Prevalence and quantitative microbial risk assessment of *Salmonella* in pork value chain in Hung Yen province, Vietnam

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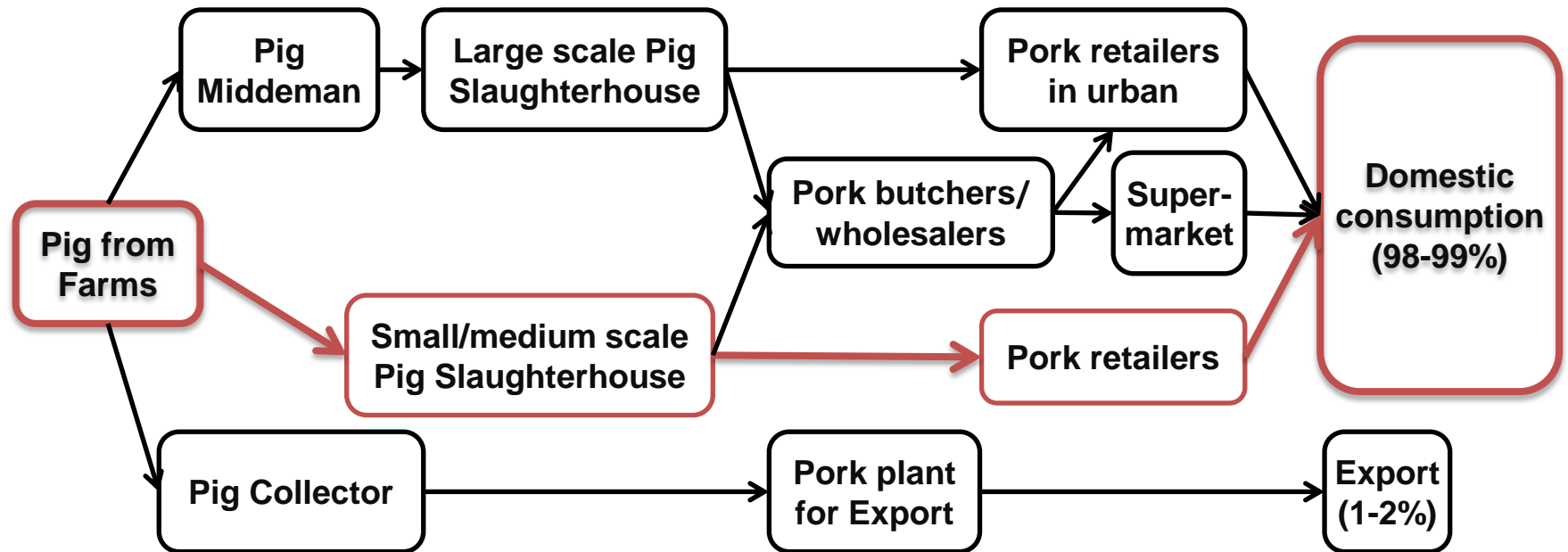2.3. Data collection and analysis

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1. Introduction

1.1. Pig value chains in Vietnam

- Pig production: About 26.5 million head/year (2015)

- Up to 80% of pork is produced by smallholder farmers and

- Most pork is sold in wet markets (Lapar, 2011)

- Popular consumed meat: 56% of total meat intake, 29.1 kg/ca/yr (OECD, 2016)

(Source: adapted from Vo T.T 2011)

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1.2. Pork safety and risk assessment

* Potential <u>biological hazards</u> in pork

Pork-borne pathogens
Parasite/Protozoa
• *Cysticercus cellulosae*
• *Trichinella spiralis*
• *Toxoplasma gondii*
Bacteria
• *Bacillus cereus*
• *Campylobacter*
• *Salmonella*
• *Staphylococcus*
• *Streptococcus suis*
• *Shiga toxin producing E. coli*
• *Yersinia*
Virus
• Hepatitis E

***Salmonella* spp.**

✓ 2 Species: S. *enterica* and S. *bongori*

✓ Serotypes: > 2,600 (Guibourdenche et al., 2010)

