

Effectiveness of light-touch intervention at small-scale slaughterhouses and traditional pork shops in Vietnam



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1. Introduction and objective

- Small-scale pork producers plays important role in Vietnam
- High risk of microbial contamination in retailed pork
- Necessary to identify low-cost and feasible interventions along pork value chain
- **Aim of this study:**
 - ✓ Implement light-touch intervention at small-scale slaughterhouse and traditional pork shop
 - ✓ Assess the effectiveness of intervention in reducing microbial contamination

2. Methodology

- **Study sites:** 4 provinces in the North of Vietnam
- **Participant recruitments:**
 - Selection criteria
 - Slaughterhouse:
 - ❖ Floor-based slaughtering, drainage system
 - ❖ Ability to separate clean-dirty area
 - ❖ Willingness to participate
 - Markets and pork shops
 - ❖ Linked to selected slaughterhouse
 - ❖ Specific area for animal sourced-food (only)
 - ❖ Equipped with table, water supply system
 - ❖ Having market management board

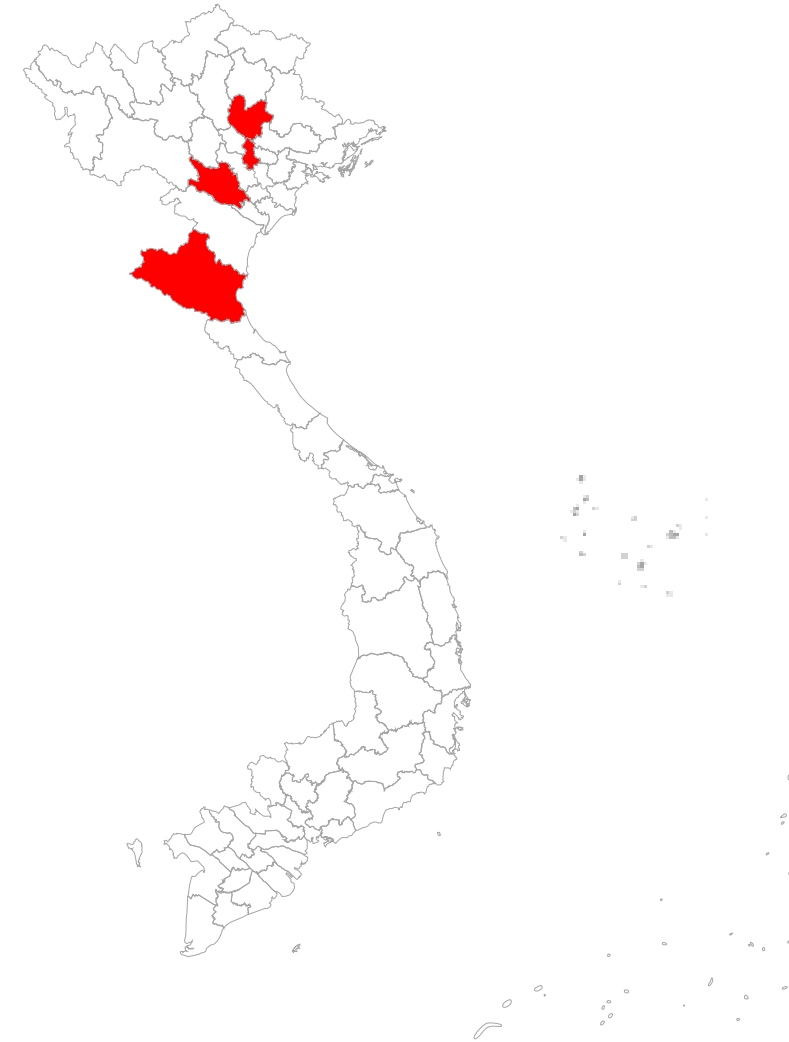


Figure 1: Study sites

2. Methodology

Intervention package:

- Slaughterhouse (n=10, investment: 300-1500\$)
 - Stainless-steel grid
 - Upgrade water system
 - Food safety training
- Pork shop (n=29, investment: ~35 \$)
 - Hygiene tools: hand sanitation, sprayer, poster
 - Selling tools: apron, cloths, cutting-board
 - Food safety training



