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RESEARCH ARTICLE

Epidemiologic Characteristics of Foodborne Outbreaks in Southern Vietnam, 2009–2013

Thuan Huu Vo[1,2], Nguyen Nhu Tran Minh[3], Vinh Le[2], Ninh Hoang Le[2], Huy Quang Nguyen[2], Tuan Van Le[4], J. Pekka Nuorti[1]

[1]*University of Tampere, School of Health Sciences, Department of Epidemiology, Tampere, Finland*
[2]*Institute of Public Health, Department of Planning and Technical Support, Ho Chi Minh City, Vietnam*
[3]*Vietnam Field Epidemiology Training Program, General Dep. of Preventive Medicine, Ministry of Health, Hanoi, Vietnam*
[4]*World Health Organization Technical Office, Ho Chi Minh City, Vietnam*

ABSTRACT

Introduction: Accurate data on the burden of foodborne diseases (FBD) are important to inform prevention and control measures. We described epidemiologic characteristics and assessed trends in foodborne outbreaks in Southern Vietnam.

Methodology: We analyzed surveillance data of outbreaks reported in Southern Vietnam during 2009–2013. A FBD outbreak is defined as “two or more people who got gastrointestinal disorder after eating the same meal or one fatal case after eating a meal”. Annual rates of outbreaks/100,000 population were calculated; trends in outbreaks were assessed in time-series analysis.

Results: During 2009-2013, there were 261 reported outbreaks, 10,263 cases, and 50 deaths; rate, 0.16 outbreaks/100,000 population/year. Of all outbreaks, 77% occurred in nine provinces (population 19.4 million) where export manufacturing zones are located (2–8 outbreaks/province/year). Of 212 outbreaks in which reporters had suspected an etiology, bacteria accounted for 41%, natural toxins for 20%, and unknown causes for 28%. Seventy-two percent of all cases were associated with meals eaten in canteens; 94% of cases lived in the nine provinces. Four percent of all cases were linked to family meals; 85% of these cases lived in the rural Mekong Delta region. All 50 fatal cases were attributed to toxic chemicals or natural toxins, 48 were family meals. Most outbreaks occurred in warmer months, but no temporal trend was seen in reported outbreaks.

Conclusions: The rate of reported outbreaks and total reported cases of FBD were low, suggesting underdetection and underreporting. Most identified outbreaks were associated with meals eaten in canteens; fatal cases were linked to family meals. *J Microbiol Infect Dis 2017; 7(1): 13-20*

Keywords: Foodborne diseases, epidemiology, outbreaks, surveillance, Vietnam

INTRODUCTION

In developing countries, foodborne diseases (FBD) surveillance systems are often suboptimal; epidemiologic characteristics of FBD are insufficiently described, and morbidity and mortality due to FBD is probably underestimated [1]. In Vietnam, available data on FBD come primarily from foodborne outbreak reports [2]. The Vietnam Food Administration (VFA) and Food Safety Agencies (FSAs) generally receive reports of food poisonings or gastroenteritis outbreaks when local reporters suspect transmission through food. Most outbreaks are detected when severe cases are admitted to health facilities or when deaths have occurred. A few events have been reported by district hospitals, health workers, or local residents while some events have been detected from daily newspaper reports.

Peer-reviewed publications related to epidemiology of FBD in Vietnam are scarce. We described the epidemiologic characteristics and assessed trends of foodborne outbreaks in Southern Vietnam from 2009 to 2013.

Correspondence: Dr. Thuan Huu Vo, University of Tampere, School of Health Sciences, Department of Epidemiology, Tampere, Finland, E-mail: Huuthuan.Vo@uta.fi
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METHODS

In Vietnam, national surveillance schemes related to food safety are passive. The surveillance systems for FBD are under the authority of the VFA in Ministry of Health (MOH). In 2009, a FSA was established in each of 63 provinces to be responsible for surveillance and control of FBD. According to current regulations, all health officials, public and private health services are responsible to notify FSAs at district or provincial levels when a suspected foodborne outbreak occurs in their setting. When cases of FBD are admitted to a health facility, the facility has to report to a higher-level facility and ultimately to the VFA. In severe outbreaks or those associated with deaths, preventive medicine services, health facilities, or district FSAs are allowed to share data/reports outside their jurisdiction [3,4].

