Listeria monocytogenes and Ready-to-Eat Foods: Tackling a Wicked Problem using Grounded Theory

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Outline of Presentation

- Rationale
- L. *monocytogenes* and RTE foods
- Wicked problems
- Purpose
- Methodology
- Results
- Strengths and limitations
- Potential implications

Study Rationale

- Large-scale outbreaks (e.g. Maple Leaf, 2008)
- L. *monocytogenes* and RTE meat recalls
- Ingestion of L. *monocytogenes* can cause listeriosis
- Invasive vs. non-invasive
  - Invasive form of listeriosis
    - 25.23% case fatality rate (Ruzante et al., 2010)
    - Salmonellosis (non-typhoid) < 1% case fatality rate
- RTE meat industry to Canada
  - $1 billion dollars in sales annually

L. *monocytogenes*, listeriosis and ready-to-eat foods

- Gram positive bacterium, ubiquitous and hardy
- Can endure harsh pH and salt concentrations, grow at 4℃, with some studies demonstrating quaternary ammonium resistance (Heir et al., 2004)
- Concern for:
  - Immunocompromised and the elderly
  - Pregnant women

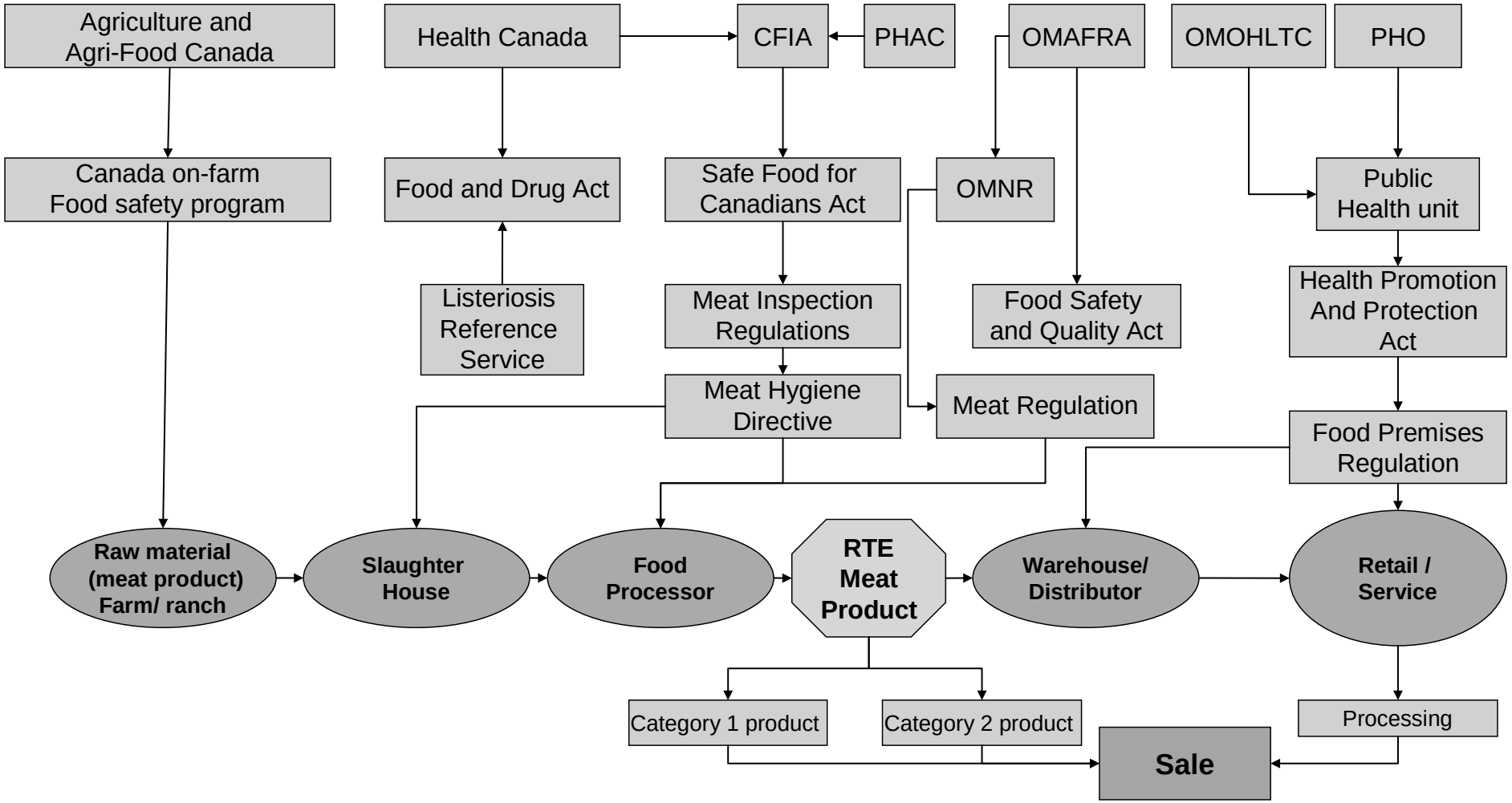
L. *monocytogenes*, listeriosis and ready-to-eat foods

- Low incidence rate
  - Non-invasive forms and mild symptomology
  - Long incubation period
- Evolving product compositions and products
  - Weatherhill report – low sodium products
  - Movement towards ready-to-eat, prepared foods with little 'hazard reduction' steps
- High profile microorganism due to the products it is associated with
  - Children and lunches
  - The elderly

