Food safety assessment and interventions in selected pork value chains (Traditional slaughterhouse and retails - exotic pigs)

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3. Next steps

1. Food safety assessment along the pig value chain
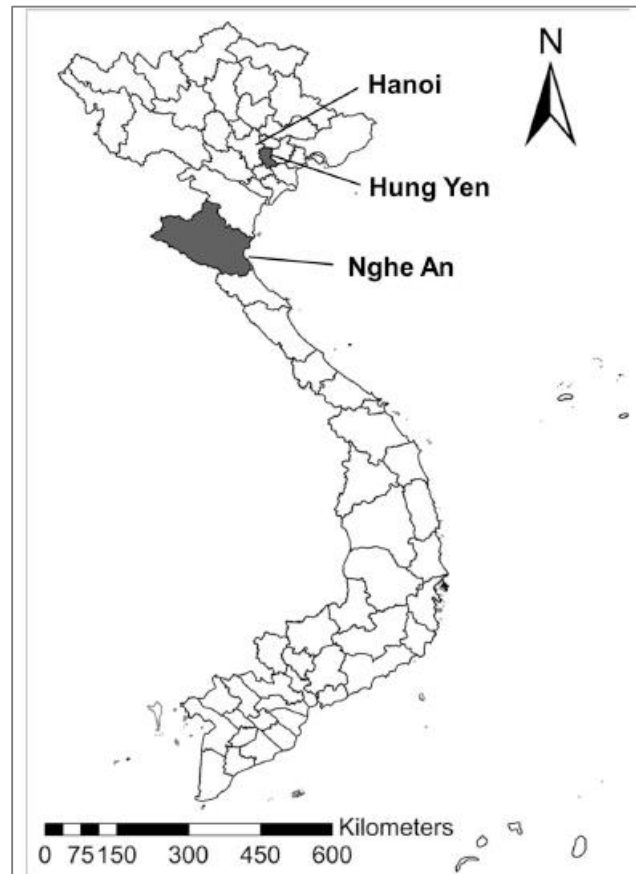
PigRISK project: 2012-2017

Sampling: 4/2014-2/2015

Fig. 1. A map showing the locations of study sites: Hung Yen and Nghe An provinces, and the capital city of Vietnam, Hanoi.

Risk factors associated with *Salmonella* spp. prevalence along smallholder pig value chains in Vietnam

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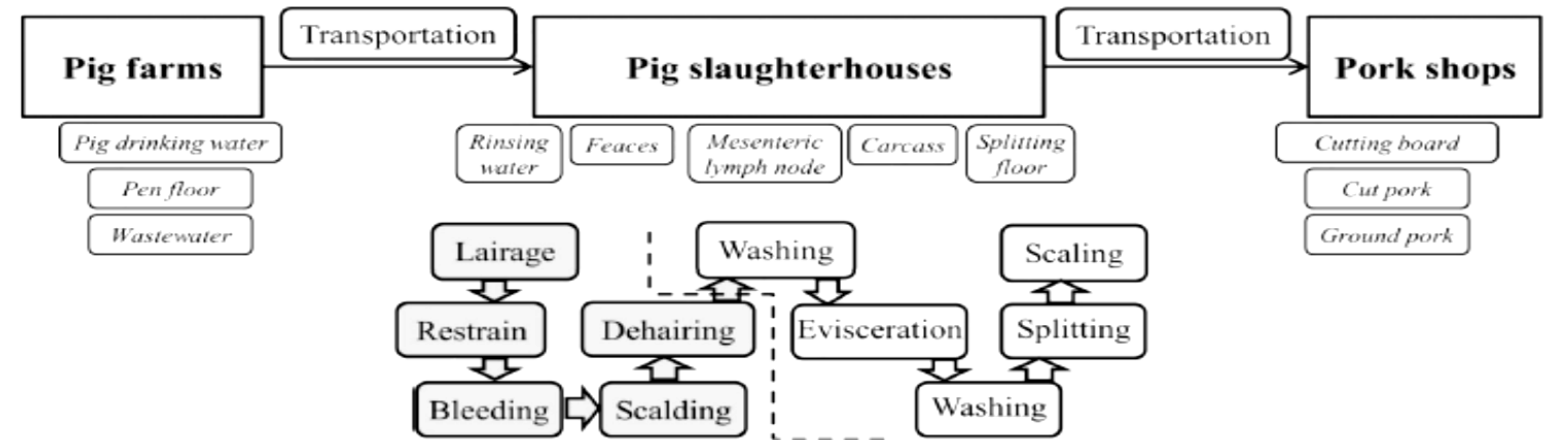
1. Food safety assessment along the pig value chain