In 2013, the population of 19 Southern provinces of Vietnam was 33 million (37% of the total population of Vietnam) [5]. We analyzed routine surveillance data of notified foodborne outbreaks from these provinces during 2009–2013. A FBD outbreak is defined as "two or more people who got gastrointestinal disorder after eating the same meal or one fatal case after eating a meal" [4]. The FSAs in Southern provinces of Vietnam use a standard reporting form which includes the following items: location of outbreak, implicated meal and food, patient's clinical signs and symptoms, causative agents, number of exposed, cases, deaths and hospitalization by age groups, samples taken from cases and foods for laboratory analysis, environmental inspections, as well as conclusions and recommendations related to the outbreak. Investigated outbreaks are reported to the Institute of Public Health in Ho Chi Minh City [3].

Categorized variables were described in frequencies and proportions. Rates were calculated by using the total annual outbreaks during 2009-2013 divided by mean population of the region/province during the study period. Time-series analysis was used to assess trends and seasonal factors in outbreaks. Data were analyzed by using R software (t series and forecast packages).

RESULTS

During 2009–2013, 261 foodborne outbreaks were reported in the 19 provinces in Southern Vietnam. Annually, about 2–8 foodborne outbreaks were reported in Ho Chi Minh City (HCMC) and eight provinces around HCMC (Figure 1A), accounting for 77% of all outbreaks. The population of HCMC and the eight provinces were about 7.5 and 11.9 million, respectively. The rate of general foodborne outbreaks in Southern Vietnam was estimated at 0.16 per 100,000-population per year. Rates of outbreaks in provinces around HCMC were higher than those in provinces in Mekong Delta region (Figure 1B).

Of the 261 reported outbreaks, 38% were associated with canteens, 31% with family meals and 18% with restaurants. About 7% of the outbreaks occurred in schools and 6% were associated with street vendors. On average, approximately 20 outbreaks were associated with canteens and 16 with family meals annually in the region (Figure 2).

Of the 212 (81%) outbreaks in which etiology was suspected, bacteria were postulated in 87 (41%), natural toxins in 42 (20%), and unknown/undefined causes in 59 (28%) of the outbreaks (Table 1). Of the 49 (19%) outbreaks in which etiology was confirmed by laboratory tests (laboratory methods were based on the Vietnam Food Safety Standard – approved by ISO/IEC 17025 – and the Association of Official Analytical Chemists international standards for food items), bacteria (*E. coli, S. aureus, Salmonella spp., B. cereus, C. perfringens*, and *Shigella spp*.) accounted for 23 (47%), histamine for 17 (35%), chemicals (methanol, inorganochlorine, organophosphorus, nitrates, and rodenticides) for 7 (14%), and tetrodotoxin for 2 (4%). In 181 (69%) outbreaks links to specific foods were suggested, but these were not confirmed by epidemiologic or laboratory investigation. The most common suspected food items were pork (15%), tuna fish (13%), multi-ingredient foods (12%), jellyfish (8%), alcohol containing methanol (7%), toad (6%), and puffer fish (6%).

In each specific location where foodborne outbreaks occurred, bacteria were suspected account for most (33% in family meals, 49% in large canteens, 65% in schools, 77% in

restaurants, and 84% in street vendors). The percentages of unknown/undefined causes were 12% in street vendors, 16% in restaurants, 18% in family meals, 25% in large canteens, and 35% in schools. For outbreaks which occurred in private homes, natural toxins accounted for 31% of outbreaks (Figure 3). Among 44 outbreaks caused by natural toxins, 91% were associated with family meals. Of outbreaks associated with chemicals, 61% (11) were linked to family meals.

A total of 10,263 cases were part of the reported outbreaks. About 72% of cases had eaten their meals at canteens in industrial zones and 14% in restaurants, while only 5%, 4%, and 4% of cases were associated with outbreaks in other locations (schools, street vendors, and family meals, respectively) (Figure 4). Of the cases linked with canteens, 94% (6927) lived in HCMC and the eight surrounding provinces already mentioned before. Of the 428 cases associated with 82 outbreaks occurring at private residences, 85% (363) of cases were in the rural Mekong Delta region. The number of potentially exposed persons (defined as those who ate the same meal as cases) was about 78,000 during 2011–2013 (Table 1).

Of the 50 fatal cases, 48 were associated with family meals, while one case was associated with street vendor and one with a wedding party (Table 1). The implicated foods in fatal cases were alcohol containing methanol (28), jellyfish (07), toad (07), puffer fish (06), and sea-crabs (02).