L. *monocytogenes*, RTE foods: current challenges

- The processing and distribution of RTE foods in Ontario is a complex process
  - Multiple agency involvement with regulatory and inspection requirement differences
    - Federally licenced products – CFIA
    - Provincially licensed products – Provincial health units (**new provincial regulations – 2014)
    - Locally produced products – Public Health units
  - Products cannot exceed 100 CFU/g through the stated shelf life (Health Canada, 2011)
  - Lack of laboratory testing for enumeration
  - Product labelling

Process Flow Map: Canada/ON



A wicked problem: RTE foods and L. *monocytogenes*

- Various criteria
  - No clear and correct solution
  - Many stakeholders
  - Responsibility is stretched
  - Continuing evolution and multi-causal aspects
  - Difficult to solve and clearly define
  - No agreement on problem
    - (Head & Alford, 2008; Kreuter et al., 2004)

Wicked Problem Variables

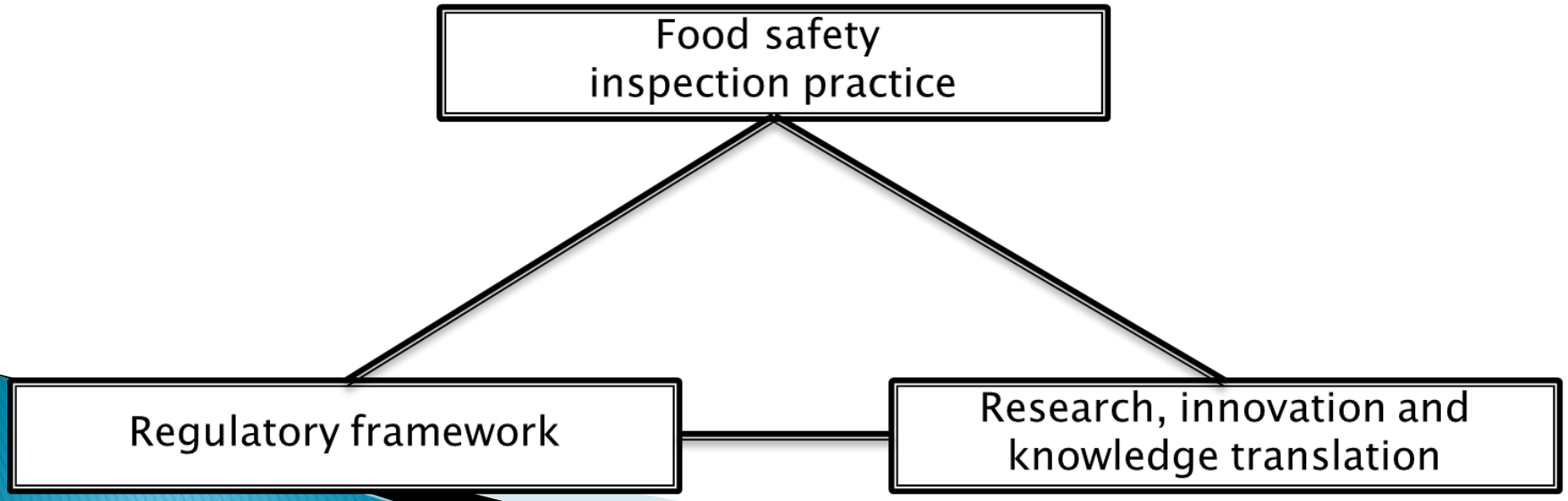
Wicked problem variables*	Examples: ready-to-eat foods and listeriosis
Difficult to solve and clearly define*	Long incubation period and source of contamination in processing environments challenges validity of incidence rates and investigations
Many interdependencies and multi-causal aspects*	Process of investigating listeriosis cases involving RTE requires examination of retail and processing environment and may involve the federal, provincial and public health unit in order to determine the source of the product and contamination
No clear and correct solution*	There are a number of differences in inspection processes and regulatory requirements between the CFIA, OMAFRA and public health units in how RTE foods are inspected and regulated
Problems have many stakeholders*	There are up to 8 governmental agencies associated with the regulation, oversight and inspection of the production and distribution of federally inspected products
Responsibility stretches across many organizations*	Agencies share responsibility at some capacity in reducing introduction of the organism within processing environments and replication of the organism within RTE products after distribution and sale
Solutions may require behavioural changes from stakeholder groups*	A number of strategies for reducing loading of L. *monocytogenes* in RTE meat products are available, however, product recalls continue to occur
Problems may be unstable and continue evolving*	470 individual RTE meat products have been recalled by CFIA due to higher than acceptable levels of L. *monocytogenes* between 2008 – 2011
No agreement exists as to what problem is**	Presence of the organism in RTE foods may originate from the initial processing or via further processing (e.g., cross-contamination) after sale/distribution
Lack of stopping rule**	Rates of listeriosis in Canada has increased since 2007***

Purpose

- Focus on public health units (36) in Ontario
- Determine how public health units address the wicked problem of Listeria *monocytogenes* and ready-to-eat foods in their food safety inspection programs
- Develop a theory that identifies gaps (if any) in public health unit inspection practices, provincial legislation or food safety research

Research Questions

- Central Research Question
  - *do Ontario health public unit inspection practices and food safety regulation use research, innovation and knowledge translation (KT) through experience to effectively address RTE foods in food premises and reduce the burden of listeriosis?*



Methodology

- Sampling – request to participate to all 36 public health units, food safety programs
  - Public Health Inspectors
  - Management (MOH, Directors, Managers, Supervisors)
- Eligibility criteria
  - Minimum 3 years in position
  - Work in food safety program (inspection, management)
  - Certified public health inspector or Medical Officer of Health