  • Typhoid *Salmonella* (S. Typhi, S. Paratyphi)

  • Non-typhoid *Salmonella* (Food-borne pathogens)
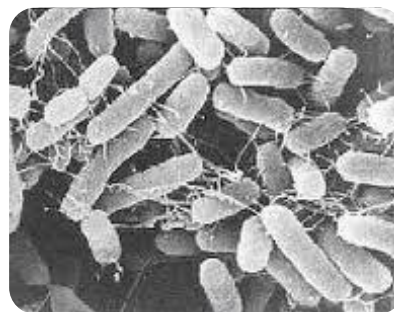
• Non-typhoid *Salmonella*

in food causes salmonellosis

Objectives: to present a QMRA model for the smallholder pork value chains for estimation of salmonellosis risk in humans in Hung Yen, Vietnam

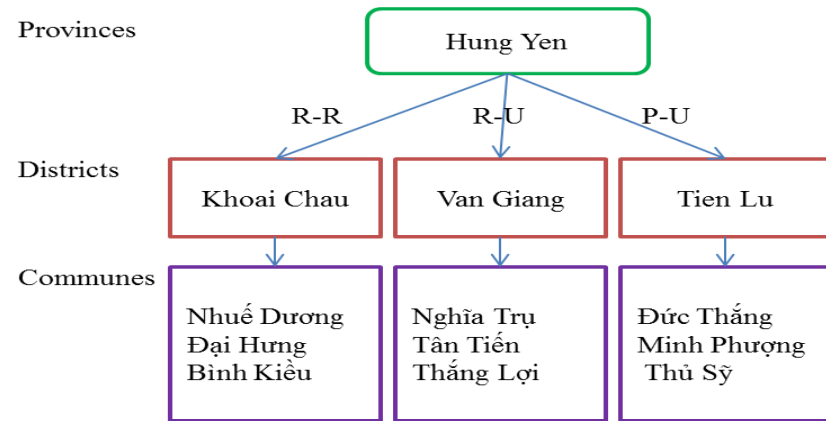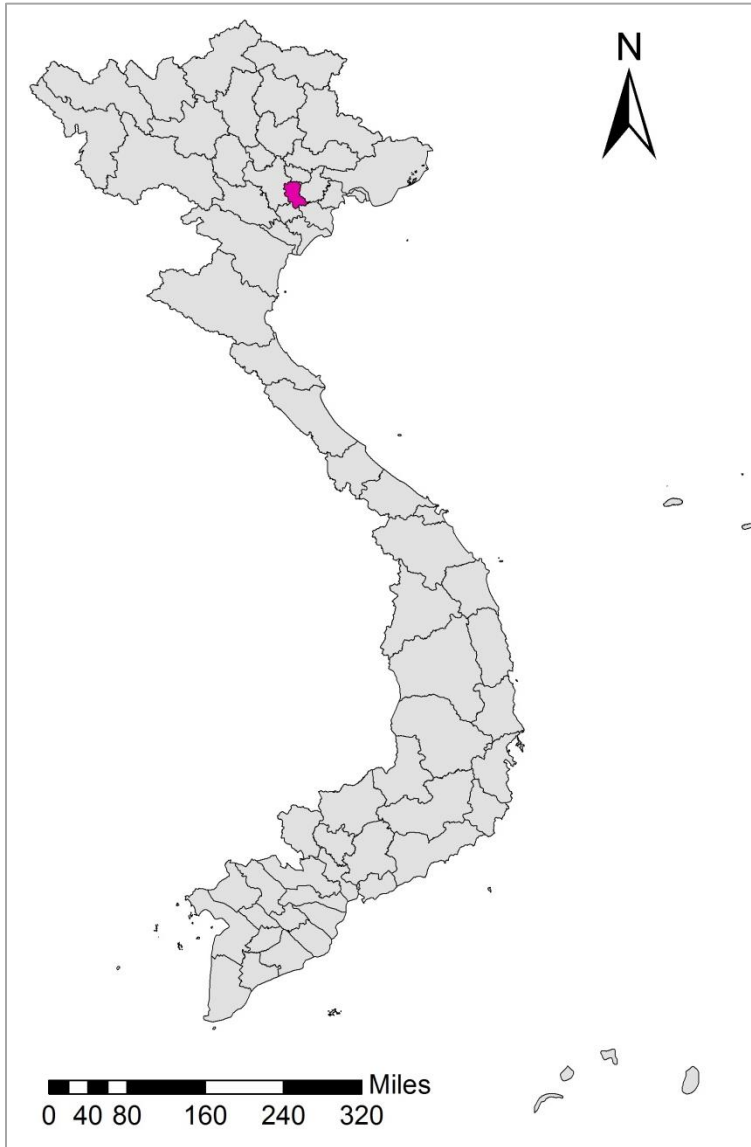*Smallholder pig value chains in Vietnam*