In Figure 5, the observed data on outbreak notifications were decomposed into three components: trend, seasonal, and random/residual components. After removing seasonal effects, no trend was seen in reported outbreaks during 2009–2013. There were more outbreaks in 2010 than in the other years. The number of outbreaks per month varied by season and was higher during summer (highest in May) and lower during winter (lowest in December). The months with fewest outbreaks were February–March and August-December.

Table 1. Baseline characteristics of the study population.

Outbreak Years	**2009**	**2010**	**2011**	**2012**	**2013**	**Total**
Number of reported outbreaks	42	80	48	48	43	261
Number exposed	NA	NA	20,555	20,675	36,639	77,869
Number of cases	1,903	3,076	1,233	2,032	2,019	10,263
Number of deaths	11	12	12	12	3	50
Number of suspected foods	35	62	32	26	26	181
Number of outbreaks with suspected etiology	17	67	37	48	43	212
Bacteria	3	30	19	15	20	87
Natural toxins	3	9	11	9	10	42
Rotten food	1	9	1	0	2	13
Chemicals	1	4	1	5	0	11
Unknown	9	15	5	19	11	59
Number of outbreaks with confirmed etiology	25	13	11	-	-	49
Bacteria	7	7	9	-	-	23
Natural toxins	0	2	0	-	-	2
Rotten food	16	1	0	-	-	17
Chemicals	2	3	2	-	-	7

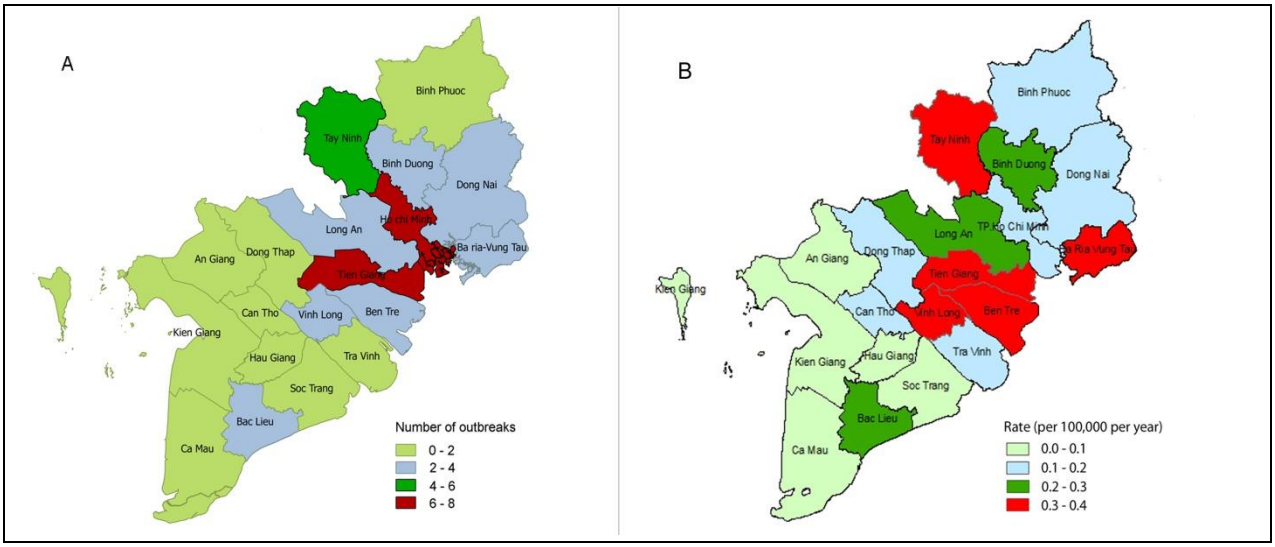

Figure 1. Annual number (A) and rate of foodborne outbreaks per 100,000 (B), Southern Vietnam, 2009–2013