Eligibility Criteria: 3 groups

Eligibility criteria	Food safety management	Public health inspectors	Key informants
Experience in position	Minimum 3 years experience in managing/supervising certified public health inspectors involved with the inspection of food premises	Minimum 3 years experience acting as a certified public health inspector involved with the inspection of food premises	Minimum 3 years experience in working with the food safety program in an epidemiology, policy or research capacity
Education	Certified public health inspector (Canada) or Medical Officer of Health	Certified public health inspector (Canada)	Minimum Bachelors degree for associated position in the public health unit
Program involvement	Involved with food safety program management in accordance with the Ontario Public Health Standards, Health Protection and Promotion Act and Food Premises Regulation	Involved with inspection of food premises in accordance with the Health Protection and Promotion Act and Food Premises Regulation	Involved with assisting the public health unit food safety program in reducing foodborne illness through various initiatives and activities
Association with Food Premises Regulation	Administrator of public health inspectors with direct application of the Food Premises Regulation	Administrator of regulation to food premises	Knowledge of the application of the Food Premises Regulation to the public health unit food safety program
Employment status	Currently employed with 1 of the 36 public health units in the province of Ontario	Currently employed with 1 of the 36 public health units in the province of Ontario	Currently employed with 1 of the 36 public health units in the province of Ontario
Consent	Has provided consent to be interviewed in accordance with ethics requirements and letter of consent	Has provided consent to be interviewed in accordance with ethics requirements and letter of consent	Has provided consent to be interviewed in accordance with ethics requirements and letter of consent

Methodology

- 3 phases
  - Phase 1 & 2 – interviews (telephone and in-person)
    - Health units grouped into categories based on size of health unit (1,2 or 3)
  - Phase 3 – survey (internet via Fluid surveys)
    - Likert scale (level of agreement) – phase 3 surveys
- Grounded theory approach – interviews
  - Coding
  - Richardson and Kramer (2006):
    - Glaser (1967) – traditional
    - Strauss and Corbin (1999)
    - Charmaz (2006)

Charmaz principles

Charmaz principles*	Study activity
Structuring of inquiry*	Facilitation of semi-structured interviews using open-ended questions to generate dialogue and free-style response
Simultaneity of data collections and analyses*	Use of interview data, public health unit documentation, memoing and constant comparison approach to theory generation
Generation of a new theory rather than the verification of an existing theory*	A lack of theory generation addressing the wicked problem exists in research. Theory generation based on methods described in grounded theory research
Refinement and exhaustion of conceptual categories through theoretical sampling*	Through the process of triangulation and in implementing 3 phases of inquiry, conceptual categories were processed through a staged approach

Phase 1 Questions

Participants	Question	
-Food safety management **-Public health inspector** **-Key informants**	What is your opinion in regards to the roles and responsibilities of public health units in inspection and investigation of RTE meats and L. *monocytogenes?*	
	Sub-questions (if necessary)	- What are your thoughts on provincial policies and regulation of RTE meats and L. *monocytogenes*? - How does your public health unit incorporate research, innovation and knowledge translation into your inspection program in relation to RTE meats and L. *monocytogenes*? - Does your public health unit face technical, economic and political issues in regards to RTE meats and L. *monocytogenes*?
	Tell me about a time when you addressed L. *monocytogenes* and RTE meats within your food safety program?	
	Sub-questions (if necessary)	- Did this result in a change to your policies and procedures related to RTE meats and L. *monocytogenes*? If so, what was the change? - Are there any other examples you can provide?
	What resources do you use for the purposes of the development of your food safety program in particular to RTE meats and L. *monocytogenes*?	
	Sub-questions (if necessary)	- Are there any best practice documents that you can reference that you have used in the past? - Are there any resources you would like to have developed for your food safety program in particular to RTE meats and L. *monocytogenes*? Who would you say is the best organization to develop these resources?
	What lessons has your food safety program drawn from outbreaks, recalls and investigations involving L. *monocytogenes* and RTE meats?	
	Sub-questions (if necessary)	- How did you address these outbreaks/recalls? - How would you have liked to have addressed these outbreaks/recalls?

