RUTGERS
New Jersey Agricultural Experiment Station

Quantitative Microbial Risk Assessment: Introduction and Examples

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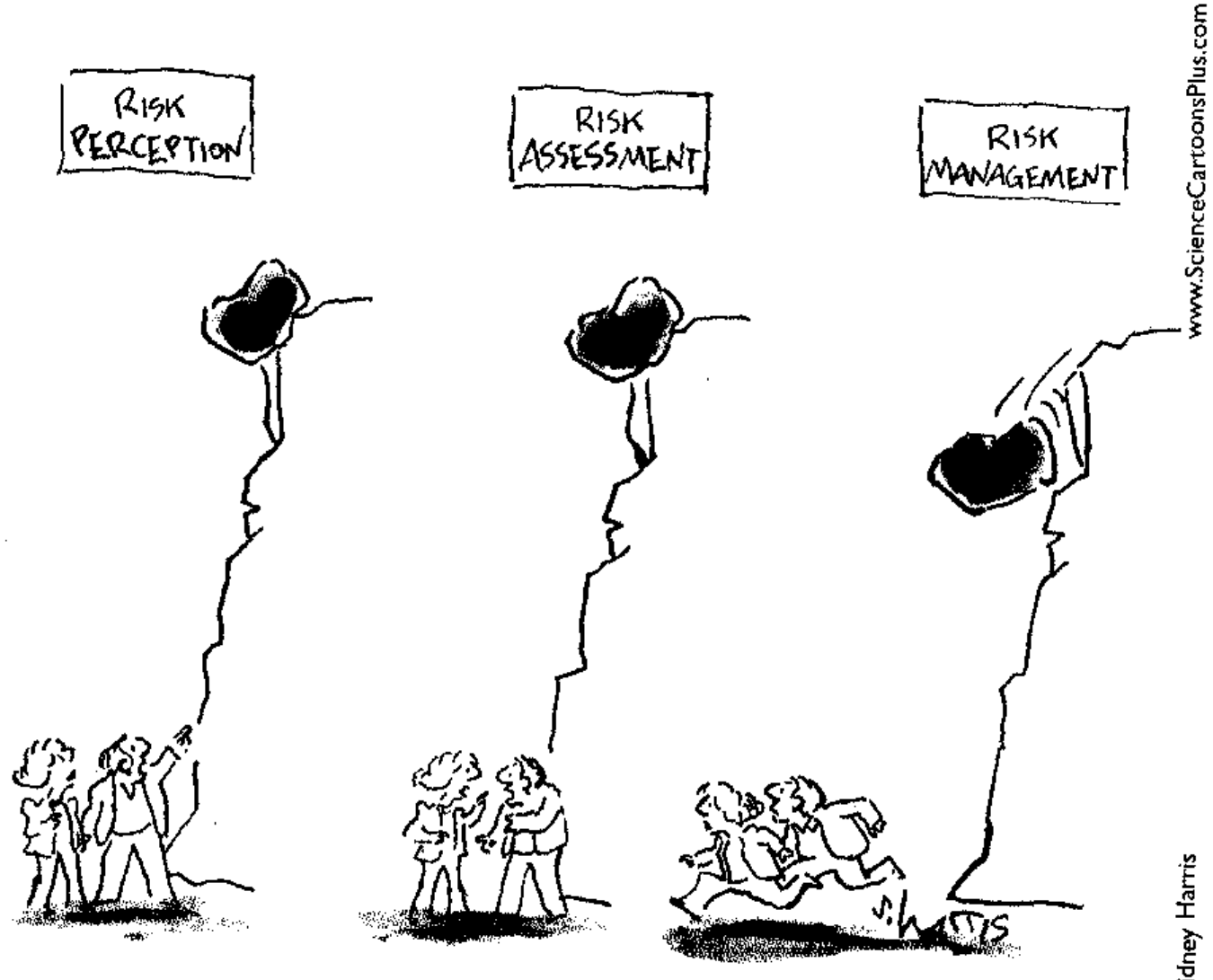
Risk Analysis Components

