

Risk pathways and prevalence in slaughtered pig blood of *Streptococcus suis* in Vietnam

Sinh Dang-Xuan¹, Juliet E Bryant², Fred Unger³, Bao Ngo-Thanh², Bich Vu Thi Ngoc², Phuc Pham-Duc¹, Delia Grace³, Hung Nguyen-Viet^{3,4}

¹ Center for Public Health and Ecosystem Research, Hanoi School of Public Health, Vietnam; ² Oxford University Clinical Research Unit, Wellcome Trust Major Overseas Programme, Hanoi, Vietnam; ³ International Livestock Research Institute (ILRI), Vietnam and Kenya; ⁴ Swiss Tropical and Public Health Institute, Basel, Switzerland



Introduction

Streptococcus suis is a leading cause of bacterial meningitis in Vietnamese adults, and the major risk factors have been identified as consumption of raw pig blood (*Tiet canh*), and occupational exposure to pigs. Previous studies of *S. suis* prevalence in pigs sampled from southern Vietnam have indicated very high levels of commensal infection in tonsil specimens, however there is relatively little data on prevalence rates of systemic infections in pigs (as indicated by detection from fresh blood), and prevalence rates from northern and central Vietnam have yet to be described.

Methods

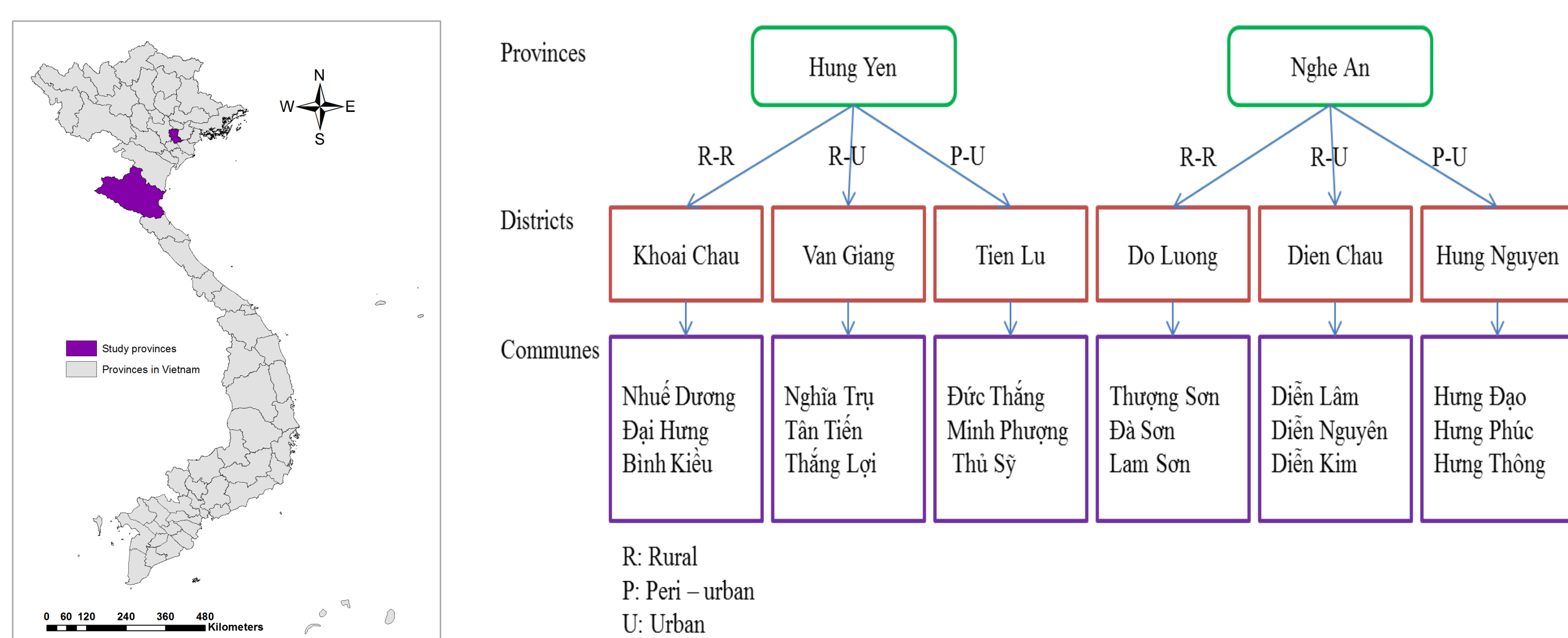


Fig 1. Study locations in Hung Yen and Nghe An provinces

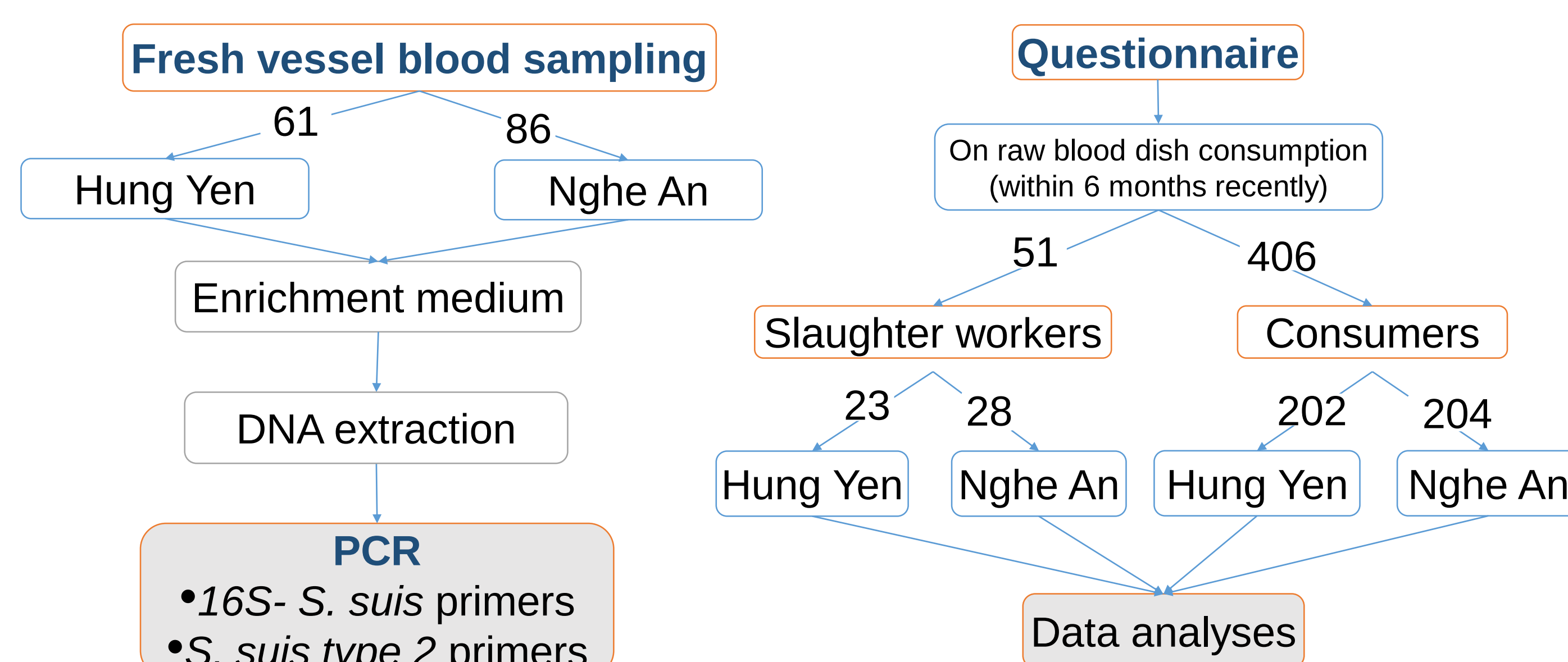


Fig 3. Number of analysed samples and interviews



Fig 4. Raw pig blood pudding dish (left), workers at pig slaughterhouse (center) and interview with consumer (right)

Acknowledgments

- PigRISK project: "Reducing disease risks and improving food safety in smallholder pig value chains in Vietnam".
- Farmers, slaughterhouses, sellers and local authorities in Hung Yen and Nghe An provinces.
- This project is funded by the Australian Centre for International Agricultural Research (ACIAR) and the CGIAR Research Program Agriculture for Nutrition and Health (A4NH).

Results and discussion

Eating pig raw blood dish: slaughterhouse workers & consumers

Table 1. Raw pig blood dish consumption by slaughterhouse workers group

