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Farming Practices in Smallholder Pig Production in Vietnam: Implications for Food Safety

Nguyen Thi Thu Huyen¹, Nguyen Thi Duong Nga², Pham Van Hung³,
Ma. Lucila A. Lapar⁴, Ninh Xuan Trung⁵, Fred Unger⁶, and Nguyen Van Pho⁷

Abstract

This paper aims to examine changes in pig farming practices that can improve food safety of pig products in Vietnamese smallholder pig production. The study covered 615 pig households, which were analyzed using descriptive statistical analysis. Results show that there is an increased trend of using own-produced piglets because farmers can apply strict vaccine scheme for their piglets. The percentage of farmers applying vaccine in pig production varies much depending on the type of diseases and location. Besides vaccine, farmers follow good farming practices such as applying “all-in all-out” rule, isolating new pigs, spraying disinfectant and cleaning pig barn regularly, and restricting visitors away from the pig pens.

T-test results show that there are significant differences in some farming practices between the two provinces considered in the study. In general, farmers in Hung Yen adopt better production practices than farmers in Nghe An in terms of preventing pig diseases and dealing with sick and dead pigs. However, some farmers are also engaged in risky practices such as slaughtering sick pigs for home consumption, selling sick pigs to slaughterhouses at lower price, and throwing away dead pigs instead of properly disposing them. Increasing awareness of farmers about the importance of adopting good farming practices through training and use of mass media could mitigate food safety and animal health risks from pig production.

Keywords: *pig production, farming practice, food safety*

Introduction

In Vietnam, the pig industry contributes about 74-80% to total quantity of meat products and generates around 14% of household income. In particular, for pig sector, smallholders produce around 80% of total pig products (Nga *et al.* 2013). Pigs are raised in the whole country but mainly produced in the Red River Delta and the North East. Currently, farmers producing pigs face some difficulties such as fluctuations in output price, high input cost, frequent occurrence of diseases, and emerging demand for food safety of consumers (Lapar *et al.* 2011).

¹ Lecturer, Faculty of Economic and Rural Development, Vietnam National University of Agriculture. E-mail: huyenquyet2002@gmail.com

² Lecturer, Faculty of Economic and Rural Development, Vietnam National University of Agriculture. E-mail: ngantd@gmail.com

³ Lecturer, Faculty of Economic and Rural Development, Vietnam National University of Agriculture. E-mail: pvhung@vnua.edu.vn

⁴ International Livestock Research Institute. E-mail: L.Lapar@cgiar.org

⁵ Researcher, Faculty of Economic and Rural Development, Vietnam National University of Agriculture. E-mail: xuantrunghua@gmail.com

⁶ International Livestock Research Institute. E-mail: F.Unger@cgiar.org

⁷ Department of Academic Affairs, Vietnam National University of Agriculture. E-mail: nvphohp@gmail.com



Recent studies show that food safety concerns are becoming important among Vietnamese consumers (Lapar *et al.* 2011; Nga *et al.* 2015). About 90% of the consumers interviewed in an ILRI and VNUA study have concerns about pork safety, namely, disease from pork and chemical contaminants. Hence, ensuring pork safety is a priority development issue given the importance of pork in Vietnamese diets and the significant contribution of the pork value chain to livelihoods of smallholder farmers and other value chain actors.

This paper aims to 1) describe current farming practices in pig production and 2) examine changes in pig farming practices that can improve food safety of pig products in Vietnamese smallholder pig production.

Review of Literature

According to Hanh *et al.* (2016), chemical hazards could be problematic in pork meat and its products. Exposure to veterinary drug residues and other chemical hazards in pork can cause acute or chronic adverse health consequences, depending on the chemical types and concentrations, and amount of pork consumed (Beyene 2016; Baynes *et al.* 2016; Sundlof (2014). Sundlof (2014) also indicated that chronic dietary exposure to drug residues at sub-acute doses is another important public health concern.

Hung *et al.* (2017) pointed out that globally, the biggest health problems related to food are infections from consuming food contaminated with viruses, bacteria or parasites. In their review of some success stories, control was incorporated into the value chain, with emphasis on reducing disease in the animal reservoir rather than in the retail product. In addition, according to Sinh *et al.* (2017), small-scale production created challenges for zoonotic disease management. They reported that utilization of the services of veterinarians, enhanced farm biosecurity, and improvements in commune drinking water/waste infrastructure should be priority efforts to control zoonotic disease transmission.