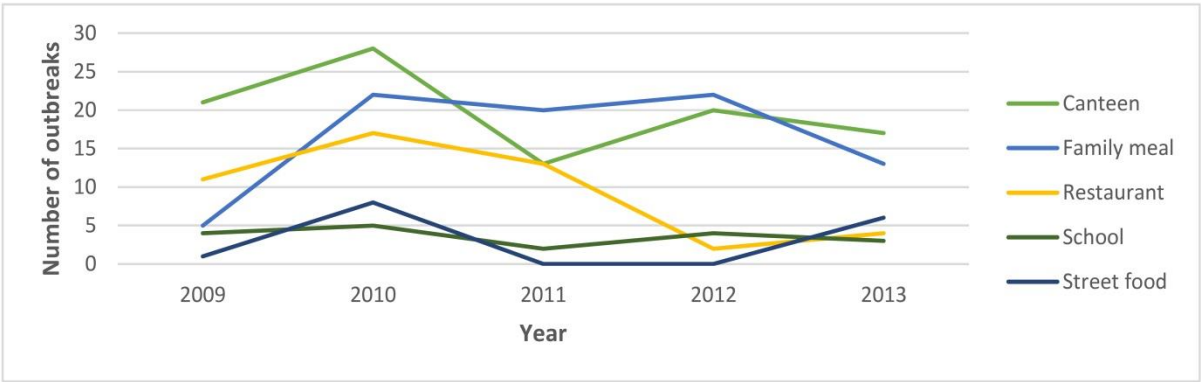

Figure 2. Annual number of outbreaks by implicated location, Southern Vietnam, 2009–2013

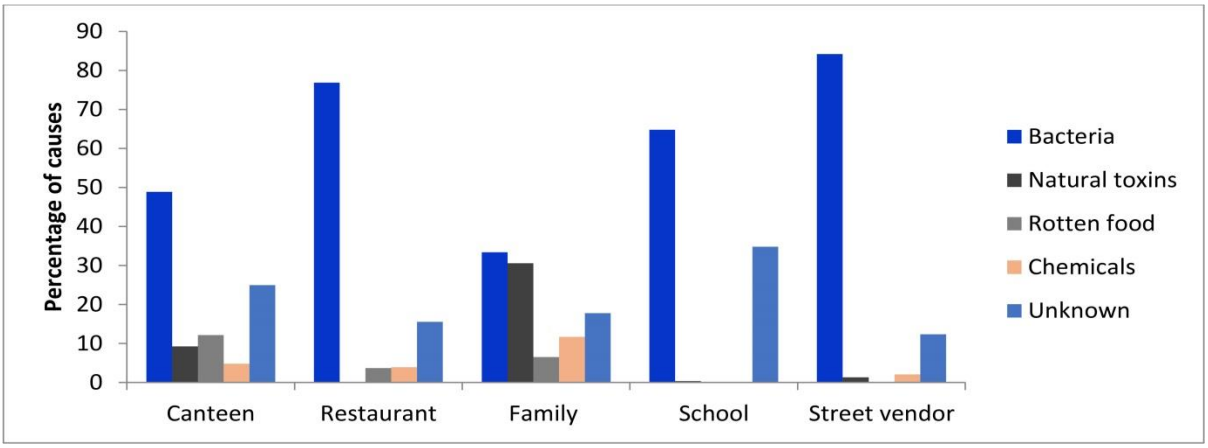

Figure 3. Etiology of foodborne outbreaks by place of occurrence, Southern Vietnam, 2009–2013

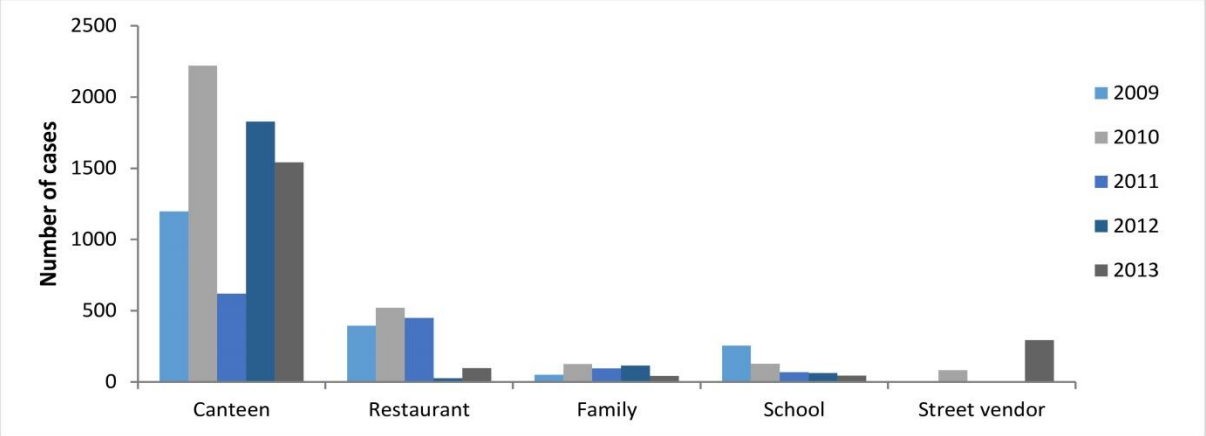

Figure 4. Location of foodborne outbreaks and number of cases by year, Southern Vietnam, 2009–2013