Phase 2 Questions

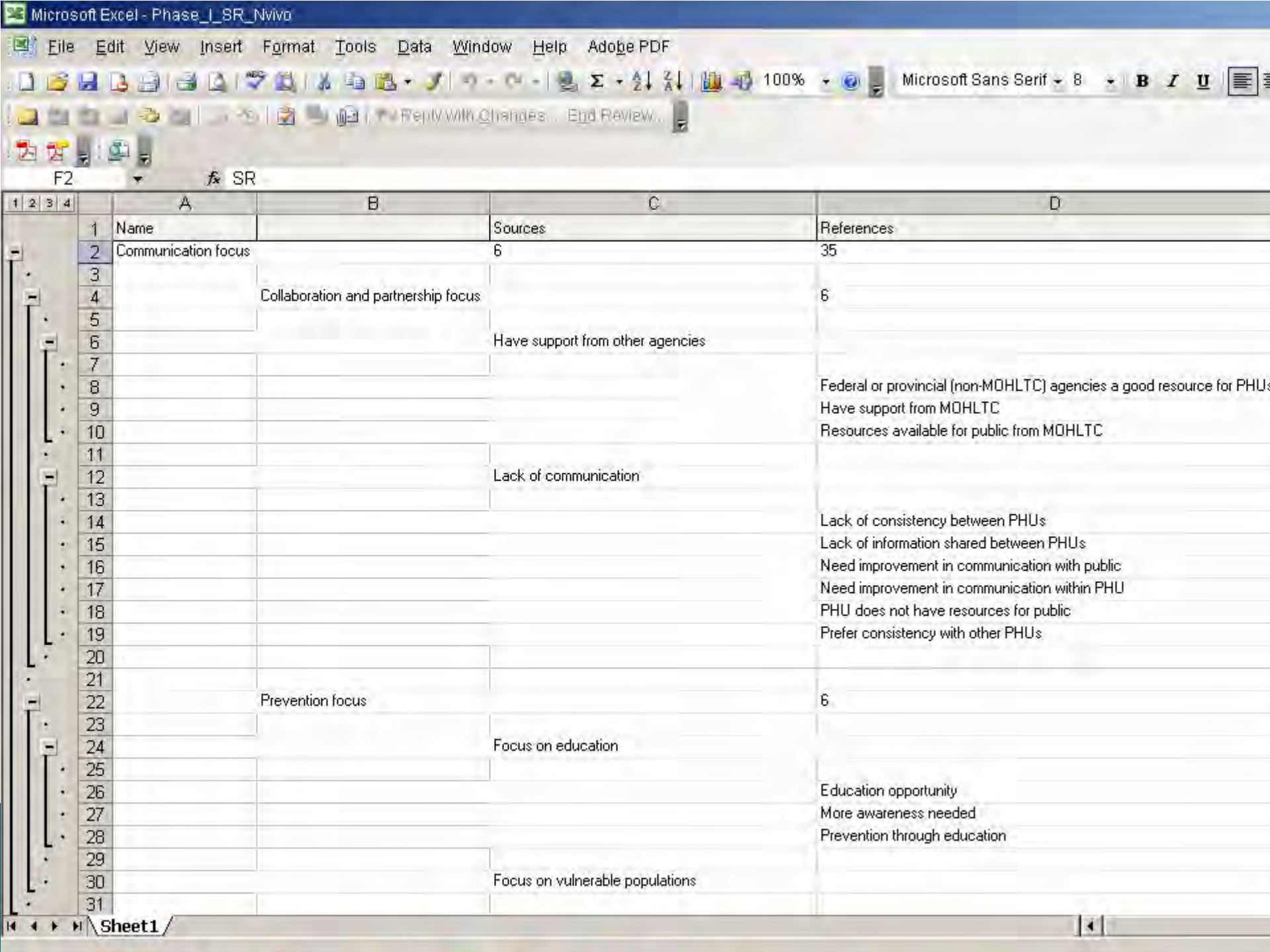
Core categories (phase I analyses)	Questions and sub-questions	
Prevention through collaboration	Based on your experience with the following agencies, describe your relationship in particular to L. *monocytogenes* and RTE meats with: (i) CFIA (ii) PHAC (iii) OMAFRA (iv) OMOHLTC (v) PHO Is there any room for improvement in the relationship you currently have with each of these agencies that would support the manner in which you address L. *monocytogenes* and RTE meats? Please describe.	
	Sub-questions (if necessary)	- What are your thoughts in regards to the roles of provincial and federal agencies in providing knowledge and expertise to Ontario public health units? - To what extent is the current MOU between OMAFRA, CFIA and Ontario public health units where processing facilities are not inspected by public health inspectors beneficial or a detriment to the overall inspection process?
Population and product-based management	What do you think Ontario public health units' role in institutional settings should be where vulnerable populations such as the elderly or the immunocompromised are housed and are served RTE meats?	
	Sub-questions (if necessary)	- Should the manner in which inspections are conducted at these facilities in Ontario public health units differ from other retail establishments that serve RTE meats? - Has your public health unit established a different approach in regards to these populations and facilities? Please provide any examples.
Response driven research	- In what ways did the L. *monocytogenes* outbreak in 2008 (Maple Leaf Foods) lead to changes to the manner in which your health department addresses RTE meats and L. *monocytogenes*?	
	Sub-questions (if necessary)	- What is your opinion in regards to the use of scientific research or government publications in public health units for the purposes of inspection and investigation of listeriosis? - Have government publications or scientific research had any effect on the day-to-day operations of your public health unit? - Does your public health unit currently have a L. *monocytogenes* policy in place? (YES - why did you feel it necessary to have one in place? NO – are there reasons why your public health unit does not have a policy?)
Regulatory and microbiological limitations	What is you opinion in regards to the current provincial food safety program in Ontario including the *Food Premises Regulation*, Ontario Food Safety Standard and Food Safety Protocol (2008) as it relates to L. *monocytogenes* and RTE meats?	
	Sub-	- Do you believe that past outbreaks, recalls and research in regards to L. *monocytogenes* and RTE meats have had an impact on the *Food Premises Regulation* along with the Protocol and Standard? Please explain.