Figure 2: Slaughterhouse before and after intervention



Figure 3: Pork shop before and after intervention



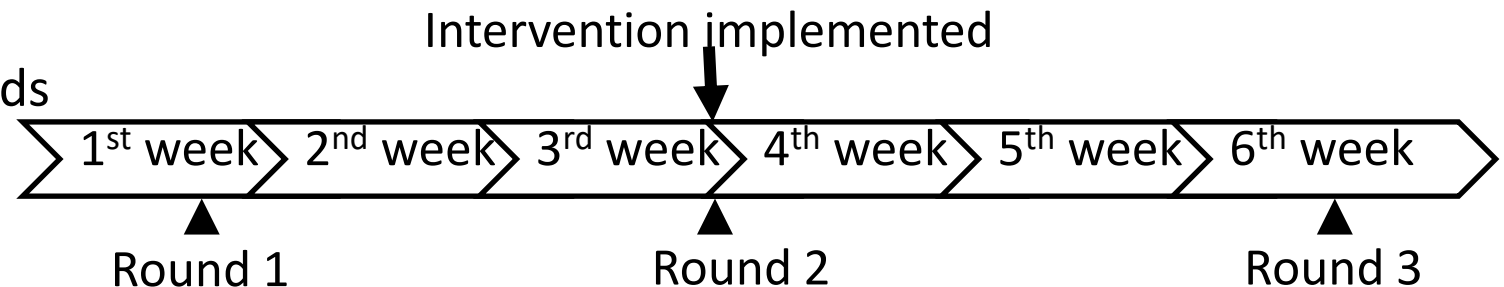
2. Methodology

Sampling method

- Samples:
 - Slaughterhouse: total bacterial count (TBC)
 - Pig carcass (swab): 20 samples/round
 - Workers' hand (swab): 14 samples/round
 - Floors (swab): 10 samples/round
 - Pork shops:
 - Pork (excision): 29 samples/round (*Salmonella* prevalence, TBC)
 - Vendor's hand (swab): 29 samples/round (TBC)
 - Cutting board (swab): 29 samples/round (TBC)
- Observe food safety practice
- Timeline: 6 weeks with 3 rounds



Figure 4: Sampling technique



2. Methodology

Sample testing

- *Salmonella* detection: ISO 6579:2017 (amend)
- *Salmonella* concentration: 3-tube most probable number (MPN)
- TBC: ISO 4833-2: 2013

Data analysis

- *Salmonella* prevalence: McNemar's test
- TBC: Wilcoxon signed rank test
- Identify risk factors:
 - Univariate analysis
 - Multivariate analysis:
 - Linear mixed-effects models (for TBC in pig carcass and retailed pork)
 - Generalized linear mixed-effects models (for *Salmonella* presence in retailed pork)

3. Result



Figure 5&6: Slaughterhouse worker and pork seller after intervention

Slaughterhouses:

- Most of slaughtered pigs **sourced from local farm**
- Have 2-3 permanent labors, in addition to **pork seller involved in slaughtering** activities
- Only few slaughterhouse use electric stunning
- Number of pig slaughtered/day: 1-8 pigs/day

29 Pork shops

- Most vendors are **female**
- One third of shops had person to help seller
- Average **sale volume: 43 kg/day**
- **Transportation distance:** 4 km (in ~12 minutes), most by motorbike



3. Result

Microbial analysis

	Round 1 (baseline)	Round 2 (Follow up)	Round 3 (End line)
Slaughterhouse (TBC)			
Pig carcass (log ₁₀ CFU/cm ²)	4.46 (3.48-6.64)	4.23^a (2.75-5.6)	4.37 (3.05-5.74)
Floor (log ₁₀ CFU/cm ²)	6.01 (5.38-7.06)	4.41 ^{a**} (3.31-6.12)	4.61 ^{a*} (2.87-7.12)
Worker hand (log ₁₀ CFU/hand)	7.09 (5.33-8.54)	7.07 (4.57-8.65)	7.04 (5.83-8.85)
Pork shop (TBC or <i>Salmonella</i>)			
Pork (log ₁₀ CFU/g)	5.47 (3.26-7.18)	5.34 (4.17-6.81)	5.36 (4.35-6.34)
Cutting board (log ₁₀ CFU/cm ²)	7.69 (5.87-10.31)	7.55 (5.75-8.94)	7.40 (6.20-9.38)
Seller's hand (log ₁₀ CFU/hand)	6.47 (3.41-8.33)	6.36 (4.77-8.38)	6.97 (4.73-8.33)
<i>Salmonella</i> prevalence on pork	52%	28%^b	24%^b

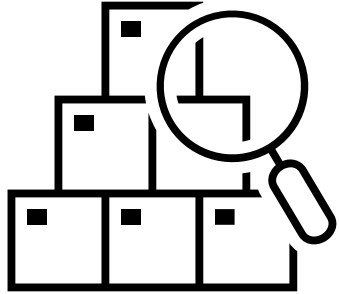
*, ** p-value: 0.05 and 0.01, respectively- compared to Round 1. ^{a,b}: Wilcoxon's test and McNemar's test

- 41.6% of retailed pork meets Vietnamese standard for TBC (<5.7 log₁₀ CFU/g)

3. Result Factors associated with microbial contamination (Multivariable analysis)

Variables	Coefficient	95% CI	p-value
Slaughterhouse (TBC)			
Workers wore boots while slaughtering	-0.78	-1.33 – -0.27	0.004
Workers cleaned floors after slaughtering	-0.49	-0.86 – -0.07	0.02
Workers smoked cigarettes or ate while slaughtering	0.66	0.24 – 1.09	0.005
Pork shop (TBC)			
Sellers cleaned knives while selling	-0.38	-0.70 – -0.04	0.04
Tables were covered with rough material that was difficult to clean	0.32	0.001 – 0.61	0.02
Pork shop (<i>Salmonella</i> presence)			
Having helpers at shop	0.14	0.04 – 0.46	0.02
Sellers wore aprons	0.17	0.05 – 0.51	0.02

4. Discussion



- **41.6% of retailed pork meets Vietnamese standard for TBC ($<5.7 \log_{10}$ CFU/g)**
- ***Salmonella* prevalence** at retail after intervention was reduce compared to **before intervention**
- **Improved food safety practices** with provision of appropriate tools can **reduce microbial contamination** in pork

Conclusions

- Piloted light-touch intervention can make pork safer at traditional slaughter and retail
- Important for success was the participatory approach and compliance of involved VC actors and stakeholders
- Larger scale testing recommended to further consolidate results, e.g., current implemented
- Consumers involvement required as incentive for changes and sustainability



Figure 7: Vendors participated in the FS training/intervention

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