Methodology

The study utilized data from a survey of 412 pig households in Hung Yen and Nghe An provinces in 2013 and a supplemental survey of 203 pig households on Vietnamese Good Animal Husbandry Practices (VietGAHP) done in those provinces in 2015. Hung Yen is close to Hanoi and represents a scenario of rapid, unplanned, demand driven development, brought about by its proximity to urban markets. Nghe An is the largest province in the north-central coast and represents a more traditional pig production system, with different possible trajectories of development.

Within each province, three districts were selected based on different pig value chain gradients which are rural-rural, rural-peri-urban, and peri-urban-urban value chains. Thereafter, communes were chosen according to pig density. The households surveyed were selected randomly from the list of pig producers in each commune. Descriptive statistics and t-test were used to describe the situation of farming practices in pig production and make inferences about the relationship between farming practices in pig production and food safety issue.

Results and Discussion

Overview of Pig Production in Vietnam: Small Scale versus Large Scale

Pig production in Vietnam is typical of agricultural production characteristics in developing countries in that the number of producers is very large but the scale of production is quite small. As the pig industry has developed, the scale of pig production of households has increased since the mid-1990s (Tisdell 2008). However, the majority of producers are still smallholders. According to Tung (2009), in 2006, about 92% of pig production households had a scale of 1-10 head. The proportion of households producing more than ten pigs per year was very small, comprising only 8%.

At present, small-scale production remains predominant in Vietnam. Household pig production supplies at least 80% of Vietnam's pork (Lapar *et al.* 2011; Lapar *et al.* 2012). According to GSO (2011), there are more than 4 million pig raising smallholders in the country, of which 52% grow only 1-2 pigs (Table 1).

Table 1. Scale of pig holdings in households, Vietnam, 2011

Pig Head	Share of Pig-Rearing Households (%)
1-2	51.9
3-5	25.7
6-9	8.9
10-49	12.7
>50	0.8

Source: GSO 2011

According to Nga *et al.* (2013), small-scale pig farmers are perceived to be sources of animal disease risks. Small-scale pig farmers are also less likely to be involved in contract farming schemes due to the high transaction costs of monitoring and supervision of many small units (Tiongco *et al.* 2009). Food safety issues are also likely to pose new constraints to smallholder participation and their ability to compete in modern markets. In practice, in Vietnam, there are food safety issues at all stages of the pork value chain from pig producers up to pork consumers in the market (Nga *et al.* 2015).

Considering the above issues, there is a need to generate robust empirical evidence to encourage debate on food safety and accompanying issues of health risks and quality problem, especially in pork production.

Farming Practices in Small-Scale Pig Production

Source of Piglets

Quality of piglets is important in both increasing productivity and reducing disease occurrence. Farmers now pay more attention to the source of piglets and some farmers produce their own piglets to ensure their quality. Figures 1 and 2 show that the majority of piglets are own-produced by farmers. The second most important source of piglets is other farmers, preferably those already known to them, for reasons of convenience and also for quality assurance. Farmers who know each other can visit each other's houses to check the quality of piglets before buying.



Figure 1. Farmers' sources of piglets, Vietnam, 2013

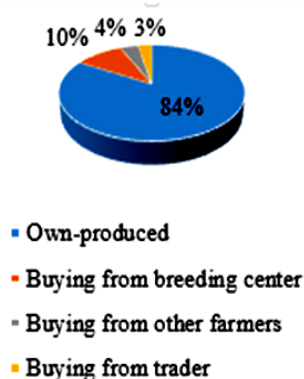


Figure 2. Farmers' sources of piglets, Vietnam, 2015

Source: ILRI-VNUA survey 2013 and 2015

In relation to changes in sourcing piglets recently, about 20% of surveyed farmers have shifted to other types of piglet sources, e.g., either producing piglets on their own or buying from well-known sellers. Some farmers interviewed expressed their intention to shift to other types of piglet sources in the future, either to produce piglets on their own or to buy from well-known sellers. This intention to shift is mainly driven by perception of the need for quality assurance in knowing the origin of the piglets. For example, when they produce piglets themselves, they can apply a vaccine scheme using correct timeline and dosage.