Phase 3 Questions

Core variables (Phase 2 Analyses)	Questions
Communication and collaboration	Question # 1: Please indicate your level of agreement with the following statement: "The 2008 L. *monocytogenes* outbreak, along with subsequent food recalls involving L. *monocytogenes*, have had an effect on my public health unit's food safety inspection program and specifically, inspection of RTE meats in food premises"
Knowledge and statistical relevance	Question # 2: Please indicate your level of agreement with the following statement: "Research and government publications are tools that my public health unit uses to address food safety risks, including RTE meats and L. *monocytogenes*."
Responsibility and procedure	Question # 3: The current MOU between the OMAFRA, the CFIA and Ontario public health units states that licensed RTE meat processing plants are to be inspected by the licensing body (i.e., either by OMAFRA or the CFIA). Thus, typically, licensed facilities are not inspected by Ontario public health units. Based on your experience with this MOU, to what extent do you agree with the following statement: "Our public health unit rarely (if ever) communicates with OMAFRA or the CFIA in regards to their inspection of licensed RTE meat processing plants"
Responsibility and procedure	Question # 4: Please indicate your level of agreement with the following statement: "In order to address the risks of L. *monocytogenes*, Ontario public health units that inspect long term care facilities, homes for the aged, assisted living centres and retirement homes should have specific food safety requirements for food handlers who prepare RTE meats and serve to residents."
Regulatory focus	Question # 5: Please rate your level of agreement in regards to the following statement: "Our public health unit addresses L. *monocytogenes* and RTE as a part of the general inspection process. We do not currently have microorganism and product-specific policies and procedures in place that address L. *monocytogenes* and RTE meats explicitly"
Regulatory focus	Question # 6: Please indicate your level of agreement with the following statement: "The Ontario Food Safety program - including the Ontario Food Safety Standard, Ontario Food Safety Protocol (2008), and *Food Premises Regulation* -- has effectively incorporated recent research findings, and is using lessons from previous outbreaks (e.g., Maple Leaf Foods 2008) to better address L. *monocytogenes* in RTE foods"
Regulatory focus	Question # 7: Please indicate your level of agreement with the following statement in regards to *Food Premises Regulation*: "The *Food Premises Regulation* is sufficient for Ontario public health units to effectively address food safety risks, specifically RTE meats and L. *monocytogenes*"

Coding – Grounded theory and Nvivo

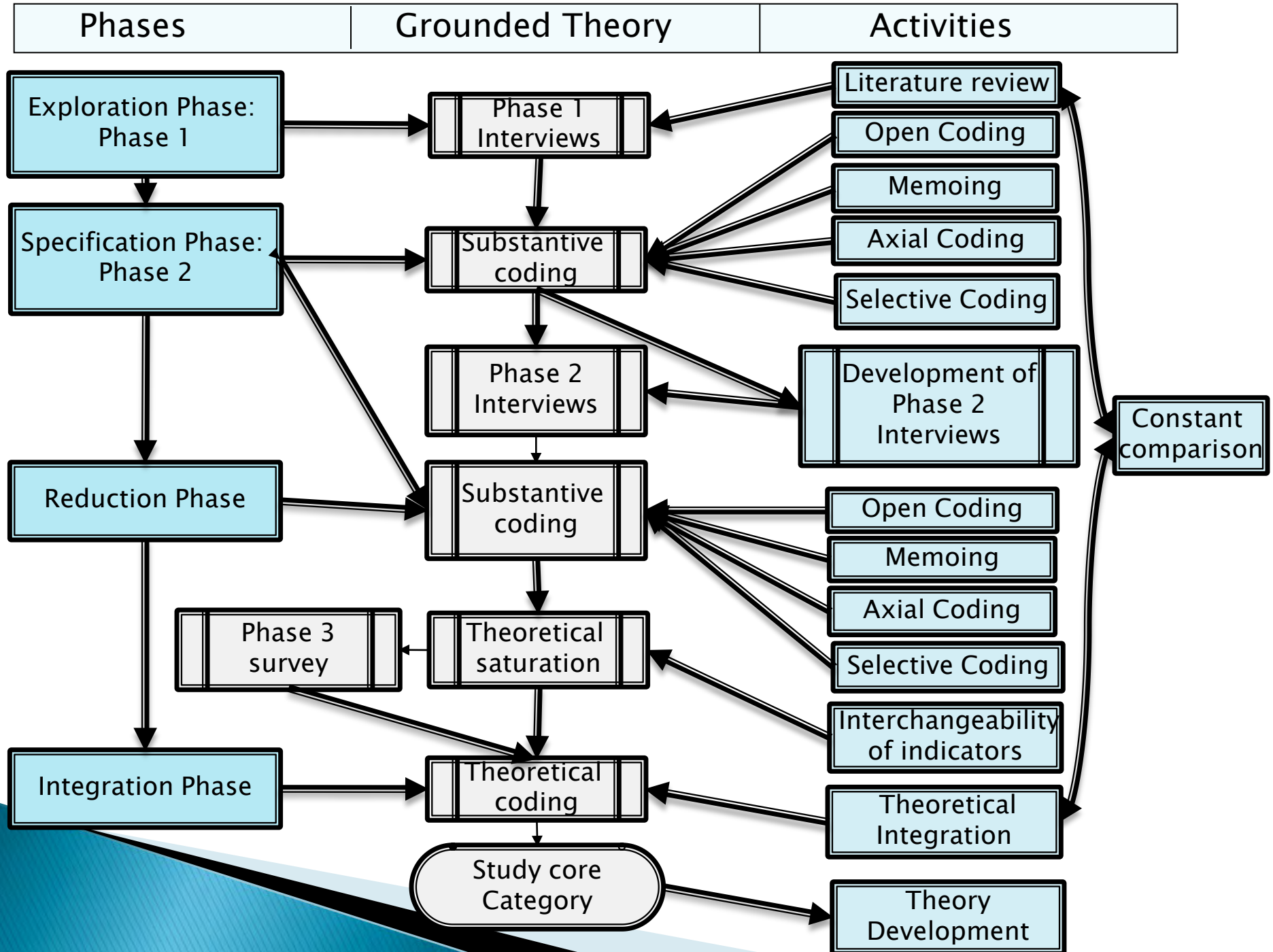
Open Coding (n)	Axial Coding (n)	Core Variable (n)	Selective Coding	Core Categories
- Have support from other agencies (8) - Lack of communication (10)	Collaboration and partnership focus (18)	Communication and Population-based focus (60): - agency collaboration, consistency and partnership - communication and information sharing - Crises management and response - prevention through communication - response - population-specific focus -	- Established process - Evidence-based practice - targeted prevention and education - Collaborative and partnership resourcing	- Prevention through collaboration - population and product-based management
- Focus on education (4) - Focus on vulnerable populations (13) - Already have sufficient regulations (12) - Enforce quality assurance by food premises (4) - Insufficient regulations (9)	Prevention focus (17) Regulatory focus (25)			
- Documentation is important (8) - Need revision of internal policies and procedures (3)	Procedural focus (11)	Procedural, microorganism and epidemiological focus (122): - Outbreak and recall approach - procedural and risk based activities - regulatory and microbiological approach - microorganism limitations to case association - microbial prevention and reduction - regulatory and statistics based - regulatory-based control	- reactive and collaborative response - Reactive and risk-based research - Prevention in investigative restriction	- Response driven research - regulatory and microbiological limitations
- Disconnect between inspection and responsibility (14) - Lack of support (16)	Responsibility focus (30)			
- Effectiveness is a priority (1) - Efficiency is a priority (3) - Focus on credibility (5)	Results focus (9)			
- Inspecting for microbiological hazards (29) - Involved with Listeria-related cases or food recalls (19) - Listeria and RTE meats are a concern (3)	Outbreak and food recall focus (51)			
- Lack of evidence-based action (2) - Lack of relevant data - Listeria not a burden of illness	Statistical focus (21)			