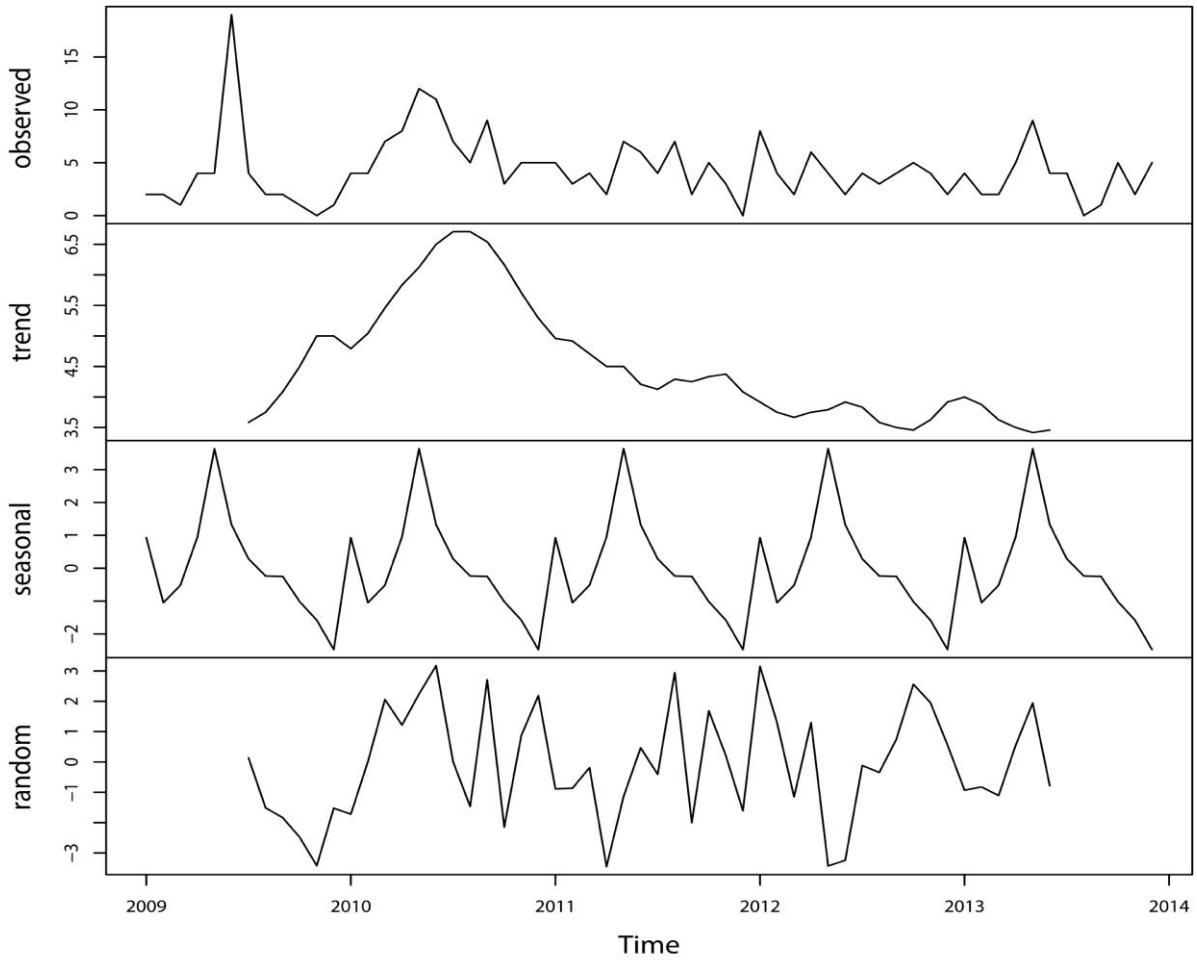

Figure 5. Decomposition of additive time-series of reported outbreaks by year, Southern Vietnam, 2009–2013