Using Vaccine in Pig Production

Applying vaccine is a good practice for preventing diseases that could rebound to reduced use and exposure of drug contaminants in pigs and pork products. According to Monger *et al.* (2014), using a vaccine is one of the measures to reduce disease in pig farming. Another research conducted by James and Jonathan (2002) has confirmed that following a vaccine program to reduce the occurrence of diseases (e.g., foot and mouth disease) is very costly. However, he has also confirmed that using vaccines as a preventive measure is more cost-effective than treatment of the disease if it happens. Durr *et al.* (2013) has suggested that using the vaccine will reduce the size of an outbreak of disease and the length of the period of the disease existing.

From this study, overall, more pig producers in Hung Yen use vaccine than pig producers in Nghe An (Table 2). More large-scale producers use vaccine than small-scale producers, as observed in the study sites. In addition, the percentage of households applying vaccine for pigs has increased over time, especially in Hung Yen province.

Table 2. Profile of vaccines used in pig production by province, Vietnam, 2013 and 2015

Name of Vaccine	2013		2015	
	Hung Yen (% Households)	Nghe An (% Households)	Hung Yen (% Households)	Nghe An (% Households)
Porcine reproductive and respiratory syndrome	72.8	22.6	70.3	5.4
Foot and mouth disease	63.6	9.4	83.5	17.0
Erysipelas suis	4.9	0.0	64.8	0.9
Pasteurellosis	58.6	24.5	80.2	56.3
Salmonellosis	46.9	11.3	0.0	0.0
Diarrhea syndrome	80.9	56.6	79.1	60.7
Edema disease	34.6	3.8	81.3	0.9
Swine enzootic pneumonia	22.8	3.8	63.7	0.9

Source: ILRI-VNUA survey 2013 and 2015

Applying “all-in, all-out”

Table 3 provides information about applying “all-in all-out” practice in pig herd. This practice simply means that each cell/house has only one age-group of pigs. It is conjectured that if farmers apply this practice, it is expected that those farmers will reduce the possibility of disease spread across the herd. According to Hurnik (1994), mixing different age classes and the contact between those pigs is considered as a risk factor for diseases in pig production.

In this study, about half of farmers indicated that they do not apply the rule. The overlap in time period is about one to nearly two months. The overlap time is not significantly different between Hung Yen and Nghe An. Farmers have identified reasons for not applying the rule. Firstly, seasonality of production will depend on the time of giving birth of sows. Secondly, there is a limitation of pig houses. Farmers do not mention about preventing disease as a motivation when they talk about applying this rule.

Table 3. Situation of applying “all-in all-out” rule by province, Vietnam, 2013

Item	Unit	Hung Yen (A)	Nghe An (B)	Difference (A-B)
Percentage of households not applying the rule	%	57.1	32.7	-
Overlap time period	day	42.3	36.8	5.5 ^{ns}

^{ns} not significant at 10% probability level

Source of basic data: ILRI-VNUA survey 2013

Applying Other Treatments to New Pigs Before Introducing to the Farm

Applying other treatments to new pigs before introducing to the farm is expected to protect pigs from disease exposure. In practice, some studies that have been carried out by Garforth *et al.* (2013), Simon-Grife *et al.* (2013), and Lambert *et al.* (2012) indicated that in order to prevent diseases from newly introduced herd, farmers should have preventive measures such as isolation activity, application of disinfection measures for newly purchased pigs, and only buying new pigs from trusted sources.

In this study, about 60% and 29% of surveyed producers in Hung Yen and Nghe An, respectively, apply other treatments to new pigs before they are introduced to the farm (Table 4). The most common treatment is to use vaccine and dewormers (as in the case of Nghe An). A few farmers use other preventive drugs for new piglets. Almost all farmers do not isolate new pigs because they do not have a separate barn for isolating them and they do not seem to see the value of doing so. Many farmers do not apply any treatments to new pigs. This is a risky practice in terms of increasing the likelihood of spreading diseases to their pigs.