	A	B	C	D
1	Name		Sources	References
2	Communication focus		6	35
3				
4		Collaboration and partnership focus		6
5				
6			Have support from other agencies	
7				
8				Federal or provincial (non-MOHLTC) agencies a good resource for PHUs
9				Have support from MOHLTC
10				Resources available for public from MOHLTC
11				
12			Lack of communication	
13				
14				Lack of consistency between PHUs
15				Lack of information shared between PHUs
16				Need improvement in communication with public
17				Need improvement in communication within PHU
18				PHU does not have resources for public
19				Prefer consistency with other PHUs
20				
21				
22		Prevention focus		6
23				
24			Focus on education	
25				
26				Education opportunity
27				More awareness needed
28				Prevention through education
29				
30			Focus on vulnerable populations	
31				

Public Health Unit Criteria

Category	Criteria
Category # 1 public health units	> 15 public health inspectors within the food inspection program of the participating public health unit > 3000 food premises inspected annually within the food program of the public health unit > 10 managers dedicated to public health programming in the public health unit
Category # 2 public health units:	≥5 and ≤15 public health inspectors within the food inspection program of the participating public health unit ≥ 1500 and ≤3000 food premises inspected annually within the food program of the public health unit ≥ 5 and ≤ 10 managers dedicated to public health programming in the public health unit
Category # 3 public health units:	< 5 public health inspectors within the food inspection program of the participating public health unit < 1500 food premises inspected annually within the food program of the public health unit < 5 managers dedicated to public health programming in the public health unit


Phases
Grounded Theory
Activities
Exploration Phase: Phase 1
Specification Phase: Phase 2
Reduction Phase
Integration Phase
Phase 1 Interviews
Substantive coding
Phase 2 Interviews
Substantive coding
Phase 3 survey
Theoretical saturation
Theoretical coding
Study core Category
Literature review
Open Coding
Memoing
Axial Coding
Selective Coding
Development of Phase 2 Interviews
Open Coding
Memoing
Axial Coding
Selective Coding
Interchangeability of indicators
Theoretical Integration
Theory Development
Constant comparison

Participant Survey Profile

Management Cohort

Public Health Inspector Cohort

Years in Mngmt	# of OB's investigated	# of food premises selling RTE foods	# staff devoted to fs prgm	Training with the OMAFRA CFIA YES/NO?	Joint inspctn with OMAFRA/CFIA YES/NO?	If NO, HU acquires inspctn reports from OMAFRA/CFIA?	# years as a PHI	#outbrk involving listeria past 3 years -	#trainings on HACCP / Codex in the past 3 years -	# trainings on best before, product labeling in past 3 years -	Trained by a prfsnl instion in HACCP YES/NO	# full HACCP audits on RTE meat products	# food premises cndctd food/non-food contact surface testing
10 AVG	1.46 AVG	1378 AVG	16.5 AVG	3 YES	9 YES		13.6 AVG	0.95 AVG	2 TOTAL	4 TOTAL	8 YES	NONE	6 TOTAL
	35 total			21 NO	15 NO	2 TOTAL		23 TOTAL			16 NO		

Results

- 27/36 Health units participated (45 participants)
- Phase 1
  - 3 health units, 6 interviews
- Phase 2
  - 8 health units, 16 interviews
- Phase 3
  - 25 health units, 45 participant surveys
  - Phase 1 and Phase 2 participants were permitted to answer phase 3

Results – study themes and participant comments

- Population and product focus
  - *"the risks associated with RTE foods and their preparation can be dangerous for long term care facilities where vulnerable populations reside"*
- Responsibility and procedure
  - *"public health units have little control with regards to these products since they enter food premises in a contaminated state that we (public health inspectors) can do little with".*
- Communication
  - *"(we) have minimal or no contact with either agency (CFIA or OMAFRA) or the processing plants in regards to their inspections".*