Location	Raw pig blood dish consumption	
	Yes	No
Hung Yen	9 (39.1%)	14 (60.9%)
Nghe An	13 (46.4%)	15 (53.6%)
Overall	22 (43.1%)	29 (56.9%)

No significance difference on raw blood dish consumption among slaughterhouse worker groups between two provinces

Table 2. Raw pig blood dish consumption by consumers group

Location	No. family consume/n (%)	No. of family members consuming raw pig blood dish				Total
		Children (<15yrs)	Adult women	Adult men	Old person (>60yrs)	
Hung Yen	9/202 (4.6)	1	6	16	7	30
Nghe An	7/204 (3.4)	0	12	16	0	28
Overall	16/406 (3.9)	1	18	32	7	58

No significance difference on raw blood dish consumption among consumers group between two provinces, however, the rate of eating raw blood dish by slaughterhouse workers was significantly higher compared to consumers.

S. suis prevalence in raw pig blood

Table 3. Overall *S. suis* 16S and *S. suis* type 2 prevalence in fresh pig blood

Sample type	16S- <i>S. suis</i> Positive/n (%)	<i>S. suis</i> - type 2	
		Positive/n (%)	Positive/ <i>S. suis</i> -16S (%)
Fresh pig blood	49/147 (33.3)	2/147 (1.4)	2/49 (4.1)

Table 4. *S. suis* and *S. suis* serotype 2 prevalence in Hung Yen and Nghe An

Type of <i>S. suis</i>	Hung Yen			Nghe An		
16S- <i>S. suis</i>	19/61 (31.1%)			30/86 (34.9%)		
<i>S. suis</i> type 2	2/61 (3.3%)			0		
By districts	Khoai Chau	Tien Lu	Van Giang	Dien Chau	Do Luong	Hung Nguyen
16S- <i>S. suis</i>	2/20 (10%)	3/11 (27.3%)	14/30 (46.7%)	8/27 (29.6%)	10/31 (32.3%)	12/28 (42.9%)
<i>S. suis</i> type 2	0	0	2/30 (6.7%)	0	0	0

Both positive serotype 2 strains in Van Giang districts, Hung Yen where *S. suis* human cases had been reported before.

Conclusions

- Circulation of *S. suis* type 2 in raw blood pig was 1.4% which can cause the infection by the habit of consuming raw pig blood.
- Slaughter worker groups show a higher frequency of raw pig blood eating, thus can pose to potential health effect by *S. suis*.
- Culinary practices involving raw or undercooked pig products, and risk mitigation strategies to minimize disease transmission need to be discussed.