestic and international food safety policy developments have spurred interest in the design and interpretation of experimental growth challenge studies to determine whether ready-to-eat (RTE) foods are able to support growth of *Listeria monocytogenes*. This information is relevant to assessing the risk of RTE foods and determining the applicable regulatory standard. In existing protocols for *L. monocytogenes* growth challenge studies, a commonly cited reason for extending the study duration beyond the intended shelf-life of a RTE food product is the recognition that some users may hold and consume RTE product beyond its intended shelf-life. However, assuming microbial population lag time is exponentially distributed among food samples, if no growth is detected in a challenge study with a sample size of three per sampling time (the maximum under current protocols) and a duration of 1.44 times the intended shelf-life, there is 95% confidence that no more than half of samples drawn from the assumed population would initiate growth before the intended shelf-life expires. The assumption that lag time is exponentially distributed may overstate the likelihood that *L. monocytogenes* growth initiates before the intended shelf-life of a RTE food expires. The memoryless assumption of the exponential distribution would be violated, for example, if the mechanism of inhibition is a sublethal injury of *L. monocytogenes* cells requiring some minimum recovery time prior to growth. This would result in an initially low probability of growth onset, with the probability of growth increasing over time as cells recover. However, the illustrative results reinforce food microbiology expert recommendations that the duration of challenge studies preferably should extend beyond the length of the intended shelf-life. Furthermore, the analysis emphasizes that consideration of data censoring and lag time variability provide a science-based rationale apart from concerns about consumer behavior.

Validating models for the growth/no-growth boundary for *Listeria monocytogenes* in mis-formulated ready-to-eat foods

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Abstract: There is interest in determining the margin of safety provided by the current formulations of various food products that might support the growth of *Listeria monocytogenes*. Understanding the susceptibility of such product to misformulation can be important to risk assessment and food safety. One example of such a formulated food product is the “pocket sandwich” developed by the US Army. These products are considered stable with respect to growth of *L. monocytogenes* because their water activity is either less than 0.90, or the water activity is less than 0.95 and the pH is less than 5.5. A challenge study with various product formulation omissions was used to simulate accidental mis-formulations that could raise either the pH and/or water activity. A total of nine variants of two sandwich products (Honey Barbeque and Bacon Cheddar) variants were made, including control for each. Samples of each of these variants were analyzed for pH and Aw. All product variants were inoculated with a seven strain *L. monocytogenes* cocktail. Samples were incubated at 25°C for 360 days. Microbial testing was performed at regular time intervals during this period. *Listeria monocytogenes* appears to gradually die off in all formulations of BBQ Beef and Bacon Cheddar sandwiches. A decline from 5 log CFU to 3 log CFU was observed over a 6 month period or about 0.33 log CFU per month. Therefore, *L. monocytogenes* growth in pocket sandwiches (even if

incorrectly formulated) appears very unlikely. The results from this study also validate a model previously developed by Koutsoumanis et al (2004) on growth limits of *Listeria monocytogenes* as affected by temperature, pH and water activity when grown in suspension or on a solid surface. This approach (model validation against deliberately mis-formulated products) might prove useful in expanding the scope of current *L. monocytogenes* risk assessments.

Prevention through Surveillance: The Efficacy of the PulseNet Laboratory System as a Means of Preventing Foodborne Illness

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Abstract: The PulseNet surveillance system was designed to identify and mitigate the harm from outbreaks associated with foodborne illness. Despite tangible successes of PulseNet activities, the results from improved outbreak surveillance have been misinterpreted by both commentators and policymakers. Most notably, an increase in observed food-related outbreaks has been seen as evidence of a crumbling food safety system. The truth is not so clear. While identified outbreaks have increased, identified illnesses (as measured by the FoodNet active surveillance system) have fallen. This suggests that the increase in outbreaks reported may be an artifact of improved outbreak surveillance, not declining safety. In this study, I examine the economic efficacy of the PulseNet system. Benefits from this system are generated both as a result of earlier detection of outbreaks and, perhaps more importantly, through a deterrence effect operating on companies that seek to avoid litigation and negative publicity (reputation costs) that would accrue to companies associated with an outbreak. Thus, the surveillance system creates important, but often overlooked, market-based incentives to improve supply-chain risk management and traceability. The costs of this system are limited; especially when compared to the cost of a proposal to inspect (with questionable results) all domestic food facilities subject to FDA regulation (at a cost of \$525 million).

