

# Exploring the relationship between product testing and risk

## SUMMARY

Risk to consumers is directly related to prevalence and concentration of pathogens in products. Sampling to determine if levels of pathogens are at acceptable levels is one approach adopted to manage the consumer risk. However, the relationship between different sampling options, and the reduction in risk provided by implementing those options has not been well described. In this project we will develop a sampling-risk model that quantifies the relationship between product testing and the risk to consumers. This model will consider factors such as sample size (mass), number of samples, lot size, and many others. These analyses can be used to explore the efficacy of alternate risk management strategies, and help answer questions such as “If I increase the sample mass what is the impact on risk?” or “If I sample at point X instead of point Y, what will the benefit be?”

## OBJECTIVES

1. Develop a sampling-risk model that quantifies the relationship between product testing, lot rejection rates, and risk (which is directly related to prevalence and concentration in products post testing).
2. Provide detailed, fully documented, analyses of the relationship between product sampling variables driving the risk.
3. Support risk reduction initiatives through analyses that explicitly enable the exploration of risk management options, facilitating selection of actionable sampling strategies that have the biggest impact on risk reduction.

## METHODS

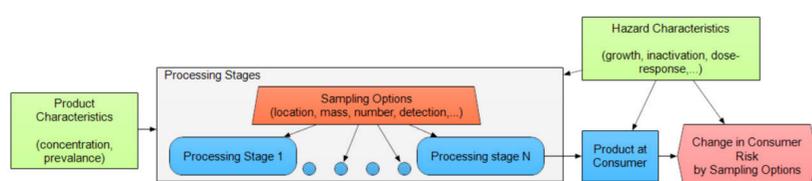
**Risk model development:** We are developing a quantitative model that links the frequency of contamination and concentration to lot rejection considering multiple sampling plan options (sample location, sample mass and number, proportion of lots tested, etc.). We will link this sampling model to a supply chain model to predict concentration and prevalence of microbial hazards post sampling to estimate risk to the consumer, and explore the residual risk post sampling (model framework is shown in **Figure 1**).

**Model analyses:** We will use the sampling-risk model to explore the impact of the sampling options and incorporate factors that will further impact the risk post-testing (e.g., possible pathogen growth) and develop real-world case studies.

**Stakeholder engagement:** The project stakeholder group is involved throughout the project, including an online workshop to discuss the early findings and the sampling options that are most (and least) influential on lot rejection and residual risk.

## RESULTS TO DATE

Model development has begun. To date we have explored the current knowledge base with respect to the underlying statistical properties of sampling plans and have identified the key components required by the mathematical model. The underlying statistics behind the basic properties of sampling plans are being implemented in the modelling system to describe the relationship between sample plan options and the risk remaining post sampling. Both two-class and three-class sampling types are being implemented in a way that allows easy exploration of the impact of the inputs (number of samples, sample mass, etc.). **Figure 2** and **Figure 3** show examples of the types of relationships being explored.

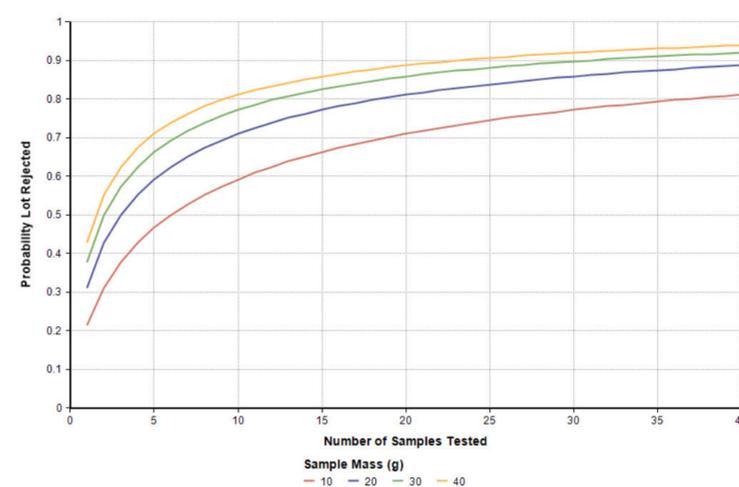


**Figure 1.** Model framework for the sampling-risk model linking sampling options to consumer residual risk.

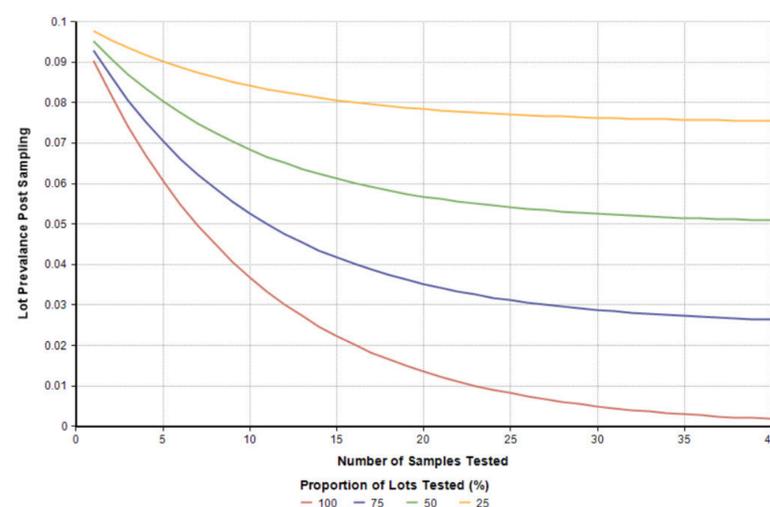
To support the case study development we are researching the source of outbreaks and recalls (related to microbial contamination) to determine candidates for the case studies that are recognized as part of the current produce risk issue.

## BENEFITS TO THE INDUSTRY

- Provide industry with a modelling approach that facilitates exploration of the benefit of various sampling strategies to reduce risk to the consumer
- Enable industry to explore the efficacy of alternate risk management strategies, helping answer questions such as “If I increase the sample mass what is the impact on risk?” or “If I sample at point X instead of point Y what will the benefit be?”
- Access to a detailed report, including a series of tables and charts that describe the relationship between the factors and risk
- A series of analyses relevant to a range of produce items (e.g., baby greens, whole head greens, cole crops, tomatoes, onions, peppers, celery, pome fruits, stone fruits, and tropical fruits).



**Figure 2.** Relationship between the number of samples tested, the sample mass, and the probability a lot is rejected based upon a hypothetical contamination scenario.



**Figure 3.** Relationship between the prevalence of contaminated lots post sampling, the percentage of lots tested, and the number of samples tested per lot (based upon a hypothetical contamination scenario).



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