Smallholder pig value chains in Vietnam

2. Materials and methods

2.1. Study sites

Hung Yen province

R: Rural
P: Peri – urban
U: Urban

Source: PigRISK project

2.2. Sample analysis

Salmonella analysis: ISO 6579:2002

- *Salmonella* qualitative (Pos/Neg): n=302
- *Salmonella* quantitative (pork) (MPN/g): n=108

2.3. Data collection and analysis

- Checklist and questionnaire: Hygiene practice (farm, slaughterhouse, market)

- Questionnaire and FGD: Cooking and consumption behaviour of consumers

- Quantitative microbial risk assessment (QMRA):

- *QMRA steps (CAC-GL30, 1999), Monte Carlo simulation using @Risk 7.5 (Palisade US)*

3. Results and discussion

3. Results and discussion

Table 1. *Salmonella* prevalence along pork value chains in Hung Yen

Level and sample type	*Salmonella* prevalence (No. positive/n (%))
Farm	
Drinking water for pig	8/36 (22.2)
Pen floor	12/36 (33.3)
Waste water from pig pen	19/36 (52.8)
Slaughterhouse	
Carcass surface	30/72 (41.7)
Slaughterhouse floor	6/25 (24.0)
Rinsing water	4/25 (16.0)
Market	
Cut pork from roadside vendor	6/17 (35.3)[a]
Cut pork from commune market	10/23 (43.5)[a]
Cut pork from center market	32/68 (47.1)[a]
Overall of cut pork	*48/108 (44.4)*

[a] not significantly different ($\chi^2 = 0.8$, df = 2, p = 0.7) among market types