Use of molecular subtyping and surveillance data to support risk assessments for *Listeria monocytogenes*

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Abstract: Transmission of foodborne diseases is complex and is affected by various host, environmental, and pathogen factors. While current risk assessments for the foodborne pathogen *Listeria monocytogenes* (Lm) incorporate differences in human host susceptibility to this pathogen, pathogen variability and environmental factors still need to be better integrated into risk assessments. To address these issues, we have used Lm as a model system to: (i) understand pathogen variability with regard to transmissibility and virulence; and (ii) perform field studies using molecular subtyping methods to probe environmental transmission of this pathogen. These studies provide additional data for use in Lm risk assessments, particularly those assessing the risk associated with Lm contamination at retail. Specifically, we conducted a cross-sectional study on Lm contamination patterns in 121 retail establishments, including testing both food and the retail environment. Overall, 73 (60%) of establishments had at least one sample that tested positive for Lm; 13.0% of the 1,161 environmental samples tested positive for Lm, including 125 (16.7%) and 26 (6.3%) of non-food contact and food contact surface samples, respectively. Our data indicate that (i) Lm is commonly found in retail environments, (ii) Lm strains are often widely distributed among different environmental sites in retail, indicating cross-contamination and dispersal, (iii) Lm can persist in retail environments for > 1 year, and (iv) a number of Lm subtypes isolated at retail are also common among human listeriosis cases. These findings indicate that Lm risk assessments focusing on retail should include

modeling of cross-contamination from environmental sources at retail. Subtype data, combined with animal and human tissue culture studies, also showed that Lm strains differ in virulence with >50% of food associated Lm showing reduced ability to cause human disease. Incorporation of pathogen variability and environmental transmission parameters thus will be critical for Lm risk assessments.

Microbial risk assessment

Risk-based design of thermal processes for preservation of low-acid foods

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Abstract: Ambient-stable, low-acid foods rely on thermal processing as the main preservation factor to ensure microbiological safety and stability. Food companies have traditionally used hazard-based approaches for designing thermal processes whereby a performance criterion is expressed as the number of log-cycle reductions of a population of spores of a microorganism of concern. As such, the required heat treatment does not consider the bioburden to be reduced by the thermal process, nor does it consider a maximum concentration of microorganisms in the final product that may still provide an acceptable level of consumer protection. This approach often leads to over-designed thermal processes which may have a negative impact on product quality. In this study we present a risk-based approach to estimate the required heat treatment to ensure microbiological safety and stability of a low-acid soup containing particulates. The approach used a probabilistic model with the following set of inputs: (1) frequency and concentration of naturally occurring bacterial spores in ingredients, (2) heat resistance of these spores, and (3) product temperature distribution during processing. Inputs (1) and (2) were obtained from an internal ingredient database in which data were captured on the concentration of spores after three different heat treatments in laboratory media (i.e. 15 min at 80°C for input (1), and 15 min at 100 and 110°C for input (2)). Input (3) was obtained by heat transfer modelling, which in turn accounted for the expected operational variability of key process parameters (e.g. particulate size distribution). A sensitivity analysis was carried out to rank the inputs in terms of their impact on end-product stability, and to help interpreting the results in the presence of uncertainty. The results obtained by the proposed risk-based approach supported the design of a milder thermal process compromising neither end-product stability nor consumer safety.

A swift quantitative microbiological risk assessment (sQMRA) – tool

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Abstract: Classical extensive QMRA is a valuable method to assess the effects of control measures on the public health risk of a pathogen – food product combination. However, development of these QMRA models is time consuming, data needs are substantial and it requires modeling expertise. We therefore developed a simplified QMRA model especially aimed at comparing the risk of pathogen - food product combinations and education. The swift Quantitative Microbiological Risk Assessment (sQMRA) – tool is implemented in Microsoft Excel and, like in classical QMRA, pathogen numbers are followed through the food chain, which in this case starts at retail and ends with the number of human cases. The model is deterministic and includes cross-contamination and preparation (heating) in the

kitchen and a dose-response relationship. The general setup of the sQMRA tool consists of consecutive questions for values of each of the 11 parameters, always followed by intermediate model output broken down into treatment categories. In a separate sheet, model input and output are summarized and exposure as well as cases are attributed to treatment categories. As a relative risk measure, intermediate and final model outputs are always compared with results from an extensive QMRA of *Campylobacter* in chicken fillet. First calculations with the sQMRA-tool were done for all combinations of *Campylobacter* spp., *Salmonella* spp. and *Listeria monocytogenes* with chicken fillet, filet americain and table eggs. The predicted risk was highest for *Salmonella* spp. in table eggs. The sQMRA-tool proves to be useful for quickly obtaining relative risk estimates of pathogen - food combinations, which can serve as a guide for risk management or selection of combinations for applying classical QMRA. The usefulness of the sQMRA-tool for QMRA education follows from the positive reactions received thus far. A probabilistic sQMRA version is being developed at present.