Table 4. Situation of applying other treatments to new pigs before introducing to the farm by province, Vietnam, 2013

Item	Hung Yen (% Households)	Nghe An (% Households)
Percentage of households applying other treatments	56.9	29.0
Type of treatments		
Isolating new pigs	4.8	15.8
Spraying disinfectants	9.7	21.1
Using vaccine	82.3	34.2
Using dewormers	0	21.1
Using preventive drugs	3.2	7.9

Source: ILRI-VNUA survey 2013

Response to Disease Outbreak in the Commune

When there is a disease outbreak in the commune, farmers continue to raise their pigs while increasing application of disinfectants. They also restrict access of visitors to their farm and give antibiotics to their pigs (Table 5). These activities are considered as reasonable responses to eliminate the possibility of disease occurrence on their pigs. They cannot sell pigs immediately to avoid price loss because the pigs will be sold at much lower price.

Generally, responses of farmers in Hung Yen to disease outbreak are better than those of farmers in Nghe An. In both provinces, there are still a few farmers (3.8% in Hung Yen and 19.7% in Nghe An) who do nothing when a disease outbreak happens in the commune. This puts their pigs at higher risk of infection due to absence of biosecurity measures in these farms.

It is necessary to improve farmers' awareness about disease prevention and strengthen the role of local authorities during disease outbreak. For example, more trainings on animal health, especially application of biological methods to prevent pig diseases, are necessary. Moreover, provision of vaccines for small holder pig farmers at reduced price should be considered. In addition, when disease outbreak occurs, more quarantine activities should be implemented.

Table 5. Responses to disease outbreak in the communes by province, Vietnam, 2013

Item	Hung Yen		Nghe An		Difference (A-B)
	% Households	Frequency Level ^a (A)	% Households	Frequency Level ^a (B)	
Sell pigs immediately	2.8	2.3	1.0	2.1	0.2 ^{ns}
Keep but increase disinfection	83.0	1.2	60.6	1.5	-0.3***
Restrict access of visitors to farm	24.1	1.5	16.4	1.7	-0.2***
Give antibiotics	12.7	1.4	4.3	1.6	-0.2*
Do nothing	3.8	2.0	19.7	1.9	0.1 ^{ns}

^a 1=always, 2=mostly, 3=sometimes, 4=rarely, 5=never

*, *** significant at 10% and 1% probability levels, respectively

^{ns} not significant at 10% probability level

Source of basic data: ILRI-VNUA survey 2013

Cleaning Pig Barns and Waste Treatment

Cleaning pig houses is a good and cheap practice to prevent pig diseases and increase productivity. Farmers often clean their pig houses daily and usually do this task during the time of feeding pigs (Table 6). For farmers without biogas system, they usually gather manure and take it out of the barns and use water to clean the barns of remaining manure. For farmers with biogas system, they use water (water hose or normal water buckets) to wash away manure and waste water that will be discharged into the biogas system.

Table 6. Frequency of and disinfectants used for cleaning barns by province, Vietnam, 2013 and 2015

Item ^a	2013		2015	
	Hung Yen (% Households)	Nghe An (% Households)	Hung Yen (% Households)	Nghe An (% Households)
Frequency of cleaning barns				
Daily	99.5	97.6	100	100
Weekly	0	1.4	0	0
After selling pigs	0.5	1.0	0	0
Frequency of spraying disinfectant				
Daily	0	0	0	0
Weekly	34.9	6.3	60.7	21.4
Twice a week	30.2	9.6	3.6	6.3
Monthly	27.8	23.1	10.7	14.3
After selling pigs	6.6	39.9	25.0	58.0
Disease outbreak time	0.5	21.2	0	0
Type of disinfectant				
Drug	91.5	51.9	79.5	77.7
Flaming/smoking	1.9	1.9	26.8	0.9
Lime	52.4	79.8	75.0	78.6
Others	0.5	0.5	0	0

^aMultiple responses

Source: ILRI-VNUA survey 2013 and 2015

The frequency of spraying disinfectant varies across farmers and depends on occurrence of diseases. During periods of disease outbreak, disinfection is done more frequently than during normal periods of no disease outbreak. Drugs such as Omecine and Hanidoin 10% are the most common disinfectants used. Farmers also use lime as a disinfectant. They sprinkle lime inside and outside the barn. Waste treatment practice is also associated with hygienic issue. In general, frequency of spraying disinfectant in 2015 has increased in comparison to that in 2013.