Salmonellosis annual incidence rate

Table 2. Annual incidence rate of salmonellosis due to boiled pork consumption by age and gender groups in Hung Yen
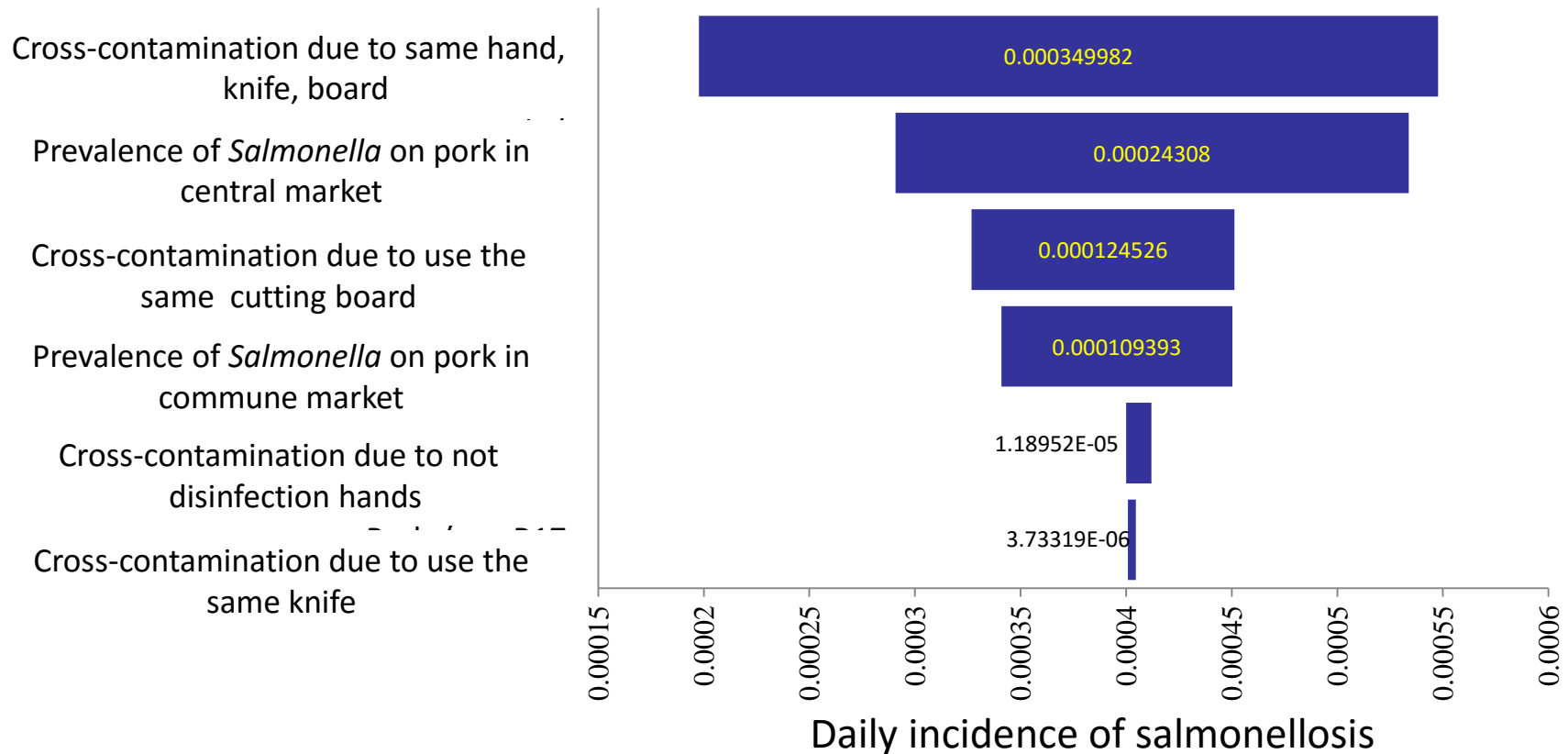
Age and gender groups	Estimated annual incidence rate (Median (90% CI)) (%)
Children (under 5 yrs)	4.3 (0 – 36.1)
Adult female (6-60 yrs)	10.6 (0 – 51.5)
Adult male (6-60 yrs)	12.0 (0 – 55.5)
Elder (over 60 yrs)	12.0 (0.1 – 54.4)
Aggregated	*12.6 (0.5 – 42.6)*

The annual incidence of foodborne salmonellosis in the Asian region including Vietnam was 1% (range 0.2-7%) (Havelaar 2015)

CI: Confidence interval

Sensitivity analysis

Sensitivity analysis result revealed the factors most influencing to the estimation of daily salmonellosis incidence

Cross-contamination due to same hand, knife, board — 0.000349982

Prevalence of *Salmonella* on pork in central market — 0.00024308

Cross-contamination due to use the same cutting board — 0.000124526

Prevalence of *Salmonella* on pork in commune market — 0.000109393

Cross-contamination due to not disinfection hands — 1.18952E-05

Cross-contamination due to use the same knife — 3.73319E-06

Daily incidence of salmonellosis

Previous QMRA studies: related to the product's storage and cleaning/separation kitchen equipment (Gonzales-Barron, Redmond et al. 2010, Swart, van Leusden et al. 2016)

4. Conclusion

✓ High *Salmonella* contamination in pork aligned with QMRA results demonstrate the health risks for consumers

✓ QMRA continues to be an important target to propose evidence risk based approach in food safety management in Vietnam

✓ Feasible mitigations to improve hygiene practices are required to reduce the risk for the Vietnamese consumers

Thank for your kind attention!