Foodrisk.org: an online resource for food safety risk

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Science plays a vital role in food safety assurance through the application of risk analysis. FoodRisk.org is an on-line resource that supports the use of food safety risk analysis by i) providing quality risk assessment resources with a special emphasis on data and models, ii) providing an introduction to the theory, methods and practice of risk management applicable to food safety, iii) providing an introduction to the theory, methods and practice of risk communication applicable to food safety, iv) establishing and maintaining open channels of communication within the food safety risk analysis community, and v) promoting the use of food safety risk analysis globally. FoodRisk.org collects and catalogues available data and methodology on food safety risk analysis from the private sector, trade associations, federal and state agencies, and international sources. Each resource is evaluated for relevance, reliability, timeliness, quality and value before being included in FoodRisk.org. Examples of the data and tools that are made available through Foodrisk.org are the EcoSure dataset on cold temperature storage of food products during transportation and 24 hours after being placed in consumer home refrigerators/ freezers, an Australian risk assessment model for *Listeria monocytogenes* in ready-to-eat meats and the updated version of the food handling practices model developed by the U.S. Food and Drug Administration. The audience for FoodRisk.org is comprised of scientist from government, industry, and academia, as well as consumers and members of the media. Users can search the contents of the FoodRisk.org database using either simple or advance search mechanisms that retrieve records using free-text keywords contained anywhere in the record. Approximately 6,500 individuals visit FoodRisk.org each month, and about 44%/11 of those are located within the U.S., the remaining users are spread over 100 other countries.

Modeling and Risk Assessment for the Growth of Samonella on Cut Tomatoes Schaffner DW, Pan WJ; schaffner@aesop.rutgers.edu Rutgers University

Abstract: Outbreaks of salmonellosis associated with fresh tomatoes continue to be major food safety concern. When whole tomatoes are cut, any *Salmonella* present can be transferred from the surface to the inside of the fruit. Despite their low pH, cut tomatoes provide a favorable environment for *Salmonella* to grow when temperature abused. Few reports quantify the growth rate of *Salmonella* on cut tomatoes, and only at limited number of incubation temperatures. While modeling software (the pathogen modeling program - PMP and ComBase Predictor - CBP), can be used to predict *Salmonella* growth, no models have been validated for cut tomatoes. Our purpose was to

build a mathematical model to describe the growth of Salmonella on cut tomatoes and use that model to assess the risk posed by incubation at different temperatures. Whole red round tomatoes were dip inoculated with a cocktail of four Salmonella strains obtained from the Centers for Disease Control and Prevention (CDC). Inoculated tomatoes were dried overnight, cut with a sterile knife, placed in a sterile plastic bag, incubated at 10 temperatures and plated on XLT4 agar for enumeration. Growth rates were calculated using D1IFit. Relevant data on Salmonella prevalence and concentration were determined from the literature. Temperature data were obtained from a survey of holding practices in Rutgers University dining halls. The software @risk (palisade Corporation, Ithaca, NY) was used for risk modeling. A plot of the square root (SR) of growth rate (GR) was linear with temperature (1), such that $SR(GR) = 0.026T - 0.1065$, ($R^2=0.9398$). The growth rate was slightly faster than that predicted by CBP, but slower than that predicted by PMP. The Salmonella in cut tomato model created here provides a useful tool for estimating the risk posed by different abuse temperatures. The results show that a small number of food samples held at elevated temperature conditions contribute to the greatest risk.

Opportunities and challenges for industry and government to utilize risk assessments for making food safety risk management decisions

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Abstract: A principal use of risk assessments by the food industry will be to design new processes to meet safety criteria or to validate the acceptability of existing processes. However, for this to become a reality regulatory agencies must, in a public and transparent process, decide upon a feasible acceptable level of protection (ALOP) and food safety objective or performance objective (FSO/PO) that minimizes adverse health outcomes. The PO will then be analogous to the maximum residue levels (MRL) issued for controlling chemical hazards. With an established FSO/PO, a company can then focus on conducting an exposure assessment (EA) for their process. To facilitate both the conduct and review of the EA, there would need to be accepted guidelines on data quality and EA protocols. Issues such as the number of and method for samples to be taken to establish the distribution of contamination, determination of various storage times and temperatures, specification of shelf life and consumer/food preparation behavior, and which uncertainty percentile (95th or 99th) meets the standard, would need consensus. Another issue is whether an infrequent outlier or out-of-process event should be included in the distribution and determination of whether a process achieves a FSO/PO or should this event be considered a HACCP failure that should be controlled by process control/management. In the past, validation of food processes associated with HACCP plans has been quantitative in the evaluation of each process step, particularly if it is a CCP. However, a rigorous mathematical validation of the entire process is less frequently accomplished. For risk assessments to reach their potential as a tool to develop scientifically valid and effective HACCP systems, quantitative targets must be established by government and calculating EAs must become a standard procedure by the food industry.