PigRISK project: 2012-2017, sampling: 4/2014-2/2015

Table 2

Salmonella prevalence by sample type in smallholder pig value chain in Vietnam.

Sample type	No. of positive/no. of samples	*Salmonella* prevalence (95% CI)[*]	No. of negative farm, slaughterhouse, shop/no. of visits[**]
Pig farm			
Pig drinking water	14/72	19.4 (12.0–30.0)[a]	30/72
Pig pen floor	26/72	36.1 (26.0–47.7)[b]	
Pig pen wastewater	28/72	38.9 (28.5–50.4)[b]	
Pig slaughterhouse			
Rinse water	10/49	20.4 (11.5–33.6)[a]	32/49
Splitting floor	11/49	22.5 (13.0–35.9)[a]	
Rectal faeces	50/149	33.6 (26.5–41.5)[b]	73/149[***]
Mesenteric lymph node	53/149	35.6 (28.3–43.5)[b]	
Pig carcass	58/149	38.9 (31.5–46.9)[b]	
Pork market			
Ground pork	33/80	41.3 (31.1–52.2)[a]	
Cutting board	55/217	25.3 (20.0–31.5)[b]	108/217
Cut pork	97/217	44.7 (38.2–51.4)[a]	

CI: Confidence interval.

[*] Prevalences with different letters were significantly different ($p < 0.05$).

[**] Farms, slaughterhouses, and shops with no positive samples, versus positive ones had at least one positive sample.

[***] Number of pigs.

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1. Food safety assessment along the pig value chain

PigRISK project: 2012-2017, sampling: 4/2014-2/2015

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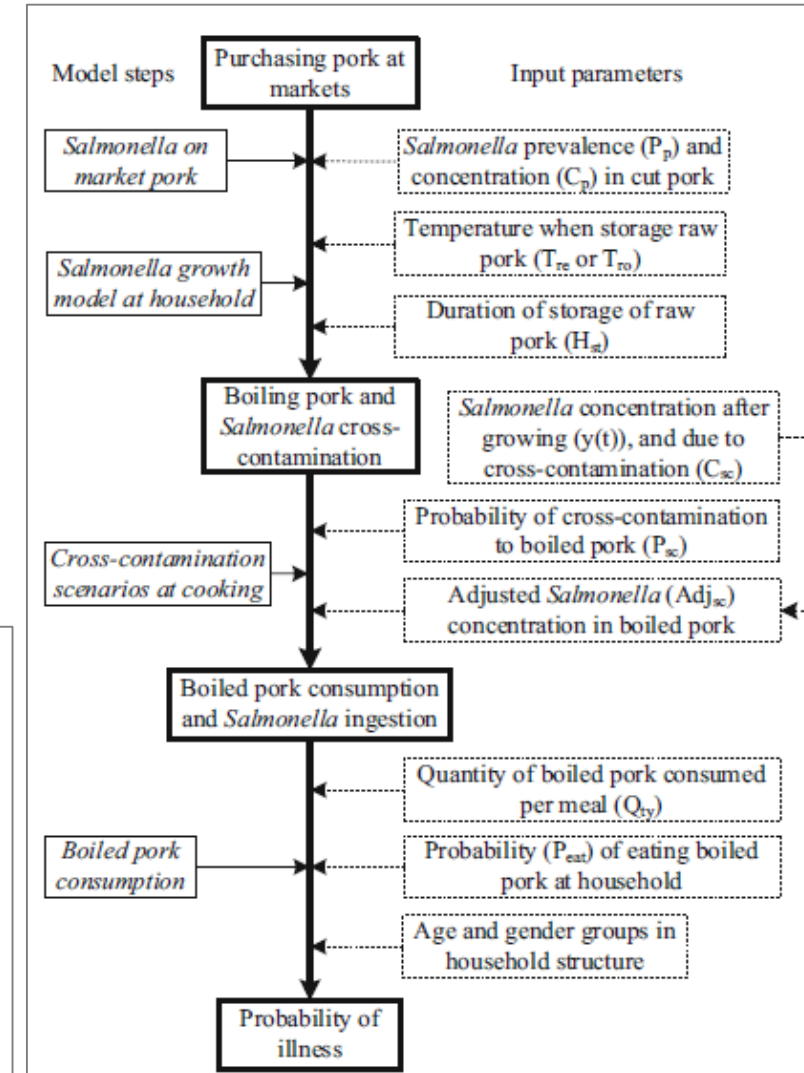
ORIGINAL ARTICLE