Core Category and Variable Summary Chart

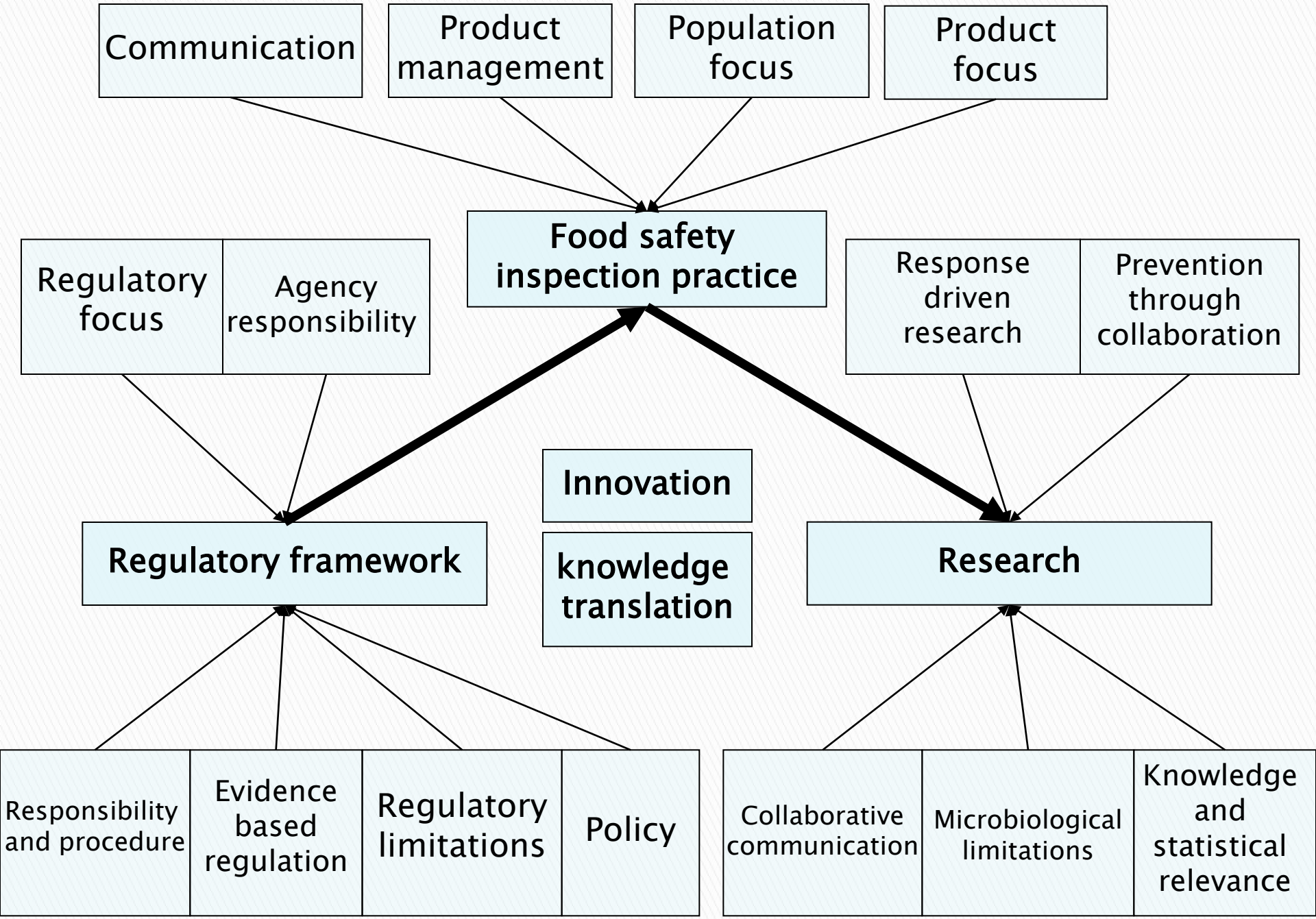
Theme	Phase 1 (core categories)	Phase 2 (core variables)	Phase 3 (core variables)
Ready-to-eat foods and population	Population and product-based management	Knowledge and statistical relevance	Population and product focus
Policy, procedure & responsibility	Prevention through collaboration	Responsibility and procedure	Agency responsibility and policy
Research, collaboration and communication	Response driven research	Collaborative communication	Communication and Research

Results

- Study core category
  - *Reactive and regulatory practice*
- Theory
  - *Ontario public health units manage ready-to-eat foods and Listeria monocytogenes through:*
    - *general population and reactive regulatory processes*
    - *focus on local-level, end-product, hazard reduction strategies*
    - *established risks in inspected food premises.*

Results and the central research question

1. The provincial regulatory framework
   - Responsible for directing food safety inspection
2. Food safety inspection/investigation activities, growth mechanics + inhibitors , government outbreak summaries
   - Focus of L. *monocytogenes* and RTE food research
   - Not being used in program delivery
3. Innovation and knowledge translation
   - Do not currently influence inspection practice
   - Traditionally found in research and gov't reports


Communication
Product management
Population focus
Product focus
Food safety inspection practice
Regulatory focus
Agency responsibility
Response driven research
Prevention through collaboration
Innovation
knowledge translation
Regulatory framework
Research
Responsibility and procedure
Evidence based regulation
Regulatory limitations
Policy
Collaborative communication
Microbiological limitations
Knowledge and statistical relevance