Wastes from pig production in the research sites were well treated. For example, in Hung Yen, more than 55% of farmers use biogas system to treat waste from pig production while only 22% of respondents in Nghe An do so (Table 7). Besides being fed into the biogas system, pig waste is also used for composting into manure for own crop production or for sale and feeding fish. Using animal manure for crop production is a common practice in rural areas by smallholder pig farmers with limited land, financial and human resources. These waste treatment methods are expected to eliminate environmental pollution in pig production. Over time, there has been more farmers applying biogas method to treat waste in pig production.

Table 7. Waste treatment in pig production by province, Vietnam, 2013 and 2015

Option	2013		2015	
	Hung Yen (% Households)	Nghe An (% Households)	Hung Yen (% Households)	Nghe An (% Households)
Biogas	55.7	22.1	70.5	39.3
Composting for crop production	26.4	69.2	13.4	53.6
Feeding for fish	15.6	7.2	15.2	2.6
Sale	1.9	1.0	0	0.9
Others	0.5	0.5	0.9	3.6

Source: ILRI-VNUA survey 2013 and 2015

Other authors also pointed out that cleaning pig houses and production tools affected the likelihood of disease risk. For instance, Lambert *et al.* (2012) in a study of risk factors in pig production in Canada showed that the proportion of pigs that have been cured has positive relationship with the state of hygiene of employees and pig barns. Sam *et al.* (2012) in a study of the risk factors of the disease in pig production in Central Vietnam also showed that cleaning pig cages makes a positive impact on reducing diseases.

Frequency of Farm Visit by Feed Suppliers, Veterinarians, and Traders

Visitors' access to farms is considered a disease risk, especially when they are known to have visited other farms with sick pigs without any protective clothing or disinfectants. Visitors such as veterinary staff, pig traders, and feed suppliers, and the movement of labor in the farm are seen as one factor affecting the disease in pig production. According to Garforth *et al.* (2013), one of the ways to prevent diseases is to limit the spread of disease from the visitors and the surrounding pig farms. Simon-Grife *et al.* (2013) also pointed out that the majority of livestock producers and animal health officials in their studies agree that restricting visitors and the means of transport are important measures to prevent the spread of disease from other areas to pig farms.

In Vietnam, among potential types of visitors to farms are feed suppliers, traders, and veterinarians (Table 8). Feed suppliers rarely go to farms because farmers usually go to shops to buy feed and transport the feeds back home by themselves. For large farms, feed suppliers may bring feed to the farm without actually going near the pig pens. Veterinarians go to farms when they are called, particularly when animals are sick. Hence, they may become a risk factor for spreading diseases. Traders usually go to farms at least once in a production cycle to buy pigs.

Table 8. Information about farm visit by type of visitors in the farm by province, Vietnam, 2013

Frequency	Hung Yen (% Households)			Nghe An (% Households)		
	Feed Supplier	Trader	Vet	Feed Supplier	Trader	Vet
Monthly	7.6	2.4	15.6	6.3	0	3.9
Twice a month	14.2	-	2.8	7.7	0	1.0
Once a production cycle	2.4	43.4	10.4	6.7	60.6	13.5
Do not come	75.0	54.3	58.0	70.7	38.0	36.1
Whenever called	0.9	0	13.2	8.7	1.4	45.7

Source: ILRI-VNUA survey 2013

Handling of Sick Pigs

When pigs get sick, especially with regular diseases, farmers often treat them by themselves. If diseases are abnormal or rare, they will call the veterinarian immediately; or if the pigs do not recover from treatment administered by the farmers, veterinarians are then called to diagnose and treat the case. More farmers in Hung Yen (81.6%) treat pig diseases by themselves at the first sign of illness compared to those in Nghe An (58.7%). More farmers in Nghe An are likely to call a veterinarian when their pigs get sick than in Hung Yen (Table 9).