CrossMark

Quantitative risk assessment of human salmonellosis in the smallholder pig value chains in urban of Vietnam

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Phuc Pham-Duc · Delia Grace · Ngan Tran-Thi · Max Barot ·
Ngoc Pham-Thi · Kohei Makita

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Table 3 Annual incidence rate of human salmonellosis due to boiled pork consumption by age and gender groups in urban Hung Yen, Vietnam, 2015

Age and gender groups	Estimated annual incidence rate [mean (90% CI)] (%)
Children (under 5 years old)	11.18 (0–45.05)
Adult female (6–60 years old)	16.41 (0.01–53.86)
Adult male (6–60 years old)	19.29 (0.04–59.06)
Elder (over 60 years old)	20.41 (0.09–60.76)
Overall	17.7 (0.89–45.96)

| Model steps | Purchasing pork at markets | Input parameters |

- Salmonella on market pork
- Salmonella prevalence (P_p) and concentration (C_p) in cut pork
- Temperature when storage raw pork (T_{re} or T_{ro})
- Salmonella growth model at household
- Duration of storage of raw pork (H_{st})
- Boiling pork and Salmonella cross-contamination
- Salmonella concentration after growing ($y(t)$), and due to cross-contamination (C_{sc})
- Probability of cross-contamination to boiled pork (P_{sc})
- Cross-contamination scenarios at cooking
- Adjusted Salmonella (Adj_{sc}) concentration in boiled pork
- Boiled pork consumption and Salmonella ingestion
- Quantity of boiled pork consumed per meal (Q_{ty})
- Boiled pork consumption
- Probability (P_{eat}) of eating boiled pork at household
- Age and gender groups in household structure
- Probability of illness

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1. Food safety assessment along key pig value chains
(modern, traditional, food service retail)

SafePORK project: 2018-2022, sampling: 9/2018-4/2019

Manuscript Number:	
Article Type:	Full Length Article
Keywords:	Food services, Modern retail, Pork, Salmonella, Traditional Retail, Vietnam

2.4 Sampling framework

Table 1 Number of samples collected and tested for *Salmonella* and Total bacteria count across retail type and location in different value chains

Retail type	Location	Value chain	No. of samples collected (n)	Salmonella Y/N	Total Bacteria Count
Traditional	Hanoi	Traditional market	114	114	27
	Hanoi	Wet market	112	112	26
	Nghe An	LIFSAP pork	20	20	10
	Hung Yen	VietGAHP pork	20	20	10
Modern	Hanoi	Supermarket	115	115	18
		Boutique shop	93	93	11
		Convenience store	120	120	24
Food service	Hanoi	Canteen	24	53	27
		Street food	53	24	12
Total			671	671	165