- (Quantitative) Risk Assessment
  - How big is the risk, what factors control the risk?
  - Scientific process
- Risk Communication
  - How can we talk about the risk with affected individuals?
  - Social and psychological process
- Risk Management
  - What can we do about the risk?
  - Political process


RISK PERCEPTION
RISK ASSESSMENT
RISK MANAGEMENT
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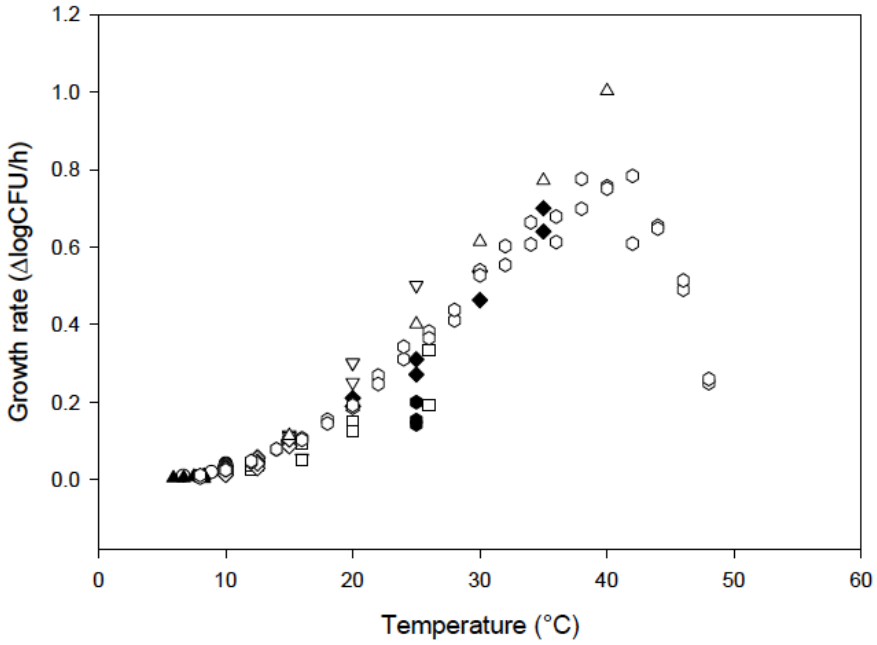
Step in Risk Assessment

- Hazard Identification
  - What microbe, food(s) and people are involved?
- Exposure Analysis
  - What is the chance of exposure?
  - How many cells?
- Dose-Response Analysis
  - What is the human health effect of the exposure?
- Risk Characterization
  - Complete picture of the assessed risk

Importance of risk assessment

- Teaching
  - Students can see “what if…”
- Research
  - Pinpointing uncertainties or knowledge gaps
- Industry
  - Optimizing safety while retaining quality
- Government
  - Designing regulations for the greatest benefit

Salmonella growth in raw chicken



- One hundred and twelve Salmonella spp. growth rates were extracted from twelve published studies
- Used to develop a model relating growth rate of Salmonella spp. on poultry to incubation temperature
- Results do show a consistent pattern, despite being collected in different labs, different methods, different strains

Application of the model

- The US regulations (9CFR, 381.66) state that eviscerated poultry to be shipped from the establishment in packaged form shall be maintained at 40F (4.4 C)
- These regulations also allow the internal temperature to rise to a maximum of 55F (12.8 C) during further processing and packaging operations provided that immediately after packaging, the internal temperature of the poultry is promptly lowered to 40F (4.4 C) or less, or the product is frozen.
- These regulations certain times for cooling from poultry body temperature after slaughter