Table 9. How sick pigs are being handled by province, Vietnam, 2013

Item	Hung Yen		Nghe An		Difference (A-B)
	% Households	Frequency Level ^a (A)	% Households	Frequency Level ^a (B)	
Sell immediately	9.4	2.9	5.3	2.9	-0.0 ^{ns}
Slaughter for own consumption	0.0	0	0.5	4.0	-4 ^{ns}
Treat by yourself	81.6	1.3	58.7	1.5	-0.2***
Call vet immediately	18.4	1.9	34.6	1.8	0.1 ^{ns}
Treat by yourself, if not improving, call for vet	23.6	1.8	42.8	2.2	-0.4***
Ask neighbor for advice	2.8	2.2	5.3	2.9	-0.7**
Do nothing	0.0	0	0.5	1.0	-1 ^{ns}

^a 1=always, 2=mostly, 3=sometimes, 4=rarely, 5=never

** , *** significant at 5% and 1% probability levels, respectively

^{ns} not significant at 10% probability level

Source of basic data: ILRI-VNUA survey 2013

Disposal of Dead Pigs

Most farmers interviewed (72.7% in Hung Yen and 85.6% in Nghe An) indicated that they bury the dead pigs (Table 10). However, there are cases where some farmers consume meat of dead pigs or sell to slaughterhouses at cheaper prices. Such risky practices will likely lead to food safety and public health issues especially if death of pigs was caused by zoonosis. Some farmers throw away dead pigs, which is also a risky practice that could lead to both environmental health hazards and disease spread.

Table 10. Manner of disposing dead pigs by province, Vietnam, 2013

Item	Hung Yen		Nghe An		Difference (A-B)
	% Households	Frequency Level ^a (A)	% Households	Frequency Level ^a (B)	
Use carcass for own consumption	1.4	3.0	2.0	3.8	-0.8*
Throw away	8.1	2.4	4.5	1.8	0.6 ^{ns}
Burn	8.6	1.7	8.5	2.9	-1.2**
Bury	72.7	1.3	85.6	1.8	-0.5***
Consult a vet	0.5	3.0	7.5	2.2	0.8 ^{ns}
Sold to slaughterhouse at cheaper prices	15.8	2.5	3.0	2.7	-0.2 ^{ns}
Give to others	6.7	1.8	20.4	1.3	0.5**

^a 1=always, 2=mostly, 3=sometimes, 4=rarely, 5=never

*, **, *** significant at 10%, 5% and 1% probability levels, respectively

^{ns} not significant at 10% probability level

Source: ILRI-VNUA survey 2013

Involvement of Farmers in Pig Value Chains

Better linkage in a pig value chain will help farmers to have better access to information about production and marketing. On the production side, information about a new practice such as VietGAHP to improve quality of pork products could be accessed via interaction with other chain actors. On the marketing side, information that will help to increase traceability of pigs and pork products could also be obtained.

However, in practice, about 91% and 88% of pig producers in Hung Yen and Nghe An, respectively, mainly perform production-related tasks and do not engage in other functions like marketing and processing in the pig value chain (Table 11). Pig producers who are involved in other activities of the pig value chain are also input suppliers, especially feed suppliers. They are often large-scale producers who procure feeds in large quantities for their own pigs and sell a portion of what they procure to other small pig producers in their surrounding area.

Table 11. Involvement of farmers in pig value chains by province, Vietnam, 2013

Item	Hung Yen (% Households)	Nghe An (% Households)
Pig production only	90.6	88.0
Involvement in other functions		
Supplying inputs	6.6	8.2
Trading	0.9	1.4
Slaughtering	0.9	2.4
Retailing	0.9	1.9
Brokering	0.9	0.0

Source: ILRI-VNUA survey 2013

Conclusion and Policy Implications

Results from the study indicate that farmers now care much about the quality of piglets. Hence, there is an increased trend of using own-produced piglets because farmers can apply strict vaccine scheme for their piglets. The practice of applying vaccine to prevent pig diseases is also clearly observed among farmers in this research. However, the percentage of farmers applying vaccine in pig production varies depending on type of diseases and location.

Besides vaccine, farmers follow practices such as applying “all-in all-out” rule, isolating new pigs, spraying disinfectant and cleaning pig barn regularly, and restricting visitors away from the pig pens. These practices are expected to eliminate pig diseases and mitigate food safety risk of pork products. Unfortunately, farmers are also observed to engage in some risky practices such as slaughtering sick pigs for home consumption, selling sick pigs to slaughterhouses at lower price, and throwing away dead pigs instead of properly disposing them.

Increasing awareness about these risky practices and their potential negative impacts by providing trainings and delivering risk communication programs through mass media could contribute to improving uptake of good farming practices. This could mitigate food safety and animal health risks from pig production.

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