Table 4 Contamination of *Salmonella* and total bacterial count in pork sold in difference retail and value chain types
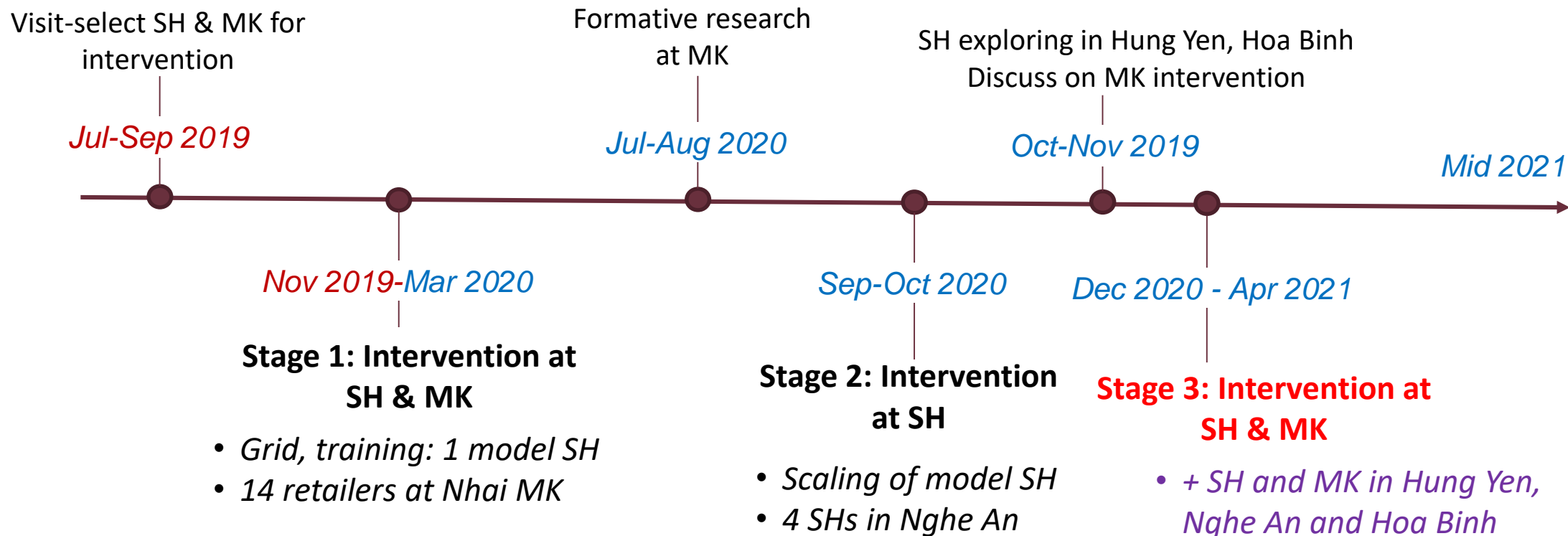
Type of market	Salmonella prevalence (n = 671)			TBC (LogCFU/g, n = 165)			
	No. of positive samples/ n	Percentage (%)	p-value	Mean	SD	% exceed standard[1]	p-value
Retail type							
Traditional retail	161/266	60.5[a]	P < 0.01	6.51	0.64	97.3	P[a] > 0.1
Modern retail	167/328	50.9[a]		6.38	0.65	88.0	p[b] < 0.01
Food service retail	62/77	80.5[b]		6.96	0.85	94.6	
Retail &value chain types							
Traditional retail							
-Traditional market	82/114	71.9[a]	P < 0.01	6.67	0.78	96.0	P[a] > 0.1
-Wet market	54/112	48.2[b]		6.52	0.55	100	p[b] < 0.01
-LIFSAP pork	13/20	65.0[b]		6.07	0.32	91.7	
-VietGAHP pork	12/20	60.0[b]		6.54	0.63	100	
Modern retail							
-Supermarket	59/115	51.3[b]		6.27	0.33	95.5	
-Boutique shop	47/93	50.5[b]		6.23	0.87	81.8	
-Convenience store	61/120	50.8[b]		6.57	0.76	82.4	
Food service retail							
-Canteen	17/24	70.8[b]		6.24	0.73	83.3	
-Street food	45/53	84.9[b]		7.31	0.68	100	
Overall	390/671	58.1		6.57	0.73	93.8	