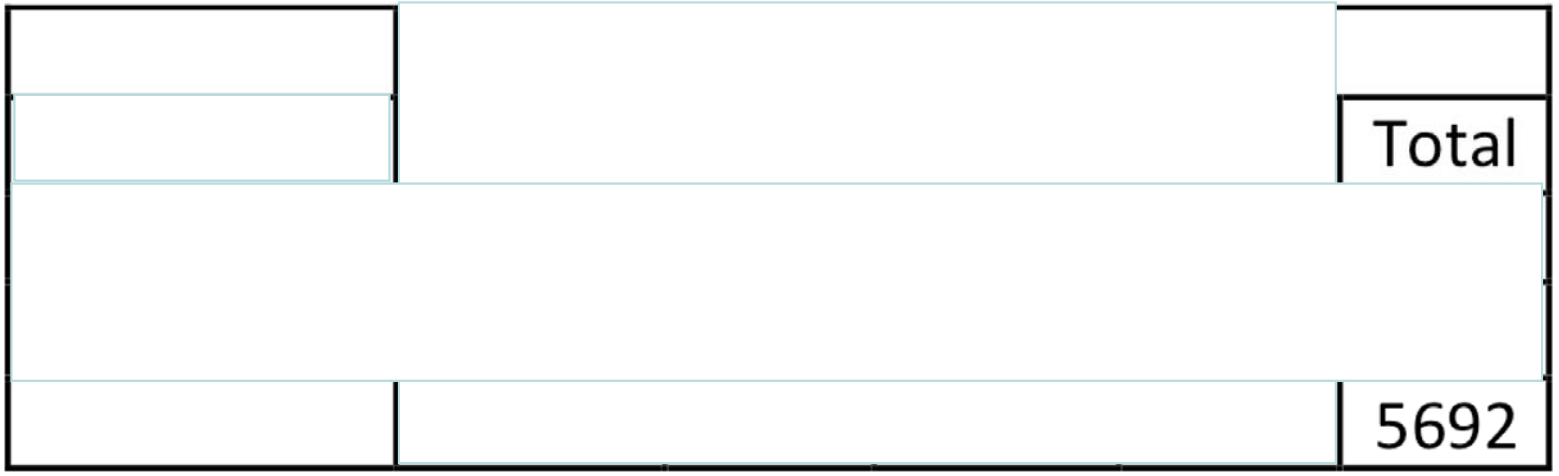
Application of the model

Slaughter (84° F [28.9° C] bird body temperature) and cooling to 40° F (4.4 ° C)	0.80 log increase (more than two doublings, one cell to six cells)	Allowed
Holding product at 54° F (12.2° C) for an entire 8 hrs shift	0.38 log increase (slightly more than one doubling)	Allowed
Holding product at 56° F (13.3° C) for an entire 8 hrs shift	0.49 log increase (one cell to three cells)	Not allowed
Processed product rises to 65° F (18.3° C) and then is cooled to 40° F (4.4° C) in 6 hrs	0.32 log increase (one doubling, one cell to two cells)	Unknown, but safe by comparison!

Salmonella and indicator organisms

- Recent U.S. Salmonella outbreaks and recalls:
  - Peanut Butter Corporation of America outbreak
  - Plainview non-fat dry milk recall,
  - Basic Food Flavors hydrolyzed vegetable
- Importance of controlling Salmonella in Formulated Dry Foods
- Typical practice is to monitor Salmonella and indicators except on food contact surfaces where indicators alone are monitored

Environmental Sampling Results*



- * fiction, based on true events…

Mathematics of Environmental Sampling

	Enterobacteriaceae				
Salmonella	Absent	<100	>=100	TNTC	Total
Absent	4400	1000	40	200	5640
Present	10	15	2	25	52
	4410	1015	42	225	5692

- Odds of salmonella occurring, 0.9%
- Odds of EB occurring at TNTC, 4%
- Odds together 0.9*4.0 = 0.04%
- Actual odds together = 24/5692 = 0.44%

Concluding messages

- Quantitative microbial risk assessments can be a valuable tool for
  - Assisting food companies (as well as government policy makers)
  - Identifying data gaps
- Environmental sampling of increased interest
  - A risk based approach can be used if large datasets are available
- Predictive models are useful
  - May be useful in developing science based regulations
- Increased recognition of value of models and risk assessments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