DISCUSSION

Most detected outbreaks and cases were associated with canteens in HCMC and neighboring provinces, where many export manufacturing zones are located. In about a half of these outbreaks the suspected etiology was bacteria and more than a quarter of suspected food items contained pork or were multi-

ingredient foods. This finding is consistent with earlier reports of food poisonings or acute gastroenteritis outbreaks in the export manufacturing zone canteens being associated with poor personal hygiene and time-temperature abuse during food preparation and serving [6,7]. Tuna fish accounted for a considerable proportion of suspected foods. Proper handling and temperature control of tuna fish are important to prevent similar outbreaks, particularly in the year-round hot weather in Southern provinces of Vietnam [8].

Outbreaks associated with family meals mainly occurred in the Mekong Delta region. Although there were few cases, these accounted for 96% of all reported fatal cases. The fatal cases were caused by consumption of counterfeit alcohol containing methanol or natural toxins. It is clear that alcohol sales should be controlled and health education should be strengthened to avoid consumption of counterfeit alcohol and the common animals containing natural toxins.

Overall, there were more outbreaks in warmer months (Figure 5). The warm and humid climate in Southern Vietnam (from 28°C to 35°C) enables microorganisms to grow and proliferate faster in contaminated foods [9,10]. The higher number of outbreaks during summer in 2010 could be related to the higher temperature during the summer than other years [11]. Authorities for food safety regularly conduct two intensified inspections annually about one month before mid-autumn festival and lunar New Year across Vietnam every year. Fewer reported outbreaks during August–December and February–March could be a result of the inspections.

Outbreak notifications only provide a crude estimate of the burden of foodborne illness. The routine surveillance database in Southern Vietnam only included foodborne outbreak reports, probably from severe events. No demographic or epidemiologic information was collected of individual cases. In addition, self-medication with specific drugs which can be obtained without prescription, could affect detection of outbreaks. Because of these reasons, many mild outbreaks may not have been notified or were under notified. It is likely that the rate of outbreaks and number of cases estimated from the surveillance data are likely an underestimation. From 2000 to 2010, a total of 2,147 foodborne outbreaks, 60,602 cases and 583 deaths were reported throughout Vietnam; the incidence of cases was 6.9 per 100,000 people per year. This was quite low compared with other countries in the region, e.g., 47.8 per 100,000 people in Malaysia and 67.8 per 100,000 people in Thailand, and even developed countries e.g., 290 per 1000 people in Netherland [12-15].

Most identified outbreaks were associated with canteens in export manufacturing zones. Outbreaks in this kind of settings where the affected cohort is well defined are more likely to be detected and investigated than outbreaks in which cases are widely dispersed in the community because of contaminated commercial products [16,17]. Therefore, detection bias should be considered when interpreting the findings related to the setting of notified outbreaks.

Beside underestimation and detection bias, our study has some limitations. First, the database did not include information of individuals and reporting time, so characteristics of cases and delays in report could not be described. Second, incubation time was not collected and most implicated foods were postulated, not confirmed by epidemiologic investigation. Third, most causative agents of the outbreaks were suspected on the basis of subjective assessments, no laboratory evidence was presented, and contributing factors were not documented. These indicate lack of application of standard epidemiologic methods in outbreak investigations making it difficult to assess which factors truly contributed to the reported outbreaks. Finally, the current surveillance system for foodborne diseases has low sensitivity and capacity for early detection of foodborne outbreaks. To enable early detection, surveillance systems for FBD that are capable of recording/reviewing notifications and complaints from the public (notification/complaint systems) and of collecting information on FBD symptoms (syndromic surveillance) should be considered. In addition, laboratory capacity should be strengthened. Data aggregation from the new and existing surveillance systems for FBD would enable better estimation of FBD burden and inform evidence-based prevention and control measures.

Conclusion

The rate of reported outbreaks and total reported cases of FBD in Southern Vietnam were low, suggesting under-detection and underreporting. Most identified outbreaks were associated with canteens in export manufacturing zones and could be linked to poor personal hygiene and time-temperature abuse [7]. Homemade food outbreaks mainly occurred in rural areas and associated with most fatal cases. Proper food handling should be implemented in export manufacturing zones and health education on common poisonous animals should be strengthened in rural areas. Food safety inspections should be implemented regularly throughout the year. Appropriate surveillance systems e.g., notification/complaint systems and syndromic surveillance for FBD should be established.

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