[1] *Vietnam National Technical Regulation of Microbiology Contaminants in Food (TBC concentration in fresh meat samples is not allowed exceeding 5.7 log CFU/g) (MOH, 2012), Different letters indicate significance difference*

2. Interventions at traditional pig slaughterhouses and pork shops

SafePORK project: 2018-2022-SH and MK intervention

Objective 2: To develop, pilot and test light-touch, incentive-based approaches to food safety in close partnership with the private sector.

Visit-select SH & MK for intervention

Jul-Sep 2019

Formative research at MK

Jul-Aug 2020

SH exploring in Hung Yen, Hoa Binh
Discuss on MK intervention

Oct-Nov 2019

Mid 2021

Nov 2019-Mar 2020

Stage 1: Intervention at SH & MK

- *Grid, training: 1 model SH*
- *14 retailers at Nhai MK*

Sep-Oct 2020

Stage 2: Intervention at SH

- *Scaling of model SH*
- *4 SHs in Nghe An*

Dec 2020 - Apr 2021

Stage 3: Intervention at SH & MK

- *+ SH and MK in Hung Yen, Nghe An and Hoa Binh*

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2. Interventions at traditional pig slaughterhouses and pork shops

Intervention at pig slaughterhouses

Hand disinfection liquid

Installed grid

Grid

Water

Training for SH owners & workers

2. Interventions at traditional pig slaughterhouses and pork shops
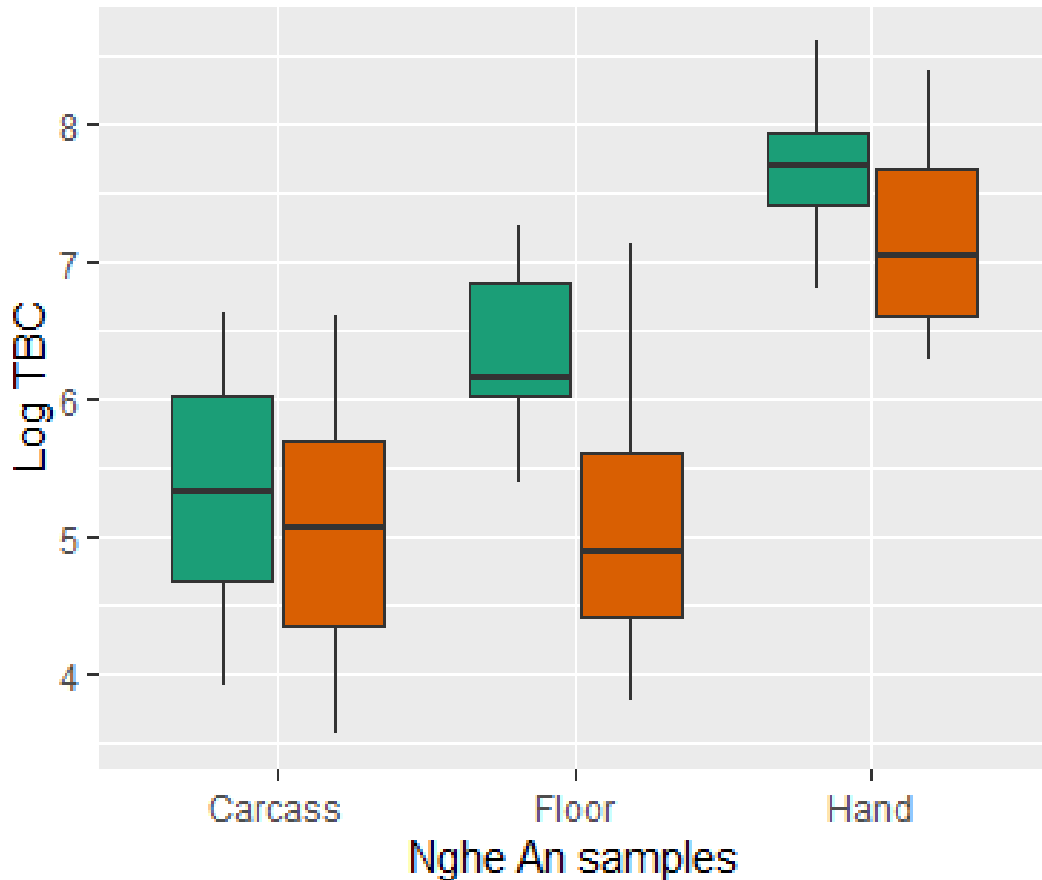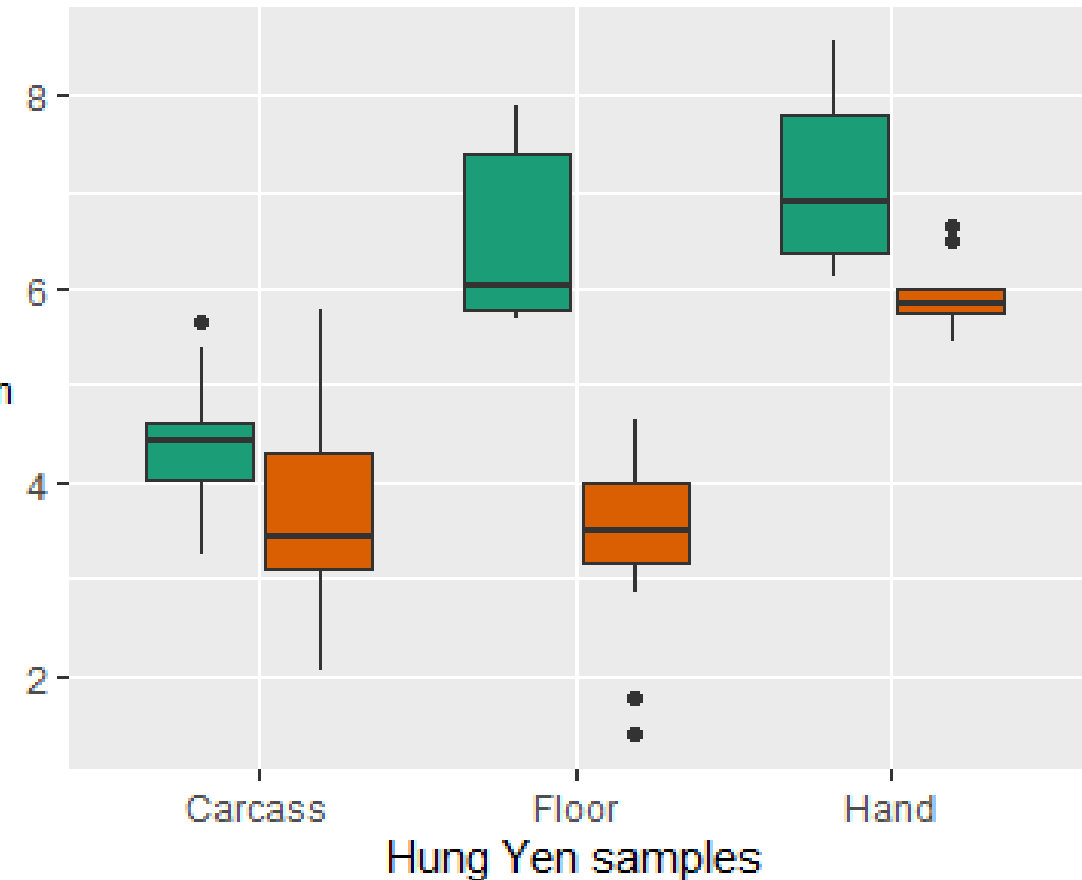
Intervention at pig slaughterhouses