Assessing the risk of foodborne illness caused by norovirus transmitted in the food service systems

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Norovirus (NoV) is currently regarded as the leading cause of gastroenteritis in the United States. The Centers for Disease Control and Prevention (CDC) estimate that 23 million cases of acute gastroenteritis are caused by NoV annually and 39% of all recorded NoV outbreaks occur in

restaurant settings. In a foodservice system, good hygiene practices can help to reduce the virus spreading rate and risk of cross contamination. The purpose of this study was to build a simulation model that mimics the complex interactions involved in NoV transmission, which may take place in a food service system and to use the model to study interventions that might reduce risk. Data from the peer-reviewed literature were collected and used to build the model. Due to the limited availability of published data, our model focused primarily on quantifying the effects of specific steps on NoV transmission including (1) transmission between food, hands and other possible sources of contamination, (2) virus survival on different surfaces and (3) the effect of different hand treatments on virus reduction. The model was built with the discrete-event simulation package, Arena® (Rockwell International), and used to simulate foodservice worker movement, as well as virus transfer and survival. The model shows key points in the virus transmission process that lead either to further spread or to reduction in the spread of the virus. Effective hand washing may prevent some but not all of the exposed population from getting infected with norovirus. The result has the potential to reduce the morbidity and economic loss currently associated with NoV outbreaks, and to identify key foodservice worker behaviors that affect virus transmission.

Estimating salmonella attribution from chicken, pork and ground beef

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Salmonellosis was the second highest reported enteric disease in the Region of Waterloo, Ontario, Canada in 2006. Retail contamination data from June 2005 through June 2008 was available through C-EnterNet, a federally funded surveillance program currently operating in the Waterloo Region, for Salmonella in chicken breasts, pork chops and ground beef. This data allowed for a model to be developed from the retail level, predicting the proportion of illness attributed to each of the three fresh meat products. The model contains modules that take into account the behavior of Salmonella on each meat product throughout the retail to consumption pathway, and was created using the @Risk v 4.5 platform for Microsoft Excel. The model estimates the probability of illness per serving of each type of meat; and then a relative risk calculation is performed to estimate attribution of salmonellosis from the three types of meat considered. The results indicated that if a person were to acquire salmonellosis from food consumption, and they had consumed all three types of meat, the likelihood that they became ill from consuming the chicken breast would be much greater than the chance of attribution from either the pork or beef. These results suggest that chicken breast consumption provides a greater risk of illness than pork chop or ground beef consumption in Waterloo Region when consumed in equivalent amounts. The model has the potential to be developed further, as additional transmission pathways could be included along with other chicken, pork and beef products, if appropriate data was available. Other pathogens could also be investigated using the developed model framework and regional data collected by C-EnterNet.

Quantitative Microbial Risk Assessment for salmonella in peanut butter

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Two large outbreaks of salmonellosis associated with peanut butter in the United States in 2006-2007 and 2008-2009 have recently underscored the potential of this shelf-stable food to cause large outbreaks. The objective of this work was to develop a quantitative microbial risk assessment (QMRA) that incorporates key variables such as: initial concentration of Salmonella, the degree of thermal process applied, and the amount of peanut butter per finished product serving and the total number of servings on the market. The QMRA was developed using @risk (Palisade Corporation,

Ithaca, NY). Non-linear inactivation kinetics for Salmonella in peanut butter was based on published models. These models were developed in model systems (not peanut butter) so they were also validated by comparison with death kinetics for Salmonella in actual peanut butter. A Salmonella dose response model was adapted from the one used for the FAO/WHO risk assessments of Salmonella in eggs and broiler chickens. Good agreement was seen when the thermal inactivation data in peanut butter was compared to the models. The QMRA demonstrates that even given a low initial concentration of Salmonella cells (1.5 CFU/ g), what would normally be considered a severe process (60 C, 10 min), and a small amount of peanut butter in the finished product (3 g/ serving), when a large number of servings (151) are considered, a significant number of illnesses (>10) are typically predicted by the risk assessment. An analysis of the publicly available data from the two outbreaks leads to similar findings even low initial levels of Salmonella contamination may not be controlled by typical peanut butter thermal processes, and can result in large numbers of illnesses. The QMRA will be useful for food companies seeking to assess the risks posed by particular raw material standards or standard processes.