Potential limitations

- Sample size
  - small
- Participant inclusion process
  - HU's could choose who they wanted to under the specified criteria
- Wicked problem applicability
- Generalizability of results
- Interview method
  - In-person vs. telephone
- Phase 3 survey's and collaboration
  - Not able to control

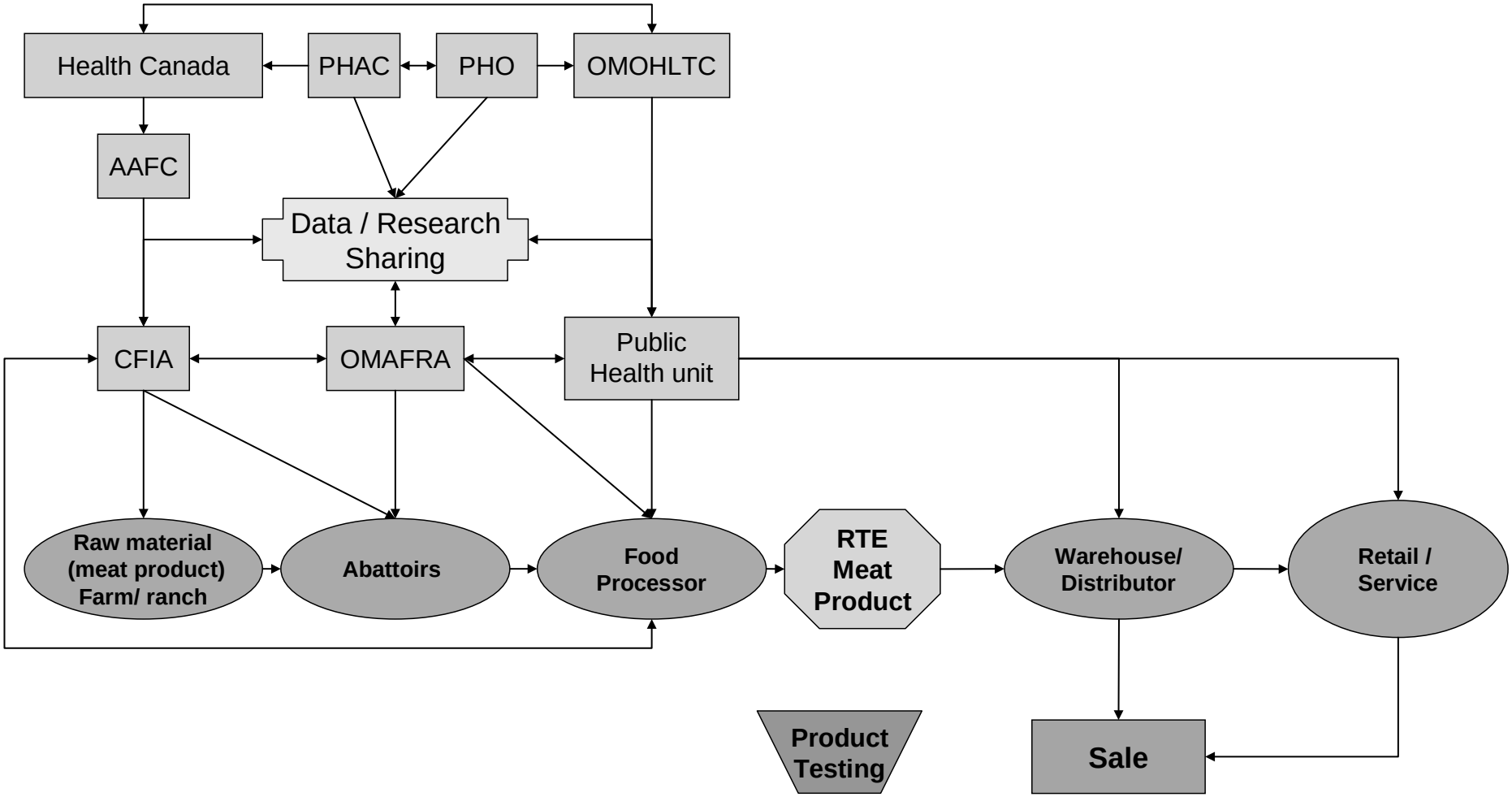
Potential Implications

- RTE foods and L. *monocytogenes* – a wicked problem
  - Under reporting
  - RTE foods
- Amending the provincial food safety regulation – training, labelling and HACCP principles
  - Frequency of amendments?

Potential Implications

- Embracing innovation, collaboration and applied research
  - Use of available research
  - Risk assessment
  - Surveillance and food borne illness
- Qualitative methodology (grounded theory) and public health
  - Applicability to other topic areas

Proposed Framework?




Blade Tenderized
For your safety, it is recommended cooking to a minimum internal temperature of 71°C (160°F).
Attendri Mécaniquement
Pour votre sécurité, il est recommandé de cuire à une température interne minimale de 71°C (160°F).
KIRKLAND Signature
STRIP LOIN GRILLING STEAK
BIFTECK DE CONTRE-FILET A GRILLER
Keep refrigerated / Garder Froid
PACK ON EMBALLE 12/OC/27
NET WT POIDS NET 0.976kg
PACK TIME HEURE EMB 03:20 PM
UNIT PRICE PRIX UNIT $15.69/kg

Past, Present and Future Steps

- CIPHI Conference 2013
- NCCEH
- PHO, MOHLTC results dissemination
- Publications
  - Environmental Health Review
  - Food Safety
  - Qualitative methods

Questions?

- Acknowledgements
  - Association of Supervisors for Public Health Inspectors in Ontario
  - Canadian Institute of Public Health Inspection
  - Research committee