Before

After

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2. Interventions at traditional pig slaughterhouses and pork shops

SafePORK project: Intervention at pig slaughterhouses

2. Interventions at traditional pig slaughterhouses and pork shops

Market intervention: 14 shops in Nhai market in Tien Lu-Hung Yen
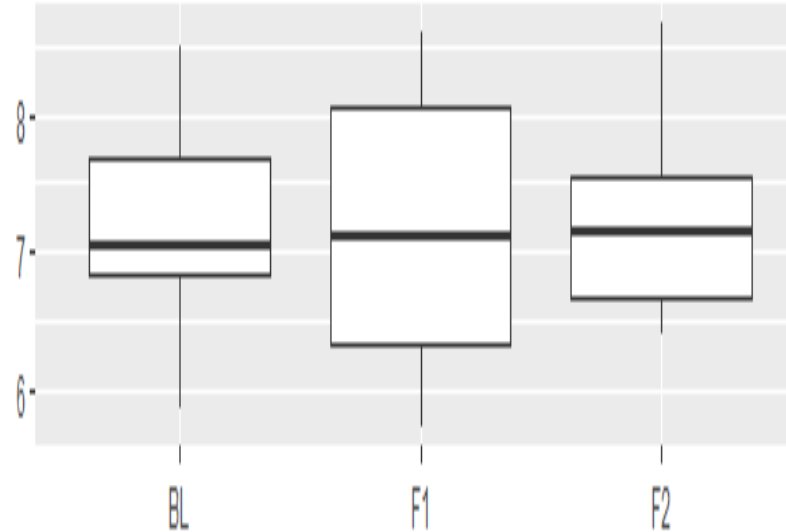
- Hygiene practices training
- Cutting board, tray
- Cloth, apron

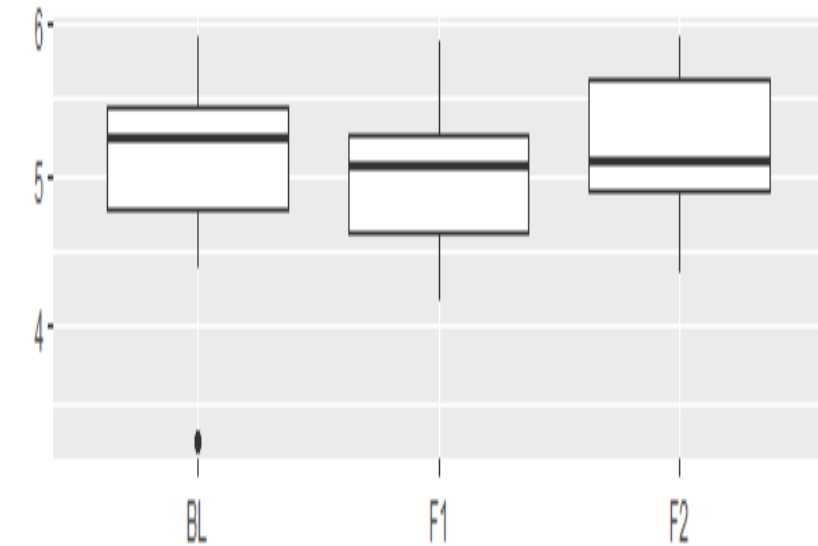# 2. Interventions at traditional pig slaughterhouses and pork shops