Recall

Predictors of consumption of recalled foods

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Abstract: The purpose of this study was to identify the demographic characteristics of Americans who are most likely to disregard public health messages and consume recalled food. This analysis may help in the design of targeted communications to those segments of the population with a high risk of becoming ill from food that has been identified as unsafe. A survey research firm was hired to conduct a national, random-digit dial telephone survey of 1,101 Americans in all 50 states. Data were collected during summer of 2008. The survey focused on perceptions of and behaviors related to food recalls. We found that 11% of the sample reported having knowingly eaten recalled food in the past. Logistic regression indicated that those who do not work outside the home and those who are not white were significantly more likely to report having knowingly eaten a recalled food (ps < .01). However, household income was not significantly associated with knowingly consuming recalled food, making it less clear whether economic hardship may be related to this risk behavior. In addition, gender, education level, and being a caretaker of at least one child were not related to consumption of recalled foods. To further explore why some Americans engage in this risk behavior, open-ended responses to a question about why respondents ate recalled foods were coded and categorized. The most frequent reasons given include the belief that they are personally invulnerable to foodborne illness, lack of trust in the government and news media, and a trust in retailers to keep them safe from harm. By identifying important demographic variables as well as the common rationalizations for engaging in the risk behaviors, these findings may help risk communicators to more effectively convince the public to take appropriate actions with foods they know to be potentially unsafe.

Understanding Consumer Responses to Food Recalls

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Abstract: When food companies discover that a product may contain unacceptable levels of pathogens or other contaminants, they usually voluntarily issue a recall notice to recover any

unconsumed products thought to pose a risk. These recall notices are intended to alert retailers to remove unsold products from their shelves, and to warn consumers to destroy or return products that they have already purchased. To be effective, food recalls must therefore generate sufficient attention and motivation among consumers that they take appropriate protective actions. Unfortunately, the typically low rates of recovery of recalled food products suggest that this is not happening. To understand why, and to yield insights into how to improve food recall risk communications, a random sample of 1101 American adults in all 50 states was interviewed in August and September of 2008. The results of this national survey suggest that most Americans view food recalls as important and as saving lives. They also report paying considerable attention to recalls and telling others about them. However, many believe that recalls are relevant to others and not to themselves, demonstrating the classic optimistic bias. Indeed, only 59 per cent say they have ever looked for recalled products, and many appear to maintain an illusion of invulnerability with 12 per cent of Americans reporting having eaten a food they thought had been recalled. The survey results also suggest that consumers conduct a kind of "lay risk assessment" to determine whether it is in their interests to pay attention to the recall or to take actions in response. Thus, they appear to highly value information that allows them to judge the potential likelihood and severity of consequences related to a food recall. Consistent with this, 73 per cent of Americans say they would want to receive personalized information about recalls on their receipt at the grocery store, and 64 per cent said they would want to receive such information through a letter or an email.

Surveillance: mapping in environmental health

Seeing and Believing: Exploring Public Understanding of Environmental

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Although maps are increasingly used to communicate environmental risk information to the public, very little is known about how map information is understood and potentially acted on. MacEachren adopted theories of spatial cognition to posit that cognitive representations derived from maps are a function of what is "seen" and prior knowledge. Visual features may influence discrepancies between the intended and imparted representations derived from a map. Representations encompass knowledge, beliefs, emotions, and behavioral intentions; beliefs are a stronger predictor of protective health behavior than knowledge. The enumeration unit used to display risk data may influence representations. For example, a map can depict risk data as points or as statistical information smoothed across a geographic area (a choropleth map). When data is sparse, hatching is recommended for conveying uncertainty on choropleth maps. For point maps, uncertainty is indirectly communicated by the density of points across an area. The purpose of this study was to apply MacEachren's framework to assess what people "see" and understand from risk information designed to vary by format (map, alphanumeric table), enumeration unit (point, choropleth), data uncertainty (high, low), and risk Oess, more). Risk information depicted water test results for private wells. Three sequential rounds of cognitive testing interviews among 13 private well users were used to collect data. Choropleth maps conveyed a stronger risk message than point maps or tables, likely due to visual salience. A dewer's perceived proximity to mapped hazards relative to their perceived residential location influenced risk beliefs. Perceived hazard proximity effects were most evident for point maps and least for tables. These and other findings suggest that ,visual features and format shape knowledge and beliefs, beliefs derived from maps can be accurate when derived knowledge is inaccurate, and prior knowledge influenced ,what was seen and understood.



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