Market intervention: TBC contaminated on cutting board, hands, and cut pork at pork shops *(BL: baseline, F1: after two weeks, F2: after 4 weeks)*
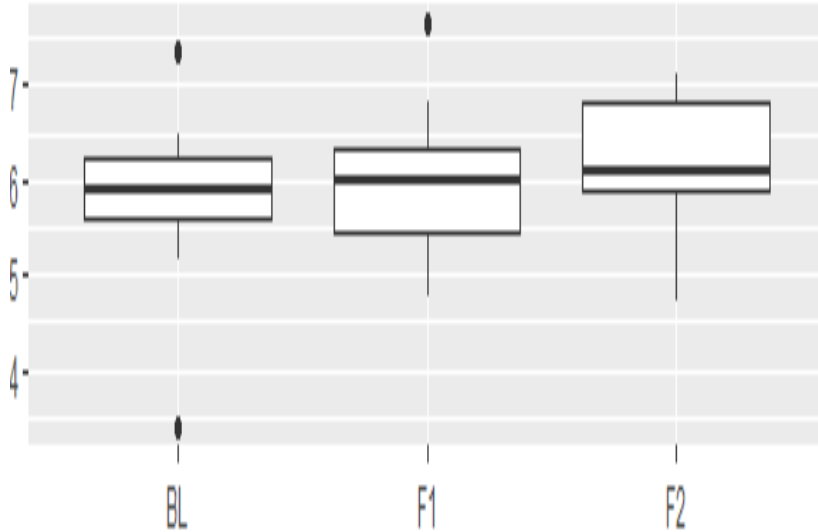
LogTBC pattern over time on cutting board
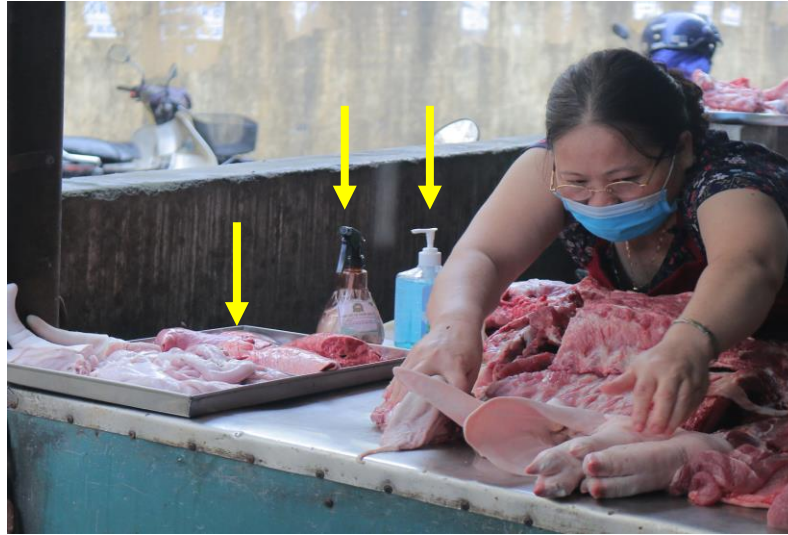
LogTBC pattern over time on pork retailers' hand

LogTBC pattern over time on cut pork at shop

Formative research for pork retailers

Training & handbook

Separation, washing/clean & disinfection

Color/label recognition

2. Interventions at traditional pig slaughterhouses and pork shops

Challenges in SH and MK intervention

- The compliance of participants decreased overtime (e.g. retailers)

- Low commitment of participants (e.g. pork sellers)
  - Missing incentive?

- Limited engagement with local authorities

- Disease outbreaks (ASF, Covid-19) severely affects overall progress

- Low awareness of consumers on interventions

3. Next steps

SH and MK intervention

- Strengthen collaboration with local authorities for implementation (Sub-DAH, local people committee)
- Organize communication events to improve awareness various groups and actors about project
- FS risk communication: Interact and seeking support from Local authorities (commune and district-DARD, etc.)

Thank you

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